7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

29th – 30th January 2018
Singapore

Organized & Published By

STEERING INNOVATION, SERVING SOCIETY
www.globalstf.org

Organized, Published and Distributed by
Global Science and Technology Forum (GSTF)
7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)
Tel: +65 6327 0166
Fax: +65 6327 0162
www.globalstf.org | info@globalstf.org

E-mail: secretariat@cognitive-behavior.org
Website: http://cognitive-behavior.org/

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)
Print ISSN: 2251-1865, E-Periodical ISSN: 2251-1881

Editorial

It is our pleasure to present you the Proceedings of 7th Annual International Conference on Cognitive and Behavioral Psychology, organized by the Global Science and Technology Forum, held in Singapore on 29th – 30th January 2018.

This conference serves as a forum for scholars, policy makers, experienced professionals, and business executives to present and exchange new ideas on cognitive and behavioral psychology. The conference is also of interest to scholars in related fields.

All papers selected for presentation at this conference and for publication in the proceedings have been subjected to double blind peer review.

We thank all review committee members, partner universities, organizing committee members, and especially all the conference participants for making this conference a great success.

We are sure that all participants will benefit from the contributions to the Proceedings of CBP 2018 and trust that this volume will be useful in their future research endeavors.

Editor-in-Chief

Prof. Craig Speelman
Associate Dean Research
Professor of Psychology
Director of the Cognition Research Group
School of Arts and Humanities
Edith Cowan University

Foreword

This volume of conference proceedings contains a collection of research papers presented at the 6th Annual International Conference on Cognitive and Behavioral Science (CBP 2018) organized by Global Science and Technology Forum in Singapore on 29th – 30th January 2018.

The CBP 2018 conference is an international event for the presentation, interaction and dissemination of new advances relevant to psychological practice. As chairman of the Board of Governors, GSTF, I would like to express my sincere thanks to all those who have contributed to the success of CBP 2018.

A special thanks to all our speakers, authors and delegates for making CBP 2018 a successful platform for the industry, fostering growth, learning, networking and inspiration. We sincerely hope you find the conference proceedings enriching and thought-provoking.

Professor the Hon. Dr. Stephen Martin
Chairman, Board of Governors, GSTF

Preface

We are pleased to welcome you to the 7th Annual International Conference on Cognitive and Behavioral Science. CBP 2018 continuously aims to foster the growth of research in cognitive and behavioral science and its concomitant benefits for the community at large. The research papers published in the proceedings are comprehensive in that they contain a wealth of information that is extremely useful to academics and professionals working in this and related fields.

It is my pleasure to announce the participation of leading academics and researchers in their respective areas of focus from various countries at this event. The Conference Proceedings and the presentations made at CBP 2018, are the end results of a tremendous amount of innovative work and a highly selective review process.

We have received research papers from distinguished participating academics from various countries. There will be "BEST PAPER AWARDS" for authors and students, to recognize outstanding contributions and research publications.

We thank all authors for their participation and are happy that they have chosen CBP 2018 as the platform to present their work. Credit also goes to all Program Committee members and Review Panel members for their contributions in reviewing and evaluating the submissions and for making CBP 2018, a success and for increasing the standing of this annual conference from year to year.

Dr. Anton Ravindran CEng (UK), FBCS
President, Global Science and Technology Forum

Program Committee

Program Chair

Editor-in-Chief

Co-Editor

Program Committee Members

Department of Education Foundation
Universiti Teknologi Malaysia

Dr. Rupan Dhillon
Department Psychology
Guru Nanak Dev University, India

Dr. Tanvir Akhtar
Head and Director Counseling
Department Psychology
Foundation University Islamabad, Pakistan

Table of Contents

Cannabidiol inhibits Methamphetamine -induced reinstatement in REM sleep deprived rats

Saeideh Karimi-Haghighi, Abbas Haghparast

Neuroscience Research Center, Shahid Beheshti University of Medical Sciences, Tehran-Iran

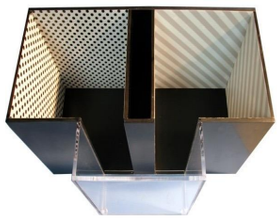
Shahid Beheshti
University of Medical Sciences

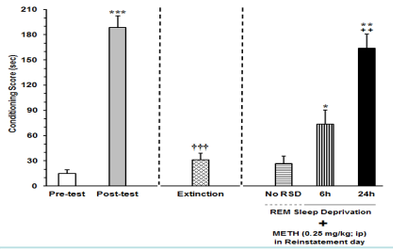
Introduction

- Methamphetamine (METH) is a kind of highly addictive psychostimulant drug (Panenka et al., 2013).
- Psychostimulant abuse, including METH, about 35 million consumers
- The second most commonly used illicit substance worldwide, after cannabis (Meredith et al., 2005).
- Sleep disturbance is common in patients during the recovery from drug abuse (Angarita et al., 2014) and may have a negative impact on the patients' mood which might be a possible factor leading to relapse (Knapp et al., 2007).
- Cannabidiol (CBD) is one of the main components of *Cannabis sativa* and has a wide spectrum of actions, including anti-inflammatory and neuroprotective properties (Iuvone et al., 2009; Zuardi, 2008).
- The findings highlight the unique contributions of CBD which may be a potential treatment for heroin craving and relapse (Ren et al., 2009).
- CBD can be used as an effective and a novel treatment for weakening the memories associated with drugs leading to abuse, thereby decreasing the risk of drug relapse (De Carvalho and Takahashi, 2016).

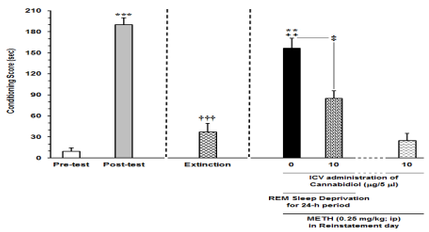
Material & Methods

In this study, we used the conditioned place preference (CPP) to investigate whether CBD, a phytocannabinoid, can prevent METH-induced reinstatement in Rapid Eye Movement sleep deprived (RSD) rats. In order to induce CPP, animals were given METH (1mg/kg; sc) for five days. CPP induced with METH lasted for 10 days after cessation of METH treatment and priming dose of METH (0.5 mg/kg, sc) reinstated the extinguished METH-induced CPP. In order to investigate the effect of RSD on METH-induced reinstatement, we used the inverted flowerpot technique to deprive rats of REM sleep for 24 hours.





Effects of microinjections of vehicle (Veh), and CBD 10 µg/5 µl, into the lateral cerebral ventricle on METH priming-induced reinstatement of extinguished METH-induced conditioned place preference.
†††P < 0.001 different from the post-test day
+ +P < 0.01 different from extinction day
‡‡P < 0.01



Effects of microinjections of different doses of CBD, into the lateral cerebral ventricle on RSD-induced reinstatement of extinguished METH-induced conditioned place preference.
**P < 0.01 and ***P < 0.001 different from the pre-test day
†††P < 0.001 different from the post-test day
+ +P < 0.01 different from extinction day
‡P < 0.05

Results

We found 24-h RSD could induce reinstatement. In addition, ICV administration of CBD 10µg/5µl could suppress the METH-induced reinstatement in No RSD and RSD rats.

Conclusion

In conclusion, ICV administration of CBD 10µg/5µl prevent METH-induce CPP effectively even in stress condition. We think that the effect of CBD, possibly relate to the interaction between CBD and different neurotransmitters such as dopamine that involve in drug reinstatement. Finally, CBD can be considered as the agent to reduce the risk of the relapse, but it needs more investigation.

Acknowledgments

We would like to thanks from all our colleagues in Shahid Beheshti Neuroscience Research Center. This work was supported by a grant from Shahid Beheshti University of Medical Sciences (Tehran, Iran).

Azadi Tower, Tehran, Iran

Hafez tomb, Shiraz,Iran

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.1

Effects of Stress on Second Language Speech Performance in Real and Virtual Public Speaking Environments

Eric Siu-Chung Lo, Andus Wing-Kuen Wong, Edwin Yuen-Sun Law, Jerry Kin Pang,
Xin Jin, Shiqi Chen
Department of Applied Social Sciences,
City University of Hong Kong,
Hong Kong, China

Abstract*— The present study investigated the effects of a real and a virtual public speaking environment on second language (L2) speech production. Participants were all undergraduate native Cantonese speakers with English as their second language. Each participant was asked to give a five"minute English speech while alone in an empty room that served as the baseline, also referred to as "Placebo TSST". Each participant was assigned randomly into either a "Vivo (real) TSST" group, where members were required to give an impromptu speech in front of a real audience (an evaluator), or a "VR (virtual) TSST" group, where members were required to give a speech in a virtual environment to simulate public speaking. The heart rates and self"reported state anxiety levels of participants were significantly higher for the two TSST sessions as compared to the baseline. More importantly, the L2 speech performance of participants dropped in the two speech sessions, with the panel of native English speakers reporting poorer results for second speech session (TSST Session) as compared to the first speech session (Placebo Session). Results indicate that a virtual L2 public speaking environment can elicit similar physiological, psychological, and behavioral responses as a real L2 speaking situation. Results further suggest that the virtual reality technique can be used as a training tool (a) to enhance the L2 performance of speakers and (b) to alleviate their L2 speaking anxiety.

Keywords- virtual reality, public speaking, second language speech, speech performance

I. INTRODUCTION

A. Virtual Reality and Language Learning

In the past two decades, the use of virtual reality (VR) as a tool to aid language learning has received increasing attention [1]. With the advancements in technology, the development of virtual environments has broadened the possibilities of pedagogical practice. Recent attempts have been made to determine how virtual environments can facilitate language learning. Accumulating evidence has shown the effectiveness of using virtual learning environments to enhance language learning, especially in the learning of a second language (L2). Some possible reasons have been proposed, including the capability of this technique to offer a vividly immersive language environment for learners to practice L2 in a safe and stimulating setting. Ellis [2] stated that a key element for learning a language is to use it and to be engaged in the language context. However, being physically present in a foreign country to learn and practice the target language might not be easily achievable for many L2 learners. Thus, to overcome time and space limitations, the virtual learning environment might offer a possible way for L2 learners to be engaged in the target language environment. Despite the surge in the number of studies investigating the effectiveness of virtual learning environments in enhancing language learning, most works have been dominated by the qualitative research method and few use both qualitative and quantitative approaches. However, studies that use the quantitative approach to investigate L2 learning have been relatively scarce.

B. Virtual Reality for Treating Anxiety or Inducing Anxiety-related responses

Most studies on the potential use of VR are not restricted to the area of language learning. Instead, much work has been done to establish how virtual environments can be used as a tool to aid clinical practice, especially for treating phobias using exposure therapy. Specifically, instead of exposing the client with actual fearful stimuli, which might be costly or even practically infeasible, virtual environments are utilized to confront the fear of clients, but in a safe, well controlled, and gradual manner. Past studies have shown the effects of virtual environments in inducing fear- or anxiety-related psychological distress and physiological responses in both healthy and clinical populations [3-6]. Evidence also suggests the effectiveness of adopting the VR technique in exposure therapy [7,8].

C. State Public Speaking Anxiety under Virtual Environment

Several VR studies have also focused on public speaking, probably because public speaking is a commonly experienced stressful situation for many, such that the targeted psychological and physiological responses relevant to the "state" public speaking anxiety can be easily observed [9]. Another reason might be that there are well established stress tasks available in the literature, such as the Trier Social Stress Task developed by Kirschbaum's research team [10]. In stress

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.2

induction, participants are asked to give an impromptu speech and perform an arithmetic task in front of a panel of evaluators and a video camera. Findings from past works suggest that participants under the TSST paradigm typically showed increase in the state anxiety indicators, involving heart rate, heart rate variability, level of stress-related hormones, and subjective rating of distress. Recent studies comparing the effects of real TSST (similar to the one originally proposed by Kirschbaum's research team [11]) and virtual TSST conditions found that participants who performed a public speaking task in a virtual environment exhibited similar anxious physiological and psychological responses as in real environments [12,13].

Almost all studies investigating the effects of public speaking in a virtual environment asked participants to give a speech in their first language. Whether similar effects can be observed if participants were to give the speech in their second language remains unclear. Although intuitively, one could be more stressed when asked to give a public speech in a less familiar language, no available empirical evidence has yet shown that a virtual public speaking task also elicits stress-related responses among L2 speakers. Most of the studies on virtual public speaking have also focused on anxious physiological and psychological responses and very little is known on the effects of the task-related stress on speech performance. Previous literature [14] have demonstrate how state anxiety cause a detrimental effect on individuals' cognitive performance. State anxiety was found to shift the individuals' attentive focus from the performing task to worrying beliefs of negative consequences and to lower task-specific self-efficacy. A recent study by Buchanan's research team has shown that anxiety-eliciting acute stress would also hamper L1 speech fluency [15]; however, knowing if the same effect of stress can be observed in L2 speech production, as well as under a virtual public speaking task, is still largely unknown.

D. Research Objectives

The present study aimed at studying the effects of a stressful public speaking task (referred to as "Vivo (real) TSST" situation) on L2 speech performance and its associated anxious psychological and physiological responses. The effects of public speaking in L2 under a virtual environment ("VR (virtual) TSST" situation) have also been investigated to determine if a virtual environment would elicit similar effects. The L2 speech performance of participants was quantified by an array of linguistic parameters adopted from Buchanan's research team [16] and was rated by a panel of evaluators who were all native English speakers. Similar to many previous studies on public speaking task, the psychological and physiological responses of the participants were measured by self-reported scales and the changes in their heart rates.

The findings of the present study have both theoretical and practical significance. Based on the media equation concept [17], people tend to mindlessly apply social rules to technological worlds, partly because our brain has evolved to react to virtual entities as if they are real social entities [18]. Accordingly, a public speaking task under a virtual environment can activate similar anxious psychological and physiological responses as those observed in a real environment [19,20]. Theoretically, this correspondence is not altered by the language used during a speaking task. Thus, the present study was also designed to extend and verify this assumption in an L2 context.

From a practical standpoint, if a virtual public speaking task in L2 is shown to exert similar effects on the speakers as if the task is done in a real life environment, then the virtual environment might be a promising tool to gradually train L2 speakers to overcome their anxieties. However, the logical first step is to demonstrate that a virtual environment can indeed induce stress associated with L2 public speaking; the present study was conducted to fill this research gap.

II. METHOD

A. Participants

Twenty-nine undergraduate students from the City University of Hong Kong were recruited through a university-wide electronic mail system. The selected participants were all native Cantonese speakers with English as a second language, born in Hong Kong, and had been living in Hong Kong for more than 15 years before participating in the present study. None of them reported of having speech or hearing impairment, physician-diagnosed hypertension, heart disease, cardiovascular disorders, or pregnancy. The mean age of the participants was 20.5 (SD = 1.91; range: 19 – 25), and 25 of them were females.

Participants were given both verbal briefing and written information on the details of the experiment, including the possibility of delivering a short speech in English in front of an evaluator or under a virtual three-dimensional public speaking situation using a head mount device (HMD) display. Participants were informed that they had the right to terminate the use of the HMD display immediately, without any negative consequence, any time during the experimental session. A compensation of HK$80 (~USD10) was provided to each participant after completing the experiment. The present study was approved by the Research Ethics Committee of the Department of Applied Social Sciences of the City University of Hong Kong. All informed consents were obtained before the start of the experiment.

B. Procedure

A 5×2 mixed factorial (within- and between- participants) design was adopted in this study. Each participant was required to undergo five sessions: (1) Pre-test Session; (2) Placebo Session, or the baseline, where participants were asked to give a speech in L2 alone inside a room without evaluators; (3) Rest Session; (4) TSST Session, where participants were randomly

assigned to either a Vivo (real) TSST group or a VR (virtual) TSST group; and (5) Debriefing Session. The experimental protocol was developed in accordance with the 5×2 mixed factorial design.

1) Pre-test Session: Upon arrival at the laboratory, participants were asked to be seated on a chair in the Preparation Room. After signing their informed consent forms, participants were instructed to place the heartbeat sensor belt with tracker to their stomachs and forearms for the entire session. Before taking the Placebo Session, each participant was asked to fill up a five-page questionnaire on trait anxiety during public speaking, a self-perceived level of subjective distress form (see Measure section below for details), and a demographic information form.

2) Placebo Session: The protocol of the Placebo Session was developed based on the study of Het's research team [21]. The Placebo TSST was developed as the standardized control condition for the Vivo (real) TSST group [22], who were tested for effects of stress on cognitive or affective variables. The aim of the present study was to investigate the relation of stress and second language (English) public-speaking. The version of Het's research team was modified to exclude the metric arithmetic task in the Placebo Session. To start the Placebo Session, participants were asked to prepare individually and give a short speech about "a movie, a novel, or a recent holiday trip" inside the Preparation Room. The speech was audio recorded for subsequent analyses. The maximum allowable time for the speech was five minutes. Participants were not required to speak all the time, and they could stop their speech any time within the five-minute period. The preparation time for each participant prior public speaking was five minutes. When the preparation time was over, each participant was asked to stand about 80 cm in front of a table with an audio recorder placed on top of it, and to deliver the speech alone inside the room. At the end of speech, each participant was asked by the evaluator to fill up the post-speech questionnaire, including the first set of self-reported stress at that moment and their state anxiety level while conducting the public speech (see Measure section for anxiety specific to the speech provided).

3) Rest Session: Participants were asked to take a rest for three minutes and to engage in casual chat with the experimenter before proceeding to the either the Vivo TSST or the VR TSST group sessions.

4) TSST Session: The protocol of the TSST session was based on the works of Kirschbaum's team and Jönsson's team [23,24]. At the beginning of the two TSST group sessions, participants were informed that they would be assigned to give a short speech in English either before a real person (evaluator) or a group of computer-generated audience. The speech topic was on "Your strengths and weaknesses." The time-limit of the speech was also five minutes, but unlike in the previous Placebo Session, the participants were instructed to speak all the time to complete the five-minute speech duration. All participants were given five minutes to prepare their speech with the aid of a pen and blank paper. They were reminded that reading from the paper was not permitted during the speech, and that their speeches would be recorded as both sound and video files for subsequent analyses. However, video recording was not conducted; a pretend video recording was implemented only to induce social evaluative threat in public speaking [25]. At the end of the speech preparation, each participant was asked to stand and wait for further instructions from the experimenter. The participants were assigned to either a VR (virtual) TSST group or a Vivo (real) TSST group.

5) VR TSST group: For those selected for the VR TSST group, the experimenter led the participants to the VR Room where the installed virtual reality system could generate virtual audiences and a speech environment. The "VR operator" was acted by another research staff who also assisted each participant to wear the HMD correctly and comfortably. First, the experimenter introduced the role (presence) of the male VR operator, which was to operate the VR system only while the participant was doing his or her public speaking. Second, similar to the Placebo Session, the experimenter guided the participant to stand about 80 cm in front of a table where an audio recorder was placed on top of it. Third, the experimenter intentionally adjusted the video camera, which was also placed on the same table; the lens angle was adjusted diagonally in front of the participant at a distance of about 200 cm. The participants were made to believe that they were being video recorded. Finally, the VR operator assisted in participant in wearing the HMD comfortably prior delivering the speech. Once the participant confirmed that he or she could see some computer images clearly, the VR operator used the VR software package to calibrate their eye view and simulated a conference room filled with audiences (Fig. 1) (see also details in the section of VR software and hardware). As soon as the participant begun speaking, the virtual audiences in the virtual conference room appeared to show randomly neutral responses, such as moving their heads slightly (neither shaking nor nodding), moving their other body parts slightly, and jotting notes, etc. The virtual audience in the virtual environment neither talked nor generated any noise while the participant was giving his or her speech. In cases where a participant finished his or her speech before the end of the five-minute period, the VR operator used a standardized verbal script ("You have some time left, please continue!") to remind the participant to continue speaking. After the participant finished his or her five-minute speech, the experimenter re-entered the VR Room and instructed the participant to take off the HMD and to return to the Preparation Room. All participants were instructed to fill up the second post-speech questionnaire using the same set of questions as those in the first post-speech questionnaire.

Figure 1. VR screenshot generated by the software package of Virtually Better©

6) Vivo TSST group: Participants selected for the Vivo (real) TSST group were asked to wait for two to three minutes after completing the five-minute speech preparation time and before proceeding to the Vivo TSST group session. The reason for the delay was to match the time allocated for wearing the HMD in the VR TSST group session. At the end of the waiting time, the experimenter led each participant to a conference room where a male evaluator was waiting for his or her arrival. The same research staff who acted as VR operator in the VR TSST group session was delegated as the male evaluator in the Vivo TSST group session. The male evaluator dressed up in smart casual, which was very similar to the virtual audiences shown in the VR TSST group session. The experimenter asked the participant to stand about 80 cm in front of a table where the evaluator sat and took notes. An audio recorder was placed on the same table right before the evaluator. Next, the experimenter intentionally adjusted the video camera, which was also located on the same table as the audio recorder; the angle of the camera lens was adjusted diagonally in front of the participant at a distance of about 200 cm. Similar to the VR TSST group session, the video recording was only a pretend recording. As soon as the participant begun speaking, the evaluator acted as if giving neutral responses, such as moving his head slightly (neither shaking nor nodding), moving his other body parts slightly, and jotting notes, etc. The evaluator did not give any response during the speech, unless the participant ended the speech earlier than the five-minute mark, to which the evaluator used the same standardized verbal script ("You have some time left, please continue!") to instruct the participant to continue talking. The same protocols from the VR TSST group session were applied to the Vivo TSST group session after the participant finished his or her five-minute speech.

7) Debriefing Session: Upon completing the two-group TSST session, the participants were asked about their feelings toward the speaking task. None expressed serious emotional and physical discomfort. The experimenter then explained the purpose of the present research. After the Debriefing Session, the experimenter helped each participant stop the heart beat watch and take off the heart beat recoding apparatus. Finally, the participants were paid for their participation.

C. Materials

1) VR Software and Hardware: The public speaking "phobia scene" included in the software package of Virtually Better© was used to generate the virtual environment in the VR TSST condition. The Alienware Andromeda R5 hardware system, installed with Intel© CoreTM i5-3330 CP @3.00GHz and 8.00GB RAM, supported the generation and output of the VR image. A SonyTM HM2-T1 personal 3D viewer HMD was used to display the VR image outputs to the participants. The HMD was connected with InterSense© InertiaCube2+TM head tracking system that enhanced the realism of the virtual environment by producing a motion parallax effect.

2) Heart Rate Record: Polar A300™ device (Polar Team Sport System, Polar Electro Oy, Finland), with a heartbeat sensor belt and a tracker watch, was used to record the heart rate of participants in BPM (beat per minute) every second throughout the entire experiment. The said equipment was suitable to the present experimental design because participants were required to move from room to room across different sessions. By referring to the second-based time records from the heart beat watch, the mean heart rate of each participant in each of the five sessions (Pre-test, Placebo, Rest, TSST, and Debriefing) was obtained.

3) Subjective Units of Distress Scale: Previous studies on VR and public-speaking-associated stress were adopted from the study of Harris, Kemmerling, and North's and the study of Owens and Beide [26,27]. For the present study, participants were asked to report their perceived level of anxiety during the Pre-test Session and after each of the two speeches during the TSST Session. However, instead of using a Likert scale, an analogue scale was used in which a 210-mm straight line printed on a questionnaire page was provided for participants to mark their ratings. The two ends of the straight line were labeled, "absolutely not anxious" and "extremely anxious".

4) State Anxiety of Public Speaking Measure. The instrument Self-Statements During Public Speaking (SSPS) [28] was used to assess the level of anxiety of participants during each of the two speeches delivered in this study. The 10-item scale has been widely employed in previous studies for speech-associated stress [29-31] because its items have been shown to have a high level of internal reliability [32]. A higher score indicates lower state anxiety. In the present study, a high reliability of the SSPS score was obtained among the participants. Cronbach's α is 0.71 and 0.81 for the first speech and second speech, respectively.

5) Trait Anxiety of Public Speaking Measure: Apart from obtaining their state anxiety, participants were also asked to complete the short-form Personal Report of Confidence as a

Speaker scale (i.e., short-form PRCS) to measure their trait anxiety of public speaking [33]. The PRCS has been widely recognized and employed because anxiety in public speaking can provide equivalent measures across gender or ethnicity groups in college-aged samples [34]. The 12-item scale short-form PRCS was adopted from Hook's Team [35]; its psychometric properties are applied similarly across genders and countries [36]. The reliability coefficient of the short-form PRCS used in the present study was satisfactory with Cronbach's $\alpha = 0.78$.

6) Speech Measures: Buchanana, Laures-Gore, and Duff [37] have investigated the effects of acute stress induced by a real TSST on a number of speech performance measures. A similar set of speech measures and their corresponding coding schemes were adopted in the present study. Three undergraduate students in their second year of study at the City University of Hong Kong were recruited and trained as coders. All coders were blinded for the experiment and were not informed on the conditions for research coding. The coders followed most of the coding schemes of Buchanana, Laures-Gore, and Duff, except that they were only required to conduct coding for three 30-second sound portions taken from the initial, middle, and last parts of the speech sound file of each participant. Coding for the middle part was randomly selected for the time between the first and the last 30-second periods. The speech measure was averaged from the three 30-second clips. Details of the speech measures employed and the corresponding coding methods are briefly discussed below.

- Number of utterances: This measure was computed by counting each word, by word approximation, and by counting all spoken utterances even if they did not provide meaning or structure for communication (e.g., fillers like "my strength is um" = four words).
- Number of productive words and word productivity: Productive words are those that remain after removing utterances that do not provide communicative meaning or structure from all counted utterances. In the present study, utterances were identified and removed using the following criteria: (a) exact repetition of words/phrases except if used for emphasis; (b) self-corrected errors, including both false starts and abandoned phrases and word parts; and (c) nonlinguistic vocalizations, defined similarly as non-fluencies. Word productivity was computed as the ratio of the number of productive words to the number of utterance.
- Pause: This measure is for the number of pauses and the duration of the pause. A counted pause is defined as silence for over one-second duration [38]. The duration of pauses was identified and measured by the coders by listening to playbacks and with the assistance of computerized sound wave form using the Audacity® software.

7) Perceptual Rating of Speech Performance: In the present study, a shortened version of the perception of speech performance measure employed by Cody and Teachman was used to assess the perception of the raters of participant speech performance [39]. Six aspects of the original measure focusing on audio assessment were adopted, namely, "voice quivered," "was understandable," "bored audience," "made a bad impression," "generally spoke well," and "was not convincing". A five-point Likert scale ranging from 0 (not all all) to 4 (very much) was used by the raters to indicate their level of agreement on each aspect. Three undergraduate students, all of whom were native English speakers, were invited and trained as the raters. All three raters were blinded for the experiment and not informed about the conditions for the research labeling. The interrater reliability of the speech performance rating was within fair to good range, from 0.42 to 0.73 (overall ICC2 = 0.73) [40].

8) Demographic Measure. Participants were asked to report their public examination grades on English speaking (i.e., Hong Kong Diploma of Secondary Education and /or Hong Kong Advanced Level Examination) and medium of instruction in their secondary school (i.e., English or Chinese) to demonstrate comparable profiles for both Vivo TSST and VR TSST groups.

III. Data Analysis

Data were analyzed using the IBM SPSS statistics ver. 23 software package. A mixed between–within participant analysis of variance (ANOVA) was conducted to test for psychological and physiological effects. For the analysis of demographic measures, independent sample t-test. Details of the results are presented in the next section.

IV. Results

A. Participant Profiles

Independent sample t-test was performed, and no significant difference was observed in the achievement scores on English public examination for the VR TSST group (M = 4.57, SD = 1.28, n = 14) and the Vivo TSST group (M = 3.93, SD = 0.70, n = 15), $t(19.86) = 1.64$, $p = 0.12$.

For trait anxiety of public speaking, an independent sample t-test was performed, and no significant difference was observed between the VR TSST group (M = 7.50, SD = 2.82, n = 14) and the Vivo TSST group (M = 6.40, SD = 3.27, n = 15) in the short-form PRCS scores ($t(27) = .97$, $p = 0.34$).

Results indicate that the participants in the two TSST groups were comparable in terms of English language proficiency and trait anxiety level.

B. Heart Rate

The mean heart rate of the VR TSST group (M = 84.20, SD = 13.11, n = 14) and the Vivo TSST group (M = 89.16, SD = 11.54, n = 15) during the Pre-test Session did not differ significantly at $t(27) = 1.08$ and $p = 0.29$, indicating that the two groups had comparable baseline heart rates. Results of

mixed ANOVA showed that the interaction of the two-group TSST session on heart rate was not significant ($F(4, 24) = 28.89$, $p = 0.68$, partial $\eta^2 = 0.09$) (see also Figure 2). The main effect of the sessions was significant at $F(4, 24) = .58$, $p = 0.00$, and partial $\eta^2 = .83$, but the main effect of the TSST groups was not significant at $F(1, 27) = 1.67$, $p = 0.21$, and partial $\eta^2 = 0.06$.

Changes in heart rate across sessions followed a similar pattern for both TSST groups: heart rate initially increased during the Pre-test Session and peaked at the Placebo Session. The heart rate returned to pre-test levels at Rest Session and then increased again and peaked at the TSST Session. Finally, heart rate dropped substantially to the lowest level at the Debriefing Session (Fig. 2). A post-hoc mixed ANOVA that compares the Placebo Session with the two-group TSST Session showed no significant differences at Fs < 1.

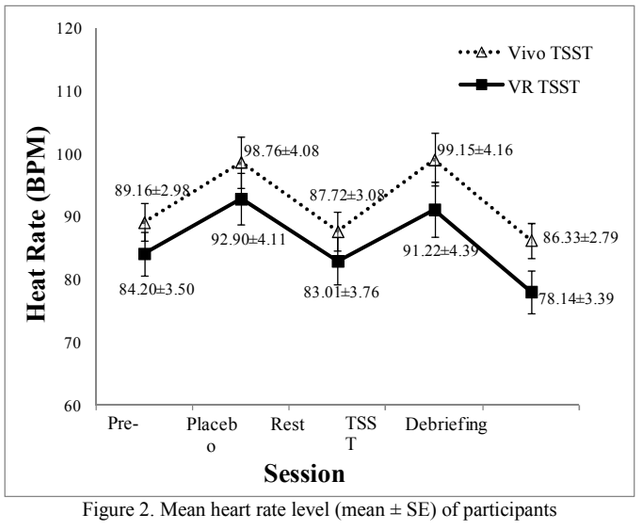


Figure 2. Mean heart rate level (mean ± SE) of participants

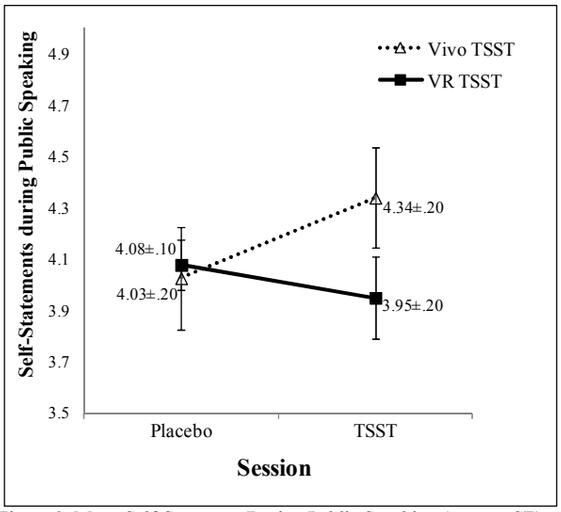


Figure 3. Mean Self-Statement During Public Speaking (mean ± SE) of participants

In contrast, for the Vivo TSST group ($n = 15$), the mean scores increased significantly from the Placebo Session ($M = 4.03$, $SD = 0.77$) to the TSST Session ($M = 4.34$, $SD = 0.76$) at $t(14) = 2.34$ and $p = 0.04$. This finding suggests a significant reduction in state anxiety in the second speech of the Vivo (real) TSST group, but not for the VR TSST group.

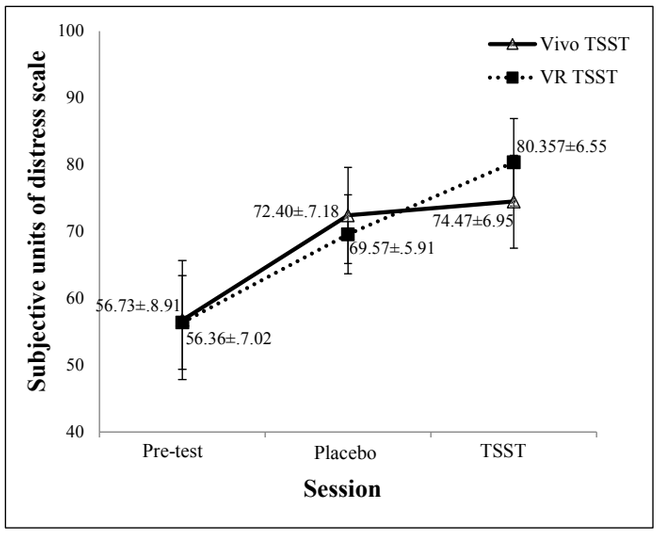


Figure 4. Mean subjective units of distress (mean ± SE) of participants

C. Anxiety of Public Speaking: Self-Statements During Public Speaking

Mixed ANOVA showed that the interaction between the TSST groups and SSPS was significant: $F(1, 27) = 5.02$, $p = 0.03$, partial $\eta^2 = 0.16$. Fig. 3 shows that the scale scores changed differently between VR TSST and Vivo TSST groups across the two time sessions. For the VR TSST group ($n = 14$), subsequent paired sample t-test showed that the mean scores did not change significantly from the Placebo Session ($M = 4.08$, $SD = 0.36$) to the TSST Session ($M = 3.95$, $SD = 0.60$) at $t(13) = 0.89$ and $p = 0.39$.

D. Subjective Units of Distress Scale

Mixed ANOVA showed that the interaction between TSST groups and sessions on subjective units of distress scale was not significant ($F(4, 26) = 0.49$, $p = 0.62$, partial $\eta^2 = 0.04$) (see also Fig. 4). The main effect of sessions was significant at $F(4, 26) = 8.29$, $p = 0.00$, and partial $\eta^2 = 0.39$, whereas the main effect of TSST groups was not significant at $F(1, 27) = 0.01$, $p = 0.92$, and partial $\eta^2 = 0.00$. The main effect of all five sessions suggests a significant variation of subjective distress. The post-hoc mixed ANOVA for the Placebo Session with the Vivo TSST group session or the VR TSST group session (i.e., only two consecutive sessions were compared) showed no significant main effect of sessions ($F(1, 27) = 2.08$, $p = 0.16$, partial $\eta^2 = 0.07$) and interaction ($F(1, 27) = 0.96$, $p = 0.34$, partial $\eta^2 = 0.03$). Results suggest that for both TSST groups, the subjective distress levels increased from the Pre-test

Session to the Placebo Session, and remained unchanged from the Placebo Session to the two-group TSST Session.

E. Speech Measures

1) Number of Utterances: Mixed ANOVA showed that the interaction between TSST groups and sessions on number of utterances was significant at $F(1, 27) = 4.51$, $p = 0.04$, and partial $\eta^2 = 0.14$. Fig. 5 shows the differences in the change in the mean number of utterances changed of VR TSST and Vivo TSST groups across different sessions. For the VR TSST group ($n = 14$), subsequent paired sample t-test showed that the mean number of utterances decreased significantly from the Placebo Session ($M = 61.69$, $SD = 10.48$) to the TSST Session ($M = 54.93$, $SD = 15.63$) at $t(13) = 2.79$ and $p = 0.02$. In contrast, for the Vivo TSST group ($n = 15$), the number of utterances did not vary significantly from the Placebo Session ($M = 61.49$, $SD = 10.55$) to the TSST Session ($M = 62.02$, $SD = 2.51$) at $t(14) = - 0.22$ and $p = 0.83$.

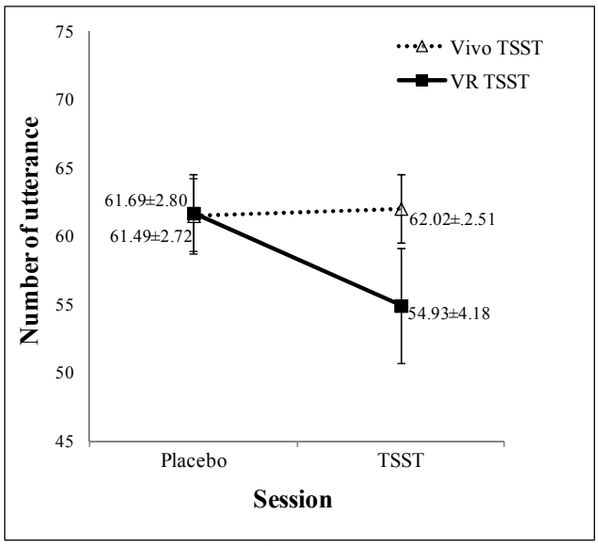


Figure 5. Participants' mean number of utterance (mean ± SE) as a function of group and session

2) Number of Productive Words and Word Productivity: The findings for these two productivity measures were very similar. Mixed ANOVA showed that the interaction between the two TSST (VR and Vivo) groups and the five sessions on both number of productive words and word productivity (i.e., number of productive words to total number of utterance ratio) were not significant. For the number of productive words, $F(1, 27) = 2.25$, $p = 0.15$, and partial $\eta^2 = 0.08$, whereas for word productivity, $F(1, 27) = 0.35$, $p = 0.56$, and partial $\eta^2 = 0.01$. The main effects of sessions on both productivity measures were significant. For the number of productive words, $F(1, 27) = 8.29$, $p = 0.03$, and partial $\eta^2 = 0.17$, whereas for word productivity, $F(1, 27) = 9.96$, $p = 0.00$, and partial $\eta^2 = .27$. Fig. 6a and Fig. 6b show that both productivity measures decreased from the Placebo Session to the TSST Session. The same pattern was observed in both VR and Vivo TSST groups. However, the main effect of TSST groups was not significant for number of productive words ($F(1, 27) = 0.31$, $p = 0.58$, partial $\eta^2 = 0.01$) and word productivity ($F(1, 27) = 0.08$, $p = 0.78$, partial $\eta^2 = 0.00$).

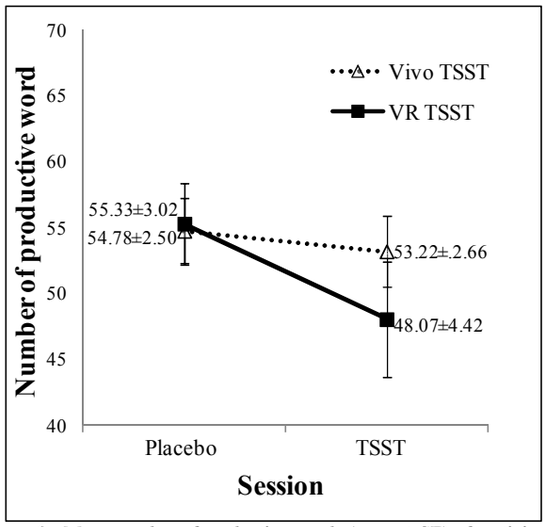


Figure 6a. Mean number of productive words (mean ± SE) of participants

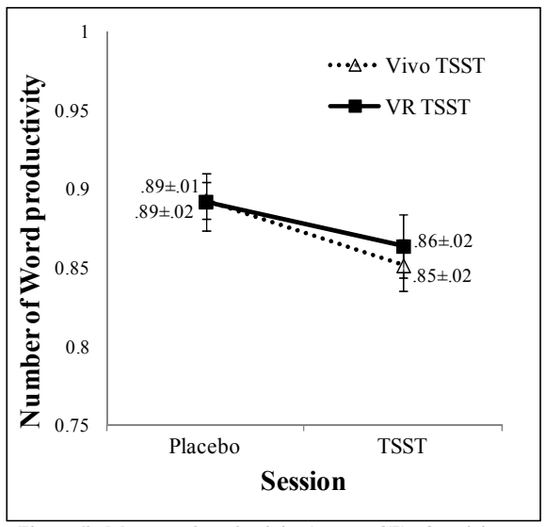


Figure 6b. Mean word productivity (mean ± SE) of participants

3) Number of Pauses and Duration of Pause: The two measures of pauses had very similar results of mixed ANOVA. The interactions between groups and sessions were significant for number of pauses ($F(1, 27) = 4.67$, $p = 0.04$, partial $\eta^2 = 0.17$) and duration of pause ($F(1, 27) = 6.91$, $p = 0.01$, partial $\eta^2 = 0.20$). Fig. 7(a) and Fig. 7(b) show that these two pause measures underwent very different changes between the two groups for the Placebo Session and the two-group TSST Session.

- Number of Pauses: During the Placebo Session, the mean number of pauses for the VR TSST group ($M = 1.40$, $SD = .99$, $n = 14$) did not differ significantly

from that of the Vivo TSST group (M = 1.36, SD = 0.98, n = 15) at $t(27) = 0.14$ and $p = 0.89$. In contrast, during the TSST Session, the mean number of pauses for the VR TSST group (M = 2.05, SD = 1.59, n = 14) was significantly greater than that of the Vivo TSST group (M = 1.02, SD = 0.74, n = 15) at $t(18.10) = 2.20$ and $p = 0.04$.

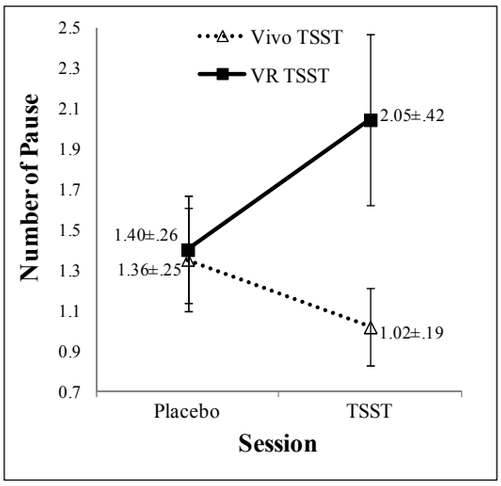


Figure 7a. Mean number of pauses (mean ± SE) of participants

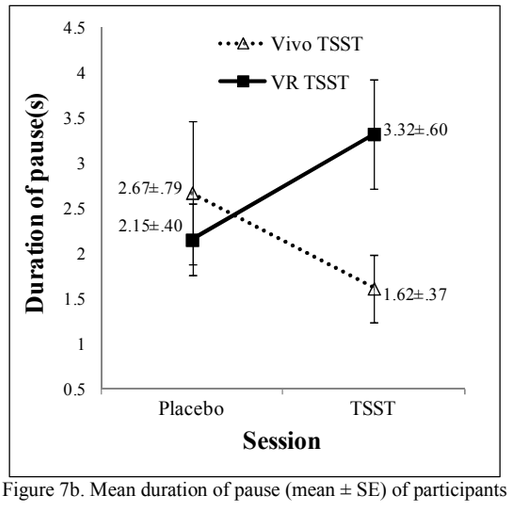


Figure 7b. Mean duration of pause (mean ± SE) of participants

- Duration of Pause: During the Placebo Session, the mean duration of pause for the VR TSST group (M =2.15s, SD = 1.48s, n = 14) did not differ significantly from that of the Vivo TSST group (M = 2.67s, SD = 3.06s, n = 15) at $t(27) = -.58$ and $p = .57$. In contrast, during the TSST Session, the mean number of pauses for the VR TSST group (M = 3.32s, SD = 2.24s, n = 14) was significantly greater than that of the Vivo TSST group (M = 1.62s, SD = 1.42s, n = 15) at $t(21.75) = 2.43$ and $p = 0.02$.

4) Perceptual Rating of Speech Performance: Mixed ANOVAs were performed on the perceptual rating data and the results (after reversing the scores for negatively worded aspects) are summarized in Tables 1a and 1b. No significant interaction between TSST groups and sessions on all six aspects of speech performance was observed. The only significant main effect for the sessions was in "voice quivered," which was significantly lower in the TSST Session (M = 2.02, SD = 0.65) than in the Placebo Session (M = 2.26, SD = 0.66) for the two TSST groups. The finding indicates that the voices of participants were perceived to have quivered more in their second speech (VR or Vivo TSST Session) than in their first speech (Placebo Session). Mixed ANOVA did not indicate any significant effect on the TSST group on all six aspects.

TABLE 1A. *MEAN AND STANDARD DEVIATION OF SIX SPEECH PERFORMANCE ASPECTS*

Speech performance aspects	Mean and standard deviation	
	Placebo Session	*TSST Session*
(a) voice quivered	VR: M = 2.29, SD = 0.63 Vivo: M = 2.24, SD = 0.72	VR: M = 1.90, SD = 0.72 Vivo: M = 2.13, SD = 0.59
(b) was understandable	VR: M = 2.10, SD = 0.72 Vivo: M = 2.40, SD = 0.57	VR: M = 2.10, SD = 0.46 Vivo: M = 2.31, SD = 0.64
(c) bored audience	VR: M = 1.95, SD = 0.79 Vivo: M = 2.02, SD = 0.75	VR: M = 2.07, SD = 0.80 Vivo: M = 2.07, SD = 0.89
(d) made a bad impression	VR: M = 2.90, SD = 0.80 Vivo: M = 3.00, SD = 0.89	VR: M = 2.83, SD = 0.48 Vivo: M = 3.13, SD = 0.63
(e) generally spoke well	VR: M = 1.88, SD = 0.75 Vivo: M = 2.02, SD = 0.57	VR: M = 1.83, SD = 0.60 Vivo: M = 1.93, SD = 0.57
(f) was not convincing	VR: M = 1.81, SD = 0.68 Vivo: M = 2.00, SD = 0.69	VR: M = 1.74, SD = 0.53 Vivo: M = 2.07, SD = 0.74

Note: 1. VR = VR TSST group; Vivo = Vivo TSST group;
2. Number of participants - VR TSST group: n = 14;
Vivo TSST group: n = 15.

TABLE 1B. *MIXED ANOVA RESULTS OF SIX SPEECH PERFORMANCE ASPECTS*

Speech performance aspects	**Test of significance and effect size**	
	Within-subjects effect	*Between-subjects effect*
(a) voice quivered	*Main:* $F(1, 27) = 4.39$, $p = 0.046$, partial $\eta^2 = 0.14$ Interaction: $F(1, 27) = 1.32$, $p = 0.26$, partial $\eta^2 = 0.05$	$F(1, 27) = 0.19$, $p = 0.67$, partial $\eta^2 = 0.01$
(b) was understandable	*Main:* $F(1, 27) = 0.21$, $p = 0.65$, partial $\eta^2 = 0.01$ Interaction: $F(1, 27) = 0.21$, $p = .65$, partial $\eta^2 = 0.01$	$F(1, 27) = 1.65$, $p = 0.21$, partial $\eta^2 = 0.06$
(c) bored audience	*Main:* $F(1, 27) = 0.32$, $p = 0.58$, partial $\eta^2 = 0.01$ Interaction: $F(1, 27) = 0.07$, $p = 0.80$, partial $\eta^2 = 0.00$	$F(1, 27) = 0.02$, $p = 0.90$, partial $\eta^2 = 0.00$
(d) made a bad impression	*Main:* $F(1, 27) = 0.03$, $p = 0.86$, partial $\eta^2 = 0.00$ Interaction: $F(1, 27) = 0.37$, $p = 0.55$, partial $\eta^2 = 0.01$	$F(1, 27) = 0.90$, $p = 0.35$, partial $\eta^2 = 0.03$
(e) generally spoke well	*Main:* $F(1, 27) = 0.48$, $p = 0.50$, partial $\eta^2 = 0.02$ Interaction: $F(1, 27) = 0.04$, $p = 0.84$, partial $\eta^2 = 0.00$	$F(1, 27) = 0.33$, $p = 0.57$, partial $\eta^2 = 0.01$
(f) was not convincing	*Main:* $F(1, 27) = 0.00$, $p = 0.98$, partial $\eta^2 = 0.00$ Interaction: $F(1, 27) = 0.34$, $p = 0.57$, partial $\eta^2 = 0.01$	$F(1, 27) = 1.43$, $p = 0.24$, partial $\eta^2 = 0.05$

Note: 1. VR = VR TSST group; Vivo = Vivo TSST group;
2. Number of participants - VR TSST group: n = 14;
Vivo TSST group: n = 15.

V. Discussion

The present study investigated the effects of a real and a virtual public speaking task on L2 speech production. Participants were all native Cantonese speakers with English as their second language. They were first asked to give a five-minute speech in English inside an empty room alone (placebo), then randomly assigned to either a Vivo (real) TSST group, where they were asked to give an impromptu speech in front of a real audience, or a VR (virtual) TSST group, where they were required to give a speech under a virtual environment simulating a public speaking context. The indicators of state anxiety, including heart rate (physiological response), subjective reports of distress (psychological response), and L2 speech performance (behavioral response) of participants were measured.

The heart rates of participants were significantly higher in the two speech sessions than in the pre-test baseline and debriefing sessions. In terms of distress level, both Vivo (real) TSST and VR (virtual) TSST groups exhibited a significant increase in subjective distress from pre-test to the first speech (Placebo Session), but no significant difference was observed between the two speech sessions (Placebo versus TSST sessions) or between the two groups. For their scores in the SSPS scale, which is a widely used measure to assess anxiety level related to speech, the Vivo group displayed a significant drop in anxiety during the second speech whereas no such a drop was observed for the VR group. These findings suggest that the speech tasks adopted in the present study were stressful enough to elicit the expected anxious physiological and psychological responses, which were comparable to the findings from previous studies. Interestingly, based on the SSPS scores, participants in the Vivo group were less anxious during their second speech with the presence of an evaluator, perhaps because of the practice effect where they were asked to speak publicly in L2 the second time. Notably, no such drop in SSPS scores was observed for the VR group, which suggests that the participants did not benefit from the practice effect from the first speech, if this indeed happened at all. Hence, for the present study, the VR public speaking task was perceived as highly stressful.

The L2 speech performance of participants was measured and analyzed. Both Vivo and VR groups exhibited a significant drop in word productivity from the first speech to the second speech (Placebo versus TSST sessions). Findings suggest that with the presence of others, either real or virtual caused a drop in the performance of L2 speech performance. The results are consistent with the social facilitation theory of Sanders [41], which assumes that one would perform poorer in the presence of others if the task at hand is perceived as difficult. Interestingly, present results indicated that the same effect on performance holds true even if the "others" are in a virtual environment.

Participants from the VR group exhibited a significant decrease in the number of utterances and a significant increase in pauses and pause duration during the second speech (TSST Session). In other words, the VR group exhibited a drop in speech performance across more speech aspects as compared to the Vivo group. Three native English speakers were asked to rate the speech of participants on a number of speech performance aspects and no significant difference was observed between the two TSST groups. However, a significant difference was observed for the degree of "voice quivered," wherein the voice of participants was perceived to have quivered more in the TSST Session than in the Placebo Session. Results indicate that participants generally performed worse in the TSST Session than in the Placebo Session (i.e., where no evaluator was present), which were consistent with the social self-preservation theory [42] that the presence of socio-evaluative threat is a crucial factor in causing stress when asked to perform a TSST task.

VI. Conclusion

The results from the present study suggest that a virtual second language speech environment can induce similar physiological, psychological, and behavioral responses, if not more salient, as a real L2 speech setting. These results are consistent with the hypothesis of media equation [43], which suggest that people tend to react to virtual entities as if they are real social entities [44]. These findings also accord with the virtual environment literature that a public speaking task under a virtual exposure can activate similar anxious psychological and physiological responses as those observed in a real environment [45-46]. The present findings extend this theoretical claim to the L2 speech context. The present study also highlights the importance of measuring multiple dimensions for convergent evidence.

More importantly, the present results show that the VR technique can simulate a real L2 public speaking environment. One merit of using VR is it can overcome time and space constraints because users can use the technique anytime. A simulated language environment can also be tailored according to the specific needs of the user. As such, the use of VR as a tool for L2 skill enhancement has considerable potential. Future research may investigate how the VR technique can be incorporated into L2 training programs to reduce speech anxiety while at the same time enhancing L2 speech performance through multiple sessions and exposure training.

References

[1] T. J. Lin and Y. J. Lan, "Language Learning in Virtual Reality Environments: Past, Present, and Future," Educ. Technol. Soc., Vol. 18, pp. 486-497, 2015.

[2] R. Ellis. The study of second language acquisition. Oxford University., 1994

[3] S. B. Brundage, J. M. Brinton, and A. B. Hancock. "Utility of virtual reality environments to examine physiological reactivity and subjective distress in adults who stutter," J. Fluency Disord., Vol. 50, pp. 85-95, 2016

[4] O. D. Kothgassner, A. Felnhofer, H. Hlavacs, L. Beutl, R. Palme, I. Kryspin-Exner, and L. M. Glenk, "Salivary cortisol and cardiovascular reactivity to a public speaking task in a virtual and real-life environment," Comput. Hum. Behav., Vol. 62, pp. 124-135, 2016.

[5] M. E. Owens and D. C. Beide. "Can virtual reality effectively elicit distress associated with social anxiety disorder?" J. Psychopathol. Behav., Vol. 37, pp. 296-305, 2015.

[6] Y. Shiban, J. Diemer, S. Brandl, R. Zack, A. Mühlberger, and Wüst, S. "Trier social stress test in vivo and in virtual reality: dissociation of response domains," Int. J. Psychophysiol., vol. 110, pp. 47-55, 2016.

[7] P. L. Anderson, E. Zimand, L. F. Hodges, and B. O. Rothbaum, "Cognitive behavioral therapy for public-speaking anxiety using virtual reality for exposure," Depress. Anxiety, Vol. 22, pp.156-158, 2005

[8] S. R. Harris, R. L. Kemmerling, and M. M. North, "Brief virtual reality therapy for public speaking anxiety," Cyberpsychol. Behav., Vol. 5, pp. 543-550, 2002.

[9] G. Bodie, "A Racing Heart Rattling Knees and Ruminative Thoughts: Defining Explaining and Treating Public Speaking Anxiety," Commun Educ, Vol. 59, pp. 70-105, 2010.

[10] C. Kirschbaum, K. M. Pirke, and D. H. Hellhammer. "The 'Trier Social Stress Test'——a tool for investigating psychobiological stress responses in a laboratory setting," Neuropsychobiology, Vol. 28, pp. 76-81, 1993.

[11] C. Kirschbaum, K. M. Pirke, and D. H. Hellhammer. "The 'Trier Social Stress Test'——a tool for investigating psychobiological stress responses in a laboratory setting," Neuropsychobiology, Vol. 28, pp. 76-81, 1993.

[12] O. D. Kothgassner, A. Felnhofer, H. Hlavacs, L. Beutl, R. Palme, I. Kryspin-Exner, and L. M. Glenk, "Salivary cortisol and cardiovascular reactivity to a public speaking task in a virtual and real-life environment," Comput. Hum. Behav., Vol. 62, pp. 124-135, 2016.

[13] Y. Shiban, J. Diemer, S. Brandl, R. Zack, A. Mühlberger, and Wüst, S. "Trier social stress test in vivo and in virtual reality: dissociation of response domains," Int. J. Psychophysiol., vol. 110, pp. 47-55, 2016.

[14] F. Gino, A. W. Brooks, and M. E. Schweitzer, "Anxiety, advice, and the ability to discern: Feeling anxious motivates individuals to seek and use advice," J Pers. Soc. Psychol., Vol. 102, pp. 497–512, 2012.

[15] T. W. Buchanana, J. S., Laures-Gore, and M. C. Duff, "Acute stress reduces speech fluency," Biol. Psychol., Vol. 97, pp. 60–66, 2014.

[16] T. W. Buchanana, J. S., Laures-Gore, and M. C. Duff, "Acute stress reduces speech fluency," Biol. Psychol., Vol. 97, pp. 60–66, 2014.

[17] B. Reeves and C. Nass,. The media equation: How people treat computers, television, and new media like real people and places. Stanford, CA: Center for the Study of Language and Information, 1996.

[18] C. Nass and Y. Moon, "Machines and mindlessness: Social responses to computers,"J Soc. Issues, Vol. 56, pp. 81-103, 2000.

[19] C. Kirschbaum, K. M. Pirke, and D. H. Hellhammer. "The 'Trier Social Stress Test'——a tool for investigating psychobiological stress responses in a laboratory setting," Neuropsychobiology, Vol. 28, pp. 76-81, 1993.

[20] Y. Shiban, J. Diemer, S. Brandl, R. Zack, A. Mühlberger, and Wüst, S. "Trier social stress test in vivo and in virtual reality: dissociation of response domains," Int. J. Psychophysiol., Vol. 110, pp. 47-55, 2016.

[21] S. Het, N. Rohleder, D. Schoofs, C. Kirschbaum, and O. T. Wolf, "Neuroendocrine and psychometric evaluation of a placebo version of the'Trier Social Stress Test'," Psychoneuroendocrino., Vol. 34, pp. 1075-1086, 2009.

[22] C. Kirschbaum, K. M. Pirke, and D. H. Hellhammer. "The 'Trier Social Stress Test'——a tool for investigating psychobiological stress responses in a laboratory setting," Neuropsychobiology, Vol. 28, pp. 76-81, 1993.

[23] C. Kirschbaum, K. M. Pirke, and D. H. Hellhammer. "The 'Trier Social Stress Test'——a tool for investigating psychobiological stress responses in a laboratory setting," Neuropsychobiology, vol. 28, pp. 76-81, 1993.

[24] P. Jönsson, M. Wallergård, K. Osterberg, A. M. Hansen, G. Johansson, and B. Karlson, "Cardiovascular and cortisol reactivity and habituation to a virtual reality version of the Trier Social Stress Test: A pilot study," Psychoneuroendocrino., Vo. 35, pp. 1075-1086, 2010.

[25] C. Kirschbaum, K. M. Pirke, and D. H. Hellhammer. "The 'Trier Social Stress Test'——a tool for investigating psychobiological stress responses in a laboratory setting," Neuropsychobiology, vol. 28, pp. 76-81, 1993.

[26] S. R. Harris, R. L. Kemmerling, and M. M. North, "Brief virtual reality therapy for public speaking anxiety," Cyberpsychol. Behav., Vol. 5, pp. 543-550, 2002.

[27] M. E. Owens and D. C. Beide. "Can virtual reality effectively elicit distress associated with social anxiety disorder?" J. Psychopathol. Behav., Vol. 37, pp. 296-305, 2015.

[28] S. G. Hofmann and P. M. Dibartolo, "An instrument to assess self-statements during public speaking: scale development and preliminary psychometric properties," Behav. Ther., Vol. 31, pp. 499–515, 2000..

[29] P. L. Anderson, B. O. Rothbaum, and L. F. Hodges, "Virtual reality exposure in the treatment of social anxiety," Cogn. Behav. Pract., Vol. 10, pp. 240–247, 2003.

[30] P. L. Anderson, E. Zimand, L. F. Hodges, and B. O. Rothbaum, "Cognitive behavioral therapy for public-speaking anxiety using virtual reality for exposure," Depress. Anxiety, Vol. 22, pp.156-158, 2005

[31] M. E. Owens and D. C. Beide. "Can virtual reality effectively elicit distress associated with social anxiety disorder?" J. Psychopathol. Behav., Vol. 37, pp. 296-305, 2015.

[32] S. G. Hofmann and P. M. Dibartolo, "An instrument to assess self-statements during public speaking: scale development and preliminary psychometric properties," Behav. Ther., Vol. 31, pp. 499–515, 2000.

[33] J. N. Hook, C. A. Smith, and D. P. Valentiner, "A short-form of the Personal Report of Confidence as a Speaker," Pers. Individ. Dif., Vol. 44, pp. 1306-1313, 2008.

[34] G. C. Phillips, G. E. Jones, E. J. Rieger, and J. B. Snell, "Normative data for the personal report of confidence as a speaker. J. Anxiety Disord., Vol. 11, pp. 215-220, 1997.

[35] J. N. Hook, C. A. Smith, and D. P. Valentiner, "A short-form of the Personal Report of Confidence as a Speaker," Pers. Individ. Dif., Vol. 44, pp. 1306-1313, 2008.

[36] M. Roberto and D. Mercedes, "Social communication fears-Factor analysis & gender invariance of the short-form of the personal report of confidence as a speaker in Spain," Pers. Individ. Dif., Vol. 55, pp. 680–684, 2013.

[37] T. W. Buchanana, J. S., Laures-Gore, and M. C. Duff, "Acute stress reduces speech fluency," Biol. Psychol., Vol. 97, pp. 60–66, 2014

[38] T. W. Buchanana, J. S., Laures-Gore, and M. C. Duff, "Acute stress reduces speech fluency," Biol. Psychol., Vol. 97, pp. 60–66, 2014.

[39] M. W. Cody and B. A. Teachman, "Global and local evaluations of public speaking performance in social anxiety," Behav. Ther., Vol. 42, pp. 601–611, 2011.

[40] D. V. Cicchetti, "Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology," Psychol. Assess., Vol. 6, pp. 284–290, 1994.

[41] G. S. Sanders, "Driven by distraction: An integrative review of social facilitation theory and research," J. Exp. Soc. Psychol., Vol. 17, pp. 227-251, 1981.

[42] S. S. Dickerson and M. E. Kemeny, "Acute stressors and cortisol responses: a theoretical integration and synthesis of laboratory research," Psychol. Bull., Vol. 130, pp. 355-391, 2004.

[43] B. Reeves and C. Nass,. The media equation: How people treat computers, television, and new media like real people and places. Stanford, CA: Center for the Study of Language and Information, 1996.

[44] C. Nass and Y. Moon, "Machines and mindlessness: Social responses to computers,"J Soc. Issues, Vol. 56, pp. 81-103, 2000.

[45] O. D. Kothgassner, A. Felnhofer, H. Hlavacs, L. Beutl, R. Palme, I. Kryspin-Exner, and L. M. Glenk, "Salivary cortisol and cardiovascular reactivity to a public speaking task in a virtual and real-life environment," Comput. Hum. Behav., Vol. 62, pp. 124-135, 2016.

[46] Y. Shiban, J. Diemer, S. Brandl, R. Zack, A. Mühlberger, and Wüst, S. "Trier social stress test in vivo and in virtual reality: dissociation of response domains," Int. J. Psychophysiol., vol. 110, pp. 47-55, 2016.

Music Preferences, Lifestyle, Leisure Activities and Personality Traits.

A Cross-Sectional Research on a Group of Italian Adults

Monica Pellerone, Riccardo Granà, Simona Migliorisi
and Calogero Iacolino
Faculty of Human and Social Sciences
"Kore" University of Enna
Enna, Italy

Abstract— **The present study explored the relationship between personality traits, preferences towards specific musical genres, attitudes and beliefs about various lifestyle and leisure activities. The study was conducted on a group of 91 Italian students from "Kore" University, aged between 19 and 37 (*M* = 23.70; *SD* = 3.71), of which 71 boys and 20 girls. Participants completed the following instruments: an ad hoc questionnaire to identify attitudes and beliefs about various lifestyle and leisure activities; Big-Five Questionnaire 2; and Short Test of Music Preferences. Results indicated that participants listened to music more often than any of the other activities (for example watching television, reading books, and watching movies) across all the situations. Confirming the literature, data underlined that younger participants seemed to manifest a higher preference toward pop music than older ones. Data underlined that attitudes and beliefs about various lifestyle and leisure activities seemed to influence personality traits; furthermore, analyses showed the presence of a correlation between personality traits and music preferences. Results confirmed that music preferences are at least as important as or more important than the other seven domains, supporting our belief that music is an important part of people's lives.**

Keywords- identity; personality; music; lifestyle.

I. INTRODUCTION

Music is present in the lives of most individuals and is widespread in every culture. Although literature underlines the role of music in clinical research - to enhance concentration and multiple cognitive functions, to create cohesion within groups, to facilitate the social adaptation, and to regulate emotions - its relevance has been underestimated [1].

It is not surprising, then, that listening to music is connected to important moments for many individuals, especially teenagers and young adults, as it contributes to the formation of identity and maintains cohesive groups [2]. Much research has shown that musical preferences reveal much more about personality than preferences for books, clothing, food and television [1,3].

However, despite its pervasiveness, music has remained hidden within social and individual psychology. In fact, as reference [4] has pointed out: -"So powerful is the effect of music ... that one is surprised to find so few researches in the history of psychology and psychotherapy, and theories concerning the use of music."

Since the nineties, researchers have shown a particular interest in musical preferences, defined as an individual variable that differentiates and reflects the various traits of personality [5,6,7]. In particular, the interactionist theories emphasize the presence of ties between a person and one's environment, and suggest that individuals select and create social and physical environments that strengthen and reflect elements of their personality, self and values [8,9,10]. In fact, the few studies that have examined musical preferences suggest some ties with the personological and characteristic aspects of each individual.

Recently, some criticisms have been raised about the lack of attention to the behavior exhibited on a daily basis within social psychology and personality studies. For example, reference [11] has underlined that although there is a wide range of information and studies on the personality structure, the theoretical models relating to relationships between personality and behavior remain subtle. According to the author [11], a way researchers can tackle this problem is to develop their research of the structural components of personality, by introducing the study of different behaviors that are manifested in everyday life, such as listening to music, which is an omnipresent social phenomenon.

II. RELATIONSHIP BETWEEN MUSIC AND PERSONALITY TRAITS

Music can meet a number of needs beyond the social context, in fact, as individuals manage and change their lives

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.3

according to their perception of reality, music can also have a similar function [8,10,12]

For example, a person with a high openness to experience could favor the preference for an artistic and sophisticated musical style. Others may prefer and choose specific musical styles to adjust their emotional states, such as individuals with depressive features, who are prone to a musical style that supports their melancholy mood [3].

Although the psychological and social processes that influence the musical preferences are undoubtedly articulated, it can be assumed that studying the affinities between personality basic traits and musical preferences could shed light on why people listen to a particular type of music [3].

An appropriate method to investigate this particular aspect of individuals is to deepen the study of human personality. In the field of international literature, the study of the relation between musical preferences and aspects of personality has used four fundamental theoretical models: Cattell's theory [13], Eysenck's theory [14], Zucherman's sensation seeking theory [15], and the Big Five model [16].

Reference [13] was the first to theorize the existence of relationships between musical tastes and personality traits. He has argued that various musical preferences can detect the importance of aspects of personality and may provide a gateway to the unconsciousness by offering a series of information that would otherwise be ignored by personality researchers.

In particular, references [17] have been pioneers in the systematic study of personality in relation to musical preferences. In their studies, they asked the participants to indicate the music genres and favorite singer, in order to estimate music preferences and compare them to the aspects of personality. On the basis of their analysis, authors have obtained the profiles of 23 traits of temperamental nature, grouped in 8 categories, namely: intelligence, extroversion, anxiety, certitude, independence, prudence, subjectivity, good education [18].

Instead, according to Eysenck's model, personality is the result of inherited behavioral patterns; in fact, there is a high percentage of genetic elements that influences both temperament and intelligence [14]. The author formulates his theory as a system which provides a complete interpretation of the overall personality and seeks to elaborate general laws regulating individual development and behavior. On this basis, reference [14] has developed a test based on three main factors, which are capable of measuring personality, such as extroversion-introversion, neuroticism and psychoticism, in which: the degree of introversion or extroversion is the result of cortical activation or inhibition; neuroticism has been related to the activity mainly carried out by amygdala and hypothalamus; and psychoticism - difficult theoretical construct – represents a dimension of nonconformity and asociality.

Reference [19], after analyzing Eysenck's model, assumes that people with a stable neurotic temperament prefer a classical and romantic music genre. Classical music has many aspects anchored to form, emotion and sense of aesthetics, as are the central emotional aspects of romantic music. In order to get a list of preferences, the author asked the group of participants to indicate a list of favorite songs and authors, by classifying them in terms of romance and classicism. The results obtained were later compared to the Eysenck's model, confirming the original hypotheses of the research.

Conversely, reference [20], devoted to the study of personality in relation to music, perfected an ad hoc instrument, the *Musical Preference Scale*, which aimed to investigate the relationship between musical preferences and the search for sensations according to the Zuckerman' model of personality [15]. The search for sensations, according to the author, represents a dependent personality variable, which balances the homeostasis of physiological activation levels. Consequently, a persuasive personality with high levels of arousal will be more likely to seek stimulation that attenuates excitement; conversely, a person with a low initiative excitement will seek stronger stimuli in order to increase their activation levels.

Similarly, reference [21] conducted a study aimed at finding positive relationships between search of sensations and preferences for rock music, and negative relationships between search of sensations and preferences for sound tracks. Authors showed that subjects with higher scores in adventure, emotion and quest for experience manifested preferences for folk and classical music, while the more uninhibited ones manifested greater preference for rock music, which can be considered a less conventional and more complex music than the sound tracks music.

More recently, in order to find an integration between personality and musical preferences, research tends to study personality characteristics through the Big Five model, which describes five main personality factors: extroversion, agreeableness, conscientiousness, neuroticism and openness (toward the experience). In particular, reference [22], analyzing musical preferences in relation to the Big Five model, highlighted the presence of significant and positive relationships between: openness and preferences for classical, jazz, soul/rhythm and blues music; extroversion and jazz, though less intense than latter; the search for excitement and hard rock music; and finally, neuroticism and popular music. These results confirm the hypothesis of the presence of a relationship between openness toward experience and different types of music, especially non-conventional, as well as the search for excitement and music with a strong activation potential, and between neuroticism and more conventional forms. The openness toward experience is therefore linked to the enjoyment of a variety of musical forms outside pop, folk and rock music.

III. Objectives and Hypothesis

The present study explores the relationship between personality traits, preferences towards specific musical genres, attitudes and beliefs about various lifestyle and leisure activities, in a group of Italian adults.

According to the literature, we hypothesized that attitudes and beliefs about various lifestyle and leisure activities could influence personality traits, and in particular that: the importance attributed to music could influence Mental

Openness dimension, the importance attributed to movies could influence Mental Openness and Openness to Culture dimensions.

Furthermore, we hypothesized that specific musical preferences could be correlated to personality traits, in particular that: pop music could be correlated to dynamism, and dominance traits, alternative genre could be correlated to high level of dominance, openness to culture and experience, but to a low level of emotion control.

IV. Materials and Methods

Participants and Procedure

The present study was conducted on a group of 91 students from "Kore" University, aged between 19 and 37 (M = 23.70; SD = 3.71), of which 71 boys (78%) and 20 girls (22%).

The data collection lasted about three months, although all research project lasted for one year, conducted between 2015 and 2016. The aims of the study and instruments were explained to participants. The questionnaires were distributed by qualified researchers, and students were given 40 minutes to complete them. The researcher remained at a distance, to guarantee anonymity.

The Internal Review Board (IRB) of Faculty of Human and Social Sciences at the "Kore" University of Enna has approved the present research.

Instruments

For the measurement of the variables, participants completed the following instruments: an ad hoc questionnaire to identify attitudes and beliefs about various lifestyle and leisure activities; Big-Five Questionnaire 2 (BFQ-2); and Short Test Of Music Preferences (STOMP-R).

An ad hoc questionnaire, constructed according to the model of reference [3], is formed by five questions that were designed to assess the participants' attitudes and beliefs about various lifestyle and leisure activities, as follows:

- the first question deals with the importance individuals give to music, using a scale ranging from 1 to 7;
- the second question is about participants' beliefs and how much their musical tastes communicate their self-views, using a scale ranging from 1 (Strongly disagree) to 7 (Strongly agree);
- the third question is about participants' beliefs and how much musical tastes communicate about their personalities and other people's personalities, using a scale ranging from 1 (Strongly disagree) to 7 (Strongly agree);
- the fourth question deals with the importance individuals give to various lifestyle and leisure activities. Participants were presented with a list of eight different activities and were asked to indicate how personally important each domain was to them using a scale ranging from 1 (Strongly disagree) to 7 (Strongly agree);
- finally, using a scale ranging from 1 (Never) to 7 (All the time), participants were asked to indicate the frequency with which they engaged in various activities while in nine different contexts (alone at home, going to sleep, hanging out with friends, driving, getting up in the morning, studying, working, exercising, and getting ready to go out).

BFQ-2 is a questionnaire consisting of 132 items, designed to investigate personality traits, grouped in 10 sub-dimensions: Dynamism, Dominance, Cooperativity, Friendliness, Scrupulosity, Perseverance, Emotion Control, Impulse Control, Openness to Culture and Openness to Experience [23].

It identifies five fundamental dimensions for describing and evaluating each individual's personality:

- Extraversion (E), which is inherent in a confident and enthusiastic orientation towards the various circumstances of life, most of which are interpersonal;
- Amicability (A), which includes, in a pole, features like altruism, caring, giving emotional support, and, at the opposite pole, features such as hostility, indifference to others and selfishness;
- Conscientiousness (C), which refers to features such as accuracy, reliability, responsibility and perseverance;
- Emotional stability (S), which is a very large dimension comprising a variety of features related to anxiety and emotional problems such as depression, instability of mood and irritability;
- Mental Openness (M), which refers to the opening up to new ideas, to the values of others and to their own feelings.

BFQ-2 demonstrated excellent internal consistency (Cronbach alpha values are between 0.60 and 0.90) and good test-retest reliability (Pearson's correlation values are between 0.68 and 0.87). In reference to the group of participants, general item analysis shows good indices of reliability (Table 1).

TABLE I. Reliability of the BFQ-2

Scales	Cronbach alpha
Extraversion	0.71
Amicability	0.53
Conscientiousness	0.62
Emotional stability	0.97
Mental Openness	0.61

STOMP-R was designed to assess music preferences, which are related to personality variables, self-views, and cognitive abilities. The original STOMP [3] is a 14 item scale using 7-point rating. STOMP-R [1] which was used in this study is a 23 item scale, listing various types of music (e.g. rock, punk, jazz). Using 7-point rating scale, ranging from 1= "strongly dislike", to 7= "strongly like", the participant reflected their preferences. Reference [3] derived four different sub-scales from their original questionnaire: Reflective & Complex (such as classical music), Intense & Rebellious (such as rock music), Upbeat

& Conventional (such as pop, country music), and Energetic & Rhythmic (such as hip-hop music). Subsequent analyses suggest that five factors provide a better fit for data; these factors are: Mellow, Unpretentious, Sophisticated, Intense and Contemporary [1].

In reference to the group of participants, general item analysis shows good indices of reliability with Cronbach's coefficients equal to 0.83.

V. Data analysis

All analyses were conducted with SPSS software (v 23.0).

In reference to preliminary data the following analyses were performed: frequency distribution and descriptive analysis, in order to assess attitudes and beliefs about various lifestyle and leisure activities. Furthermore, an univariate analysis of variance (ANOVA) was carried out to measure the influence of age and gender on personality traits and musical preferences.

The multivariate analysis of variance (Manova) was carried out in order to verify the first research hypothesis.

The Pearson's correlation was used in order to verify the second research hypothesis.

VI. Preliminary analyses

To the question "*How much importance do you place on music?*", 40.7% attributed the maximum score (equal to 7), followed by 23.1% which attributed a score of 5, and 22% a score equal to 6.

When the participants were asked: "*How much do you believe music preferences reveal something about yourself?*", 35.2% attributed the score of 6, followed by 24.2% which attributed a score of 5, and 22% a score equal to 7 .

Similarly, to the question "*How much do you believe music preferences reveal something about your own and others' personalities?*", 33% attributed the score of 6, followed by 26.4% which attributed a score of 5, and 20.9% the maximum score (equal to 7).

Tab. 1 shows descriptive analysis relating to the following question: "*How much importance do you place on various lifestyle and leisure activities?"*

TABLE II. How much importance do you place on various lifestyle and leisure activities?

Variables	N	*M.*	*S.D.*
Music	90	5.93	1.28
Movies	90	5.62	1.26
Books	90	5.60	1.42
TV Programs	89	4.73	1.40
Food preferences	89	5.43	1.27
Bedrooms	89	5.55	1.35
Hobbies	89	5.88	1.23
Clothes	89	5.48	1.49

Tab. 2 shows responses that participants reported to the following question: *"In which contexts do you listen to music?"*.

TABLE III. In which contexts do you listen to music?

Variables	N	*M.*	*S.D.*
Alone at home	89	6.24	1.33
Getting up in the morning	89	3.84	2.03
Going to sleep	89	4.36	1.90
Studying	89	6.01	1.54
Working	89	2.39	1.84
Exercising	89	3.18	2.06
Getting ready to go out	89	4.82	1.87
Hanging out with friends	89	4.56	1.90
Driving	89	3.39	1.84

In reference to the personality traits, the univariate analysis of variance (Anova) underlines the influence of age on Dynamism ($F=1.90$, $p<0.05$) and Scrupulosity ($F=1.80$, $p<0.05$); in particular the analysis of the mean scores shows that the younger seem to manifest a higher level of Dynamism than older, which have a higher level of Scrupulosity. The gender variable seems not to influence personality traits ($p=n.s$).

In reference to the musical preferences, the univariate analysis of variance (Anova) underlines the influence of age on ancient genre ($F=1.87$, $p<0.05$) and pop music ($F=1.92$, $p<0.05$); in particular, the analysis of the mean scores shows that the younger seem to manifest a higher preference toward pop music than older, which have a higher preference toward ancient genre. The gender variable seems not to influence musical preferences ($p=n.s$).

VII. Results

In order to verify the first research hypothesis, an multivariate analysis of variance was carried out, which shows how personality traits can be influenced by the following dimensions: the importance attributed to music ($F=1.93$, $p<0.01$), how much musical tastes communicate their self-views ($F=1.86$, $p<0.01$), how much musical tastes reveal something about other people's personalities ($F=2.69$, $p<0.001$); and the importance attributed to movies ($F=1.70$, $p<0.05$), tv programs ($F=1.86$, $p<0.01$), food preferences ($F=1.55$, $p<0.05$), and hobbies ($F=1.76$, $p<0.01$). In particular:

- the importance attributed to music influences Mental Openness dimension ($F=3.00$, $p<0.05$);
- how much musical tastes communicate their self-views influences Openness to Culture ($F=4.67$, $p<0.01$) and Openness to Experience sub-dimensions ($F=3.50$, $p<0.05$);
- how much musical tastes communicate other people's personalities influences Scrupulosity sub-dimension ($F=3.16$, $p<0.05$);
- the importance attributed to movies influences Mental Openness dimension ($F=2.88$, $p<0.05$) and Openness to Culture sub-dimension ($F=5.35$, $p<0.01$);
- the importance attributed to tv programs influences Openness to Culture ($F=2.84$, $p<0.05$);
- the importance attributed to food preferences influences Mental Openness dimension ($F=3.11$, $p<0.05$) and Openness to Culture sub-dimension ($F=3.37$, $p<0.05$);

- the importance attributed to hobbies influences Conscientiousness dimension ($F=2.76$, $p<0.05$).

In order to verify the second research hypothesis, a Pearson's correlation was carried out, which shows the presence of the following correlation: Dynamism with soul music ($r=-.24$, $p<0.05$); Dominance with alternative ($r=.23$, $p<0.05$) and pop music ($r=.22$, $p<0.05$); Cooperativity with ancient ($r=-.26$, $p<0.05$) and pop music ($r=.23$, $p<0.05$); Amicability with alternative ($r=.26$, $p<0.05$), folk ($r=.23$, $p<0.05$), rock ($r=.23$, $p<0.05$) and soul music genres ($r=.27$, $p<0.05$); Scrupulosity with alternative ($r=-.34$, $p<0.01$), country ($r=.25$, $p<0.05$), punk ($r=.25$, $p<0.05$), and soul music ($r=.30$, $p<.01$); Perseverance with classical ($r=.26$, $p<0.05$) and country music ($r=-.23$, $p<0.05$); Emotion Control with alternative ($r=-.49$, $p<0.001$) and opera genres ($r=.24$, $p<0.05$); Impulse Control with blues music ($r=.24$, $p<0.05$); Openness to Culture with alternative ($r=.27$, $p<0.05$) and blues music ($r=.27$, $p<0.05$); finally, Openness to Experience with alternative ($r=.50$, $p<0.001$), dance ($r=.25$, $p<0.05$), foreign ($r=.24$, $p<0.05$), and punk music ($r=.22$, $p<0.05$).

VIII. Conclusion and Discussion

The primary purpose of this research was to examine the relationship between personality traits, preferences towards specific musical genres, attitudes and beliefs about various lifestyle and leisure activities, in a group of Italian adults.

The preliminary analysis indicates that music is the most important among leisure activities, followed by hobbies and movies.

Furthermore, participants believed that their music preferences revealed a substantial amount of information about their own personalities and the personalities of other people.

Data confirmed that music is part of the life of most individuals, and is often heard during many moments of the day, for example alone while studying, driving or getting ready to go out.

Confirming the literature, data underline that younger participants seem to manifest a higher preference toward pop music than older ones, who have a higher preference toward ancient genre, although the gender seems not to influence musical preferences.

Confirming the first research hypothesis, attitudes and beliefs about various lifestyle and leisure activities seem to influence personality traits [24]. In particular individuals characterized by mental openness tend to attribute importance to music, movies and food. Similarly, individuals with a high level of openness to culture and experience believe that music preferences could communicate their self-views; although, the importance attributed to movies, tv programs and food only seems to influence openness to culture. Finally, individuals characterized by a high level of scrupulosity tend to believe that music preferences could reveal something about other people's personalities [25].

According the second research hypothesis, data show the presence of correlation between personality traits and music preferences; in particular pop music seems to be preferred by individuals characterized by dynamism, dominance and cooperativity; alternative genre appears to be preferred by adults with a high level of dominance, scrupulosity, openness to culture and experience, but with a low level of emotion control. Furthermore, the funk genre is preferred by individuals characterized by scrupulosity and openness to experience; similarly, country and classical music is preferred by perseverant and scrupulous subjects; finally, blues is the music genre preferred by individuals characterized by pulse control and openness to culture; conversely, openness toward experience seems to be correlated to preferences toward dance and foreign music.

Confirming literature[3], data suggest that individuals who enjoy listening to conventional music - such as pop and country genres - are cheerful, socially outgoing and with the tendency to enjoy helping others; they also are perseverant and scrupulous subjects. Furthermore, individuals who prefer the intense and rebellious genres - such as alternative music - tend to be curious about different things, enjoy taking risks, are active, and consider themselves dominant and open to culture and experience.

Disconfirming the literature [3,26], individuals who enjoy listening to reflective and complex music - such as classical and blues genres - tend to be perseverant and scrupulous, with a high ability to control their impulse.

Finally, individuals who enjoy energetic and rhythmic music - such as funk and dance genres - tend to be talkative, full of energy, tend to eschew conservative ideals and to manifest openness toward experience [27,28].

Using a broad and systematic selection of music genres and personality dimensions, the results from the present study shed light on the variables that link individuals to their music of choice. Across the sample of college students, relationships between music preferences and existing personality dimensions, self-views, and cognitive abilities were identified.

The present research provides a foundation on which to develop such a framework. Future research can build on this foundation by including a wider array of music from various genres and by exploring music preferences across generations, cultures, and social contexts. Such work will serve to inform an understanding of the nature of music preferences and music's importance in people's lives.

Generally, the present study provides support for the research hypotheses, although some limitations need to be better addressed by future research, such as the absence of a sampling method, which prevents the presence of a representative sample, the generalization of the results, and the external validity.

Furthermore, results should be interpreted with caution due to the participants involved, in particular because of the presence of a greater number of women than men in both groups of the sample, which makes generalizations difficult.

Furthermore, the use of a cross-sectional design is not sufficient for establishing a causal relationship. In this sense, future research should conduct studies in other cultural contexts, not belonging to Mediterranean regions, in order to

compare different cultural patterns with the object of enriching the database and facilitating the identification of further variables that contribute to generating positive outcomes [29].

REFERENCES

[1] P.J. Rentfrow, L. R. Goldberg, and D. J. Levitin, "The structure of musical preferences: a five-factor mode", *Journal of Personality and Social Psychology*, 2011.

[2] M.Mehl, and J. Pennebaker, "The sounds of social life: a psychometric analysis of students' daily social environments and natural conversations", *Journal of Personality and Social Psychology,* 84, pp. 857–870, 2003.

[3] P. J. Rentfrow, and S. D. Gosling, "The Do Re Mi's of Everyday Life: The Structure and Personality Correlates of Music Preferences", *Journal of Personality and Social Psychology,* 84, pp. 1236-1256, 2003.

[4] R. B. Cattell and R. D. Saunders, "Musical preferences and personality diagnosis: A factorization of one hundred and twenty themes", *Journal of Social Psychology,* 39, 3-24, p.3, 1954.

[5] P. Little, and M. Zuckerman, "Sensation seeking and music preferences", *Personality and Individual Differences,* 7, pp. 575–577, 1986.

[6] W. McCown, R. Keiser, S. Mulhearn, and D. Williamson, "The role of personality and gender in preferences for exaggerated bass in music", *Personality and Individual Differences,* 23, pp. 543–547, 1997.

[7] T. O. Robinson, J. B. Weaver, and D. Zillmann, "Exploring the relation between personality and the appreciation of rock music", *Psychological Reports,* 78, pp. 259–269, 1996.

[8] S. D. Gosling, S. J. Ko, T. Mannarelli, and M. E. Morris, "A room with a cue: Judgements of personality based on offices and bedrooms", *Journal of Personality and Social Psychology,* 82, pp. 379-398, 2002.

[9] W. B. Swann "Identity negotiation: Where two roads meet", *Journal of Personality and Social Psychology,* 53, pp. 1038-1051, 1987.

[10] W. B. Swann, P. J. Rentfrow, and J. S. Guinn, "Self-verification: the search for coherence", in *Handbook of self and identity*, M. Leary and J. Tagney, 2002, pp. 89-132.

[11] D. C. Funder, "Personality", *Annual Review of Psychology,* 52, 2001.

[12] M. Snyder, and W. Ickes, "Personality and social behavior", in *Handbook of Social Psychology*, vol. 2, G. Lindzey and E. Aronson, 1985, pp. 883-947.

[13] R. B. Cattell, and P. Kline, "Personality and motivation", "Personalità e motivazione". Bologna: Il Mulino, pp. 135-157, 1982. Italian

[14] H. J. Eysenck, "The structure of human personality", New York: Macmillan, 1960, pp. 125-152.

[15] M. Zuckerman, "Sensation seeking: beyond the optimal level of arousal", Hillsdale, N.J.: Erlbaum, 1979, pp. 45-62.

[16] L. R. Goldberg, "The structure of phenotypic personality traits", *American Psychologist*, 48, pp. 26–34, 1993.

[17] R. B. Cattell, and R. D. Saunders, "Musical preferences and personality diagnosis: a factorization of one hundred and twenty themes", *Journal of Social Psychology,* 39, pp. 3-24, 1954.

[18] G. Caprara and A. Gennaro, "Psychology of npersonality", "Psicologia della personalità", Bologna: Il Mulino, pp. 58-72, 1994.

[19] E. Payne, "Musical taste and personality", *British Journal of Psychology,* 58, pp. 133-138, 1967.

[20] M. Zuckerman, "Behavioral expressions and biological bases of sensation seeking", Cambridge: University Press, 1994, pp. 26-45.

[21] P. Litle, and M. Zuckerman, "Sensation seeking and music preferences", *Personality and Social Psychology,* 20, pp. 33-45, 1986.

[22] S. Dollinger, "Research note: personality and music preference: extraversion and excitement seeking or openness to experience?", *Psychology of Music,* 21, pp. 73–77, 1993.

[23] G. V. Caprara, C. Barbaranelli, L. Borgogn, and M.Vecchione, "BFQ-2", Firenze: OS, 2007.

[24] M. J. M. H. Delsing, T. F. M. Ter Bogt, R. C. M. E. Engels, and W. H. J. Meeus, "Adolescents' Music Preferences and Personality Characteristics", *European Journal of Personality*, 22, 109–130, 2008.

[25] F. S. Barrett, K. J. Grimm, R. W. Robins, D. T. Wildschut, C. Sedikides, & P. Janata, "Music-Evoked Nostalgia: Affect, Memory, and Personality", *Emotion*, 10, No. 3, pp. 390-403, 2010.

[26] T. Chamorro-Premuzic, and A. Furnham, "Personality and music: can traits explain how people use music in everyday life?", *British Journal of Psychology*, 98, 2, pp. 175-185, 2007.

[27] P. G. Dunn, B. de Ruyter, & D. G. Bouwhuis, "Toward a better understanding of the relation between music preference, listening behavior, and personality", *Psychology of Music*, 40, No. 4, pp. 411-428, 2012.

[28] A. Bonneville-Roussy, P. J. Rentfrow, M. K. Xu, & J. Potter, "Music through the ages: Trends in musical engagement and preferences from adolescence through middle adulthood", *Journal of Personality and Social Psychology*, 105, No. 4, pp. 703–717, 2013.

[29] M. Pellerone, M. Cascio, G. Costanzo, A. Gori, U. Pace, and G. Craparo, "Alexithymia and psychological symptomatology: a research conducted on a non-clinical group of Italian adolescents", *International Journal of Culture and Mental Health,* 10, 3, pp. 300-309, 2017.

Pattern Recognition for Identifying Mathematically Gifted Children

Yan Kong, Fen Zhu
Department of Humanities and Social Science
University of Science and Technology of China
Hefei, China

Benny Y.C. Hon
Department of Mathematics
City University of Hong Kong
Hong Kong SAR, China

***Abstract*—The study aims at proving that pattern recognition is a key factor in the identification of mathematically gifted children. The identification tools include one questionnaire for parents on the behavior of their children (N=212) in childhood stage and three tests for evaluating memory, computing, and pattern recognition ability of their children in mathematics. The nested structure of the data including demographic variables as controls were analyzed based on our recently developed theoretical framework on giftedness. Findings showed that: i) pattern recognition ability was a core variable to distinguish mathematically gifted children in the discriminant function; ii) memory and computing were important auxiliary variables respectively.**

Keywords-pattern recognition, mathematically gifted children

I. INTRODUCTION

To a large extent the cultivation of top talent determines the competitiveness of a nation. As the subject of science and technology, mathematics is always considered to be a important standard to evaluate the talent. Recently, many countries have paid more attention to the cultivation of mathematics gifted children since the spread of STEM education. However, due to their "strange" way of thinking and unusual behavior, mathematics gifted children are often seen as "problem children" in the school during the process of practical education. Additionally, the definition of "giftedness" and "talent" has still been controversial over these years. Thus, it is indeed unfortunate that there is no standard method to identify mathematics gifted children until now.

II. DEVELOPMENT OF MATHEMATICAL GIFTEDNESS

Since Lewis Terman linked up the giftedness and intelligence quotient (IQ), he designed the Stanford-Binet IQ test as the first measurement of the gifted children based on the Binet-Simon Intelligence Scale. He defined that children, whose IQ was 140 of above, were called "gifted" [1]. At that time, mathematical giftedness was equal to high intelligence. But in IQ test, which was commonly used to categorize the various abilities of children, the truly mathematically gifted children could not be identified due to the intrinsic weakness of these in learning languages at their early childhood ages. In the middle of 20th century, the level of difficult mathematical problem-solving ability related to mathematical giftedness. Soon afterward, Stanley underlined the importance of mathematical reasoning [2], as opposed to the skillful use of algorithms, in distinguishing the mathematically gifted children. With the emergence and development of multiple intelligence theory, the late study starts to focus on the mathematical ability, such as calculating, logical, and reasoning and so on [3]. However, on some large projects, the common tool used for identification of the giftedness is still Wechsler tests (child and adult), which had a standard score ceiling of 160 [4]. This study will reveal some shortages of a traditional test for mathematically gifted children and find a convincing identification method, or ensure some indices for the future work at least.

III. PATTERN RECOGNITION IN MATHEMATICS

In 1986, Simon firstly put forward the concept of pattern recognition, which can be used to explain intuitive, or equal to intuitive, can explain why those particular talents have a very good memory [5]. An early but classic research by Krutetskii revealed that the individuals with high-level mathematical performance linked to a set of qualities including the ability to comprehending formal structure, reasoning logically, thinking critically, and generalizing rapidly [6]. Miller also pointed out that mathematically gifted students usually have the ability in seeking patterns and associations [7].

Pattern recognition is a cognitive concept which originated from psychology and now widely used in the areas of computer science and mathematically learning theory. In the field of cognitive psychology, pattern recognition ability is the fundamental human cognition or intelligence, which stands heavily in various human activities. It refers to a process of in putting stimulating information and matching with the information in long-term memory, and recognizing the category which the stimulation belongs to [8]. In math, pattern recognition is just like spatial ability, which will show different signs at the different stage [9]. It can be measured through the construction, separation, and fold of polygonal graphics in middle and primary school stage.

IV. THEORETICAL FRAMEWORK

It will be impossible to give a precise definition of giftedness because the cutting edges depend on many factors

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.7

such as geographical, national and traditional variances. However, some observable facts that mathematically gifted children exert certain kinds of characteristics that lead us to give in the following a mathematical-like formal definition of giftedness.

Acknowledging of the difference between giftedness and talent is the premise of the new theory. In the differentiated model of Giftedness and Talent, giftedness designates the possession and use of untrained and spontaneously expressed natural abilities, in at least one domain, to the degree that places an individual at least among the top 10 per cent of age peers. Talent designates the outstanding mastery of systematically developed abilities in at least one field of human activity to the degree that places an individual at least among the top 10 per cent of age peers who are or have been active in that field or fields [10]. To define both capabilities, we follow the law of normal distribution to describe the difference between these two factors. Let G = {G1, G2, G3 …} denotes the set of all possible areas of giftedness. Suppose some kinds of testing tools have been used to a population P of persons with all the achievement scores mean μi and standard deviation σi of Gi available. A person in the population P is said to be gifted in Gi if his score in Gi falls above the third standard deviation $(\mu i + 3\ \sigma i, \infty)$ and is said to be talented in Gi if his score in Gi falls above the second standard deviation interval $(\mu i + 2\ \sigma i, \infty)$. In other words, approximately the top 2.3% population will be classified to be talented in each area whereas the further top 0.15% is gifted. From the definitions, gifted implies immediately talented who may become gifted, which is a reason why the two terms are messed up in our daily usage.

Based on the normal definition of gifted and talented, we categorize the giftedness G in the following:

- G1 = Memory
- G2 = Learning/Processing Power
- G3 = Pattern Recognition
- G4 = Sensitivity Power
- G5 = Linguistic Power
- G6 = Musical Power
- G7=Artistic Power (creative)
- G8=Bodily-Kinesthetic Power

According to experiential structuralism theory, the human mind is organized into three levels [11].The third level of mind refers to the speed of processing, control of processing, and storage. Speed and memory have been found to be essential abilities that complement skills in persons with remarkable mathematical behavior. In the new theoretical framework, memory is highlighted to be crucial to receive and store old information and processing power is unavoidable to analyze the information for advance development. In other words, the giftedness G1 in memory is a necessary condition for a gifted child. More precisely speaking, a person must be at least talented in G1 to be called gifted/talented in a discipline.

The achievement score value of a person in area G1 (memory/processing power) should come from the unknown overall structure of neurons and neural network of his brain. The values of the other areas, except G3, in related to different parts of the brain have intensively been studied in the fields of neuroscience, psychology, and gifted education. This paper wishes to emphasize in the following that G3 is the principal area of giftedness without which one cannot be classified to be mathematically gifted.

From the above discussion, we define that a mathematically gifted person is a person with at least talented in G1 and gifted in G3.

Due to the similar structure of human brain, it will be rare to have a person gifted in more than two areas of giftedness. For instance, a mathematically gifted person will have reasonably good achievement in G3 but performs poorly in other remained areas, in particularly G7 and G8. That explains why it is rare to have a gifted mathematician from outstanding athletes or artists. Most mathematically gifted persons are called “high-IQ-low-EQ.” This strange phenomenon can be explained by the fact that the giftedness in G3 of a mathematically gifted person motivates his whole life focusing on understanding the beauty of the universe in pattern-sense and hence his development in those emotional quality activities will be weakened.

A person is said to be gifted in multi-talents if he or she is talented in many areas of giftedness. These multi-talented can usually be found from the elite class of outstanding students of schools/universities and best employees of companies. To the society, these multi-talented persons will serve as CEO, professionals, and engineers. Their high memory power and robust talents plus stable emotion will lead them to succeed as leaders in various disciplines. On the contrary, those single-gifted persons, such as mathematically gifted persons, will suffer from compromising with others due to their weakness in emotional quality and communication skill. It is hope in the authors’ mind that these single-gifted persons if an opportunity is allowed will reward the society with the development of new science and technology from their giftedness. Unfortunately, most of these single-gifted children will not even be admitted into the university due to their lack of compromising ability to the strict requirement of general knowledge.

V. CURRENT RESEARCH

A. Basic information

The research conducted experiments in some volunteered secondary school. The empirical and analytic methodological approach included four parts, which were a questionnaire for parents, memory test, logical test and pattern recognition test for students, in an attempt to find the core factors for identifying the mathematical ones. A total of 203 valid questionnaires from 212 students were taken back (95.8%), including 120 boys (59.1%), 83 girls (40.9%). The students who took the test ranked from Grade 4 to Grade 6. The average age of subjects is 11.12.

B. Procedures

The empirical, methodological approach included four stages to obtain corresponding inputs. The details are listed as follows:

- Questionnaires for Parents: There is one checklist designed by the authors to check whether a child has gifted characteristics in his childhood from his daily behaviors. The reliability coefficient of the total questionnaire is 0.72. The core of the questionnaire was comprised of three parts, which reflected the attentiveness, memory and empathy ability of target children in different age.

- Tests for students: There are three different test designed to test children's computing, logical, pattern recognition ability. The core of the test was comprised of 15 questions and the limited time was 45 minutes. Take one of these as an example. The question was asking for matching. It was required the short term memory power of children. Also, children had to analyze difference of answer to seek out the right answer which could be classified as the start point in the identification of gifted children.

- An interview was arranged for selected children' parents and teachers to obtain further information for the confirmation of the preliminary conclusion about the samples.

- A discriminant-function analysis was performed using SPSS to determine the optimum weighting of the predictors examined in the study to distinguish group membership.

C. Results and Analysis

To verify the accuracy of the questionnaires for parents and tests for students, the descriptive statistics about the variables are shown in Table I and Table II respectively. It can be seen from Table I that the parents' score shows a high positive correlation with all the other variables from 0.662 to 0.818. The student' score is also statistically significant with the other three variables from 0.647 to 0.842.

TABLE I. DESCRIPTIVE STATISTICS OF PARENT QUESTIONNAIRE (N=203)

Variable	M	SD	1	2	3	4
1.attentiveness	1.19	0.91	1			
2. memory	1.68	1.28	0.425**	1		
3.empathy	1.92	1.18	0.147**	0.291**	1	
4.questionnaire（total）	4.80	2.47	0.662**	0.818**	0.684**	1

**. Correlation is significant at the 0.01level

*. Correlation is significant at the 0.05 level

TABLE II. DESCRIPTIVE STATISTICS OF STUDENT TESTS (N=203)

Variable	M	SD	5	6	7	8
5.computing	1.98	1.20	1			
6. logical	1.86	1.32	0.497**	1		
7.pattern recognition	0.91	0.82	0.299**	0.420**	1	
8.tests（total）	4.73	2.62	0.779**	0.842**	0.647**	1

**. Correlation is significant at the 0.01level

*. Correlation is significant at the 0.05 level

Fig.1 describes the overall distribution of parent's score and student's score. Based on the results of parent questionnaire and student math test, a deeper analysis was performed from six cases whose scores were both extremely high in both areas. The grouping criteria of high or low score area was the principle of highest and lowest 27% of the total records.

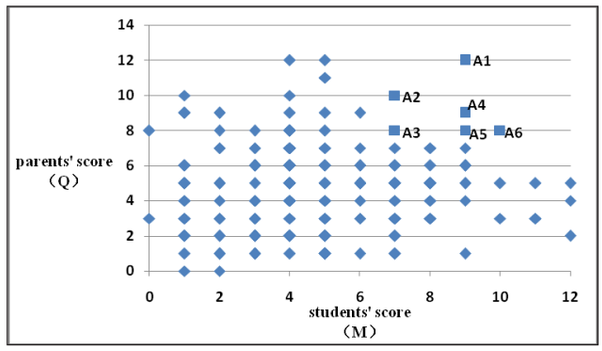


Figure1. Distribution of parents' score and students' score

Based on the theoretical framework on giftedness mentioned before, the top-rightmost corner (marked from A1 to A6), is the area of mathematically gifted children. On the contrary, the lower-rightmost corner (M≤6 & Q≤7) is the area of other gifted children.

To figure out the core factor that related to mathematically giftedness, discriminant function was created to determine the optimum weighting of the predictors examined in the study to distinguish group membership (mathematically gifted or average-ability). Standardized discriminant function coefficients and structure coefficients were achieved together with a classification analysis.

Table III showed that two groups were significantly separated by the discriminant function (Wilk's Lambda=0.837, x2=35.090, p<0.01). The discriminant function made up by these three variables had a good fit. Three significant variables finally retained in the process of stepwise discriminant analysis: memory, pattern recognition, and computing ability.

TABLE III. WILK'S LAMBDA

Test of function	Wilk's Lambda	chi-square	df	Sig
1	0.837	35.090	3	0.000

TABLE IV. STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS AND STRUCTURE COEFFICIENTS

Variable	Standardized Discriminant function	Structure coefficients
memory	0.744*	0.760*
Pattern recognition	0.429*	0.546*
computing	0.389*	0.515*

Table IV described the effect size of three significant variables in the discriminant function. Examination of both the standardized and the structure coefficients indicated that subjects who scored high on memory and pattern recognition are likely to meet the criterion of mathematical giftedness.

A three-step discriminant-function analysis revealed that 76.6% subjects were correctly classified when memory scores were used to predict the group membership; when pattern recognition ability was added, an additional 12.5% was accounted for—89.1% subjects were classified rightly; when computing ability was added, the overall prediction accuracy was 90.0%. The findings indicate that pattern recognition ability has a unique role in the identification of mathematically gifted children, which is beyond the role played by computing ability; and memory is a basic one for distinguishing these groups.

VI. CONCLUSION

With real case experiments, the current study demonstrated that pattern recognition ability is a predictor in identifying mathematically gifted children based on the new theoretical framework on giftedness.

When it comes to the other characteristics suggested by professionals, the characteristics of mathematically gifted or talented children will almost match to the definition of our new theory. Then, comparing the data of research and the definition of the theory, it would be clear to firmly identify the characteristics of mathematically gifted children in their early age which are interest in puzzles or models, refusing sleep, strong memory in map, sensitive towards numbers, weak in languages etc. It is sincerely hoped that teachers, parents or other educators can notice the importance of characteristics of mathematically gifted children; therefore, the mathematically gifted children can be nurtured and receive the fair education in the future.

Instead of forcing children to study, parents are recommended to understand their need first. Although mathematically gifted children have extraordinary ability in seeking the patterns in mathematics, they usually refused to finish the repeated simple arithmetic questions in primary studies and hence misunderstood by teachers and parents. Parents are suggested to explore their knowledge of mathematical giftedness rather than compelling their mathematically gifted children to complete the mathematics questions for school examination. The more interests towards mathematics these mathematically gifted children have, the greater the success they gain in it. When it comes to teachers, the teaching styles or materials towards mathematically gifted children should be flexible. Mathematically gifted children will lose interest in classroom learning due to the mechanical computing methods. As a suggestion, teachers can provide some challenge questions to them in a hope to explore their interest towards mathematics. Also, teachers should identify the difference between mathematically gifted, low intelligence quotient and hyperactive children in an attempt to be sure of the suitable development in children's learning.

References

[1] Terman L M. Mental and Physical Traits of a Thousand Gifted Children.[M]. Appleton-Century-Crofts, 1961.

[2] Krutetskii V A. The Psychology of Mathematical Abilities in Schoolchildren[J]. 1976.

[3] Sowell,E. J., Zeigler, A. J., Bergwall, L., & Cartwright, R. M. Identification and description of mathematically giftedstudents:A review ofempirical research.[J].Gifted Child Quarterly,1990, 34, 147–154.

[4] Heller K A, Mönks F J, Subotnik R, et al. International Handbook of Giftedness and Talent[J]. 2000.

[5] Simon H A. The information processing explanation of Gestalt phenomena[J]. Computers in Human Behavior, 1986, 2(4):241-255.

[6] Stanley J C. Study of Mathematically Precocious Youth (SMPY). Summary of Points Made in the Symposium.[J]. Advanced Placement, 1987:9.

[7] Miller, Richard C. Discovering Mathematical Talent. ERIC Digest[J]. Ability Identification, 1990:5.

[8] Liu G H, Yang J Y. Content-based image retrieval using color difference histogram[J]. Pattern Recognition, 2013, 46(1):188-198.

[9] Waisman I, Leikin M, Leikin R. Brain activity associated with logical inferences in geometry: focusing on students with different levels of ability[J]. ZDM, 2016, 48(3):321-335.

[10] Françoys Gagné. Transforming gifts into talents: the DMGT as a developmental theory1[J]. High Ability Studies, 2004, 15(2):153-155.

[11] Demetriou A, Christou C, Spanoudis G, et al. The development of mental processing: efficiency, working memory, and thinking[J]. Monogr Soc Res Child Dev, 2002, 67(1):i.

Coping with Bipolar Disorder

Lynn Van Camp
Collaborative Antwerp Psychiatric Research Institute (CAPRI), Faculty of Medicine, University of Antwerp.
Psychiatric Hospital Duffel, University Department.
Antwerp, Belgium

Bernard G. C. Sabbe
Collaborative Antwerp Psychiatric Research Institute (CAPRI), Faculty of Medicine, University of Antwerp.
Psychiatric Hospital Duffel, University Department.
Antwerp, Belgium

***Abstract*— How individuals with bipolar disorder cope with stressful life events has an impact on the course of their illness. Ineffective coping strategies can lead to higher relapse rates and worse functional outcome. Our aim was to investigate the coping strategies of inpatients with bipolar disorder, to examine if these strategies are stable over time, and to investigate if coping is associated with mood status. In the current study, 96 inpatients with bipolar I or II disorder completed the Utrecht Coping List at admission (T1) and after three months (T2) of hospitalization. The outcomes were compared with normative data. The results show that inpatients with bipolar disorder have a more avoidant and passive coping style compared to the healthy population. Also, depressed patients used more passive coping in comparison to manic and euthymic patients. No differences in coping styles were found between T1 and T2. These findings create potential intervention targets for use in bipolar disorder. However, this study implicates that without a specific intervention, coping is a trait in bipolar disorder.**

Keywords- bipolar disorder, mood, coping, inpatients, life events, managing.

I. INTRODUCTION

Bipolar disorder is a severe and complex psychiatric illness which is characterized by recurrent episodes of depression, (hypo)mania and mixed episodes [1]. It has an overall estimated lifetime prevalence of 2.8% [2]. An important finding is that almost 50% of the patients who suffer from this severe disorder are unable to keep their mood stable [3]. It is shown that with each depression or (hypo)mania, there is a significant deterioration in quality of life [4] and overall functioning [5]. Relapses of mania and depression can be caused, amongst others, by negative life events [6].

To prevent new episodes of (hypo)mania and depression, individuals with bipolar disorder need to acquire strategies that enable them to respond adequately to difficult situations [7]. The way in how we deal with stressful situations is called coping [8]. Coping is a reaction that is formed after an event has took place that is intended to prevent, avoid, or to keep under control emotional distress [9]. Both effective and poor coping strategies are described in the literature. Overall it is taken that individuals who use an active or an approach and task-oriented coping style tend to react better to life stressors [10]. These strategies are for example: making attempts to alter the problem situation, seeking information, and problem-solving [11]. On the other hand, passive and emotion-oriented coping styles such as rumination are believed to be associated with more distress [12]. Despite its importance, only a few studies have focused on coping in bipolar disorder.

In a recent study [13], the stress-coping behaviors of stable individuals with bipolar disorder were compared to coping in healthy individuals. It was found that in bipolar disorder social coping behaviors such as 'talking something over', 'socializing', and 'journey', were significantly less used in comparison with the healthy control group. In addition, they found that maladaptive strategies, such as smoking, were more frequently applied in bipolar disorder than in healthy controls. In line with the former study, it was found that euthymic outpatients with bipolar disorder apply a more avoidant coping style when confronted with problems and unpleasant events in comparison with a healthy control group [7]. A review [8] regarding coping in affective disorders showed that emotion-oriented and avoidance coping strategies go together with relapses of depressive episodes. A good outcome was associated with problem-focused and task-oriented strategies. However, this review included only two studies that exclusively focused on bipolar disorder. The first found that the level of social functioning was associated with how well individuals with bipolar disorder cope with the prodromes of mania [14]. The other study, from the same research group, found that patients with bipolar disorder who used passive coping strategies had more chance of a depressive relapse [15].

Coping is commonly described as a trait in the general population [16]. However, given the cross-sectional design of former research on coping in bipolar disorder, it is unknown if this also applies to this specific population. Another limitation of previous research is the inclusion of exclusively stable patients. Therefore, it is unclear if coping is associated with current mood status in bipolar disorder. This study seeks to fill in these lacunae by investigating coping in a longitudinal design in inpatients with bipolar disorder.

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.8

II. Method

A. Participants

The current study was approved by the local Ethics Committee of the Antwerp University Hospital, Emmaüs. Data was collected from 95 patients at "De Fase 2"; a University Department of the Psychiatric Hospital Duffel, Belgium. The following inclusion criteria were used: age between 18 and 65, being able to speak and understand Dutch, and having the diagnosis of bipolar disorder I or II, which was given by a psychiatrist according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [17]. The diagnoses were confirmed by a psychologist by means of the Mini International Neuropsychiatric Interview (MINI) [18]. Written informed consent was obtained for all participants. In our sample, the mean age was 41.2 years and 54.7% of the participants were female. Sixty% were diagnosed with bipolar I disorder (n = 57), 40% met criteria for bipolar II disorder (n = 38).

B. Measures

1) Coping styles

The coping styles of the inpatients were assessed by use of the Utrecht Coping List (UCL) [19]. The UCL is a self-report questionnaire and consists of 47 items concerning the way individuals would cope with a problem. Each statement is rated on a four-point scale ranging from 1 = rarely or never to 4 = very often. The UCL consists of seven subscales, which are subdivided into three passive and four active coping styles. The active coping styles are: active approach, seeking social support, expression of emotions, and reassuring thoughts. Avoidance, passive reaction and palliative reaction are thought to reflect more passive coping styles. The internal consistency of the UCL in the current study was moderate to good (α = .78). We compared our results to the mean scores of the norm groups in the manual of the UCL [19]. Because coping styles significantly differ between the two sexes [19], we made a distinction between men and women in our analyses.

2) Affective status

The Young Mania Rating Scale (YMRS) [20] was used to assess current symptoms of (hypo)mania. It consists of 11 items, and it was administered by a psychologist. Depressive symptoms were assessed by means of the Hamilton Depression Rating Scale (HDRS) [21]. The HDRS was clinician administers and it consists of 17 items. Both mood scales were administered at admission at the University ward of the psychiatric hospital. In our analyses, we subdivided the patients based on their scores on the mood questionnaires. The mood states were defined as follows: (1) euthymia, HDRS & YMRS total < 8; (2) depression: HDRS total > 16 and YMRS total < 12, (3) (hypo)mania: HDRS total < 17 and YMRS total > 12. Patients with subthreshold symptoms were attributed to the depression or the (hypo)mania group based on the clinical impression.

3) Procedure

At admission patients underwent a psychiatric interview by means of the MINI [18]. In addition, their mood states were defined by means of the HDRS [21] and the YMRS [20]. The coping styles of the participants were assessed at admission (T1) and after three months of hospitalization (T2).

During hospitalization the patients underwent a psychotherapeutic treatment that included cognitive training, metacognitive training (MCT) [22], and psycho-education.

C. Statistics

The analyses were done using the Statistical Package for Social Science [23], version 22. Statistical significance was defined at the 5% level for two tailed tests. One-sample *t* tests were conducted to compare the scores of the general population on the UCL with those of the participants. Paired sample *t* tests were used to examine if the coping styles changed over time in the patients with bipolar disorder. To assess if mood states were associated with coping, One-way ANOVA Tests were preformed. To further analyze the association between mood and coping, Pearson Correlations were conducted.

III. Results

A. Comparison of the normative data to the data of the participants

As demonstrated in Table 1, in comparison with the norm group, female inpatients with bipolar disorder significantly use a less active approach ($t(48) = -5.68$, $p < .001$), they have a more avoidant style ($t(48) = 4.3$, $p < .001$), and report more passive and palliative reactions ($t(48) = 8.4$, $p < .001$; $t(48) = 2.5$, $p = < .05$, respectively). With regard to the male participants, more avoidance, more passive and palliative reactions are being reported in comparison with the general population ($t(41) = 6.3$, $p < .001$), ($t(42) = 9.7$, $p < .001$; $t(41) = 6.7$, $p < .001$, respectively).

B. Longitudinal assessment of coping

When comparing the data of the UCL at admission and after three months of hospitalization, no difference was found for any of the coping domains. These results are captured in Table 2.

Table 1. Comparison of coping styles between the norm group of the UCL manual (age 19 to 65) and the patient group.

	Normative data M (SD)	BD M (SD)
Females ($N = 52$)		
Active approach	19.3 (5.1)	16.10 (3.9)***
Seeking social support	14.5 (4.9)	14.22 (4.5)
Expression of emotions	6.4 (2.3)	5.98 (1.9)
Reassuring thoughts	12.1 (3.8	11.57 (3.5)
Avoidance	15.2 (6.0)	17.55 (3.7)***
Passive reaction	10.9 (5.4)	16.37 (4.5)***
Palliative reaction	17.3 (6.1)	18.71 (3.8)*
Males ($N = 43$)		
Active approach	18.3 (3.5)	17.2 (4.3)
Seeking social support	11.3 (3.0)	12.1 (3.7)
Expression of emotions	6.2 (1.7)	6.36 (2.2)
Reassuring thoughts	11.6 (2.5	11.74 (2.9)
Avoidance	14.8 (3.3)	18.5 (3.7)***
Passive reaction	10.7 (2.9)	17.7 (4.6)***
Palliative reaction	15.5 (3.6)	19.7 (4.1)***

Note. M, mean; SD, Standard Deviation; BD, Bipolar Disorder patients; *, $p < .05$; ***, $p < .001$.

Table 2. Comparison of the sores on the domains of the UCL on T1 and T2.

	T1 M (SD)	T2 M (SD)
Active approach	16.2 (3.7)	16.5 (3.6)
Seeking social support	13.3 (3.5)	13.4 (4.1)
Expression of emotions	5.9 (1.9)	6.1 (2.0)
Reassuring thoughts	11.3 (3.1)	12.1 (2.5)
Avoidance	18.1 (3.0)	16.8 (3.7)
Passive reaction	16.2 (4.4)	14.8 (4.9)
Palliative reaction	18.6 (3.1)	19.0 (3.3)

Note. M, mean; SD, Standard Deviation

C. *Impact of mood on coping*

Corresponding to the affective status at entry, the following groups were formed: euthymia, depression and mania. It was examined if these groups differed regarding their coping styles at T1. As shown in Figure 1, we found that depressed patients have a significant less active approach in comparison with euthymic and manic inpatients with bipolar disorder ($F(2) = 5.4$, $p < .01$, $p < .05$, respectively). Regarding the other coping domains of the UCL, no differences were found.

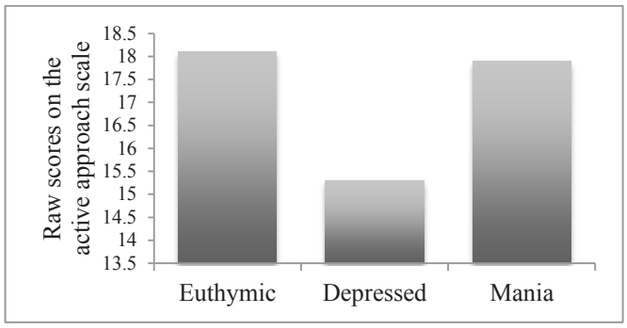


Figure 1. Scores on the active approach scale for euthymic, depressed, and manic patients at entry.

Using Pearson correlation analyses, we found that the HDRS has a significant negative relationship with an active approach ($r = -.29$, $p < .01$), and a positive association with a passive reaction pattern ($r = .38$, $p < .001$). The scores on the YMRS correlate positively with an active approach, expression of emotions, and the use of reassuring thoughts ($r = .27$, $p < .05$; $r = .33$, $p < .01$; $r = .25$, $p < .05$, respectively).

IV. Discussion

To our knowledge, this is the first study that examined the coping styles of inpatients with bipolar disorder in a longitudinal design. Also, it investigated the association between current mood status and coping styles.

Our results show that in comparison with the general population, both females and males with bipolar disorder tend to report a more avoidant coping style and more passive and palliative reactions to a problematic situation. In addition, the female participants of the current study reported a less active approach when confronted with stressful life events. These results are in accordance with a previous study in outpatients with bipolar disorder, where a less active and a more avoidant coping style was found in comparison with the norm group of the UCL [7]. Furthermore, we found that at T1, scores on the HDRS were positively associated with passive coping styles, and the results on the YMRS were positively correlated with an active coping style. In addition, we found that at T1, the depressive group used significantly less active approaches in comparison with euthymic and manic patients.

The former results are in line with research in major depressive disorder, where a clear positive relationship is demonstrated between the prevalence of depressive symptoms and emotion-oriented and avoidance coping strategies [24, 25]. These coping styles include for example leaving the problem to what it is, or redefine a stressful situation rather than to directly tackle the problem [26]. These reactions to stressful life events are thought to represent ineffective coping [10]. It is important to detect these negative approaches to life events, as these could cause a negative spiral, which might support depressive thinking [27].

Furthermore, we found that in bipolar disorder, all the domains of the UCL were stable constructs over a period of

three months. These results are in line with a previous longitudinal study in major depressive disorder [28]. However, there are studies in major depressive disorder were coping is found to be state-dependent as it was related to changes in mood [29, 30]. In the former studies, it was shown that the recovery from depression was associated to a reduction in the use of ineffective emotion-focused coping strategies. A limitation of the current investigation is that it did not include the affective status of the participants at T2. Therefore, future research should explore if a change in depressive or manic symptomatology has an impact on the coping styles of patients with bipolar disorder.

Although patients in the current study received psychotherapeutic training, this therapy did not directly focus on the improvement of the coping strategies. Previous research in schizophrenia and schizoaffective disorder did apply a coping-orientated group therapy. They found that the outcome of the patients after one year was best predicted by their use of active and problem-focused coping strategies [31]. The authors of the former investigation have taken this to indicate that it is of great importance to focus on healthy coping strategies in psychological therapy.

Taken together, it seems that individuals with bipolar disorder apply a non-effective, passive way of coping. Without a specific intervention, this study indicates that coping is a trait-like construct in bipolar disorder. Future research should investigate if individuals with bipolar disorder are able to adapt more effective ways of coping after a coping-orientated therapy.

ACKNOWLEDGMENT

The authors wish to thank the team of the University Department of the Psychiatric Hospital Duffel, “De Fase 2”, for their assistance and collaboration in the collection of the data that was used in the current study.

REFERENCES

[1] American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders (5th ed.). Arlington, VA: American Psychiatric Publishing.

[2] Kessler, R. C., Ormel, J., Petukhova, M., McLaughlin, K. A., Green, J. G., Russo, L. J., ... & Uestuen, T. B. (2011). Development of lifetime comorbidity in the World Health Organization world mental health surveys. *Archives of general psychiatry*, *68*(1), 90-100.

[3] Colom, F., Vieta, E., Tacchi, M. J., Sánchez-Moreno, J., & Scott, J. (2005). Identifying and improving non-adherence in bipolar disorders. *Bipolar disorders*, *7*(s5), 24-31.

[4] Judd, L. L., Akiskal, H. S., Schettler, P. J., Endicott, J., Leon, A. C., Solomon, D. A., ... & Keller, M. B. (2005). Psychosocial disability in the course of bipolar I and II disorders: a prospective, comparative, longitudinal study. *Archives of general psychiatry*, *62*(12), 1322-1330.

[5] MacQueen, G. M., Young, L. T., Robb, J. C., Marriott, M., Cooke, R. G., & Joffe, R. T. (2000). Effect of number of episodes on wellbeing and functioning of patients with bipolar disorder. *Acta Psychiatrica Scandinavica*, *101*(5), 374-381.

[6] Koenders, M. A., Giltay, E. J., Spijker, A. T., Hoencamp, E., Spinhoven, P., & Elzinga, B. M. (2014). Stressful life events in bipolar I and II disorder: cause or consequence of mood symptoms?. *Journal of affective disorders*, *161*, 55-64.

[7] Goossens, P. J., Van Wijngaarden, B., Knoppert-Van Der Klein, E. A., & Van Achterberg, T. (2008). Family caregiving in bipolar disorder: caregiver consequences, caregiver coping styles, and caregiver distress. *International Journal of Social Psychiatry*, *54*(4), 303-316.

[8] Christensen, M. V., & Kessing, L. V. (2005). Clinical use of coping in affective disorder, a critical review of the literature. *Clinical Practice and Epidemiology in Mental Health*, *1*(1), 20.

[9] Pearlin, L. I., Schooler, C. (1987) The structure of coping. *J Health Soc Behav, 19*, 2 – 21.

[10] Folkman, S., & Lazarus, R. S. (1988). The relationship between coping and emotion: Implications for theory and research. *Social science & medicine*, *26*(3), 309-317.

[11] Ray, C., Lindop, J., & Gibson, S. (1982). The concept of coping. *Psychological Medicine*, *12*(2), 385-395.

[12] Matsushita, T., Matsushima, E., & Maruyama, M. (2005). Psychological state, quality of life, and coping style in patients with digestive cancer. *General hospital psychiatry*, *27*(2), 125-132.

[13] Moon, E., Chang, J. S., Choi, S., Ha, T. H., Cha, B., Cho, H. S., ... & Ha, K. (2014). Characteristics of stress-coping behaviors in patients with bipolar disorders. *Psychiatry research*, *218*(1), 69-74.

[14] Lam, D., & Wong, G. (1997). Prodromes, coping strategies, insight and social functioning in bipolar affective disorders. *Psychological medicine*, *27*(5), 1091-1100.

[15] Lam, D., Wong, G., & Sham, P. (2001). Prodromes, coping strategies and course of illness in bipolar affective disorder–a naturalistic study. *Psychological medicine*, *31*(8), 1397-1402.

[16] Endler, N. S., & Parker, J. D. (1990). Multidimensional assessment of coping: a critical evaluation. *Journal of personality and social psychology*, *58*(5), 844.

[17] American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

[18] Lecrubier, Y., Sheehan, D. V., Weiller, E., Amorim, P., Bonora, I., Sheehan, K. H., ... & Dunbar, G. C. (1997). The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI. *European psychiatry*, *12*(5), 224-231.

[19] Schreurs, P. J. G., Van de Willige, G., Brosschot, J. F., Tellegen, B., & Graus, G. M. H. (1993). *De Utrechtse coping lijst: omgaan met problemen en gebeurtenissen*.

[20] Young, R. C., Biggs, J. T., Ziegler, V. E., & Meyer, D. A. (1978). A rating scale for mania: reliability, validity and sensitivity. *The British Journal of Psychiatry*, *133*(5), 429-435.

[21] Hamilton, M. (1960). A rating scale for depression. *Journal of neurology, neurosurgery, and psychiatry*, *23*(1), 56.

[22] Moritz, S., & Woodward, T. S. (2007). Metacognitive training in schizophrenia: from basic research to knowledge translation and intervention. *Current Opinion in Psychiatry*, *20*(6), 619-625.

[23] IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp

[24] Dekker, J., & Oomen, J. (1999). Depression and coping. *The European journal of psychiatry*, *13*(3), 183-189.

[25] McWilliams, L. A., Cox, B. J., & Enns, M. W. (2003). Use of the Coping Inventory for Stressful Situations in a clinically depressed sample: Factor structure, personality correlates, and prediction of distress. *Journal of Clinical Psychology*, *59*(4), 423-437.

[26] Lazarus, R. S., & Folkman, S. (1987). Transactional theory and research on emotions and coping. *European Journal of personality*, *1*(3), 141-169.

[27] Pyszczynski, T., & Greenberg, J. (1992). Consequences of Self-Regulatory Perseveration: The Depressive Spiral. In *Hanging On and Letting Go* (pp. 77-93). Springer New York.

[28] Yamada, K., Nagayama, H., Tsutiyama, K., Kitamura, T., & Furukawa, T. (2003). Coping behavior in depressed patients: A longitudinal study. *Psychiatry Research*, *121*(2), 169-177.

[29] Ravindran, A. V., Griffiths, J., Waddell, C., & Anisman, H. (1995). Stressful life events and coping styles in relation to dysthymia and major depressive disorder: variations associated with alleviation of symptoms following pharmacotherapy. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *19*(4), 637-653.

[30] Uehara, T., Sakado, K., Sato, T., & Takizawa, R. (2002). Coping measurement and the state effect of depression and anxiety in psychiatric outpatients. *Psychopathology*, *35*(1), 48-51.

[31] Andres, K., Pfammatter, M., Garst, F., Teschner, C., & Brenner, H. D. (2000). Effects of a coping-orientated group therapy for schizophrenia and schizoaffective patients: a pilot study. *Acta Psychiatrica Scandinavica*, *101*(4), 318-322.

The Effectiveness and Quality of Decision Making

Gabriel Jarillo Enríquez
Faculty of Psychology
Universidad Nacional Autónoma De México (Unam)
México City

ABSTRACT

As a new option to optimize effectiveness and the quality of decision-making process in teams and individuals, we apply the Bernard Lonergan´s rationalistic model, which deals with the cognitive operations involved in the way we acquire knowledge (heuristic method). A group of Engineering professors and two groups of Psychology graduate students participated in a workshop about methodological aspects and phases of human knowledge in the Bernard Lonergan's heuristic system, also called the Transcendental Method. We compare the quality, effectiveness, and satisfaction of intra-group and intergroup decisions. The Engineering team obtained higher levels of satisfaction with the quality and fulfillment of decisions as the consequence of the best results in the implementation of the method. The results show a new and more complete view of psychosocial dynamics for working teams and how to propitiate its effectiveness and satisfaction.

Keywords: Transcendental method, the operations of human knowledge, self-appropriation, self-consciousness, insight, effectiveness, quality.

I. INTRODUCTION

Dynamics and effectiveness of groups have been an area of study in the unflagging search of productivity, and educational and organizational qualities approach, specifically during the last decade.

The most relevant aspect within the range of possibilities for execution of quality and effectiveness of teams, because of the practical significance in the personal application and of the group as a unit, is the dynamic that occurs during the processes of analysis, problem-solving and decision making.

This present work is an approach to achieve a new and wider vision, in the research of the implementation and range of cognitive operation involved in the processes of analysis, problem-solving and decision making, both within an individual and within groups. The participants are professors from the Faculty of Engineering and graduate students from the Faculty of Psychology from the National Autonomous University of Mexico (UNAM).

To optimize these processes, the methodological aspects of the rational model or phases of the human knowledge that underlies in the heuristic proposal of Bernard Lonergan (1904-1984), were introduced in the dynamics of the group as a new alternative in this task. Lonergan carried out several approaches to educative, economic, philosophic, religious, scientific, artistic, and historical topics. He created what he called the Transcendental Method (in the Kantian sense, which is not a method for a particular knowledge, but for any knowledge), based on the rational method. The elements recovered from his work are those considered as constitutive of his heuristic proposal of knowledge to apply them to processes for individual and team decision making.

II. THE HEURISTIC MODEL OF BERNARD LONERGAN

According to Lonergan, the human knowledge shows two elements in the cognitive processes for the decision making:

a) The discovery methods, which mainly refer to the intelligence, and

b) The discussion methods that belong to a reflexive level and are more related to the goals and values.

The learning of these methods (exercise of intelligence and reflection) is a fundamental element for both processes (individual and group) to achieve successful and responsible solutions, that is, qualitative and correct. And therein the continuous search lies for the training of pre-service individuals and productive teams that are responsible regarding education and work.

The pursuit of knowledge in an intentional, intelligent, rational and methodical manner that allows confirming her/his cognitive processes constitutes the essence of the proposal.

The human knowledge consists of an elemental group of operations:

- Experiential. It is the empiric level, and corresponds to the data, sources or information obtained through the senses.
- Understand. It constitutes the intellectual level. We express what we have comprehended, figured out, or developed

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.14

presupposes and implications of our expression. We develop a hypothesis, which does not imply to know yet.

- Judge. It is the rational level of human knowledge, in which we ponder, control the evidence and judge the truth or untruth, the certainty or probability of an asserting. There is a more comprehension of things. At this point, we take a position about a specific issue. To assert something represent a compromise and thus a major responsibility than only think how things could be.
- Decide and act. It is the level of trustworthiness. Based on elaborated judgments, we reason about the courses of possible action; we evaluate them and make our own decision (Lonergan, 1972, 1993). This trustworthiness level has to do with ourselves, our operations and our goals and not only with our knowledge. This stage concerns to morality, freedom, and responsibility. Make a decision and act in consequence implies a conscious action, which brings about more responsibility.

When setting value judgments, consciousness becomes self-consciousness, since not only we take a position about something, but we internalize and vindicate what we believe in and act according to our beliefs. Based on the above, it is necessary to create responsible teams that –as Norman R.F. Maier mentions- make qualitative decisions not only for effectiveness purposes of theirs contents, but basically by the acceptance and in consequence, its successful implementation.

The prior refers to another element that Lonergan contributes: the self-appropriation of the theory of knowledge, which means to experience, understand and judgment supported on a self-presence and self-knowledge, and only the addition of these three operations makes possible the acquaintance with reality. Such reality independently exists from that person but now acquires a significance that will develop within that person, to the extent of his/her development and self-consciousness using a dynamic process within his/her particular scope of personal reality. An element incorporated into the process of knowledge is the insight concept that in the case of this model means "an intelligent spark", that happens when he/she becomes aware of grasping something within the context of his/her reality.

All the above should be considered in the proper processes when a person or a group makes attentive, smart, correct, and responsible decisions. Theses aspects underlie not only in the intellectual development but mostly in the reflexive one and that of the judgment, which constitutes a training focused on an educative and working development in highly technological societies, in the pursuit of a socio-human evolution from their reality and perspective.

III. Objective

The general purpose of this work was to identify the quality, acceptance, and effectiveness of the individual and team decision-making process, obtained through the application of the heuristic proposal from Bernard Lonergan from his "Transcendental Method".

A. Specific objectives proposed

a) To verify the possibility of producing a significant conscious acceptance of reality by incorporating the operations of human knowledge into the dynamics of individual and team decision-making process, according to the Lonergan's theory.

b) To identify the possible differences in process and results from the individual and group decision-making produced by Lonergan's method, in groups with a different career (Psychology vs Engineering) and occupational category (Professors vs Graduate Students).

IV. SUBJECTS

The first group consisted of eleven professors formed by four men and seven women from the Faculty of Engineering, UNAM, registered to the open call to participate in a workshop of decision-making with a humanist perspective. We integrated two more groups on a voluntary basis from the Faculty of Psychology. One of these with fifteen students (ten women and five men) completing their last semester of Psychology, and another with twenty participants (seventeen women and three men) who recently completed their degree. Both groups were formed to take a workshop similar to one designed for the professors from the Faculty of Engineering. 7

V. Procedure

Each group took the workshop which consisted of two phases. During the first phase, the coordinator of the workshop provided information about the humanistic perspective in the educational training, contrasting it with the different theoretical approaches to the analysis, problem-solving and decision-making. The main topic was to review each operation integrated into the structures thinking of the human knowledge, as Lonergan proposes in his theory of knowledge.

Participants collaborated to solve a decision-making exercise, where no one in the group was an expert on this task. This activity sought to identify the application of the universal process of knowledge. The process and results from individual and group decision-making were observed and recorded. At the end of the workshop, each group analyzed the consequences and implications of the results of the process, such as effectiveness, quality, and satisfaction about the individual decisions and those when working in teams, as a unit.

A. Development of the exercise

Each participant individually read a copy of the short story "The Sign in the Sky", by Agatha Christie. Professor Armando Bravo recommended this material, Bravo is a meticulous compiler of Lonergan's works and manuscripts and author of several books on this field, as well as an international expert concerning the universal process of knowledge proposed by Lonergan. Additionally, each participant received a format including the operations that correspond to the appropriate way to deal with the above process; this served as a guide to identify, classify, and individually report such operations according to the diverse situations exposed in the story of Agatha Christie.

Subsequently, participants developed the same activity in teams, based on their work.

We videotaped the dynamics and discussion in teams, and the most representative interactions were transcribed, depending on the results obtained.

VI. Results and Discussion

The classification of the operations experiential, understand, judge and assess in the context of the assigned task (short story) obtained an effectiveness greater than 60 percent in all groups, in contrast to the individual work.

In the team of professors from the Faculty of Engineering, the success of the classification of the various operations of knowledge was higher than 80 percent.

Neither of the groups from the Faculty of Psychology alluded to the application in the operations involved (in their analysis and decision-making processes) in the model they were working.

In contrast, almost at the end of the end of the work in the group, the professors from the Faculty of Engineering clearly and openly referred to the application in the team related to the operations of the universal process of knowledge.

Insight explicitly occurred –first in one of the participants and then by synergy to rest of the group– concerning the self-recognition that in the assigned task the team developed each of their operation of experiential, understand, judge, and value; and thus they became aware of the self-appropriation of the universal process. The above-provoked astonishment and satisfaction not only because of the quality (assertiveness in decisions), which indeed was a significant result of the Transcendental Method in team, but also because they observed in and by themselves (a self-consciousness and self-appropriation of the group about knowledge) the theory process. This lead to each also transferred this knowledge of the group to their individual experience in retrospect to their work. The product, that is, the group decision was perceived as of its own, not as imposed and therefore accepted.

The knowledge the group grasped in this way was highly efficient and confirms what Norman R. F. Maier mentioned. He considers effectiveness involving two dimensions: one is the objective or characterless quality of the decision because of the correct technical application; the other is related to the acceptance because of the satisfaction and appropriation. Decision quality multiply by acceptance of the achievement by the group participation: $E = Q \times A$ (effectiveness is equal to quality per acceptance).

The prior enables the construction of new paradigms to link individual decisions that affect other persons through the group implementation (groups responsible for executing the decisions of others). A relevant factor for behavior emerges, not only efficient and effective but referred to motivation considered beyond the guidance of goals. The motivation focused on the appropriation of the decision, implementation without resistance, and satisfaction in the development of the activities aimed at the achievements of goals with a sense of proud for accomplishing them.

Regarding productivity and its relation to the process and the quality of intra-group interactions, our results support the theoretical standpoint that indicates that such factors evidently affect the productivity of a group. Groups, whose members mutually know each other well, are cohesive, have information or prior education, perform better than those who do not have these characteristics (Cohen). This context has more influence that a simple comparison between individuals and groups. The group of professors from the Faculty of Engineering obtained better results in productivity than the student groups from the Faculty of Psychology because the professors previously formed working teams in courses and workshops, where they developed successful group interactions.

VII. Conclusions

The quantitative and qualitative results of the study show a new and more complete view of psychosocial dynamics in working team and how to propitiate its effectiveness and satisfaction.

Results differ depending on professional training and occupational status. However, the general pattern of Lonergan's proposal does not diminish its potentiality in effectiveness and quality of results.

The self-consciousness that subjects have about their processes individually experienced and observed in group manages to improve the quality of decisions.

The commitment and responsibility of the team to carry out the assigned tasks had a remarkable improvement. Therefore, the implementation of this method generates an alternative for the construction of this type of attitudes and also to arouse motivation and satisfaction.

Results obtained coincide with comparative studies about individual and group learning that show with a significant coherence, teams learn more and faster than individuals who work in isolation.

The structure of the knowledge process in this model leads to a self-appropriation of our rational and intellectual consciousness, which enables the fulfillment of the educative and work goals but above all, it facilitates the beginning of a genuine human development.

In particular in highly technological societies, whose educative and work development demand training, besides the expertise in the intellectual area, in scopes such as reflection, and judge that allow individuals go through the experience of their reality and perspective towards an authentic socio-human evolution.

References

[1] Brandler, S. & Roman, C.P. "Group work: Skills and strategies for effective intervention" (2nd ed.). New York: The Haworth Press. 1999

[2] Bravo, Armando. “Una introducción a Lonergan”. México: Universidad Iberoamericana. 2001

[3] Bravo, Armando (trad.) “Conocimiento y aprendizaje”. México: Universidad Iberoamericana. 2008

[4] Corey and Corey. “Groups: process and practice”. 8th edition. California: Brooks/Cole Publishing Company. 2010

[5] Cronin, Brian. “Value Ethics: A Lonergan Perspective”. Nairobi: The Consolata Institute of Philosophy Press. 2006

[6] Delgado, Araceli. “Formación valoral a nivel universitario”. México: UIA. 2001

[7] Díaz Barriga, Frida. “Estrategias docentes para un aprendizaje significativo. Una interpretación constructivista”. México: McGrawHill. 2004

[8] Drucker, Peter, et al. Harvard Business Review on Decision Making. Cambridge, Mass.: Harvard Business School Press. 2001

[9] Galán, Francisco. “Metafísica como meta-metodología”. Tesis doctoral. México: UIA. 2004

[10] Gendlin, Eugene. "On Decision-Making." En Marshall, B. (Ed.) Experiences in Being. Belmont, CA: Brooks-Cole. 1971

[11] Hirsch, Ana. “Educación en Valores”. México: Gernika. Tres volúmenes. 2001

[12] Johnson, D. W. & Johnson F. P. “Joining together: Group theory and group skills “ (10th ed.). Needham Heights: Allyn & Bacon. 2008

[13] Johnson, Richard; Coscarelli, William; Johnson, Jadean. “Decision Making Inventory.” Columbus, OH: Marathon Consulting and Press. 1978

[14] Kohlberg, Lawrence; Power, Clark; Higgins, Ann. “La Educación Moral según Lawrence Kohlberg”. Barcelona: Gedisa. 1997

[15] Lonergan, Bernard. “Insight: estudio sobre la comprensión humana”. México — Salamanca: UIA — Sígueme. (Originalmente publicado en 1957 por Longmans, Green And Co., Nueva York. Traducción de Francisco Quijano.) 1999

[16] López, Martín. “Educar la libertad: más allá de la educación en valores”. México: Trillas. 2001

[17] Maier, Norman R.F. “Toma de Decisiones en Grupo; Técnicas de conducción de juntas para la solución de problemas en las organizaciones”. México: Trillas 1980

[18] Martínez, Jorge. "El reto pedagógico de la educación en valores para un profesor lego." Nuestra Comunidad. México: UIA. 2005

[19] Martínez, Jorg . “Hacia una pedagogía de las decisiones”. Tesis doctoral. México: UIA. 2009

[20] Muñoz, Carlos. “Formación universitaria, ejercicio profesional y compromiso social”. México: UIA. 1993

[21] Muñoz, Carlos. “La contribución de la educación al cambio social: reflexiones a partir de la investigación”. México: UIA — CEE – Gernika. 1994

[22] Peronard, Marianne; Velásquez, Marisol. “Desarrollo del conocimiento metacomprensivo,” en Revista Signos, vol. 36, número 53, Valparaíso: Pontificia Universidad Católica de Valparaíso. 2003

[23] Quijano, Francisco (trad.). “Insight: estudio sobre la comprensión humana”. México — Salamanca: UIA – Sígueme. 1999

[24] Red Centroamericana de Educación en Valores. http://www.oei.es/caev

[25] Rest, James. “Postconventional moral thinking: a Neo-Kohlbergian approach”. Mahwah, N.J.: L. Erlbaum. 1999

[26] Salton, Gary. “DecideX: Strategic Decision Making Instrument.” Amherst, MA: HRD Press. 2000

[27] Ugartetxea, José. “La metacognición, el desarrollo de la autoeficacia y la motivación escolar,” en Revista de Psicodidáctica, enero – junio, número 13. España: Universidad del País Vasco. 2002

[28] Zarzar, Carlos. “La formación integral del alumno”. México: Fondo de Cultura Econ. 2003

Destigmatizing Generalized Anxiety Disorder: The Effects of Three Causal Explanations.

John McDowall & Lucy Lightfoot
School of Psychology
Victoria University of Wellington
Wellington, New Zealand

Abstract

Stigma constitutes a significant barrier to the recovery and social integration of individuals affected by mental illness. Research exploring anti-stigma initiatives primarily focus on an educational approach, with a view that accurate information will replace misconceptions and decrease stigma. Research comparing the efficacy of differing causal explanations of mental illness have yielded inconsistent results. The current study compared the efficacy of three explanations: biogenetic, psychosocial, and a novel evolutionary explanation in reducing stigma toward individuals with Generalized Anxiety Disorder. The biogenetic explanation led participants to rate the locus of causality as significantly less internal than participants in the other two conditions. No other differences in stigma were found as a function of causal explanation. Ethnic minorities were slightly less likely to react with fear and anger, and people who had contact with mental illness in the past were significantly less stigmatizing across a wide range of measures.

Keywords: Generalized Anxiety Disorder; Stigma; Stereotypes.

Destigmatizing Generalized Anxiety Disorder: The Effects of Three Causal Explanations

Anxiety disorders are a group of disorders characterized by excessive fear, anxiety, and related behavioral disturbances. Generalized Anxiety Disorder (GAD) is an anxiety disorder which affects roughly 3% of the population. Key features included uncontrolled anxiety and worry that is excessive regarding intensity, duration or frequency, and tends to be out of proportion to the realistic likelihood or impact of the event. Individuals' worries also tend to be more pervasive, pronounced, distressing and enduring, and are more likely to occur without an antecedent. Although evidence shows treatment to be highly effective for many mental disorders, acquisition of adequate treatment is low for those affected. Large scale studies have found that less than 40% of individuals with mental health concerns seek any kind of professional help, and the percentage of those who seek help from a mental health professional is even smaller (11%). The most commonly cited reason for not seeking help is the fear of stigma (Vogel, Wade, & Shawn, 2006).

Stigma

Stigma constitutes a formidable barrier to the recovery of people with mental illness, over and above the challenges conferred by their actual condition. It encapsulates a range of interactive beliefs, attitudes, and behaviors that are sustained by complex social processes which are not easily observed or interpreted, making it difficult to design effective interventions. The development of sound conceptualizations of stigma is crucial to understanding the underlying maintaining processes, and ultimately, constructing a framework which can effectively guide the development of anti-stigma initiatives
(Krupa, Kirsh, Cockburn, & Gewurtz, 2009).

The Three Components of Stigma

Although there is some debate in the literature regarding the definition and utility of stigma as a concept, it is widely accepted that it comprises at least three components: stereotypical beliefs, prejudicial reactions, and discrimination (Corrigan & Watson, 2002; Link, Yang, Phelan, & Collins, 2004).

Stereotypical beliefs describe the cognitive component of stigma, referring to beliefs (often negative) about members of a group that are based on cultural and societal norms (e.g. 'People with anxiety are actually just weak'). Prejudice ('prejudicial reactions') refers to the affective/evaluative component of stigma. When an individual appraises stereotypes as being accurate, and incorporates them into their belief system, they can become prejudiced. Prejudice describes the endorsement of negative stereotypes and the resulting negative emotional reactions (e.g. 'People with anxiety are weak, and they frustrate me').

Finally, discrimination refers to the behavioral component of stigma, which is arguably the most problematic, as it exerts a direct effect on the stigmatized. Prejudicial reactions lead people to behave in a hostile or avoidant way towards stigmatized groups (i.e. refusal to hire them).
Evidence shows that influencing one component of stigma may not necessarily impact on the other factors. Hence,

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.16

it is imperative to ensure that anti-stigma initiatives effectively address all three components (Beyondblue, 2015).

Destigmatizing stigma

Destigmatization initiatives have primarily focused on disseminating educational information regarding mental health, with the view that accurate information will replace misconceptions, increase empathy and sympathy, and decrease stigma (Corrigan & Watson, 2002; Beyondblue, 2015). A large body of research exists evaluating the educational approach, instigated by research that began in the 1960's. Costin and Kerr (1962) administered the Opinions about Mental Illness (OMI) scale (Cohen & Struening, 1962) to assess attitudes of students toward the mentally ill before and after a psychology course. The scale measures five commonly expressed stigmatizing attitudes: authoritarianism (beliefs regarding unpredictability and dangerousness), social restrictiveness (desire to control), mental health ideology and belief in the influence of psychosocial factors. The effects of completing the psychology course were compared to the effects of completing a sociology class, which served as a control group. Results were mixed, but a number of changes were attributable to the psychology class: women became less authoritarian, high achieving males became less authoritarian and less restrictive, and psychology students of both genders showed reductions in social restrictiveness, and an increase in beliefs that psychosocial events early in life can contribute to mental illness. The results of this early study provided foundational evidence that an educational initiative providing information about mental illness could effectively improve attitudes.

Since the 1990's, which were accordingly referred to as the 'Decade of the Brain', the primary approach of anti-stigma education initiatives and research has focused on encouraging the public to accept a biogenetic model of mental illness (Schomerus et al, 2012). This model emphasizes the genetic and biological causes of mental illness, and frames mental illness in medical terms such as 'an illness like any other', 'a disease' and 'a brain disorder'. The logic of advocating for this approach is based on the assumption that if you are ill, you cannot be held responsible for your actions or blamed, because they are out of your control (Angermeyer & Matschinger, 2005; Read. 2007). By reducing the blame placed on patients, and increasing public knowledge regarding mental illness, it is theorized that sympathy, empathy, understanding and openness regarding treatment and its potential benefits should increase, resulting in an overall decrease in stigma (Read, 2007; Schomerus et al, 2012).

However, some research has shown results to the contrary, sparking concern about the potential harmful effects of the biogenetic approach. Corrigan and Fong (2014) state that emphasis on framing mental illness as a medical issue highlights a fundamental difference between people with mental health issues and the general public, facilitating the cognitive separation of people into groups. This 'us and them' style of thought, and the salience of difference is what underpins and exacerbates stigma processes. The authors express concern that many initiatives stress this biological difference when doing so may emphasize the fundamental quality of prejudice - the perception of otherness.

Indeed, research appears to support this claim. A meta-analysis conducted by Kvaale et al (2013) examined 28 studies investigating the relationship between biogenetic explanations for mental disorders and three elements of stigma: blame, perceptions of dangerousness and social distance. They found that biogenetic explanations effectively reduced blame - however, they were no more effective than other types of explanations, such as psychosocial and non-specific explanations. Furthermore, biogenetic explanations were associated with heightened prognostic pessimism (the belief that a mental disorder was permanent, stable, and rarely overcome), and heightened endorsement of dangerousness. The authors pointed out that a biogenetic explanation may induce essentialist thinking - the belief that members of a group share a deep-seated, fixed, and defining essence. This is problematic in the context of mental health stigma, because the stereotypes associated with mental illness are largely negative in nature, and essentialist thinking may reinforce stereotypes and encourage perception of them as permanent and innate.

Similarly, Schomerus et al (2012) conducted a meta-analysis which aggregated data across the U.S, U.K, Austria, the Netherlands, Poland, Germany, Australia and New Zealand. The study found an increase in mental health literacy - especially in terms of endorsement of a biogenetic model and greater acceptance of professional help for those with mental health issues - however, it also found no change in stigma toward people with mental health conditions, and even some evidence of worsening attitudes. The authors concluded that increasing public understanding of the biological indices of mental illness is not conducive to reducing stigma.

Lam and Salkovskis (2007) found that when anxious and depressed patients were given either a biogenetic, psychosocial, or unclear etiological explanation of panic disorder, the patients in the biogenetic condition had more prognostic pessimism (in terms of how curable panic disorder is) and were more likely to say that an affected individual was at risk of self-harm, harming others, and suicide attempts. This has significant implications - the dissemination of biogenetic explanations could potentially be contributing to self-stigma and the associated negative outcomes.

Comparing the two explanations

Results investigating the comparison of the two approaches (psychosocial vs. biogenetic) have been variable, and overall, inconclusive. Lincoln, Arens, Berger & Rief (2008) presented a biogenetic or a psychosocial explanation to 121 medical and psychology students, and found that both educational interventions produced a significant reduction in stereotype appraisal. The biogenetic approach decreased attribution of blame, but increased prognostic pessimism, while the psychosocial decreased dangerousness and the desire for social distance. These results were interpreted as evidence that perhaps each explanation exerts differential effects on the

various components of stigma, and therefore, educational initiatives should teach a vulnerability-stress model to be most effective, which incorporates both approaches. However, subsequent studies have not substantiated this claim.

Walker and Read (2002) presented participants with either a biogenetic, psychosocial, or combined etiological explanation of psychotic symptoms, and measured attitudes before and after. Analyses revealed no significant changes in attitudes overall for any of the three conditions. However, significant differences were found regarding the specific scale items: the biogenetic and the combined condition led participants to rate patients as significantly more dangerous compared to their pre-test score, and contrary to expectations, the psychosocial intervention had no effect.

Similarly, Schlier, Schmick and Lincoln (2014) hypothesized that a vulnerability-stress model would be most effective. They presented three explanations: psychosocial, biogenetic, and a vulnerability-stress model, and assessed stereotypes and desired social distance. They found that none of the interventions significantly reduced stigma, but the psychosocial and vulnerability-stress models both increased blame. The authors concluded that their results strengthened the view that promotion of etiological information is not in fact a favorable approach to reduce stigmatization.

Because of the contradictory results, it is difficult to make conclusive statements regarding the effects of etiological explanations on the various components of stigma. Hence, more research is required to elucidate the differential efficacy of common etiological explanations, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

The Current Study

The current study evaluated the efficacy of three etiological explanations of GAD on associated stigma. The commonly used biogenetic explanation, along with a psychosocial explanation and a novel evolutionary explanation, which emphasized the adaptive features of anxiety were investigated.

In accordance with the previous literature, it was expected that a) the biogenetic explanation would engender prognostic pessimism, and the harshest stigma scores overall, but would reduce ratings of personal responsibility/blame, b) The psychosocial explanation would differ from the biogenetic explanation in terms of engendering views of mental illness as less stable and more temporary, and would be associated with less endorsement of stereotypes, c) No prediction was made regarding the exploratory introduction of an evolutionary explanation, and d) those who have had contact with mental illness would be less stigmatizing.

Method

Participants

Undergraduate students were recruited from the first-year Psychology programme at Victoria University of Wellington and completed the thirty-minute study in exchange for course credit. A total of 144 students participated - 104 females, and 40 males. The average age was 19.26 (*SD* = 3.22).

Forty-three percent (63 people) of the sample reported contact with people with mental illness, 40.3% (58 people) reported none, and 16% (23 people) were unsure. Participants were also asked the same question regarding anxiety disorders. Forty-seven percent (68 people) reported contact, 33.3% (48 people) reported none, and 19.4% (28 people) were unsure.

Forty-seven participants took part in the psychosocial condition, 54 took part in the biogenetic condition, and 43 took part in the evolutionary condition.

Materials

Demographic Questions. At the beginning of the session, participants were presented with some demographic questions asking their gender (male, female, or other), age, and ethnicity.

Exposure to Mental Illness. Participants were also asked whether they, or someone they are close to suffer from a) an anxiety disorder or b) a mental illness other than anxiety.

Video. Participants watched an informational video depicting a typical case of GAD. The video was eight minutes long and showed a female actor displaying symptoms of GAD in everyday scenarios. The video ended with a doctor presenting some facts about GAD, and emphasizing that when early intervention occurs, recovery is possible. The video was sourced from the YouTube channel of the Institute of Mental Health, Singapore (IMHsingapore, 2012).

Information about GAD. Participants read a page of information summarizing symptoms of GAD, typical course of the condition, associated disability, distress and impairment, comorbidity, and social/individual costs.

Content-check questions. Participants were required to answer an identical pair of multiple choice content-check questions to confirm they had paid attention to the video. All participants answered the first question correctly, and only one participant answered the second question wrong. No participants were excluded from the analyses.

Causal Primes. Dependent on which condition they had been assigned to, participants read one of three causal explanations of GAD. The Biogenetic prime informed participants that GAD is caused by a heritable disorder which leads to the development of brain abnormalities. The Psychosocial prime informed participants that GAD develops as a result of contextual and environmental factors. Finally, the Evolutionary prime informed participants that GAD constituted one end of a distribution of primarily adaptive strategies, and could be predictive of positive outcomes in certain contexts. Copies of these are available from the authors.

Scales used to measure stigma. Participants filled out a survey comprising 87 items derived from five separate scales, each of which measured a different aspect of stigma and were included to ensure that stigma was measured in a

comprehensive way. Participants responded to each statement using a 5-point scale which was the same for three of the scales (1 = strongly agree, 2 = agree, 3 = uncertain, 4 = agree, and 5 = strongly agree) but different for the social distance scale (1 = I certainly wouldn't, 2 = I probably would, 3 = unsure, 4 = I probably would, 5 = I certainly would), and the Revised Causal Dimension Scale (McAuley, Duncan, & Daniel, 1992), where the participant indicated which of two spatially opposite statements they agreed with, and to what extent (1 = strongly agree, 2 = agree, 3 = unsure, 4 = agree, 5 = strongly agree).

Revised Causal Dimension Scale (CDSII). The CDSII (McAuley, Duncan, & Daniel, 1992) measures causal attributions. Four causal beliefs are measured: locus (is the root of the problem internal, or external to the person), stability (is the cause permanent, or temporary), external control (can other people can control the cause), and internal control (can the person themselves can control the cause). Participants responded on a 5-point Likert Scale. The wording was altered to shift the focus toward sufferers of GAD (e.g. 'Is the cause(s) something' was modified to read 'is the cause(s) of GAD something', and 'That reflects an aspect of yourself' was changed to 'that reflects an aspect of the person affected).' The participant was presented with two opposite statements, e.g. 'That is permanent', 'That is temporary', and were required to indicate which statement they agreed with, and to what extent. The CDSII is made up of 12 pairs of statements in total - three pertaining to each of the four factors. Scores for each factor ranged from 3 to 15.

Participants scoring high on the locus factor believe the cause is external, while those who score low believe that the cause is internal. Participants scoring high on the stability factor believe the cause is variable/changeable, while those who score low believe the cause is permanent/stable. Participants scoring high on the external control factor believe other people cannot control the cause, while those who score low believe they can. Similarly, a high score on the personal control factor indicates belief that people with GAD cannot control the cause of their condition, while a low score is indicative of belief that they can. McAuley et al (1992) reported good reliability across four studies, with Cronbach's alpha ranging from .60 to .92. In the current study the CDSII had a Cronbach's alpha of .54. However, it must be taken into consideration that each factor only consists of three items.

Generalized Anxiety Stigma Scale (GASS). The GASS (Griffiths, Batterham, Barney & Parsons, 2011) measures stereotypes and prejudicial attitudes toward people with GAD. It consists of two subscales - a personal stigma subscale (measuring the participants own endorsement of stereotypes and prejudicial attitudes) and a perceived stigma subscale (measuring the participants' beliefs about the endorsement of stereotypes and prejudicial attitudes in the wider community). It is important to measure both personal and perceived stigma, because as mentioned earlier, perceived stigma can be a powerful force in terms of predicting outcomes.

The ten themes probed by the scale were beliefs that the authors deemed relevant to GAD in particular: perceptions that it is not a real illness, a sign of weakness, laziness, instability, and self-absorption, that people could snap out of it, that the condition is their fault, that people with GAD make poor employees, are a danger to others, and that the condition is shameful/embarrassing. The scale has 20 items in total - ten asking to what extent the respondent endorses each statement, and the other ten asking to what extent the participant believes the wider community endorses these statements. Participants responded on a 5-point Likert Scale. Griffiths et al (2011) reported excellent reliability (α = .86 and α = .91) for the personal and perceived scales respectively. Similarly, the current study found excellent consistency for the GASS overall (α = .87).

Emotional Reactions Questionnaire (ERQ). The ERQ measures prejudicial reactions that people may experience in response to contact with mental illness: fear, anger and pity. The nine items in the ERQ assess nine emotional reactions which fit within these categories: the need to help, uneasiness, anger, pity, irritation, fear, ridicule, empathy, and insecurity (Angermeyer & Matschinger, 2003). Participants responded on a 5-point Likert Scale. Scores range from 9 - 45, with a higher score indicative of higher prejudice overall. Angermeyer and Matschinger reported good reliability across all three factors in the ERQ (α = .79 for fear, α = .74 for pity and α = .77 for anger). In the current study, the ERQ was found to have good overall reliability (α = .67).

Community Attitudes towards the Mentally Ill (CAMI). The CAMI (Taylor & Dear, 1981) measures commonly held prejudicial attitudes toward the mentally ill. Four types of attitudes are measured: authoritarianism (the view that people affected by mental illness are inferior and need coercive management), benevolence (a humanistic, sympathetic view), community mental health ideology (the view that the community has a central role in the recovery process), and social restrictiveness (the view that people affected by mental illness are a threat to society). The CAMI comprises 40 items in total, 10 pertaining to each of the four attitudes. Five of the 10 statements in each subscale are positively worded, and the other five are negatively worded (e.g. for benevolence: 'more tax money should be spent on the care and treatment of the mentally ill' vs. 'the mentally ill don't deserve our sympathy'). Participants responded on a 5-point Likert Scale. Six items were excluded from the current study because they were out-dated/irrelevant in terms of language used or referral to mental health facilities - GAD has a very low rate of hospital admission (2%) and inpatient care (Burgess et al, 2009). Scores range from 34 to 170, a higher score indicating higher negative attitudes overall. The CAMI scale was found to have excellent reliability in the current study (α = .87).

Social Distance Scale (SDS). The SDS measures the social distance that participants' desire from a stigmatized group, and is widely used in the literature as a proxy for discrimination. An adapted version was used in the current study that comprised twelve items and allowed for response on

a 5-point Likert scale (Norman, Windell, & Manchada, 2010). Wording was altered to ask about individuals with GAD in particular. The items probed whether or not, and to what extent, the respondent would willingly engage in a social situation that varied in terms of intimacy (e.g. 'I would have lunch with a person with GAD') with an affected individual. Participants responded on a 5-point scale from 'I certainly wouldn't' to 'I certainly would'. A higher score on the SDS reflects a greater preference for social distance (and theoretically, higher levels of discrimination). Scores on the SDS ranged from 12 to 60. Norman et al (2010) reported the adapted SDS had excellent reliability (α = .89), which was replicated in the current study (α = .93).

Procedure

After giving informed consent, individuals watched an eight minute video depicting a typical case of GAD. At the end of the video, they were given the information sheet about GAD and one of three causal primes. Following this, participants were required to answer some content questions ensuring that they paid attention to the video. They then answered some demographic questions as well as some questions regarding contact with mental illness. Finally, they filled out the survey, comprising the 87 items from the five scales outlined prior. On completion, participants were thanked, debriefed verbally, and provided with a debriefing document containing contact details of the researchers and support services for mental health issues.

Results

Preliminary Analyses

Analyses were conducted in order to determine whether any demographic variables, or contact with mental illness were related to the dependent measures.

Contact with an anxiety disorder. Exposure to an anxiety disorder had a significant effect on emotional reactions, $F(2, 141) = 4.66$, $p = .011$, as measured by the ERQ. Post hoc comparisons using the Tukey HSD test indicated that those exposed were significantly lower in prejudicial emotional reactions ($M = 14.91$, $SD = 3.33$) than those who had not been exposed ($M = 16.81$, $SD = 4.07$) and those who were not sure ($M = 17.04$, $SD = 4.83$). There was no significant difference between participants who had no contact or were unsure.

Second, exposure to an anxiety disorder had a significant effect on the endorsement of prejudicial attitudes, $F(2, 141) = 5.62$, $p = .005$, as measured by the CAMI. Post hoc comparisons using the Tukey HSD test indicated that participants exposed to an anxiety disorder were significantly less endorsing of prejudicial attitudes ($M = 64.78$, $SD = 11.50$) than those who had not been exposed ($M = 70.38$, $SD = 11.46$) and those who were not sure ($M = 72.43$, $SD = 12.29$). There was no significant difference between participants who had no contact or were unsure.

Finally, exposure to an anxiety disorder had a significant effect on personal stigma toward GAD $F(2, 141) = 6.08$, $p = .003$ as measured by the GASS personal stigma subscale. Post hoc comparisons using the Tukey HSD test indicated that participants exposed to an anxiety disorder were significantly less stigmatizing towards those with GAD ($M = 14.21$, $SD = 3.83$) than those who had not been exposed ($M = 16.67$, $SD = 4.87$) and those who were not sure ($M = 17.11$, $SD = 5{,}46$). There was no significant difference between participants who had no contact or were unsure.

No difference as a function of exposure was found in regards to the four causal beliefs as measured by the CDSII (all $F \leq 1.86$, $p \geq .16$) or the desire for social distance, as measured by the SDS ($F(2, 141) = 2.76$, $p = .067$).

Contact with a mental illness other than anxiety Exposure to mental illness had a significant effect on emotional reactions, $F(2, 141) = 4.39$, $p = .014$, as measured by the ERQ. Post hoc comparisons using the Tukey HSD test indicated that those exposed were significantly lower in prejudicial emotional reactions ($M = 14.90$, $SD = 3.49$) than those who had not been exposed ($M = 17.00$, $SD = 4.14$) and those who were not sure ($M = 16.22$, $SD = 4.39$). There was no significant difference between participants who had no contact or were unsure.

Second, exposure to mental illness had a significant effect on the endorsement of prejudicial attitudes, $F(2, 141) = 4.84$, $p = .009$, as measured by the CAMI. Post hoc comparisons using the Tukey HSD test indicated participants exposed to an anxiety disorder were significantly less endorsing of prejudicial attitudes ($M = 64.81$, $SD = 10.95$) than those who had not been exposed ($M = 71.38$, $SD = 12.46$) and those who were not sure ($M = 69.04$, $SD = 11.74$). There was no significant difference between participants who had no contact or were unsure.

No difference as a function of exposure was found in regards to the four causal beliefs as measured by the CDSII (all $F \leq 2.74$ $p \geq .068$), stigma toward GAD as measured by the GASS, $F(2, 141) = .640$, $p = .529$) or the desire for social distance, as measured by the SDS, $F(2, 141) = 1.47$, $p = .233$).

Ethnicity. Ethnicity was found to have an effect on prejudicial emotional reactions. Participants who identified as an ethnic minority felt slightly less fearful $F(1, 142) = 6.75$, $p = .010$ and angry, $F(1, 142) = 3.96$, $p = .049$, toward sufferers of GAD as measured by the ERQ.

Primary Analyses: Dependent variables.

A series of one-way between-groups ANOVAs were conducted with condition (causal prime) as the independent variable, to evaluate the impact of the experimental manipulation on the measures of stigma.

Revised Causal Dimension Scale (CDSII) Four one-way between-groups ANOVAs were conducted to examine whether the experimental manipulation exerted any effects on causal beliefs. Analyses found no significant difference between experimental conditions on beliefs concerning personal control, $F(2, 141) = .732$, $p = .483$),

stability, F (2, 141) = .315 p = .730, external control, F (2, 141) = 2.72, p = .069. A significant effect was found for beliefs concerning the locus of the cause, F(2, 141) = 3.81, p = .024. Post hoc comparisons using the Tukey HSD revealed that participants in the psychosocial condition were significantly more likely to view the cause as significantly less internal to the affected individual (M = 8.02, SD = 2.23) than those in the biogenetic condition (M = 6.89, SD = 2.20) and those in the evolutionary condition (M = 7.07, SD =2.05). There was no significant difference between the biogenetic and evolutionary condition. Since each scale had a score range of three to fifteen, all of the groups still indicated a belief that the locus of the cause was more internal than it was external. These results do not support the prediction that a biogenetic causal explanation would reduce attribution of blame (i.e a higher score on the personal control factor), or engender prognostic pessimism (i.e. a lower score on the stability factor). However, they do appear to indicate that a psychosocial explanation influences people to view the cause as slightly less internal to the affected individual than the alternative causal explanations.

Generalized Anxiety Stigma Scale (GASS) A one-way between-groups ANOVA was performed to assess whether the experimental manipulation exerted any effects on stereotypes and prejudicial attitudes toward people with GAD. Analyses found no significant difference as a function of experimental condition, F(2, 141) = .844, p = .432.

Community Attitudes Toward the Mentally Ill (CAMI) A one-way between-groups ANOVA was performed to assess whether the experimental manipulation exerted any effects on prejudicial attitudes. Analyses found no significant difference as a function of experimental condition, F (2, 141) = .493, p = .612.

Emotional Reactions Questionnaire (ERQ) A one-way between-groups ANOVA was performed to assess whether the experimental manipulation exerted any effects on prejudicial emotional reactions. Analyses found no significant difference as a function of experimental condition, F (2, 141) = .288, p = .750.

Social Distance Scale (SDS) A one-way between-groups ANOVA was performed to assess whether the experimental manipulation exerted any effects on prejudicial emotional reactions. Analyses found no significant difference as a function of experimental condition, F (2, 141) = .057, p = .945,

Discussion

The current study evaluated the efficacy of three etiological explanations of GAD on stigma. It aimed to contribute to the literature by a) presenting a novel etiological explanation, b) measuring all three components of stigma comprehensively and c) by measuring stigma associated with an anxiety disorder.

Contrary to the hypotheses, the biogenetic explanation did not engender harsher stigma scores, or significantly reduce attributions of blame. The psychosocial explanation led to participants rating the cause of GAD as slightly less internal to an individual than the other two explanations, but it had no effects on perceptions of stability or levels of stigma overall. Finally, the introduction of a novel evolutionary explanation did not result in stigma scores that significantly differed from the other two approaches (psychosocial and biogenetic).

These results support the growing body of literature suggesting that educational initiatives which emphasise etiology are not effective in reducing stigma. Fifty years of research evaluating the employment of the typically used biogenetic approach suggests that it is ineffective at best, and may even be exacerbating stigma (Kvaale et al, 2013). Regardless, if it were powerfully effective, a wealth of supporting evidence should have emerged by now.

There is a possibility that the generalisability of the current findings is limited due to the homogeneous nature of the sample. Participants were first-year psychology students, which is problematic for a number of reasons. There was low variability in terms of age and level of education, and the vast majority of the sample identified as European/New Zealand. Participants in the current study had already engaged in a Psychology course, and as Costin and Kerr (1962) demonstrated, they were therefore likely to have low levels of stigma already. Indeed, compared to a sample of the general Australian population, the sample used in the current study scored substantially lower in levels of stigma (Griffiths et al, 2011).

In support of the hypothesis that contact with mental illness is associated with lower levels of stigma, participants who reported intimate contact with an anxiety or another mental illness were less stigmatising across a range of measures. This finding supports the idea that approaches incorporating contact could be a powerful way to reduce stigma. Indeed, the evidence base for this approach is strong - Corrigan and Fong (2014) found that contact was more effective than education in reducing levels of stigma, with effect sizes twice the size.

Future studies should focus on exploration of destigmatisation initiatives that may have a greater impact on the stigma associated with mental health conditions. The current study, and much of the literature suggests that a focus on contact has the potential to powerfully reduce stigma - future research should explore efficient ways to employ this approach. Additionally, it should aim to rectify the gap in knowledge regarding whether or not the stigma surrounding mental illness (i.e. the stereotypes, reactions, and behaviour) varies in regards to the specific mental illness that is being considered.

References

Angermeyer, M., & Matschinger, H. (2005a). Causal beliefs and attitudes to people with schizophrenia: Trend analysis based on data from two population surveys in Germany. British Journal of Psychiatry, 186, 331 – 334.

Beyondblue. (2015). Beyondblue Information Paper: Stigma and discrimination associated with depression and anxiety. Retrieved September 20, 2016, from Beyond

Blue: https://www.beyondblue.org.au/docs/default-source/policy-submissions/stigma-and-discrimination-associated-with-depression-and-anxiety.pdf?sfvrsn=0

Burgess, P. M., Pirkis, J. E., Slade, T. N., Johnston, A. K., Meadows, G. N., & Gunn, J. M. (2009). Service use for mental health problems: findings from the 2007 National Survey of Mental Health and Wellbeing. Australian and New Zealand Journal of Psychiatry, 43(7), 615-623.

Cohen, J., & Struening, E. L. (1962). Opinions about mental illness in the personnel of two large mental hospitals. The Journal of Abnormal and Social Psychology, 64(5), 349.

Corrigan, P. W., & Fong, M. W. M. (2014). Competing perspectives on erasing the stigma of illness: what says the dodo bird? Social Science & Medicine, 103, 110–117.

Corrigan, P. W., & Watson, A. C. (2002). Understanding the impact of stigma on people with mental illness. World Psychiatry: Official Journal of the World Psychiatric Association , 1(1), 16–20.

Costin, F., & Kerr, W. D. (1962). The effect of an abnormal psychology course on students' attitudes toward mental illness. Journal of Educational Psychology, 53(5), 214.

Griffiths, K. M., Batterham, P. J., Barney, L., & Parsons, A. (2011). The Generalized Anxiety Stigma Scale (GASS): psychometric properties in a community sample. BMC psychiatry, 11(1), 1.

Krupa, T., Kirsh, B., Cockburn, L., & Gewurtz, R. (2009). Understanding the stigma of mental illness in employment. Work , 33(4), 413–425.

Kvaale, E. P., Haslam, N., & Gottdiener, W. H. (2013). The 'side effects' of medicalization: A meta-analytic review of how biogenetic explanations affect stigma. Clinical psychology review, 33(6), 782-794

Lam, D. C., & Salkovskis, P. M. (2007). An experimental investigation of the impact of biological and psychological causal explanations on anxious and depressed patients' perception of a person with panic disorder. Behaviour research and therapy, 45(2), 405-411.

Lincoln, T. M., Arens, E., Berger, C., & Rief, W. (2008). Can antistigma campaigns be improved? A test of the impact of biogenetic vs psychosocial causal explanations on implicit and explicit attitudes to schizophrenia.Schizophrenia Bulletin, 34(5), 984-994.

Link, B. G., Yang, L. H., Phelan, J. C., & Collins, P. Y. (2004). Measuring mental illness stigma. Schizophrenia Bulletin, 30(3), 511–541.

McAuley, E., Duncan, T., & Russell, D. (1989, June). The revised Causal Dimension Scale (CDS-II): Multi-group construct validity. In annual meeting of the North American Society for the Psychology of Sport and Physical Activity, Kent, OH.

Norman, R. M., Windell, D., & Manchanda, R. (2012). Examining differences in the stigma of depression and schizophrenia. International Journal of Social Psychiatry, 58(1), 69-78.

Read, J. (2007). Why promoting biological ideology increases prejudice against people labelled "schizophrenic". Australian Psychologist, 42(2), 118-128.

Schlier, B., Schmick, S., & Lincoln, T. M. (2014). No matter of etiology: Biogenetic, psychosocial and vulnerability-stress causal explanations fail to improve attitudes towards schizophrenia. Psychiatry research, 215(3), 753-759.

Schomerus, G., Schwahn, C., Holzinger, A., Corrigan, P. W., Grabe, H. J., Carta, M. G., & Angermeyer, M. C. (2012). Evolution of public attitudes about mental illness: a systematic review and meta-analysis. Acta Psychiatrica Scandinavica, 125(6), 440–452.

Taylor, S. M., & Dear, M. J. (1981). Scaling community attitudes toward the mentally ill. Schizophrenia Bulletin, 7(2), 225.

Vogel, D. L., Wade, N. G., & Shawn, H. (2006). Measuring the self-stigma associated with seeking psychological help. Journal of Counseling Psychology, 53(3), 325–337.

Walker, I., & Read, J. (2002). The differential effectiveness of psychosocial and biogenetic causal explanations in reducing negative attitudes toward "mental illness". Psychiatry, 65(4), 313-325.

Evaluating the Efficacy and Feasibility of the Mindful Awareness Resilience Skills Training (MARST) App to Cultivate Cognitive Resilience and Mindfulness, While Reducing Perceived Stress in University Students

Aileen Pidgeon
School of Psychology
Bond University
Gold Coast, QLD,
Australia

Ashleigh Upton
School of Psychology
Bond University
Gold Coast, QLD,
Australia

Natalie Eckberg
School of Psychology
Bond University
Gold Coast, QLD,
Australia

Aidan Carlan
Faculty of Society and
Design
Bond University
Gold Coast, QLD,
Australia

Abstract—The aim of the current study was to evaluate the efficacy and feasibility of using the Mindful Awareness Resilience Skills Training (MARST) app to promote mindfulness and the components of cognitive resilience: working memory and positive reappraisal, while reducing perceived stress in university students. The 27 University students who participated in the study completed a series of questionnaires in addition to a working memory task pre-training and post-training. After completing the pre-training measures and tasks, participants were provided with the MARST app and instructed to listen to a meditation on the app at least once a day for two-weeks. Results were analyzed using a one-way repeated measures MANOVA. Results found a significant main effect of time from pre-post training on perceived stress, working memory capacity, positive reappraisal, and mindfulness. Follow-up univariate analyses found significant effects of time from pre-post training on decreasing perceived stress, increasing working memory capacity, and mindfulness. Analysis of the Mobile Application Rating Scale (MARS) and qualitative results found the MARST app to be a feasible mindfulness app for university students. Limitations and recommendations for future research are discussed.

Keywords: **MARST, mindfulness, cognitive resilience, working memory, positive reappraisal, perceived stress.**

I. Introduction

University can be a stressful time for students, adapting to new routines and making new friends, all while managing an academic workload, and assessment deadlines. While some students cope well others become overwhelmed by these stressors, which can result in reduced cognitive capabilities such as cognitive resilience (Bolton, Yariush, Staal, & Bourne Jr, 2008; Zandara et al., 2016). Individuals with greater cognitive resilience report more effective use of working memory capacity and positive reappraisal capacity to overcome adverse and stressful events (Zandara et al., 2016). The ability to use working memory and positive reappraisal is pertinent for university students as they experience multiple stressors daily, and need to have the resources and knowledge on how to overcome or cope with the perceived stressors.

Mindfulness and Mindfulness Apps

Mindfulness is associated with enhancing an individual's ability to attend consciously to the events surrounding them, and to be curious, accepting, and open of these events (Eberth & Sedlmier, 2012). In addition, mindfulness has been shown to reduce stress and improve working memory capacity (Banks, Welhaf, & Srour, 2015), and facilitate positive reappraisal capacity (Garland, Gaylord, & Park, 2009).

Mindfulness apps are becoming increasingly popular in society with approximately 13,500 health apps available to download on the app store in 2012, 24% of these apps were related to improving mental health, stress, and wellbeing (Donker et al., 2013). The purpose of mindfulness apps is to provide the user with knowledge about mindfulness and meditation practice (Chittaro & Vianello, 2014). Additionally, mindfulness apps provide the user with mindfulness meditations that aim to reduce stress and increase cognitive resilience (Fernandez, 2016). Previous research has not assessed the effectiveness or feasibility of these health-related apps, in particular, mindfulness apps, are a viable method to provide accessible and interactive interventions for improving health and wellbeing (Howells, Ivtzan, & Eiroa-Orosa, 2014).

The current study aimed to evaluate the efficacy of a mindfulness app, MARST, to reduce perceived stress in a university student sample while promoting mindfulness and enhancing the components of cognitive resilience: working memory capacity and positive reappraisal.

Perceived Stress

Individuals manage and cope with the demands of their stress differently (Chao, 2011). However, if the stressor is not effectively managed a reduction in cognitive capabilities can be observed. Executive functions such as working memory capacity can be negatively impacted (Zandara et al., 2016) resulting in a reduced ability to retrieve, store or manipulate information (Baddeley, 1983). Lazarus and Folkman (1984) proposed two stages when perceiving and coping with a stressor. Primary appraisal such as positive reappraisal, and secondary appraisal. The purpose of assessing perceived stress in the current study was to evaluate how mindfulness interventions such as the MARST app, can reduce the degree of perceived stress university students experience. In addition to how university students use mindfulness and reappraisal techniques such as positive reappraisal to overcome the perceived stress while protecting their cognitive resources such as cognitive resilience.

Cognitive Resilience

Cognitive resilience is a new construct which research has not been adequately operationally defined (Bolton et al., 2008). Research has postulated there are many factors which constitute cognitive resilience (Bolton et al., 2008). The current study operationalized cognitive resilience as consisting of two

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.19

components: positive reappraisal and working memory capacity.

Cognitive resilience is defined as an individual's capability of preserving or retrieving cognitive capacities, which are at risk of depleting under stressful or adverse circumstances (Jha, Morrison, Parker, & Stanley, 2016). Cognitive resilience can be affected by situational stressors such as impending examinations or other perceived stressful situations (Luethi, Meier, & Sandi, 2008). Previous research indicates that as the perception of the stressor increases, there are greater decreases in cognitive capabilities (Jha et al., 2016). The capacity to encode, store, and retrieve information required for completing specific tasks can be significantly impaired by perceived stress (Vogel & Schwabe, 2016). Subsequently, affecting an individual's cognitive resilience.

Zhang et al., (2013) theorized that cognitive resilience could be enhanced by an individual's capacity to positively reappraise situations. Positive reappraisal is postulated to reduce the negative outcomes associated with stressful events, which depletes working memory capacity and consequently, cognitive resilience (Chang et al., 2013).

Working Memory (WM)

Working memory (WM) refers to the interim storage of information, in conjunction with performing other tasks (Baddeley, 1983). It is an active workbench where information is simultaneously being updated, transformed, and combined (Solso, MacLin, & Maclin, 2014).

Enhancing WM can have many benefits such as improving academic performance, increased attention, and improved everyday cognitive functioning (Spencer-Smith & Kilgberg, 2015). Previous research also suggested that individuals with greater WM capacity are more effective at using primary reappraisal techniques (Lazarus & Folkman, 1984) such as positive reappraisal to reframe and regulate stressful experiences.

Mindfulness, Cognitive Resilience, and Perceived Stress

Mindfulness has been shown to have many benefits on varying aspects of wellbeing and cognition, such as perceived stress, mindfulness, and WM capacity. Ramasubramanian (2016) conducted a study to evaluate the efficacy of a mindfulness intervention on increasing adaptive coping and resilience in first-year university students. Results found that there was a significant decrease in levels of perceived stress from pre-test to post-test after completing the mindfulness sessions. In addition to a significant change in coping from pre-test to post-test, so that participants were more effective at using coping strategies to overcome stressors after completing the mindfulness intervention.

Similarly, Sorgi (2016) conducted a study to assess the effectiveness of a Mindfulness-Based Stress Reduction (MBSR) program to improve mindfulness and reduce stress in a high-stress community sample. Results found a significant decrease in levels of perceived stress and a significant increase in levels of mindfulness from pre-program to post-program.

Engaging in mindfulness training has also been researched to enhance WM capacity. Zieden, Johnson, Diamond, David, and Goolkasian (2010) investigated the effects of a brief mindfulness training on aspects of cognition. Results found there were significant improvements in working memory capacity from pre-training to post-training. A paucity of research has been conducted to assess the benefits of mindfulness training on decreasing perceived stress and increasing the components of cognitive resilience, namely WM capacity and positive reappraisal. Garland et al. (2015) proposed a model based on the Broaden and Build Theory (Fredrickson, 2004), which incorporates mindfulness, stress, positive reappraisal and working memory. This model proposes that when an individual experiences or perceives a stressor, positive reappraisal, and WM are used in conjunction with mindfulness to attend and respond to the stressor rather than emotionally reacting to the stressor. Individuals are however encouraged to positively reappraise the stressful event and create a new stimulus-response association. This new association can be stored in WM and used in future relatable stressful situations as a coping mechanism.

Based on Broaden and Build Theory (Fredrickson, 2004) and Garland et al.'s (2015) models, Figure 1, depicts a model which demonstrates the interplay between the relationship of perceived stress, mindfulness, and components of cognitive resilience. The model named the *Cognitive Resilience Model* is also based on the Lazarus and Folkman (1984) Transactional Model of Stress, for the primary appraisal component. The Cognitive Resilience Model postulates that when an adverse or stressful event is experienced, the individual perceives the degree of the stress associated with the event; this in turn negatively impacts on the resources available in WM. The Cognitive Resilience Model postulates increasing mindfulness through the use of the MARST app, which will lead to, improved cognitive resilience by promoting WM and positive reappraisal capacity, which consequently, will lower perceptions of the stressor and increase effective coping during stressful events.

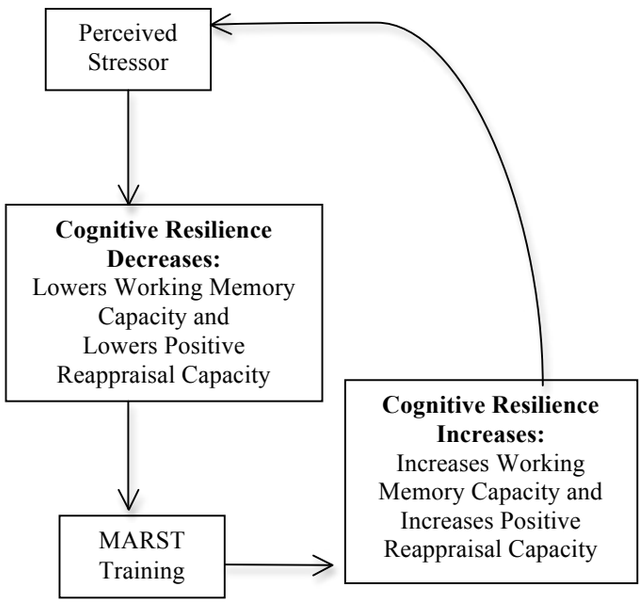


Figure 1. Cognitive Resilience Model

Aims and Hypotheses

Based on the previous research the current study aimed to evaluate the efficacy of the mobile application, MARST, to increase the levels of mindfulness and components of cognitive resilience, including WM and positive reappraisal and reduce the levels of perceived stress in university students. The current study also aimed to assess the feasibility of the MARST app with a university student sample. With the consideration of previous literature and theory, it was hypothesized that:

H1: At post-training, participants would report significantly higher levels of mindfulness and components of cognitive resilience: WM and positive reappraisal, compared to pre-training. Additionally, at post-training, participants would have significantly lower levels of perceived stress compared to pre-training.

H2: Qualitative analysis would reveal that the MARST app would be rated as a feasible app to use with university students.

II. Method

Participants

Twenty-Seven university students participated in the study (25 females, 2 males). Participant's ages ranged from 18 – 28 years (M=21.63, SD = 2.98). Participants were excluded from the study if they scored "*extremely severe*" on either or both the depression and anxiety subscales of the Depression, Anxiety, Stress Scale (DASS-21; Lovibond & Lovibond, 1995). All demographics are presented in Table 1.

TABLE 1. PERCENTAGES OF DEMOGRAPHIC INFORMATION.

Demographic	%
Ethnicity	
Caucasian	81.5
Asian	14.8
Indigenous	3.7
Employment Status	
Part Time	37
Casual	14.8
Not Employed	48.1
University Year	
1st	18.5
2nd	29.6
3rd	14.8
4th	29.6
5th	7.4
Education	
Completed Year 12	41
TAFE	18.5
Bachelor's Degree	37
Master's Degree	3.7

Note. N = 27.

Measures

Depression, Anxiety, Stress Scale. The Depression, Anxiety, Stress Scale (DASS- 21; Lovibond & Lovibond, 1995) is a 21 item self-report questionnaire that measures depression, anxiety, and stress. Higher scores indicate greater severity and associated symptoms of psychological distress.

Cognitive Emotion Regulation Questionnaire Short. The Cognitive Emotion Regulation Questionnaire Short (CERQ-Short; Garnefski & Kraaij, 2006) consists of 18 self-report questions. The CERQ-Short is comprised of nine subscales that measure coping strategies: self-blame, acceptance, rumination, positive refocusing, refocus on planning, positive reappraisal, putting into perspective, catastrophising, and other-blame. The higher the score on each individual subscale, the more the individual uses that strategy to manage the situation.

Perceived Stress Scale. The Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) is a 10 item self-report questionnaire that measures perceived stress.

Toronto Mindfulness Scale. The Toronto Mindfulness Scale (Lau et al., 2006) is a 13-item self-report questionnaire. The Toronto Mindfulness scale consists of two subscales assessing curiosity and decentering.

Automated version of the Operation Span Task. The Automated version of the Operation Span Task (AOSPAN; Unsworth, Heitz, Schrock, & Engle, 2005). The AOSPAN is a computer-based measure of working memory capacity. The AOSPAN comprises of three test blocks and the scored test.

Mobile Application Rating Scale. The Mobile Application Rating Scale (MARS; Stoyanov et al., 2015) was used to collect descriptive and technical information about the MARST app. The MARS consists of 23 questions, which measure engagement, functionality, aesthetics, information, quality, and user experience with the app. In the current study, only 13 questions relating to the above subsections were included in the post-training questionnaire. Scoring of the MARS is calculated on a 5-point Likert scale, with 1 being the least satisfied response, and 5 being the most satisfied response. Question 8 was scored on a 3-point Likert scale with 1 being (*No*), 2 being (*Maybe*) and 3 being (*Yes*). A total score of 63 could be obtained.

Qualitative Questions. A series of seven qualitative questions were collected in the post-training questionnaire to assess the feasibility of the MARST app. Questions relating to the participant's experience using the MARST app, what they liked most and disliked about the MARST app, and what their most and least favorite meditation sessions were.

The Mindful Awareness Resilience Skill Training (MARST) App. The Mindfulness Awareness Resilience Skill Training (MARST) app consisted of seven mindfulness meditation practices based on the essential skill sets for

mindfulness practice including mindfulness of breath, body, emotions and thoughts. The mindfulness meditations were tailored to build mindfulness skills gradually and sequentially while providing information on how mindfulness can improve resilience and responses to stressful situations. The meditations were designed for beginners, with 7 different 10-minute mindfulness meditation exercises to understand and master mindfulness meditation practice and to improve present-moment task-focused attention to improve working memory capacity.

Procedure

Participants were initially screened for "*extremely severe*" levels of anxiety or depression using the DASS-21 (Lovibond & Lovibond, 1995), and consequently were excluded if they scored at this level. Participants accessed the two-part study online. Throughout pre-training participants were required to complete a battery of questionnaires including the CERQ-Positive Reappraisal, PSS, Toronto Mindfulness Scale and then the WM task (AOSPAN). Pre-training took approximately 40 minutes to complete. After completing the questionnaires and WM task, participants were provided information on how to download and use the MARST app, which they were instructed to use at least once daily for the next 14 days.

Participants were required to return for post-training testing 14 days after completing pre-training testing. Participants were required to complete the post-training online battery of questionnaires which were the same as the pre-training questionnaires in addition to the MARS (a rating scale about the quality and user experience with the app) and qualitative questions about the app. Participants were also required to complete the AOSPAN again. Overall, post-training questionnaires and AOSPAN took approximately 45 minutes to complete.

At the conclusion of the study participants were debriefed and thanked for their participation. As compensation for their time and participation, participants were awarded a $50 Gift card and 1 course credit point.

Design

The experimental design of the study was a two-way repeated measures multivariate analysis of variance (MANOVA). The independent variable was time (pre-training and post-training. The dependent variables were perceived stress, positive reappraisal, working memory and mindfulness.

III. Results

Multivariate Analysis

A MANOVA was conducted to assess the effect time had on increasing mindfulness, WM, positive reappraisal, and decreasing perceived stress from pre-training to post-training.

Multivariate analysis of the MANOVA revealed a significant multivariate effect of time $F(4,23) = 32.12$, $p < .001$, $\eta^2_p = .848$ power => 1.

Univariate Analysis

Follow up of the multivariate main effects were conducted by assessing the univariate results. Over time, there was a significant reduction in perceived stress $F(4,23) = 13.24$, $p = .001$, $\eta^2_p = .337$, power = .938, with scores decreasing significantly at post-training ($M = 12.07$, $SD = 6.04$) compared to pre-training ($M = 14.96$, $SD = 5.52$). There was significant improvement in mindfulness scores over time $F(4,23) = 104.69$, $p < .001$, $\eta^2_p = .801$, power => 1, with scores increasing significantly from pre-training ($M = 26.33$, $SD = 8.60$) to post-training ($M = 45.07$, $SD = 7.75$). Similarly, there was a significant improvement in working memory capacity over time $F(4,23) = 18.23$, $p < .001$, $\eta^2_p = .412$, power = .984, with scores increasing significantly from pre-training ($M = 41.26$, $SD = 15.07$) to post-training ($M = 49.78$, $SD = 14.23$). Conversely, there was a non-significant increase in positive reappraisal scores over time $F(4,23) = 2.32$, $p = .139$.

MARS Results

The Mobile Application Rating Scale (MARS) was used to measure engagement, functionality, aesthetics, information, quality and user experience with the MARST app. Additionally, the MARS was used to assess the feasibility of the MARST app with university students. Overall, university students who participated rated the MARST app as effective at promoting WM, mindfulness, positive reappraisal, and reducing perceived stress, with an average MARS total score of $M = 49.00$ ($SD = 6.00$). Participants found on average the app to be easy to use ($M = 4.81$, $SD = 0.40$) and functional at increasing wellbeing while decreasing stress ($M = 4.04$, $SD = 0.76$), with greater scores indicating greater satisfaction with the MARST app.

Qualitative Results

The current study collected responses from participants whether they thought the MARST app was feasible for use with university students via the use of open-ended questions in the post-training questionnaire. Overall, majority of participants reported enjoying using the MARST app (92.6%). The first question participants were required to answer was "*What was your experience using the MARST app?"* To this question majority of participants responded positively with responses including "*It was an easy app to use*", "*I found it really useful in calming and relaxing myself*" and "*I felt energized, engaged, more alert, and calmer after using the app*".

Participants were also required to answer the question "*What was your favourite thing about the MARST app?"* Most common responses to that question were that the length of the sessions (10 minutes) was appropriate; they enjoyed the ability to have daily reminders and that there were different types of mindfulness sessions they could listen to. Additionally, participants enjoyed that there was a theory component explaining the meditation before they completed it. Furthermore, participants stated that they felt more self-aware after using the MARST app and that some of the content they learned during the meditations they could apply to their daily life. Participants also found the app to be user-friendly.

The current study also assessed what participants did not like about using the MARST app to gather further information about the feasibility of the MARST app with university students. The most common response was the quality of the recording. Participants stated that the recording quality was

not good as they could hear static and other background noises in the recording, and that the volume between meditation sessions varied significantly. Participants did state however that this could be improved by using better quality equipment or using a recording booth to ensure that the recording is of high quality and not disruptive throughout the meditation. Participants also stated that they did not like how long the theory and explanation component of the session went for. Participants stated that it often detracted from the meditation component and by the time that the meditation component started they were "*bored*" and distracted by other things on their phones.

During post-training data collection participants were also required to rate their favorite and least favorite meditations from the MARST app. On average participants enjoyed using the second meditation "*Mindfulness of Breathing Meditation"* most, with 25.9% of participants rating this to be their favorite. Conversely, participants disliked the first meditation "*Basics of Mindfulness Meditation*" most, with 40.7% of participants rating this to be their least favorite.

IV. Discussion

The current study aimed to evaluate the efficacy and feasibility of the MARST app to promote mindfulness and enhance the components of cognitive resilience while reducing perceived stress in a university student sample. The purpose for undertaking the study was to add to the limited body of research around the feasibility and efficacy of mobile mindfulness apps as identified by Mani et al. (2015).

The first hypothesis (H1) was partially supported, as there were significant improvements over time in mindfulness, perceived stress, and working memory capacity, one of the components of cognitive resilience. There was a non-significant improvement in positive reappraisal over time, the second component of cognitive resilience. The significant improvement in all variables except positive reappraisal provides partial support for Garland et al.'s (2015) model. The model proposed that: mindfulness training in addition to working memory and positive reappraisal enhances an individual's ability to attend to a stressor and not emotionally react to it, but instead to positively reappraise the stressful event and create a new stimulus-response association. This new association between the experience of the stressor and positive reappraisal of the stressor can be stored in working memory and used in similar future stressful events to cope. As there was a non-significant improvement in positive reappraisal, future research should investigate the strength of each variable in promoting cognitive resilience as the power of the mindfulness training, i.e., the usage of the MARST app, may mask the effects of the individual's positive reappraisal capacity. The partial support of hypothesis one also provides support for the Cognitive Resilience Model created to conceptualize the interplay between the variables in the current study.

Similarly, the significant improvement in one of the components of cognitive resilience, WM capacity, was consistent with previous literature that investigated the effects of mindfulness training on improving working memory over time. In particular, Zieden et al. (2010) that found brief mindfulness training could improve WM capacity. The significant result improvement in WM capacity showed that the MARST app was effective in increasing the capacity of WM to manage and overcome perceived stressors.

Furthermore, the significant improvement in mindfulness over time after using the MARST app was consistent with previous research. Sorgi (2016) found in a high-stress cohort there were significant improvements in mindfulness over time after completing a modified online MBSR program.

The significant decrease in perceived stress is consistent with previous research conducted by Ramasubramanian (2016) who found a significant decrease in perceived stress from pre to post-training after completing mindfulness training.

Finally, positive reappraisal, the second component of cognitive resilience, did not improve over time. This non-significant result was not consistent with previous research such as the study conducted by Garland et al. (2009) which found significant improvements of positive reappraisal over time after engaging in mindfulness. The reason for the null result in the current study may have been due to the small 4-item subscale used to measure positive reappraisal. Future research could overcome this null result by using a larger and more comprehensive measure of positive reappraisal. Additionally, the non-significant result of positive reappraisal may have been masked by the powerful effects of the MARST app to promote mindfulness, the ability to not react emotionally to stressful stimuli. Therefore, the need for positive reappraisal was omitted.

Hypothesis two (H2) was supported, as there were a substantial number of positive reviews about the quality, user experience, and favorite components of the MARST app. This was consistent with the results found in Mani et al.'s (2015) study that found apps such as the Headspace app were rated more favourably if they were easy to use and were of good quality. There were also only a small number of negative comments about the app in regard to minor aspects that could be improved. Overall, participants rated the MARST app to be an easy app to use with a high degree of user-friendliness. Another aspect of the MARST app that participants rated as needing improvement was the quality of the recording. Participants stated there was a large amount of background noise, which was distracting and detracted from the quality of the mindfulness sessions themselves. Participants did however, provide a solution to this problem which a future update of the app could implement, adding background noises such as waves rolling or the sound of rain could add extra relaxing aspects to the app. Overall, the MARST app appears to be a feasible option for a mindfulness meditation app to improve mindfulness, perceived stress and the components of cognitive resilience: WM capacity and positive reappraisal in university students. After making minor modifications that could be implemented in future updates, the preliminary results suggest the MARST app has the potential to be a promising app for future research to evaluate.

The current study had several strengths and limitations. One innovative strength of the study was the use of the MARST app to promote mindfulness to assist university students to enhance the components of cognitive resilience: WM capacity and positive reappraisal, while reducing perceived stress. The current study therefore, was able to provide a platform for future research to investigate other mindfulness apps on larger and more diverse samples and assess the effects over time to improve wellbeing.

Some limitations of the current study were the use of a small and convenient sample of university students. Although some of the results were significant, the use of a student only sample limits the generalizability of the results to larger populations, as the emotional and stressful experiences of undergraduate and postgraduate students are unique to the population. Future research should address this limitation by collecting a larger and more representative sample to enhance generalizability.

Person Attribute Variables were a large limitation of the study. Although attempts were made to reduce the chance of person attribute variables being present, by asking people if they had partaken in any previous mindfulness training, some participants had completed a short one-time mindfulness session in the past. It was also difficult to exclude participants from a study that involved the use of a popular technique which, in an educational setting participants may have been exposed to. These previous experiences of the participants had the potential to confound the results and threaten the internal validity of the study. Future research could overcome this limitation by using a between subject's design and randomly allocating people to groups which would balance out the potential for confounds across groups.

In summary, the current study evaluated the efficacy and feasibility of the MARST app to enhance the components of cognitive resilience: WM and positive reappraisal, and promote mindfulness while reducing perceived stress in university students. These results provide preliminary evidence for the potential to use the MARST mobile app with University student as method to develop mindfulness and improve working memory whilst reducing perceived stress.

REFERENCES

[1] Baddeley, A. D. (1983). Working Memory. *Philosophical Transactions of the Royal Society B: Biological Sciences, 302*(1110), 311–324. doi:10.1098/rstb.1983.0057

[2] Banks, J. B., Welhaf, M. S., & Srour, A. (2015). The protective effects of brief mindfulness meditation training. *Consciousness and Cognition, 33*, 277–285. doi:10.1016/j.concog.2015.01.016

[3] Bolton, A., Yaroush, R., Staal, M., & Bourne Jr., L. (2008). *Cognitive performance and resilience to stress.* In A.Bolton, R.Yaroush, M.Staal, & L.Bourne Jr (Eds.) *Biobehavioral Resilience to Stress*, (pp.259–299). doi:10.1201/9781420071788.ch10

[4] Chang, Y., Mauss, I.B., Dmitrieva, J., Green, K., McRae, K., & Watamura, S. (2013). *The relationship between executive function and positive reappraisal abilities in adulthood.* (Doctoral Dissertation, University of Denver). Retrieved from http://digitalcommons.du.edu/cgi/viewcontent.cgi?article=1775&context=etd

[5] Chao, R.C.L. (2011). Managing stress and maintaining well-being: Social support, problem- focused coping, and avoidant coping. *Journal of Counseling & Development*, *89*(3), 338–348. doi:10.1002/j.1556-6678.2011.tb00098.x

[6] Chittaro, L., & Vianello, A. (2014). Computer-supported mindfulness: Evaluation of a mobile thought distancing application on naive meditators. *International Journal of Human- Computer Studies, 72(*3), 337–348. doi:10.1016/j.ijhcs.2013.11.001

[7] Cohen, S., Kamarck, T., & Mermelstein, R. (1983). Perceived Stress Scale. PsycTESTS Dataset. doi:10.1037/t02889-000

[8] Donker, T., Petrie, K., Proudfoot, J., Clarke, J., Birch, M.R., & Christensen, H. (2013). Smartphones for smarter delivery of mental health programs: A systematic review. *Journal of Medical Internet Research*, *15*(11), e247. doi:10.2196/jmir.2791

[9] Eberth, J., & Sedlmeier, P. (2012). The effects of mindfulness meditation: A meta-analysis. *Mindfulness*, *3*(3), 174–189. doi:10.1007/s12671-012-0101-x

[10] Fernandez, R. (2016). Help your team manage stress, Anxiety, and burnout. *Harvard Business Review.* Retrieved from https://und.edu/finance- operations/_files/docs/newsletter-articles/help-your-team-manage-stress-anxiety-and- burnout.pdf

[11] Fredrickson, B. L. (2004). The Broaden-and-Build Theory of positive emotions. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *359*(1449), 1367–1377. doi:10.1098/rstb.2004.1512

[12] Gall, T. L., Evans, D. R., & Bellerose, S. (2000). Transition to first-year university: Patterns of change in adjustment across life domains and time. *Journal of Social and Clinical Psychology*, *19*(4), 544–567. doi:10.1521/jscp.2000.19.4.544

[13] Garland, E. L., Farb, N. A., R. Goldin, P., & Fredrickson, B. L. (2015). Mindfulness broadens awareness and builds eudaimonic meaning: A process model of mindful positive emotion regulation. *Psychological Inquiry*, *26*(4), 293–314. doi:10.1080/1047840x.2015.1064294

[14] Garland, E., Gaylord, S., & Park, J. (2009). The role of mindfulness in positive reappraisal. *The Journal of Science and Healing*, *5*(1), 37–44. doi:10.1016/j.explore.2008.10.001

[15] Garnefski, N., & Kraaij, V. (2006). Cognitive Emotion Regulation Questionnaire--Short Version. PsycTESTS Dataset. doi:10.1037/t07143-000

[16] Howells, A., Ivtzan, I., & Eiroa-Orosa, F. J. (2014). Putting the "app" in happiness: A randomised controlled trial of a smartphone-based mindfulness intervention to enhance wellbeing. *Journal of Happiness Studies*, *17*(1), 163–185. doi:10.1007/s10902-014-9589-1

[17] Jha, A. P., Morrison, A. B., Parker, S. C., & Stanley, E. A. (2016). Practice is protective: Mindfulness training promotes cognitive resilience in high-stress cohorts. *Mindfulness*, *8*(1), 46–58. doi:10.1007/s12671-015-0465-9

[18] Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., ... Carmody, J. (2006). Toronto Mindfulness Scale. PsycTESTS Dataset. doi:10.1037/t05515-000

[19] Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping.* New York, NY: Springer.

[20] Lovibond, S.H. & Lovibond, P.F. (1995). *Manual for the Depression Anxiety Stress Scales. (2nd. Ed.)* Sydney: Psychology Foundation. ISBN 7334-1423-0

[21] Luethi, M., Meier, B., & Sandi, C. (2008). Stress effects on working memory, explicit memory, and implicit memory for neutral and emotional stimuli in healthy men. *Frontiers in Behavioral Neuroscience*, *2*(5), 1-9. doi.org/10.3389/neuro.08.005.2008

[22] Mani, M., Kavanagh, D. J., Hides, L., & Stoyanov, S. R. (2015). Review and evaluation of mindfulness-based iPhone apps. *JMIR mHealth and uHealth*, *3*(3), e82. doi:10.2196/mhealth.4328

[23] Ramasubramanian, S. (2016). Mindfulness, stress coping and everyday resilience among emerging youth in a university setting: A mixed methods approach. *International Journal of Adolescence and Youth*, *22*(3) 308–321. doi:10.1080/02673843.2016.117536

[24] Solso, R. L., MacLin, O. H., & MacLin, M. K. (2014). Memory models and short term memory. In Solso, MacLin, & MacLin (Eds.), *Cognitive Psychology* (pp. 180 - 181). Essex: Pearson.

[25] Sorgi, A. (2016). *Online mindful stress management for the military: A study using a civilian population*. (Doctoral Dissertation, Adler University). Retrieved from https://search.proquest.com/docview/1845881537?accountid=26503

[26] Spencer-Smith, M., & Klingberg, T. (2015). Benefits of a working memory training program for inattention in daily life: A systematic review and meta-analysis. *PLOS ONE*, *10*(3), 1-4. doi:10.1371/journal.pone.0119522

[27] Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile App Rating Scale: A new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth*, *3*(1), 1-9. doi:10.2196/mhealth.3422

[28] Unsworth, N., Heitz, R. P., Schrock, J. C., & Engle, R. W. (2005). Operation Span Task-- Automated Version. PsycTESTS Dataset. doi:10.1037/t38797-000

[29] Vogel, S., & Schwabe, L. (2016). Learning and memory under stress: Implications for the classroom. *Npj Science of Learning*, *1*(1), 1-10. doi:10.1038/npjscilearn.2016.11

[30] Zandara, M., Garcia-Lluch, M., Pulopulos, M. M., Hidalgo, V., Villada, C., & Salvador, A. (2016). Acute stress and working memory: The role of sex and cognitive stress appraisal. *Physiology & Behavior*, 164, 336–344. doi:10.1016/j.physbeh.2016.06.022

[31] Zeidan, F., Johnson, S. K., Diamond, B. J., David, Z., & Goolkasian, P. (2010). Mindfulness meditation improves cognition: Evidence of brief mental training. *Consciousness and Cognition*, *19*(2), 597–605. doi:10.1016/j.concog.2010.03.014

[32] Zhang, J., Xiong, K., Qiu, M., Zhang, Y., Xie, B., Wang, J., ... Zhang, J. (2013). Negative emotional distraction on neural circuits for working memory in patients with Post Traumatic Stress Disorder. *Brain Research*, 1531, 94–101. doi:10.1016/j.brainres.2013.07.042

Exploring the relationship between the acceptability of an Internet-based intervention for depression in primary care and clinical outcomes

Adriana Mira
Universitat Jaume I
Spain

Carla Soler
Universitat Jaume I
Spain

Azucena García-Palacios
Universitat Jaume I
Spain

Rosa María Baños
Universidad de Valencia
Spain

Javier García-Campayo Universidad de Zaragoza Spain

Fermín Mayoral

Hospital Regional de Málaga
Spain

Margalida Gil

Universitat de les Illes Balears
Spain

Cristina Botella

Universitat Jaume I
Spain

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.20

Abstract

Depression is one of the most disabling psychological disorders worldwide. Although psychotherapy for depression has been found to be effective, there are barriers to its implementation in primary care. The use of the Internet has been shown to be a feasible solution. However, the acceptability of Internet-based interventions has not been studied sufficiently. In fact, in Spain no studies are available on the participants' expectations and satisfaction with this kind of interventions in primary care. The aim of the present work is to assess the acceptability of an Internet-based intervention for depression in primary care, and explore the relationship between expectations and satisfaction, and the improvement in the clinical variables. Data were based on depressive patients who were participants in a multicenter, three-arm, parallel, randomized controlled trial (Montero-Marín et al., 2016). In this study we present the data regarding expectations and satisfaction from all the participants in both Internet intervention groups. All participants fulfilled expectancy, satisfaction and depression measures. The results show high expectations and satisfaction, and a positive relation between these variables and the intervention efficacy. It is worthwhile to develop interventions that include not only effective treatment components, but also aspects aimed to improve patients' expectations and satisfaction, in order to increase their response to the treatment.

Introduction

➢Depression is one **of the most disabling and prevalent psychological disorders worldwide** (Haro et al., 2014).

➢**In primary care**, it is common to prescribe medication for depressive patients (Mohr et al., 2010), but **many patients would also like to receive psychological treatment** (Lester & Howe, 2008).

➢There are **barriers to the implementation of psychotherapy in primary care,** such as the face-to-face time required, the cost, and the lack of trained professionals, which makes it difficult to reach everyone in need and provide the suitable treatment (Kazdin & Rabbit, 2013).

➢**The use of the Internet has been shown to be a feasible solution** for the accessibility problem (Kaltenthaler et al., 2006). A growing body of research supports the **efficacy of Internet-based interventions (IBIs) for the treatment of depression** (Johansson & Andersson, 2012; Karyotaki et al., 2017; Kazdin, 2015).

➢**IBIs for depressed patients could be an appropriate solution in mental healthcare,** specifically in primary care (Montero-Marín et al., 2015; Whiteside et al., 2014).

➢This line of research is growing at an impressive rate (De Graaf et al., 2009), but **little is known about the acceptability of the IBIs in this area** (Ebert et al., 2015).

➢To the best of our knowledge, **no study in Spain has examined participants' expectations and satisfaction with an IBI delivered in primary care, and how these variables can influence its efficacy.**

The objectives of the present study are: **a) to analyze participants' expectations and satisfaction with an IBI for depression in primary care in Spain**; **b) to analyze the relationship between expectations and satisfaction and the primary outcome measure (depression).**

Methods and Results

Design: In the present study data were based on **198 depressive patients,** participants in a multicenter, three-arm, parallel, randomized controlled trial with three experimental groups: low-intensity therapist-guided Internet-based intervention group, a completely self-guided Internet-based group, or improved treatment as usual. In this study we present the data regarding expectations and satisfaction from all the participants in both Internet intervention groups.

Participants: The sample was **mainly composed of women** (76.4%). The age range was **between 25 and 69 years** (M: 48.33; SD: 9.99). In the case of the study level, 1.5% had higher education, 16.9% had mid-level studies, 69.2% had basic studies, and 12.3% had no studies. Regarding marital status 12.3% were single, 69.2% were married or had a partner, 16.9% were separated or divorced, and 1.5% had widowed. Depression severity at pre-treatment: the mean on the Beck Depression Inventory-II (BDI-II) was 23.50 (SD: 8.40).

Intervention: The protocol used for the treatment of depression is an **Internet-based program called "*Smiling is Fun*".** See Table 1.

Main references
Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Beck depression inventory-II. *San Antonio, 78*(2), 490-498.
Borkovec, T. D., & Nau, S. D. (1972). Credibility of analogue therapy rationales. *Journal of behavior therapy and experimental psychiatry, 3*(4), 257-260.
Ebert, D. D., Berking, M., Cuijpers, P., Lehr, D., Pörtner, M., & Baumeister, H. (2015). Increasing the acceptance of Internet-based mental health interventions in primary care patients with depressive symptoms. A randomized controlled trial. *Journal of affective disorders, 176*, 9-17.
Haro, J. M., Ayuso-Mateos, J. L., Bitter, I., Demotes-Mainard, J., Leboyer, M., Lewis, S. W., ... & Robbins, T. W. (2014). ROAMER: roadmap for mental health research in Europe. *International Journal of Methods in Psychiatric Research, 23*(S1), 1-14.
Karyotaki, E., Riper, H., Twisk, J., Hoogendoorn, A., Kleiboer, A., Mira, A., ... & Andersson, G. (2017). Efficacy of self-guided Internet-based cognitive behavioral therapy in the treatment of depressive symptoms: a meta-analysis of individual participant data. *JAMA psychiatry, 74*(4), 351-359.
Kazdin, A. E. (2015). Technology-based interventions and reducing the burdens of mental illness: Perspectives and comments on the special series. *Cognitive and Behavioral Practice, 22*(3), 359-366.
Montero-Marín, J., Araya, R., Pérez-Yus, M. C., Mayoral, F., Gili, M., Botella, C., ... & Nogueira-Arjona, R. (2016). An Internet-based intervention for depression in primary Care in Spain: a randomized controlled trial. *Journal of medical Internet research, 18*(8).

Measures:

Beck Depression Inventory II *(BDI-II; Beck, Steer, & Brown, 1996).*

Expectations and Satisfaction Scales (Adaptation Borkovec & Nau, 1972). Each scale has six items, with responses ranging from 0 ("not at all") to 10 ("very much"): 1) the logic of treatment, 2) the satisfaction experienced, 3) level of recommendation, 4) the perceived usefulness treating other psychological disorders, 5) perceived usefulness in their case 6) Unpleasantness. Its objectives are to measure the expectation that the patient has formed before receiving treatment and the opinion/satisfaction with this treatment after receiving it.

Results: The results show high expectations and satisfaction by the participants (See Table 2) , and a positive relation between these variables and the intervention efficacy: In case of the **expectations** the **"*Intervention usefulness for the patient*" score was a predictor statistically related to the result in BDI-II (*t* (88) = 3.16, *p*= .002).** In case of **satisfaction *"Treatment logic"* score was a predictor statistically related to the result in BDI-II (*t* (88)= 5.23, *p*<.001).** Thus, the higher scores reflected in these items, the greater the pretest-posttest change in the BDI-II.

Table 1. ***Intervention Modules and Main Objectives***

Intervention Modules	Main Objective
1. Medication management	To emphasize the importance of medication.
2. Sleep hygiene	To teach the main difficulties with sleep and how to manage them.
3. Motivation for change	To analyze the patient's motivation and emphasize the importance of the treatment.
4. Understanding emotional problems	To explain to the patient some typical emotional responses to stressful events.
5. Learning to move on	To teach the importance of the activity for our well-being and for getting involved in life.
6. Learning to be flexible	To learn to be more flexible in our way of thinking in different situations.
7. Learning to enjoy	To teach the role of positive emotions and promote involvement in pleasant and significant activities.
8. Learning to live	To understand the concept of well-being and the importance of identifying one's own psychological strengths and life values and goals.
9. Living and learning	To develop an action plan to promote one's psychological strengths.
10. From now on, what else?	To fortify what was learned during the program and analyze future goals.

Table 2. ***Means and standard deviations for expectation and satisfaction scales***

Statements	Expectation M (SD)	Satisfaction M (SD)
1. Treatment logic	7.14 (2.47)	8.07 (1.71)
2. Treatment satisfaction	6.93 (2.49)	7.87 (1.81)
3. Recommending to others	7.37 (2.67)	8.47 (1.76)
4. Usefulness for other disorders	7.32 (1.91)	7.79 (1.72)
5. Usefulness for the patient	7.18 (2.03)	7.57 (1.90)
6. Unpleasantness*	7.31 (2.38)	7.77 (2.10)
Total	7.42 (1.60)	7.92 (1.43)

Notes. *Item 6 is answered in reverse, and so it has been recoded to follow the same scoring criteria as the other 5 items on the scale.
Number of participants (N) on expectation scale (from 1 to 3 items) =198, N on expectation scale (from 4 to 6 items, and total score) =187, N on satisfaction scale = 90. M=Mean, SD=Standard Deviation

Discussion and Conclusion

This is the first study in Spain to address this issue in the field of IBIs for depression in primary care. The IBI showed high acceptance that is related to the intervention's efficacy. Research on IBI acceptability in relation to completion and efficacy variables could help to implement the treatment offered, reaching more people and improving the outcome. It is worthwhile to develop interventions that include not only effective treatment components, but also aspects aimed to improve patients' expectations and satisfaction, in order to increase their response to the treatment.

The Unpacked Role of Bullying On Self-Esteem and Psychological Distress among Adult Students

Ammar Ahmed[1], Muhammad Aqeel[2], Brig(R) Dr.Tanvir Akhtar[3],
Jaffar Abbas[4], Kinza Noor[5]

1: M.s Psychology Scholar, Department of Psychology, Foundation University, Rawalpindi.
2: Lecturer, Department of Psychology, Foundation University, Rawalpindi Campus.
3: Head of Psychology Department, Foundation University, Rawalpindi Campus.
4: Ph.D. Scholar, Shanghai University, Baoshan Campus, Shanghai China
5: M.sc Psychology Scholar, Department of Psychology, Foundation University, Rawalpindi.

ABSTRACT

Bullying is a global concern and plays a crucial role in developing various psychological problems among adult students. The current study intended to inspect the relationship among bullying, self-esteem and psychological distress in adult students. Moreover, it examined the impact of bullying on self-esteem and psychological distress. 200 participants (Male n=92, Female n=108) were incorporated from various universities of Rawalpindi and Islamabad, Pakistan. Purposive convenient sampling technique was employed based on cross-sectional design. Three instruments were employed to evaluate self-esteem, bullying and psychological adjustment in adults. Results highlighted that bullying was negatively related to self-esteem, and positively associated with psychological distress in adult students. Current study findings elaborated that bullying was negatively predicting self-esteem (r = -.296, p<.01) in adult students. It was also positively influencing psychological distress regarding anxiety (r =.234, p<.01), depression (r =.295, p<.01) and stress (r = -.226, p<.01) in adult students. This study recommends that those students who had bullying experiences were more vulnerable to develop negative self-esteem as well as psychological problems including stress, anxiety, and depression. It would also be important to understand the causes of psychological distress and to explore impeding modifiable factors pointing out towards the development of new interventions and prevention strategies for tackling this problem in adult students.
Keywords*: Bullying, Self-esteem, Psychological distress*

INTRODUCTION

Bullying is an act of frequent abuse where one person tries to impose its power over another individual and deliberately causes harm to an individual with comparatively lower power [1-3]. Bullying in educational settings has recently been the topic of interest, as adult students can become key targets of revenge, harassment, and rudeness
[4].

Self-esteem, which is a global view of oneself, is a prime factor leading a person to be bullied. Numerous previous researchers have held a bird's eye view on relationship between bullying and self-esteem [5-9]. Self-esteem is linked with some vital social life and personal outcomes. For example, high self-esteem predicts closeness in better job performance, romantic relationships, and academic achievement. However, prior studies on low selfesteem, serving as a risk factor for bullying are inconclusive [10-12]. Low self-esteem has long been hypothesized to be a jeopardizing factor for antisocial behavior and aggression. However, similar to the bullying literature, research linking self-esteem to psychological distress has reported mixed findings [13].

Low self-esteem and depression are strongly related, but there is not yet consistent evidence on the nature of the relation [14]. Operational definitions of depression specifically include low self-esteem as a possible symptom [15]. According to prior studies, it is assumed that individuals exhibiting dysfunctional attitudes or negative inferential styles about themselves are at risk of developing anxiety, stress and depressive symptoms [16-18].

7th Annual International Conference on
Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.22

Prior studies reveal that exposure to regular and long-lasting aggressive and offensive behavior is coupled with a variety of harmful health effects, including intellectual as well as somatic symptoms. Studies have also reported both cross-sectional and long-term links between bullying and symptoms of anxiety and depression, insomnia, lack of concentration, irritability and somatic complaints like muscle-skeletal pain, fatigue and gastrointestinal symptoms which are present due to psychological distress [19, 20].

Studies investigating gender and bullying have emphasized only on masculinity. Several studies have found that the majority of aggressive subjects are only those who hold a strong and traditional masculine orientation, irrespective of the gender of the one who attributes Himself/Herself these masculine traits. When examining bullying among adolescents, gender is also, a critical aspect to consider [21-24].

Numerous prior studies have shown that bullying, harassment, abuse or belittlement is a regular phenomenon faced by university students [25-27]. Very few studies in Pakistan have managed to recognize the understanding of personal and psychological aspects of bullying among university students, as it is experienced within a group of peers who adopt a variety of participant roles, such as agents, targets, bystanders or defender.

The present study assesses the aspects of bullying related to psychological symptoms of depression, anxiety, and stress along with self-esteem. Low-Self-esteem and emotional distress are two psychological factors that are implicated in the involvement of bullying. Thus it is hypothesized that there is an impact of bullying on selfesteem and psychological distress among adult students. This study examines their joint and interactive contributions to harassment and peers victimization over time causing mental trauma and health issues.

METHOD

Sample

In the present study, purposive convenient sampling technique was employed to determine the impact of bullying on the self-esteem and psychological distress among university students. The sample consisted of 200 students. Data is collected from the Foundation University Rawalpindi campus, Army public school of management sciences and Bahria University. The age ranged from 18 to 26 years. Out of 200, there were 92 male and 108 female.

Instruments

Bullying Student Survey. A scale developed by bullying prevention unit, it has 16 items which measure two aspects of bullying in the last 30 days. The first subscale is about student involvement in bullying from items 1 to 9.Second subscale is about victimization measure that measures the extent to which student is victimized due to bullying from responses 10 to 16. Each response is noted on a self reporting 5 points Likert scale [28].

Self-esteem Scale. Rosenberg Self-Esteem Scale was used [29]. There are 10-items to assess global selfesteem, with higher scores indicating towards more positive self-regard. Each item has a 4-point Likert scale ranging from 1= Strongly agree to 4= Strongly disagree. This instrument has high reliability, with a test and retest correlations value between 0.82 and 0.88. Cronbach's alpha of this scale in the present study was 0.703.

Depression Anxiety and Stress Scale (DASS). This scale is developed by Lovibond (1995). And its Urdu version was translated by Zafar and Khalily(2014). It comprises of 42 items which is further divided into three extensive subscales: (1) Depression (2) Anxiety (3) Stress. The internal reliability of translated version is α=.83 for overall DASS and subscales it is: Depression α=.63, Anxiety α=.60, and Stress α= .60 (Zafar & Khalily, 2015).

Procedure

Data was collected from the students of different universities by using bullying, self-esteem and DASS scales, students were approached individually, and informed consent was taken from the participants so that the ethical considerations were satisfied. The questionnaires were handed over to them, and they were informed about the research study. The students were given instructions about the questionnaire procedure. After the completion of surveys, the form was checked that no item is left or missed.

RESULTS

The data of the present study is analyzed through the Statistical Package for the Social Sciences (SPSS) version 22 to measure the relations between bullying, self-esteem and psychological distress among university students.

Table1

Demographic characteristics of Sample N=200

Variables	Categories	F	%
Gender	Female	108	54.0
	Male	92	46.0
Father	Died	15	7.5
	Alive	183	91.5
Mother	Died	12	6.0
	Alive	185	92.5
Family System	Nuclear	59	29.5
	Joint	130	65.0
Marital Status	Single	131	75.5
	Married	49	24.5

Cronbach's alpha reliability (Table-2) of bullying scale is 0.911, self-esteem is 0.703, and that for DASS is 0.919 which indicates that items of the scale used are internally consistent to assess bullying, self-esteem, depression, anxiety, and stress.

Table2

Cronbach's Alpha coefficient Reliabilities of bullying scale, self-esteem, and Dass in the main study (N=200)

Scale	No. of items	α
Bullying Scale	16	.911
Self-esteem	18	.703
DASS	42	.919

Note. DASS=Depression, Anxiety and Stress Scale

The overall, Cronbach alphas in Table 3 reported are satisfactory. The results in Table 3 reveal that there is a significant negative correlation between bullying and self-esteem (r = -.296, P<.01). The correlation between bullying and self-esteem shows that there is a negative relation between bullying and self-esteem along with moderate correlation; therefore it means that as bullying increases among adult students, self-esteem decreases and vice-versa. Further results indicate that there is a positive correlation between bullying and psychological distress, which means if bullying increases stress, anxiety, and depression also increase. Similarly, there is an overall negative correlation between psychological distress and self-esteem.

Table3

Pearson Product Correlation between Bullying Scale, Self-esteem and DASS(N=200)

Scales	1	2	3	4	5
1.Bullying	-	-.296**	.295**	.234**	.026
2.Self-esteem		-	-.175*	-.106	-.339**
3.Depression		-	-	.753**	.667**
4.Anxiety		-	-	-	.662**
5.Stress					-

*$^{*}p < .000$. $^{**}p < .01$. $^{*}p < .05$

Table-4 mentioned below demonstrates the mean differences for bullying, self-esteem and psychological distress among male and females. Mean score of male is 48.02 (SD=17.99) and for females is 42.60 (SD=22.29).This shows no significant differences (t=2.11, p<.05) among males and females on the scale of bullying , self-esteem and psychological distress

Table4

Gender Differences for Bullying

Variable	Gender	M	SD	t	*p*	S.E	Cohen's d	95% CI	
								LL	UL
Bullying	Male	48.02	17.99	2.11	0.026	1.88	2.93	.4132	11.99
	Female	42.60	22.29	2.55	0.024	2.19	2.90	.4884	11.91

Note. CI=Confidence Interval, LL=Lower Limit, UL=Upper Limit

Table5

Impact of bullying over depression, anxiety, stress and self-esteem

	Variables	B	S.E	β	ΔR^2	ΔF
Bullying	Depression	.428	.117	.392**	.175	40.98***
	Anxiety	.240	.115	.227**	.165	38.56**
	Stress	.547	.120	.465*	.125	20.02**
	Self -esteem	-.086	.087	-.170**	.185	50.65***

*$^{***}p < .000$. $^{**}p < .01$. $^{*}p < .05$

Simple regression was performed to examine the impact of bullying on the relationship between selfesteem (β = -.392, p<.01), anxiety (β =.227, p<.01), stress (β =.465, p<.05) and depression (β =.392, p<.01). This study revealed that self-esteem, anxiety, depression and stress were significantly predicted for bullying. Further table revealed that bullied students prediction for depression was =41.00%, self-esteem prediction=49.01% and anxiety prediction=35.15%.The result presented above are only those which are proved to be significant.

DISCUSSION

This current study had two main goals: 1) to investigate the relationship between bullying, self esteem, and psychological distress; and 2) to examine the impact of bullying on self-esteem and psychological distress.

Given the first goal, findings through Pearson Product correlation indicated that there exists a significant negative relationship (r = -.296, p<.05) of self-esteem with bullying (Table-3).The results show a moderate but significant correlation between the two. Current results suggest that adult students experiencing bullying tend to have less self-esteem. It supports the hypothesis of this present study that there is a negative relationship between bullying and self-esteem. Previous studies have also shown nearly the same results, like bullying in workplace concerning self-esteem also demonstrated lower levels of self-esteem [30, 31].

Further, it was established that there exists a negative relationship between anxiety, depression, and stress with self-esteem (Table-3).Also; it was observed that there is a positive relationship between bullying and anxiety, depression and stress. Prior studies also reported that bullying leads to psychological distress and social, educational and occupational impairments [32, 33].

The regression analysis showed that there is a significant relation between depression and bullying (β =.392, p<.01) and there was also a significant relation between anxiety and bullying (β =.227, p<.01). Further it was revealed that there was a significant negative relationship between self-esteem and bullying (β = -.392, p<.01).These findings are consistent with prior findings which suggest that victims of bullying experience adverse mental health consequences as a result of exposure to frequent bullying occurrences in various forms [34-36].

Present research has also exposed some key findings related to the indigenous and typological adult bullying victimizations in the Pakistani context, it is worth mentioning that the timing of the incidents might have important implications for strategies to combat bullying and address precise mental health outcomes at appropriate instances.

Conclusion

This study was conducted with an aim to see the relationship of bullying on self-esteem and psychological distress along with gender differences. From the literature, results and discussion, it is suggested that there exists a significant negative relationship of bullying with self-esteem (predicting lower self-esteem) and positive relationship between bullying and psychological distress. This study will be helpful for rehabilitation psychologists under clinical settings to take evidences from this research and therefore make therapies for bullied victims more effective particularly for adult students in Pakistan.

Limitations and Recommendations

The present study was done by employing correlation and cross-sectional design, in future longitudinal study regarding bulling victimization of students would be helpful and therefore its long-term psychosocial effects could also be examined in the Pakistani indigenous culture.

REFERENCES

1. Rodkin, P.C., D.L. Espelage, and L.D. Hanish, *A relational framework for understanding bullying: Developmental antecedents and outcomes.* American Psychologist, 2015. **70**(4): p. 311.
2. Swearer, S.M., et al., *What can be done about school bullying? Linking research to educational practice.* Educational researcher, 2010. **39**(1): p. 38-47.
3. Espelage, D.L., K. Bosworth, and T.R. Simon, *Examining the social context of bullying behaviors in early adolescence.* Journal of Counseling & Development, 2000. **78**(3): p. 326-333.
4. Fox, S. and L.E. Stallworth, *The battered apple: An application of stressor-emotion-control/support theory to teachers' experience of violence and bullying.* Human Relations, 2010. **63**(7): p. 927-954.
5. Seals, D. and J. Young, *Bullying and victimization: Prevalence and relationship to gender, grade level, ethnicity, self-esteem, and depression.* Adolescence, 2003. **38**(152): p. 735.
6. Chapell, M., et al., *Bullying in college by students and teachers.* Adolescence, 2004. **39**(153): p. 53.
7. Fox, C.L. and C.V. Farrow, *Global and physical self-esteem and body dissatisfaction as mediators of the relationship between weight status and being a victim of bullying.* Journal of adolescence, 2009. **32**(5): p. 1287-1301.
8. Pollastri, A.R., E.V. Cardemil, and E.H. O'Donnell, *Self-esteem in pure bullies and bully/victims: A longitudinal analysis.* Journal of interpersonal violence, 2010. **25**(8): p. 1489-1502.
9. Malecki, C.K., et al. *Frequency, power differential, and intentionality and the relationship to anxiety, depression, and self-esteem for victims of bullying*. in *Child & Youth Care Forum*. 2015. Springer.
10. Hartley, M.T., et al., *Comparative study of bullying victimization among students in general and special education.* Exceptional Children, 2015. **81**(2): p. 176-193.
11. Atik, G. and O.Y. Güneri, *Bullying and victimization: Predictive role of individual, parental, and academic*

factors. School Psychology International, 2013. **34**(6): p. 658-673.
12. Sekol, I. and D.P. Farrington, *Psychological and background correlates of bullying in adolescent residential care.* Journal of Social Work, 2016. **16**(4): p. 429-452.
13. Fanti, K.A. and C.C. Henrich, *Effects of self-esteem and narcissism on bullying and victimization during early adolescence.* The Journal of Early Adolescence, 2015. **35**(1): p. 5-29.
14. Sowislo, J.F., U. Orth, and L.L. Meier, *What constitutes vulnerable self-esteem? Comparing the prospective effects of low, unstable, and contingent self-esteem on depressive symptoms.* Journal of Abnormal Psychology, 2014. **123**(4): p. 737.
15. American Psychiatric Association, *Diagnostic and statistical manual of mental disorders (DSM-5®)*. 2013: American Psychiatric Pub.
16. Hamilton, J.L., et al., *It gets better: Future orientation buffers the development of hopelessness and depressive symptoms following emotional victimization during early adolescence.* Journal of abnormal child psychology, 2015. **43**(3): p. 465-474.
17. Sowislo, J.F. and U. Orth, *Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies*. 2013, American Psychological Association.
18. Al Nima, A., et al., *Anxiety, affect, self-esteem, and stress: mediation and moderation effects on depression.* PLoS One, 2013. **8**(9): p. e73265.
19. Lereya, S.T., et al., *Adult mental health consequences of peer bullying and maltreatment in childhood: two cohorts in two countries.* The Lancet Psychiatry, 2015. **2**(6): p. 524-531.
20. Reid, G.M., et al., *Perceived social support and mental health among first-year college students with histories of bullying victimization.* Journal of Child and Family Studies, 2016. **25**(11): p. 3331-3341.
21. Meyer, E.J., *Gender, bullying, and harassment: Strategies to end sexism and homophobia in schools*. 2015: Teachers College Press.
22. Brinkman, B.G. and L. Manning, *Children's intended responses to gender-based bullying as targets and bystanders.* Childhood, 2016. **23**(2): p. 221-235.
23. Popp, A.M., et al., *Gender, bullying victimization, and education.* Violence and victims, 2014. **29**(5): p. 843-856.
24. Sentse, M., T. Kretschmer, and C. Salmivalli, *The longitudinal interplay between bullying, victimization, and social status: Age-related and gender differences.* Social Development, 2015. **24**(3): p. 659-677.
25. Cowie, H. and C.-A. Myers, *Bullying amongst University Students in the UK.* International Journal of Emotional Education, 2014. **6**(1): p. 66.
26. Sinkkonen, H.-M., H. Puhakka, and M. Meriläinen, *Bullying at a university: students' experiences of bullying.* Studies in Higher Education, 2014. **39**(1): p. 153-165.
27. Cowie, H. and C.A. Myers, *Bullying Among University Students: Cross-national Perspectives*. 2015: Routledge.
28. Espelage, D.L. and M.K. Holt, *Bullying and victimization during early adolescence: Peer influences and psychosocial correlates.* Journal of Emotional Abuse, 2001. **2**(2-3): p. 123-142.
29. Wrosch, C. and M.F. Scheier, *Personality and quality of life: The importance of optimism and goal adjustment.* Quality of life Research, 2003. **12**: p. 59-72.
30. D'Aleo, N., et al., *Managing workplace stress: psychosocial hazard risk profiles in public and private sector Australia.* The Australian Journal of Rehabilitation Counselling, 2007. **13**(2): p. 68-87.
31. Georgakopoulos, A. and M. Kelly, *Addressing workplace bullying with workplace bullying initiatives and programs: A case study utilizing facilitation methodologies.* 2015.
32. Day, C.V., et al., *Impairment and distress patterns distinguishing the melancholic depression subtype: An iSPOT-D report.* Journal of affective disorders, 2015. **174**: p. 493-502.
33. Kendall-Tackett, K., *The effects of childhood maltreatment and of exposure to early toxic stress.* Child Abuse Neglect Worldwide, 2014. **3**: p. 155.
34. Verkuil, B., S. Atasayi, and M.L. Molendijk, *Workplace bullying and mental health: a meta-analysis on cross-sectional and longitudinal data.* PloS one, 2015. **10**(8): p. e0135225.
35. Turner, M.G., et al., *Bullying victimization and adolescent mental health: General and typological effects across sex.* Journal of Criminal Justice, 2013. **41**(1): p. 53-59.
36. Sigurdson, J.F., et al., *The long-term effects of being bullied or a bully in adolescence on externalizing and internalizing mental health problems in adulthood.* Child and adolescent psychiatry and mental health, 2015. **9**(1): p. 42.

Reduction of Addict Resistance to Treatment in the Qatari Society from the Spiritual Perspective entrance in the Clinical Social Work

Kaltam Al-Kuwari
Qatar University
Qatar

Textual Feature :

Modeling itself like other developed nations, Qatar has taken steps to provide integrated care in the area of combating drug addiction. To this end, multiple dimensions have been developed such as : national strategy for combating drugs in the state of Qatar (2010-2015), national vision of Qatar, 2030, along with conclusions reached by numerous studies affirming effectiveness and efficiency of protection, treatment, and rehabilitation in this regard. However, little evidence is available on reasons and manifestations of the addict's resistance to the provided treatment. Such resistance is therefore, a waste of material and human resources, sustained by the society, concerned foundations and families of the afflicted addicts. A direct consequence of such resistance is a relapse and return to drug abuse, thus impacting negatively on sustainable development programs within the society.

National strategy for combating drugs forged in The state of Qatar, reiterates the need to up hold genuine Islamic spirit, propagating its principles, raising awareness of values emanating from Islamic religion, to make such endeavor (i.e) combating drugs, a success.

(permanent committee on narcotics & intoxicants, 2010).

Social work profession plays a critical role in providing addicts with the needed help on the protection, treatment, or rehabilitation level, due to its close association with religiosity. Social workers have had a long history, being active players in charities. Scientific evidence points to the importance of including spiritualities as part and parcel while practicing social work. A lot of clients echo the dire need to have the spiritual dimension, involved, if sound answers are sincerely sought to their problems. Social workers also have always aspired to include spirituals within the therapeutic techniques, to ensure effectiveness exemplified in professional interventions [5] (Condwe, Edward R,1998).

Clinical proof and research results indication that spirituality introduces a pivotal part into client's lives, requiring updating social workers on the proper use of such a new element to their professional practice. Practitioner are urged to unveil skillfully the spiritual beliefs of their clients, for bringing about new dimensions to life style of their clients.[6] (Violet 'J. Morgan, Helga E. Berwick, Christine A. Walsh, 2008).

- Spiritual Approach:

This approach focuses on religious and spiritual factors as the mainstay of man's life. Tenets of this approach are basic assumptions derived from Islamic heritage, how Islam looks on human life, and the reasons for creating humans in mundane life, relationship between the human creatures and the creator, thus contemplating how man is relevant to the universe around (Attef Moftah Abdul Gawad, 2007). Based on the above, the search problem can be summarized in identifying manifestations of the addict's resistance, proposing a program based on the spiritual approach within the framework of Islamic perspective on how to mitigate the addict's resistance to treatment in the Qatari society.

- Questions:

  - What are the manifestations of an addict to treatment in the Qatari society?
  - What are the reasons for the addict's resistance to treatment in the Qatari society?
  - What is the proposed program for alleviating the addict's resistance to treatment in the Qatari society?

- Sample (subject of the study):

The research population comprised of mature, male addicts on any drugs for the inpatient department of the center for treatment and rehabilitation, Doha. The sample size was (28) individuals.

Working team at the center, they are (15) in the different professions and occupations.

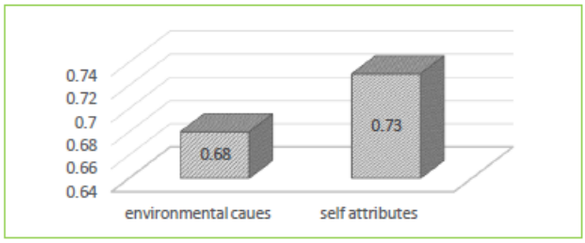
- Scales:

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.24

These are prepared by the researcher as follows:

1. Questionnaire "reasons behind the addicts resistance to treatment in the Qatari society it was administered to the (28) addicts.
2. Questionnaire "manifestations of the addicts resistance to treatment in the Qatari society it was administered to the specialists (15).



The above figure (1) shows an increase in self-attributes index, compared to environmental causes of resistance to treatment in the Qatari society, reflecting that individuals themselves are willing to put resistance to treatment.

- Questionnaire analysis: manifestations of the addict's resistance to treatment in the Qatari society, as viewed by the center's staff.

a. Initial data analysis for the center's staff

Table (1)
Job description of participants from the center's staff.

Job description	Frequency (repetition)	%
Psychiatry consultant addiction medicine	2	13.3
Psychologist	2	13.3
Participating physician	1	6.7
Internist consultant	1	6.7
Internist specialist	1	6.7
Clinical psychology consultant	1	6.7
Clinical psychology specialist	1	6.7
Social worker	1	6.7
Physiology & occupational therapy	1	6.7
Physio-therapist	1	6.7
Cultural guide	1	6.7
Psychologist	2	13.3
Total	15	100

Table (2)
Tenure for center's staff on addition (frequency)

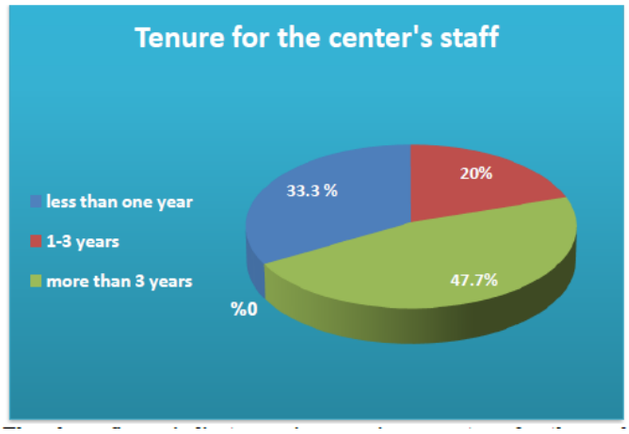
Tenure	Repetition	%
Less than one year	3	20.0
1-3 years	7	46.7
More than 3 years	5	33.3
Total	15	100

The above table (2) shows tenure for the center's staff on addiction generally with an increase for 1-3 years. (46.7 %) followed by less than 3 years. (33.3 %), while the percentage is (20%) for less than one year,.

The above table (2) shows tenure for the center's staff on addiction generally with an increase for 1-3 years. (46.7 %) followed by less than 3 years. (33.3 %), while the percentage is (20%) for less than one year,.

Figure (2).

Tenure for the center's staff, on addition generally tenure.



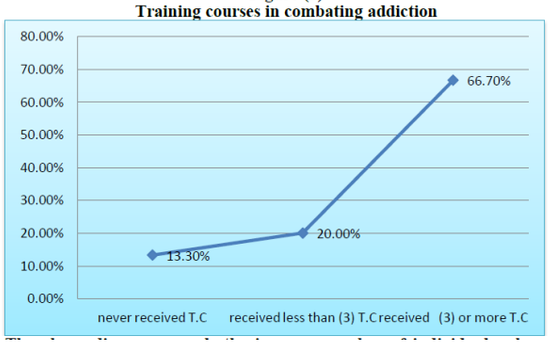
The above figure indicates an increase in percentage for those who work for the center from one to three years, reflecting an attempt by inexperienced workers to establish themselves and again more knowledge.

Table (3)
Raining courses in combating addiction

Training course	Repetition	%
I never received training courses	2	13.3
I received less than	3	20.00
(3) training courses		
I received three or more training courses	10	66.7
Total	15	100

The data of the above table (3) reveal the increased ratio of individuals who received (3) or more training courses (66.7%) followed by those who received three or less training courses (20%), while those who never received training courses accounted for (13.3%)

Figure (3)
Training courses in combating addiction



The above diagram reveals the increase number of individuals who received (3) training courses (T.C) or more in combating addiction thus reflecting cumulative knowledge on such courses along with building further experience.

Table (4)
Addict's resistance to treatment

Do you think the addict is resistant to treatment	Repetition	%
Yes	15	100
No	-	-
Total	15	100

Results of table (4) (e.g client's resistance to treatment), reveal that the study population unanimously agree that all addicts residing in the center are resistant to treatment (100%).

b- analysis of addict's resistance to treatment manifestations, as viewed by the center's staff

Table (5)

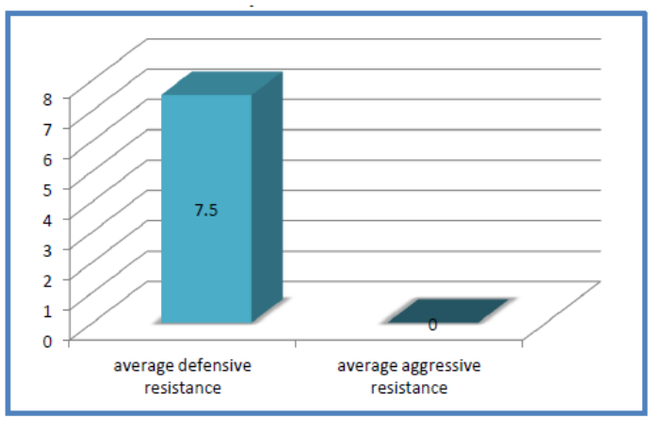
significance of differences for estimates by center's staff, on how addicts resist treatment, using Wilcoxn.

Resistance	no.	Average rankings		aggregate rankings		Z	P.
		positive	negative	positive	negative		
Defensive/ aggressive	28	7.50	0.00	105.00	0.00	3.304	0.001

The above table (5), shows that estimates made by the center's staff, for aggressive, resistance are low, with average ranking (0.00) and total negative rankings (0.00). on the other hand, their estimates of the defensive resistance, used by the addict to treatment within the Qatari society, are higher , with an average positive ranking measuring (7.50), while aggregate negative rankings measuring (105.00) (Z) value of Wilcoxn = 3.304 at p. = 0.001 , (i.e) less than (0.05). This indicates the presence of significant differences in favor of the defensive resistance. Hence, it can be said that the defensive resistance, used by the addict to counter treatment in the Qatari society, is higher than that of self-resistance.

Figure (4)

Graph of average estimates made by the center's staff for the aggressive & defensive resistance, used by the addict to resist treatment in the Qatari society.



The above figure (4), illustrates a marked increase in defensive resistance averages, compared to those of aggressive resistance, meaning that the majority of center's participants stress that defensive resistance is the most prominent among the center's addicts, compared to the aggressive resistance.

Table (6)

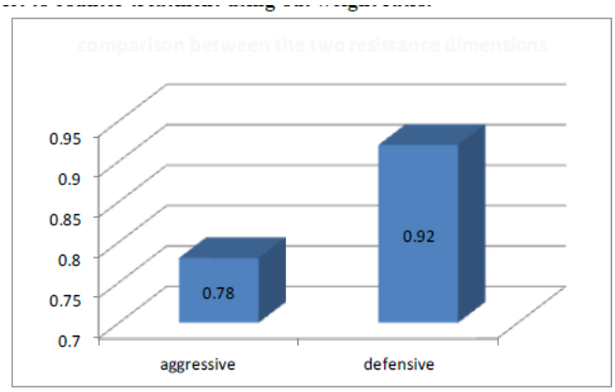
Comparison between defensive and aggressive resistance, used by the addict to counter treatment in the Qatari society, using out weights.

Rank	Relative weight	Medium weight	Out weight	Total weights	Sign of resistance to treatment
2	7.02	2.34	0.78	421	Aggressive
1	8.30	2.77	0.92	498	Defensive

The data of table (6), (e.g comparison between aggressive and defensive resistance, shown by clients to treatment), reveal a marked rise of defensive resistance, ranked first, with a total weight (498), while aggressive resistance scored (421), rise of the medium weight for defensive resistance (2.77) compared to (2.34) of the aggressive resistance. Mean while there is a marked rise of relative weight for the defensive resistance measuring (8.30) compared for the aggressive resistance finally, out weight ratio of defensive resistance scored (0.92) to the disadvantage of aggressive resistance, scoring (0.78). in sum, these figures indicate that defensive resistance is the most prevalent and used by addicts to counter treatment in the Qatari society compared to aggressive signs.

Figure (5)

Comparison between aggressive and defensive resistance used by the addict to counter treatment using out weight ratio.



The above figure (5) shows a marked rise in the defensive resistance out weight ratio scoring (0.92),while the aggressive resistance scored (0.78). in other words, the majority of the center's staff affirmed that the defensive resistance is the most prevalent by the addict to counter treatment in the Qatari society, compared to aggressive defense.

Answers to research questions :

Answers to research questions can be summarized as follows:

1. Answer to Q.1 : to answer the first research question (e.g: what are the addict's signs of resistance to treatment in the Qatari society?), the researcher used the appropriate statistical methods to find the answer to the question (e.g repetition, percentage, average estimates, standard deviation (S.D), determine significance of differences for evaluations made by study participants, using Wilcoxon coefficient, and the out weights).

Results showed that the defensive resistance used by the addict to counter treatment, is the most prevalent in the Qatari society, compared to the self resistance. This implies that resistance to treatment is mainly defensive, which in turn hurdles the treatment process.

2. Answer to the Q.2: to answer the seconed research question (e.g: what are the reasons for the addict's resistance to treatment in the Qatari society?), the researcher conducted the required statistical methods (e.g frequencies, percentages, average, standered deviation S.D, significance of differences for the estimates made by the study population using Wilcoxon coefficient, and the out weights). results of these tests revealed that sel-reasons for resistance to treatment in the Qatari society are the most prevalent compared to environmental causes, indicating that reasons for obstructing the addict's treatment are mainly due to the client's attributes thus being the culprit not the surroundings. In sum it can be said that the addict resorts to defensive resistance more than self-attributes as the latter outnumber the environmental one so in other words deficiencies to the full recovery from addiction are blamed on the individual consequently, the researcher embarked on the design of a proposed program targeting the alleviation of resistance by the addict to the treatment provided in the Qatari society from the spiritual perspective in clinical social service, to properly wrap up the treatment process.

3. Answer to Q.3 : the answer to Q.3 (e.g what is the proposed program to alleviate the addict's resistance in the Qatari society, to treatment provided) is underpinned on the theoretical and practical inputs, emanating from the following sources:

a. Results of the present study and pervious research on description and indications of the addict's resistance to treatment.

b. Field visits and observations by the researcher, to Qatari intuitions dedicated to addiction treatment:

The proposed program has the following features:

1. *Importance :*

This program seeks to enhance the outcome of therapeutic programs on combating addiction within the Qatari society. Costs of such programs are considered investment into the future while introducing a vital element (i.e) the spiritual dimension to ensure effectiveness and efficiency.

2. *Objectives:*

The program seeks to help the addict continue enrollment in the therapeutic program, along with alleviating the addict's resistance to the treatment provided. To this end, subsidiary aims are pursued as follows:

- Description and analysis of the defensive resistance as turned out to be the most prevalent to successful treatment in the Qatari society,

compared to the other from of resistance put by the client (e.g the aggressive resistance).

- Description and analysis of self- attributes by the addict to treatment in the Qatari society, viewed as the major hurdles to the client's resistance to treatment, compared to environmental causes.
- Help the addict rectify his/her path by being more relevant to Allah, through ridding of sins and pursuit of purity.

3. *Content of the program:*

The proposed professional intervention content of the program rests on scientific tenets, some of which are:

- Believe in the unknown, and resign to god's will, with the need to perform duties deemed reasonable.
- Revelation is an inevitable means to communicate with man and universe.
- Man is gifted with the freedom of choice, the blessing of reason, and therefore, held accountable for deeds, and actions committed.
- Man is created to worship Allah, construct the mundane life, achieve supreme goals.
- Man has a dual identity (i.e) the physical and spiritual creations go hand in hand and are therefore inseparable.

4. *Steps to put the program into effect:*

According to the fundamental steps of the spiritual approach, the following stages are adopted:

- Estimation phase: Here a clear picture is developed on reasons for the addict's resistance to treatment, to determine strengths that may be an asset to the sound treatment. Then suggestions are made to ensure acceptance of treatment by the addict.
- Planning the professional intervention phase: here contracts are: signed and therapeutic methods are determined, some of which are:

(spiritual and religious methods)

- Arouse the religious conscience within the addict. Help the addict understand properly lessons learned from grievances and terrible events.
- Help the addict rise to spiritual supremacy.

Worship- related therapy (e.g prayers, Holy Koran, asking for forgiveness, continuous mention of Allah).

❋ *Qualitative methods:*

- Modeling
- Logo therapy
- Acceptance and commitment therapy (A.C.T)
- Counseling & advice methods

❋ *Professional intervention phase*

Here measures are taken to execute the proposed plan through therapeutic methods and clinical interviews to determine the attained outcome. The execution could require three months' period, followed by termination and follow – up

Conclusion:

The researcher attempts to forge a proposed program to alleviate the addict's resistance to treatment in the Qatari society, using the spiritual perspective in clinical social work. With that in mind, the researcher demonstrated the theoretical aspect, depicting the importance of introducing spirituals to the therapeutic endeavor. Moreover, the present study stresses the fact that self – attributes are contributing more to the addict's resistance, than that of the environmental causes. This result points out the present research importance to overcome the resistance and hurdles put by the addict who may try to avoid completion of the therapeutic program. Further, the program is designed to help alleviate the client's resistance to treatment with better outcome for the therapeutic programs developed to combat addiction within the Qatari society.

A New Perspective of Cognitive Load Theory: Working Memory Resource Depletion

Ouhao Chen
National Institute of Education (NIE)
Nanyang Technological University (NTU)
Singapore

***Abstract*—Cognitive load theory, based on human cognitive architecture, discusses among other factors, the instructional implications of relations between working memory and long-term memory. The ultimate goal of this theory is to generate effective instructions that reduce students' working memory load to optimize their learning. In this paper, I am concerned with alterations to the theory based on working memory resource depletion that occurs after cognitive effort and is reversed after rest. Implications for the theory and instructional procedures are discussed.**

Keywords-Cognitive load theory; human cognitive architecture; working memory; depletion effect; instructional procedures

I. INTRODUCTION

Cognitive load theory, which is an instructional theory, aims to generate innovative and effective instructions to reduce students' working memory load to optimize their learning. The theoretical base of cognitive load theory is the human cognitive architecture which deals, in part, with relations between working memory and long-term memory [1].

II. HUMAN COGNITIVE ARCHITECTURE

Human cognitive architecture reveals principles on how information is processed in the external environment, working memory and long-term memory. This architecture suggests a natural information system, which is similar to evolution by selection [2]. The aspects of human cognitive architecture that are relevant to instructional issues can be summarized by five principles.

A. Information Store Principle

To perform well in a complex environment, human cognition must rely on a large amount of domain-specific knowledge [3] stored in long-term memory in the form of schemas [4]. The goal of instruction is to increase the amount of domain-specific knowledge held in long-term memory.

B. Borrowing and Reorganizing Principle

The efficient way to acquire a large amount of domain-specific knowledge is to borrow information from others, such as imitating them [5], listening to what they say and reading what they write. Before storing borrowed information, it usually is restructured and reorganized.

C. Randomness as Genesis Principle

Although most information is borrowed from others, information can be initially constructed by a random generation and testing process during problem solving. When the solution of a problem is not available for borrowing, possible moves are randomly generated and tested for their effectiveness, with successful ones retained and unsuccessful ones discarded.

D. Narrow Limits of Change Principle

To prevent rapid, significant and therefore damaging changes to long-term memory, the information system has to ensure only a small amount of novel information is processed at a given time. Working memory, which has a limited capacity when dealing with novel information [6] and duration time [7], provides that assurance.

E. Environmental Organizing and Linking Principle

The limited capacity of working memory is only for novel information. For well-organized information held in long-term memory, there are no known limits for working memory capacity [8]. Following appropriate stimuli from the external environment, working memory can process a huge amount of information retrieved from long-term memory to give a response properly to the external environment.

According to the human cognitive architecture, presenting a large amount of novel information to students may impose a heavy working memory load. In this situation, if our instructional design is suboptimal, imposing an extra cognitive load, working memory will be overloaded by breaking the *Narrow Limits of Change Principle*. Therefore, when learning materials consist of large amounts of novel information, carefully designing instructions to reduce cognitive load is critical.

III. COGNITIVE LOAD AND THE CONSTANT WORKING MEMORY RESOURCE ASSUMPTION

Within the framework of cognitive load theory, three types of cognitive load have been discussed.

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.26

A. Intrinsic Cognitive Load

Intrinsic cognitive load is imposed by the learning material. This type of load can be explained by the concept of element interactivity.

Element interactivity is an index used to evaluate the difficulty of learning material [9]. An element can be a concept, a mathematical symbol or anything that can be learned. The level of element interactivity determines the level of intrinsic load. For example, to solve, $x + 5 = 6$, for x, the five elements (x, +, 5, =, 6) that are interconnected have to be processed simultaneously rather than individually in working memory to successfully understand the equation. These five connected elements, processed simultaneously in working memory, may indicate a high level of intrinsic load. If instead, a non-English speaking student is asked to memorize English letters, such as *A*, *B*, *C,* then the intrinsic load is low. There is only one element needed to be processed in working memory, and that element can be processed without referring to the others. Therefore, this task indicates a low level of intrinsic load.

As students' expertise may influence the level of element interactivity [10], therefore, learners' expertise should also be considered to determine the level of intrinsic load. The same problem as above, solve $x + 5 = 6$, for x, may consist of five connected elements for novices, however, may only be one element for experts, as their acquired schema for solving that equation can be processed as a single entity in working memory, which reduces the level of element interactivity, and so the level of intrinsic load.

Therefore, working memory resource used to deal with intrinsic load (which is comes from the learning materials) directly contributes to students' learning, indicating that this type of load is necessary for students' learning.

B. Extraneous Cognitive Load

Extraneous cognitive load happens when the instructional design is suboptimal. Namely, this type of load is imposed because of an ineffective instructional design. Therefore, the extraneous load can be altered by modifying instructional interventions.

Element interactivity also can be used for explaining extraneous load. Interconnected elements that are only derived from a task cause intrinsic load, whereas, interactive elements, solely caused by the way you used to design your instructions, determine extraneous cognitive load [11]. Take the design for the worked example effect which indicates that showing novices worked-out solutions for learning is superior to asking them to generate solutions by themselves, [12] as an example. A large number of interactive elements generated during solution causes a high level of cognitive load. This type of cognitive load is an extraneous cognitive load, as it is caused by our instructional design.

As the extraneous cognitive load is imposed by way of presenting learning materials, using working memory resources to deal with this type of cognitive load is not relevant to students' learning. Therefore, reducing or eliminating extraneous load to free more working memory resources to deal intrinsic load is necessary.

C. Germane Cognitive Load

The germane cognitive load is closely associated with the intrinsic cognitive load. This cognitive load is regarded as the amount of working memory resources that are allocated to deal with the element interactivity caused by intrinsic factors [1].

D. Constant Working Memory Resource Assumption

Based on a dual model of cognitive load [13], two independent types of cognitive load, intrinsic and extraneous cognitive load, are additive. The *Narrow Limits of Change Principle* assumes that the working memory resource of any individual is relatively constant [14]. Therefore, under this assumption, it may provide a baseline to discuss relations between intrinsic and extraneous load. Specifically, if the total amount of intrinsic and extraneous cognitive load exceeds the assumed constant working memory capacity, learning will be restricted. To optimize students' learning, instructions should be designed to minimize extraneous cognitive load which is irrelevant to learning to relatively increase the amount of working memory left to deal with the intrinsic cognitive load.

Interestingly, the assumption of a constant working memory resource in cognitive load theory may have been challenged recently [14]. In cognitive load theory, the traditional and only factor influencing working memory capacity is the long-term memory. Based on human cognitive architecture, working memory has limited capacity when processing novel information, with no known limits for well-organized information held in long-term memory via *Environmental Organizing and Linking Principle*. Namely, the more schemas stored in long-term memory, the fewer working memory resource may be consumed. Therefore, the working memory resource is assumed to be alterable by long-term memory only. However, it has been indicated that intensive cognitive effort may also deplete working memory resources due to a working memory capacity reduction after heavy cognitive processing [14], suggesting that long-term memory may not be the only factor affecting the characteristics of working memory.

IV. Working Memory Resource Depletion

The working memory depletion effect will be discussed as an alteration to the cognitive load theory. Depletion phenomena happen when two tasks must be processed in immediate sequence, leading to worse performance on the second task because of working memory capacity reduction. After some rest, the resources can be restored [15].

There is little-documented research investigating the effect of cognitive effort on resource depletion directly. Experiments of Schmeichel may provide some evidence [16]. In the first experiment, participants, who were required to ignore irrelevant words of a person speaking with no audio on the screen, depleted their working memory resources, compared to others without this requirement. Similarly, students who were asked to write a story without using the letters *a* or *n* performed worse on a working memory capacity test than the students without this restriction. Also, Schmeichel and colleagues found general depletion effects by using self-control tasks and also

found that depletion might not be applicable for simple tasks [17].

The previous research did not demonstrate the resource depletion effect while learning but rather, during cognitive processing. However, the spacing effect, discussed in the next section, may be used as a vehicle to investigate resource depletion in learning environments.

V. Resource Depletion: Evidence from Spaced Practising Design

The spacing effect indicates that studying learning materials presented with time spaces between them is superior to learning with all the content presented under massed conditions. Therefore, this effect is also called the massed vs. spaced effect, which has been well-documented [18] [19].

To test the working memory resource depletion hypothesis, a spaced practice design was used [14]. Two experiments tested two hypotheses: 1) the spacing effect is caused by working memory resource depletion after massed practice; 2) a lower content score and more working memory resource depletion would be found after massed practice. The 1st Experiment used a quasi-experimental design. Participants in one class were in the massed condition with another class in the spaced condition. Three pairs of worked example-problem solving tasks were design to teach year-4 students how to calculate fraction addition, where two fractions had different denominators. In the massed condition, students received the three pairs at one time, whereas, in the spaced condition, each of the three pairs was taught on three separate days. The massed condition did a working memory capacity test directly after learning the last pair, while, the same test was done on the 4th day for the spaced condition. Both conditions also completed a content test after the working memory capacity test. Results confirmed our hypotheses. The spaced condition was superior to the massed condition on the content test and a higher working memory capacity compared to the massed condition. The 2nd Experiment used the same procedures and materials, but a counterbalanced design was applied. In Week 1, one class was assigned to the massed condition, and another was in the spaced condition. In Week 2, using different learning materials, the massed condition of Week 1 was changed to be the spaced condition with the spaced condition of Week 1 changed to be the massed condition. The results of Experiment 1 were replicated in Experiment 2.

The two experiments may have some important theoretical and practical implications. Concerning the theoretical implications, the two experiments may have set up a new perspective of cognitive load theory with working memory resource depletion after the cognitive effort. Also, the two experiments demonstrated the spacing effect, which may provide another explanation for this effect. Namely, the spacing effect may also be caused by working memory resource depletion after massed practice rather than study-phase retrieval only [20]. Regarding practical implications, using the spaced design may be more suitable for students' compared to the massed presentation, as more working memory resource can be used for learning using the spaced design.

VI. Conclusion

Cognitive load theory, based on human cognitive architecture, aims to generate innovative and effective instructional techniques to optimize students' learning via reducing working memory load. The *Narrow Limits of Change Principle* indicates that cognitive load theory assumes a constant working memory resource for a given learner. However, the results from spaced practice experiments may have challenged the assumption, indicating that working memory resources may be depleted after heavy cognitive effort and be restored after rest. Therefore, the constant working memory resource assumption may need to be altered to extend cognitive load theory by incorporating working memory resource depletion.

This paper may also have some instructional implications. The spaced design may be superior to massed presentation for students' learning, as there is more working memory resource depleted after massed practice compared to spaced design.

Acknowledgment

The author would like to thank Emeritus Professor John Sweller, University of New South Wales (Australia), for his valuable comments on this manuscript.

References

[1] Sweller, J., Ayres, P., & Kalyuga, S. (2011). Cognitive Load Theory. NY: Springer.

[2] Sweller, J., & Sweller, S. (2006). Natural information processing systems. Evolutionary Psychology, 4, 434-458.

[3] Chi, M., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), Advances in the psychology of human intelligence (pp. 7-75). Hillsdale, NJ: Erlbaum.

[4] Tricot, A., & Sweller, J. (2014). Domain-specific knowledge and why teaching generic skills does not work. Educational Psychology Review, 26, 265-283.

[5] Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory: Englewoods Cliffs, New Jersey: Prentice-Hall, Inc.

[6] Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. Psychological Review, 63, 343-352.

[7] Peterson, L., & Peterson, M. J. (1959). Short-term retention of individual verbal items. Journal of Experimental Psychology, 58, 193-198.

[8] Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. Psychological Review, 102, 211-245.

[9] Chen, O. Kalyuga, S. & Sweller, J. (2015). The worked example effect, the generation effect, and element interactivity. Journal of Educational Psychology, 107, 689-704.

[10] Chen, O., Kalyuga, S., & Sweller, J. (2017). The expertise reversal effect is a variant of the more general element interactivity effect. Educational Psychology Review, 29, 393-405.

[11] Sweller, J. (2010). Element interactivity and intrinsic, extraneous, and germane cognitive load. Educational Psychology Review, 22, 123-138.

[12] Cooper, G., & Sweller, J. (1987). Effects of schema acquisition and rule automation on mathematical problem-solving transfer. Journal of Educational Psychology, 79, 347-362.

[13] Kalyuga, S. (2011). Cognitive load theory: How many types of load does it really need? Educational Psychology Review, 23, 1-19.

[14] Chen, O., Castro-Alonso, J.C., Paas, F. et al. Educational Psychology Review (2017). https://doi.org/10.1007/s10648-017-9426-2

[15] Tyler, J. M., & Burns, K. C. (2008). After depletion: The replenishment of the self's regulatory resources. Self and Identity, 7, 305-321.

[16] Schmeichel, B. J. (2007). Attention control, memory updating, and emotion regulation temporarily reduce the capacity for executive control. Journal of Experimental Psychology: General, 136, 241-255.

[17] Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. Journal of Personality and Social Psychology, 85, 33-46.

[18] Gluckman, M., Vlach, H. A., & Sandhofer, C. M. (2014). Spacing simultaneously promotes multiple forms of learning in children's science curriculum. Applied Cognitive Psychology, 28, 266-273.

[19] Kapler, I. V., Weston, T., & Wiseheart, M. (2015). Spacing in a simulated undergraduate classroom: Long-term benefits for factual and higher-level learning. Learning and Instruction, 36, 38-45.

[20] Delaney, P. F., Verkoeijen, P. P. J. L., & Spirgel, A. (2010). Spacing and testing effects: A deeply critical, lengthy, and at times discursive review of the literature. In B. Ross, H. (Ed.), The Psychology of Learning and Motivation: Advances in Research and Theory (Vol. 53, pp. 63-147). New York, NY: Academic Press.

Efficacy of a Process Approach in Preparation for the COMLEX Level I Examination

Mangala Sadasivan, PhD; Hsueh-Han Yeh, MS.

PhD, Department of Psychiatry, College of Osteopathic Medicine, Michigan State University, East Lansing, MI 48824.

Abstract

Purpose: The authors were interested in measuring the efficacy of using a process approach (BOOTCAMP for BOARDS) in preparation for the Comprehensive Osteopathic Licensure Exam (COMLEX) Level I Examination.

Method: The authors collected data on MCAT and GPA scores – for a cohort of osteopathic medical students in the second year of medical school (65 registered BOOTCAMP and 219 nonBOOTCAMP students) at a single institution. In addition, the author's collected data from the Comprehensive Osteopathic Medical Self-Assessment Examination (COMSAE) version A, a shorter facsimile of the COMLEX examination, which was taken by all the students several months before they completed their academic courses, as a baseline for the two groups in the study and compared this to their COMLEX Level I scores. The data were analyzed using the two-sample Kolmogorov-Smirnov test and Odds Ratio.

Results: The odds of improving from a failing score on the COMSAE A to a passing score on the COMLEX Level I was 1.8 times higher for BOOTCAMP students compared to all other students in the same class who did not take BOOTCAMP and was significant at a 0.05 level. *(Odds ratio=1.82 p-value=0.049)*

Conclusion: A process approach to board preparation is a highly effective intervention to prepare students for the COMLEX board examinations.

Introduction

The increase in the number of qualified medical students competing for choice residency positions is making the selection process more complex for residency directors and applicants. One of the factors heavily considered by residency directors as an objective measure of student performance[1, 2] is a student's score on their licensure examinations. The COMLEX Level I board examination is the first examination taken during their pre-clerkship years. Success on this examination requires content competency, test taking stamina and efficiency of access to stored information. Students in their first two years of most medical school focus their attention heavily on learning massive amounts of basic science content while trying to integrate this information into critical thinking required to effectively understanding the mechanisms of action of disease. Naturally, students continue to focus primarily on content of information as they prepare for their board examinations. The literature on preparation for board examinations is limited and much of it focuses on commercial test preparation courses[3], online courses[4, 5], preparatory behaviors to enhance performance[6], and surveys on different approaches to preparing for board examinations[7]. Most of these studies focus on content learning that mirrors academic instruction or on student preferences regarding methods of preparation. Our data search of key medical education journals found no studies that directly examined an interactive process approach to learning focused on strength of content, testtaking stamina and efficiency collectively as a means to prepare for the board examinations. A refined search adding the word "process" resulted in only one article that focused on using process-oriented preparation[8] to decrease anxiety in students preparing for the USMLE Step 1 examination.

The "process-oriented" preparation in this study involves a five part seminar series conducted over several months focusing on early awareness, planning, and preparation for future transitions. Students are provided guidance and strategies for test preparation and emphasized facilitating conversation and mentorship opportunities between students.

This study examines the efficacy of this interactive process approach. This process approach models athletic training and begins with effectively strengthening content knowledge, adding stamina for test taking and ending with shaping exercises to build efficiency of access to stored information.

Method:

Participants

All second year osteopathic medical students (Class of 2016) at Michigan State University,
College of Osteopathic Medicine (MSUCOM) were invited to register for a program called
"BOOTCAMP for BOARDS COMLEX LEVEL I" developed by the director of the PEAK Learning

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.27

Center at the college. The deadline for registration to participate in the program was the end of
January 2014. All students had completed the Comprehensive Osteopathic Medical Self-
Assessment Examination (COMSAE) Form A offered by the National Board Of Medical Examiners (NBOME) through the college by January of 2014 before they started their final semester of their second year. Data on MCAT, GPA, COMSAE A and COMLEX LEVEL I scores were obtained from the Registrar's office after study approval by the university's institutional review board (IRB). Sixty-five students registered and completed the program making up the experimental (BOOTCAMP) group. The remainder of the class, 219 students made up the control group.

BOOTCAMP for BOARDS

BOOTCAMP Format

The format for BOOTCAMP parallels training used in preparing athletes for a competition. The process involves building strength, stamina and finally efficiency by strategically creating and playing cards.

Table 1.

COMPARING ATHELETIC TRAINING TO BOOTCAMP		
	ATHELETICS	BOOTCAMP
STAGE 1 *BUILDING STRENGTH*	*WEIGHT TRAINING & CREATING PLAYS*	*ERROR ANALYSIS & MAKING CARDS*
STAGE 2 *BUILDING STAMINA*	*EXECUTING PLAYS ON THE FIELD*	*GROUPING CARDS TO CREATE PATTERNS*
STAGE 3 *BUILDING EFFICIENCY*	*PRACTICING SPECIFIC PLAYS FOR SPEED & ACCURACY*	*PLAYING CARDS FOR QUICK PATTERN RECOGNITION (SPEED) & ACCURACY*

Time Table for BOOTCAMP for BOARDS

Students began the BOOTCAMP for BOARDS on April 14th 2014 and the formal program ended five weeks later on May 16th of 2014. Once the program ended students followed their own individually planned timetable until their test date which had to be scheduled for some time between late May and July 7th 2014. At the start of the program all BOOTCAMP students took the COMSAE B to provide the instructor with a baseline for each student and for planning. Students then went through an orientation to help them establish good habits focused on cognitive health. They were then given a scripted agenda to follow the process of BOOTCAMP.

Students physically met in a classroom Monday through Thursday from 8am to 3pm with an hour for lunch (on their own) for the five weeks of BOOTCAMP. Students were provided a healthy snack at 10am and all students were given a set of 6 one-minute exercises to complete before they started in the morning at 8am, during their snack break at 10am and before they started after lunch at 1pm. Michigan State University college of osteopathic medicine has three campuses and we accommodated the students at the distance sites through polycom video conferencing. The instructor also rotated between the sites on a regular basis. Students worked individually but in a group setting and moved through the program at their own pace. Students were given an all-day Friday workshop at the East Lansing campus on April 18th (Good Friday) for an OMM Review provided by a local resident (OMM Expert) through the PEAK Learning Center. Students from the other sites were encouraged to attend. A summary of the high yield information from the workshop was available to the students who were not able to attend for religious reasons. Students were also provided access to high yield review materials for Ethics and Bio-statistics which were not part of the BOOTCAMP Plan. Ten days before their scheduled COMLEX examination students took the COMSAE C provided for BOOTCAMP students and scheduled a feedback session with the instructor. Students must have completed all pre-tests and posttests for all the systems and mixed tests before taking the COMSAE C. The last ten days were used to increase speed and accuracy using shaping exercises. During this period students began two-hour exam blocks and made cards only as necessary based on their error analysis. They also scheduled two 4-hour examinations, one in the morning and one in the afternoon a few days later within that 10-day period. They submitted these scores to the instructor, received feedback and modified their plan as needed. Students scheduled several one-on-one sessions with the instructor to review their approach to the questions based on how they had been preparing in BOOTCAMP. The instructor used reflector exercises (these exercises were designed to help student with question patterning and style) to speed up the students processing and provided suggestions on how to improve stamina and accuracy and to finalize their cheat sheet for the examination. The cheat sheet included a list of high yield concepts (such as gram +/- charts, house of golden, etc.) that they memorized and wrote out onto their white boards provided to them on the day of the examination. The cheat sheets were used to decrease anxiety and to build confidence in the students as they approached the test date.

Results

A total of 65 students (approximately 25% of the class of 2016) formed the BOOTCAMP group in this study. The remainder of the class consisting of 219 students made up the control group. Since students in the BOOTCAMP group self-selected for the program self-selection bias was a concern. A comparison of MCAT and COMSAE A scores between BOOTCAMP students and control students was done using the nonparametric method of Kolmogoroz-Smirnov test to verify the equality of distribution. The distribution of MCAT scores did not show any difference between the two groups (p=0.682). The mean MCAT score for the control group was slightly higher at 27.43 with a standard deviation of 3.30 compared to 27.26 with a standard deviation of 3.25 for the BOOTCAMP group. Although there is some debate on the predictive value of using MCAT scores to project board performance, there are a preponderance of studies that clearly show that MCAT scores are a good predictor of a student's performance on board examinations especially USMLE Step 1.[9-12] Figure 1 shows the distribution of MCAT scores with curve of kernel density for the two groups. We also felt that using the COMSAE A examination taken by all the students in approximately the same time frame and comparing the scores of the two groups would further confirm that the two groups had a similar distribution of scores before BOOTCAMP was offered. The Kolmogoroz-Smirnov test demonstrated that COMSAE A scores did not differ between the two groups (p=0.161). Figure 2 summarizes the COMSAE A data for the two groups.

Figure 1. The distribution of MCAT scores for BOOTCAMP and CONTROL groups

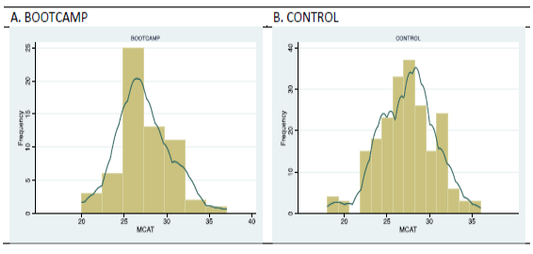
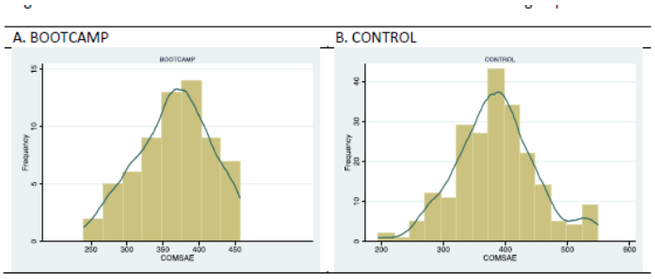


Figure 2. The distribution of COMSAE A scores for BOOTCAMP and CONTROL groups



The National Board of Osteopathic Medical Examiners (NBOME) set the PASS/FAIL cutoff score for both the COMSAE A and COMLEX examinations at 400. We used this cutoff score to measure "success" (improvement from a FAIL Score <400 to a PASS Score >400) from the COMSAE A to the COMLEX examination for both BOOTCAMP and control groups. In the
BOOTCAMP group, of the 49 students who failed the COMSAE A, 46 students passed the
COMLEX after BOOTCAMP a success rate of 93.9%. In the control group 138 students failed the COMSAE A and of them only 125 students passed their COMLEX examination giving us a success rate of 90.6%. When we looked at the 19 BOOTCAMP students who had a PASS score (PASS >400) on the COMSAE A, all of them got a PASS score of the COMLEX examination and their scores on the COMLEX were higher than their COMSAE A scores except for one student who passed but had a lower score. However, in the CONTROL group, of the 80 students who had a PASS score on the COMSAE A, 2 students received a FAIL (<400) score on the COMLEX examination and four other students scored lower on the COMLEX than their COMSAE A scores. Therefore, participating in BOOTCAMP for BOARDS not only benefits students who are struggling by giving them a better chance to pass but it also gives all students who participate a chance to improve their scores.

Table2

Table2

	IMPROVEMENT FROM <400 COMSAE TO >400 COMLEX	
	Yes	No
BOOTCAMP	46	19
CONTROL	125	94

Finally, to determine the efficacy of this process approach BOOTCAMP for BOARDS LEVEL I as an effective intervention to prepare students for the COMLEX board examination we applied the odds ratio. The odds ratio is a measure of relative effect used to estimate the degree of comparison of the intervention group relative to the control group. Using FAIL or a PASS on the COMLEX examination as a dichotomous variable, the odds ratio for BOOTCAMP graduates achieving a passing score is 1.13 (p=0.85) when compared to the control group but this result is not statistically significant. If the outcome measure is defined as "success" (improvement from a FAIL score on the COMSAE A to a PASS score on the COMLEX) students who participated in BOOTCAMP were 1.82 times more likely to show "success" and this effect is statistically significant (Table 2).

Discussion

A process approach to board preparation is a highly effective intervention to prepare students for the COMLEX Level I board examinations. The design of the program focuses on the process of learning as it pertains to the ultimate goal of passing the COMLEX LEVEL I examination. As in athletics, the program targets foundational practices (eating right, sleeping well and exercising regularly) for healthy cognitive living combined with coaching in building strength of knowledge, stamina for test-taking and efficiency of access to stored information. Since the program was individualized and self-directed but delivered in a group setting we were able to accommodate students with learning and other cognitive challenges. The built-in structure and time-management features of the program combined with the game formatting (activelearning) component provided for a fun experience to an otherwise stressful endeavor.

The difficulties in running this program were related to classroom space available to have the students physically present in classrooms four days a week from 8am to 3pm for five weeks. We were also limited in terms of other resources; the PEAK Learning Center has a staff of two to manage approximately 150 students (both first and second year students) or approximately ¼ of the student body.

Current studies underway will look at BOOTCAMP for BOARDS COMLEX LEVEL II and reformatting the process to accommodate students taking the USMLE LEVEL I and II examinations. Future studies will look at using BOOTCAMP for BOARDS with smaller numbers to specifically target students with disabilities.

Acknowledgements

The authors would like to thank Dean Strampel, College of Osteopathic Medicine and Dr. Jed Magen, Department Chair of Psychiatry, Michigan State University for their support of this project. We are grateful to Mick Goldynia, MA, PEAK Learning Center, Michigan State University for managing the logistics, collecting data, scheduling and promptly responding to student emails and running a smooth program.

Funding

Support for this study was provided by the Myron S. Magen Medical Education Fund, Michigan State University, College of Osteopathic Medicine, Grant # RT082874.

Other disclosures

None

Ethical approval

Study was approved by Michigan State University, Institutional Review Board IRB#: x12-526e; i041200

Disclaimers

Cognitive-Speech Rehabilitation Services has authorized Mangala Sadasivan PhD to use the concepts underlying BOOTCAMP for BOARDS at Michigan State University, College of Osteopathic Medicine for the purposes of research and the training of their students.

Previous presentation

Internal presentation to share data with the Clinical Chairs at Michigan State University, College of Osteopathic Medicine.

References

1. Bowles LT, Melnick DE, Nungester RJ, et al. Review of the score-reporting policy for the United States Medical Licensing Examination. Acad Med. 2000; 75:426-31.[PubMed]

2. Green M, Jones P, Thomas JX. Selection criteria for residency: results of a national program directors survey. Aced Med. 2009; 84:362-7.

3. McGaghie WC, Downing SM, Kubilius R. What is the impact of commercial test preparation courses on medical examination performance? Teach Learn Med. 2004; 16(2):202-11.

4. Battistella, Kaufman & Talley. An Online Summer Course for Prematriculation Medical Students… Academic Medicine. 2001; 76:499-500.

5. Werner LS & Bull BS. The effect of three commercial coaching courses on STEP One USMLE performance. Med Educ. 2003; 37(6):527-31.

6. Sefcik D, Church B, Falls J, et al. Bulking up COMLEX Level 1 Scores What preparatory behaviors enhances performance? AACOM 2012 Annual Meeting, Washington, DC, March 28-31,

7. Thadani RA, Swanson DB & Galbraith RM. A Preliminary Analysis of Different Approaches to Preparing for the USMLE Step 1 Academic Medicine. 2000; 75:S40-S42.

8. Strowd, RE & Lambros, A Impacting student anxiety for the USMLE Step 1 through process-oriented preparation. Med Educ Online. 2010; 1510.3402/meo.v15i0

9. Swanson DB, Case SM, Koenig J, Killian CD. Preliminary study of the accuracies of the old and new medical college admissions tests for predicting performance on USMLE Step 1. Acad Med. 1996; 71(1 suppl):S25-S27.

10. Basco WT Jr, Way DP, Gilbert GE, Hudson A. Undergraduate institutional MCAT scores as predictors of USMLE Step 1 performance. Acad Med. 2002; 77(10 suppl):S13-S16.

11. Julian ER. Validity of the Medical College Admission Test for predicting medical school performance. Acad Med. 2005; 80:910-917.

12. Donnon, T., Paolucci, E.O., & Violato, C. (2007). The predictive validity of the MCAT for medical school performance and medical board licensing examinations: A meta-analysis of the published research. Academy of Medicine *2007; 82*(1):100-106.

Using Decision Tree to Predict Response Rates of Consumer Satisfaction, Attitude, and Loyalty Surveys

Jian Han
Department of psychology and Behavioral Sciences
Zhejiang University
Hangzhou, Zhejiang Province, China
Miaodan Fang
Department of psychology and Behavioral Science
Zhejiang University
Hangzhou, Zhejiang Province, China
Shenglu Ye
Department of psychology and Behavioral Science
Zhejiang University
Hangzhou, Zhejiang Province, China
Chuansheng Chen
Department of Psychology and Social Behavior
University of California
Irvine, United States of America
Xiuying Qian
Department of psychology and Behavioral Sciences
Zhejiang University
Hangzhou, Zhejiang Province, China
Qun Wan
Zhejiang Big Data Exchange Center
Tongxiang, Jiaxing, Zhejiang Province, China

***Abstract*—Response rate has long been a major concern in survey research. Based on 244 published studies on consumer satisfaction, attitude and loyalty that are predictors of customer retention and behavior, this study aimed to identify predictors of response rates. A decision tree analysis (using the C5.0 algorithm on 70% of the studies as the training set and 30% as the test set) revealed that a model with seven attributes of the surveys attained an accuracy of 80.52% in predicting whether surveys had high (≥ 50%) or low (< 50%) response rates. Direct invitation was the most important factor (yes > no), followed by mode of data collection (face-to-face or mail > telephone or online). If it was telephone or online survey, 20 items was the crucial cutoff point for length of survey. The accuracy of the decision tree model was higher than that of the traditional logistic regression.**

Keywords- response rate; decision trees; survey research

I. INTRODUCTION

A high response rate is essential to the success of survey research in many fields such as marketing, sociology, psychology, public policy, and public health [1]. A low response rate is likely to introduce nonresponse bias and hence lower the external validity or generalizability of the survey results, because respondents and nonrespondents typically differ in the variables of interest [2]. The importance of high response rates is especially salient for consumer and marketing survey research because service organizations and firms need to gauge accurately customers' attitudes toward services or products (e.g., satisfaction, loyalty, and trust). These attitudes play an important role in determining long-term customer behavior and subsequently the success of firms and service organizations in terms of customer retention and market share [3, 4]. After all, attracting new customers is considerably more expensive than retaining old customers [5]. Firms and service providers need valid survey results in order to make decisions about their efforts at increasing customer retention. Unfortunately, past decades have witnessed declining response rates in all forms of business and academic research [6, 7], so it is imperative to understand factors that influence response rates.

Response rates in survey research can be influenced by many factors, including societal factors, individual participants' characteristics, and attributes of the survey design [8]. Societal factors include cultural values (e.g., individualism and collectivism) [9], social cohesion [8], and survey fatigue due to extensive survey research [10]. Individual characteristics include sociodemographic factors (e.g. age, gender, income, health status, race) [8, 11-14], past experience with a given product or service, past experience with surveys in general [15], personal interest in the survey topic [16-19], and personality characteristics [20-23]. Survey attributes include mode of data collection (e.g. online survey, telephone interview, face-to-face interview, etc.) [8, 24-28], prenotification [29-32], timing of the invitation [33, 34], survey sponsor [35-37], incentives [38-46], and questionnaire design (e.g. layout, length, and content)[16, 47-49].

Some of the above studies were experimental studies that investigated whether one or more factors were effective in raising response rates [38, 50, 51], whereas other studies were either quantitative or qualitative analysis of response rates of existing studies as a function of factors such as mode of data collection as mentioned earlier [24, 39, 40, 52-56]. Some researchers [24, 39] have also integrated previous findings and constructed regression models to predict response rates. Although there has been much research on the influence of various factors on response rates, [57] concluded that "any reading of this large body of works leads to the conclusion that few survey design factors have a consistent and significant effect on observed response rates" (p. 305).

In order to improve on previous attempts at understanding the factors influencing response rates, this study used a decision tree approach (with a training set and a

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.31

test set of studies) to quantitatively analyze the influence of survey attributes on response rates in a large number of published studies. A decision tree approach has several advantages over the traditional logistic regression: automatic consideration of potential interactive effects among predictors, high tolerance of multicollinearity, intuitive guidance for application of the results in decision making (ranked priority or importance of factors, cutoff point for continuous predictors), and the standard practice of using training and testing sets.

II. Method

A. Sample of studies

In this study, we focused on previous survey studies of consumer satisfaction, loyalty, and attitudes about particular topics or trust in service organizations. We conducted searches using major electronic reference databases, including ERIC, JSTOR, MEDLINE, PsycARTICLES, PsycINFO, Science Direct, Social Science Abstracts, Sociological Abstracts, and Web of Science (Social Science Citation Index). We used three clusters of key words for the searches: (1) "questionnaire" or "survey"; (2) "response rate" or "return rate" or "participation rate"; and (3) "satisfaction", "loyalty", "attitude", or "trust". The search results were examined for their relevance and the selected studies' lists of references were further investigated for additional potentially relevant studies. The searches yielded 450 studies, covering a wide range of topics in many sectors of the service industry such as restaurants, hotels, hospitals, telecommunications, websites, etc. These studies were closely examined for their reports of survey attributes. Studies with limited information on the survey attributes (see below) were excluded from further analyses, yielding a final sample of 244 studies.

B. Coding of Main Variables

The main outcome variable of this study was response rate. Its calculation is deceptively simple—valid surveys returned over the total number of people surveyed. As [58] pointed out, however, there were actually many ways of calculating response rates because the total number of people surveyed was subject to different interpretations (those who were initially contacted or those who expressed initial interest or those who were followed up with the actual surveys). In this study, we used the minimum response rate, which is the number of completed surveys divided by the number of surveys returned (completed or partially completed) plus the number of nonsurveys (refusals, breakoffs, or noncontacts) plus all cases of unknown eligibility. Although many studies did not report a breakdown the specific numbers of partially completed surveys, refusals, break-offs, noncontacts, etc., the minimum response rate could be calculated based on the total number of surveys initially sent out and the final number of completed surveys.

We recorded and coded nine survey attributes or features of each survey study: mode of data collection, type of survey sponsors, incentives, questionnaire length, relevance of the survey topic to the respondents, sensitivity of the topic, confidentiality, direct invitation, and country or region. These features were selected because they have been shown to be important in previous studies [21, 59] and because they could be coded in the studies we found. Table I describes the coding categories of these survey attributes as well as their descriptive statistics.

Table I Survey attributes and their descriptive statistics

Survey attributes	Descriptive statistics
Mode of data collection	0 = Face-to-face interview (17, 7.02%); 1 = Mail survey (165, 68.18%); 2 = Telephone/online survey (60, 24.80%)
Type of survey sponsors	0 = Government agencies (24, 9.88%); 1 = Universities or research institutions (174, 71.60%); 2 = Commercial institutions (45, 18.51%)
Incentives	Amount of money ($)[a]
Questionnaire length	Number of items (*M* = 28.9, *SD* = 15, Range: 6 to 133）
Relevance of topics	0 = Not relevant (39, 16.12%); 1 = Relevant (203, 83.88%)
Sensitivity of topics	0 = No (237, 97.13%); 1 = Yes (7, 2.87%)[b]
Confidentiality	0 =Non-confidential (161, 93.06%); 1 = Confidential (12, 6.94%)
Direct Invitation	0 = No (110, 46.4%); 1 = Yes (127, 53.6%)
Country or region's cultural value orientation	Individualism and collectivism index[c] (*M* = 58.63, *SD* = 30.55, Range: 14 to 91)

a. Only 37 studies provided incentive/compensation information, so descriptive statistics are not presented and this variable was not used in further analysis.

b. Because of the small number of studies involving sensitive topics, this variable was not used in further analysis.

c. For this index, a higher number indicated higher individualism and a lower number indicated higher collectivism.

Although there are a number of *modes of data collection* or survey methods including face-to-face interviews, mails, telephone, internet, e-mail, or other social media platforms, previous research has demonstrated that response rates varied from high to low for three modes of data collection: face-to-face interviews, mail surveys, and telephone or web surveys [60-62] We coded our studies into these three major categories.

The type of survey sponsors was classified into three categories following [31]: government agencies, universities and other research institutions or non-profit organizations, and companies and other commercial institutions.

Incentives for participation were coded in terms of the amount of money offered to the respondents.

Questionnaire length was coded based on the number of questions or items included in the surveys reported in the studies.

Whether the survey topic was of *relevance to the respondents* was determined according to whether potential respondents had direct experience with the particular services or products covered by the surveys. [63] showed that such past experience increased survey participation.

The surveys were coded for whether they covered *sensitive topics*.[62] define sensitivity of topic as a topic that possesses a substantial threat to those involved as it may be

perceived as intrusive and could raise fears about potential repercussions/consequences of disclosing the information request, including financial assets, sexual behaviors, illegal drug use, etc. [64, 65]has argued that privacy-related sensitive topics would seem intrusive to potential respondents and thus lower participation rates.

Confidentiality was coded based on whether the survey was confidential (or anonymous) or not confidential.

Direct invitation for surveys meant that researchers invited participants via face-to-face contact or telephone, whereas indirect invitation was via mail or e-mail, following [60]. In an earlier, study, [8] found that direct invitation led to higher participation rates.

Finally, we coded the *country or region* where the surveys were conducted. Most of the studies were conducted in U.S.A (31.89%), followed by China (11.89%), Taiwan/China (10.81%), and Korea (9.73%), with the remaining studies conducted in other countries or regions. Previous research has focused mainly on the influence of individualism / collectivism on response rates [21, 66]. These studies simply classified European countries and America as individualistic countries, and Asian countries (e.g. China) as collectivistic countries. In this study, we used specific values of the Hofstede's individualism/collectivism dimension [67] for each country.

III. Results

After coding the data, two survey attributes were found to lack information or variations. Only 37 of the 244 studies provided information about incentives, and very few studies (2.87%) covered sensitive topics such as financial assets, sexual behaviors, and illegal drug use. These two variables were not used in subsequent analyses.

Of the remaining seven factors, five showed significant associations with response rates in the expected direction (see Figs.1-5). First, the mode of data collection was a significant factor, $F(2, 239) = 30.778$, $p = 0.000$, with highest response rates for face-to-face interviews ($M = 77.81\%$), followed by mail surveys ($M = 56.19\%$), and lowest response rates for phone/web surveys ($M = 30.36\%$) (see Fig.1). *Post hoc* analysis showed that the three modes differed significantly from one another, $p \leq 0.001$. Second, the type of survey sponsors was also a significant factor, $F(2, 240) = 9.233$, $p = 0.000$. As shown in Fig.2, the mean response rate of surveys sponsored by government agencies was the highest ($M = 93.50\%$), followed those sponsored by universities and research institutions ($M = 52.05\%$), and then by those sponsored by commercial institutions ($M = 29.79\%$). *Post hoc* analysis showed that the three types of sponsors differed significantly from one another, $p < 0.05$. Third, confidential surveys showed higher response rates ($M = 60.33\%$) than non-confidential surveys ($M = 47.44\%$), $F(1, 173) = 4.342$, $p = 0.039$ (see Fig.3). Fourth, direct invitation was significantly associated with higher response rates, $F(1, 235) = 109.315$, $p = 0.000$. The mean response rate was 65.41% when invitations for participation were through either face-to-face contact or phone, but only 29.65% when they were sent by mail or email (see Fig.4). Finally, the individualism and collectivism index of the countries or regions where surveys were conducted was correlated with response rates, $r = -0.379$, $p = 0.000$. Greater individualism was linked to lower response rates.

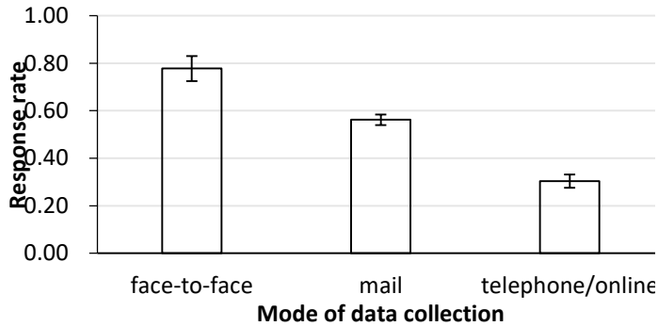


Figure 1 Mode of data collection and response rates

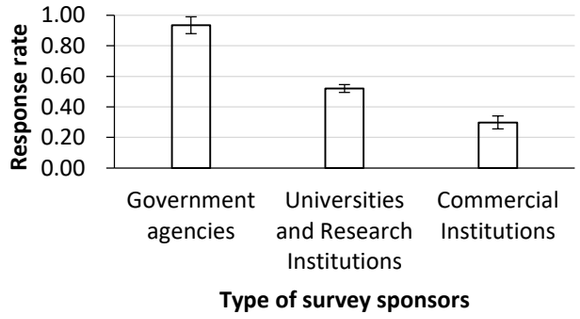


Figure 2 Type of survey sponsors and response rates.

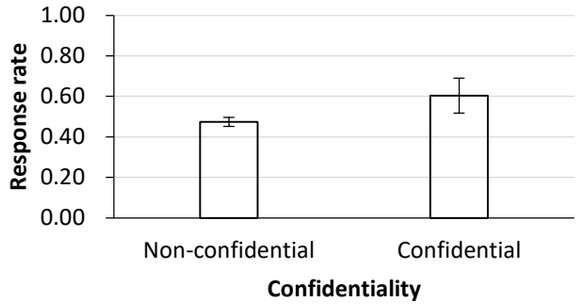


Figure 3 Confidentiality and response rates.

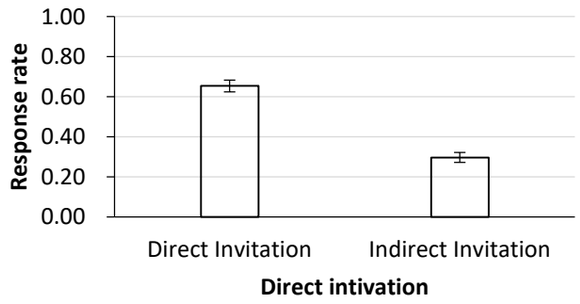


Figure 4 Direct invitation and response rates.

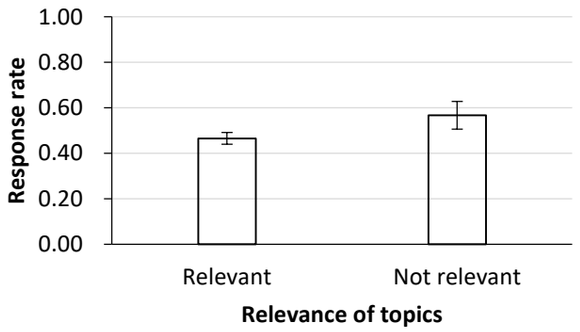


Figure 5 Relevance of topics and response rates.

Contrary to our hypothesis, relevance of the topics was associated with lower response rates, F (1, 240) = 4.339, p = 0.038, with a mean response rate of 59.95% for studies on non-relevant topics and 49.43% for studies of relevant topics (see Fig.5). Finally, the correlation between the number of items and response rates was not significant, r = 0.046, p = 0.478. We also examined non-linear relations between the two variables and found no significant results.

IV. Predicting High and Low Response Rates

In the previous section, we examined bivariate relations between survey attributes and response rates and identified significant survey attributes influencing response rates. In this section, we used all attributes to construct a decision tree model. Because survey researchers typically aimed for a response rate above a threshold [68] and the average response rate of published surveys was 52.7% [68], we used 50% as the cutoff point to divide our studies into those with "High" response rates (i.e., at or above the threshold, n = 110 studies) and those with "Low" response rates (i.e., below the threshold, n = 134). C5.0 algorithm implemented in IBM SPSS Modeler 14.1 was used to construct the prediction model. The data were divided into the training set (70%) and the test set (30%). Cart algorithm and Quest algorithm were also used to handle multi-collinearity among predictor variables.

Results showed that the prediction model's overall accuracy in the test set was 80.52% with the C5.0 algorithm (Table II), 78.33% with the Cart algorithm, and 73.33% with the Quest algorithm.

Table II Recall and precision of the prediction model

	Recall rate[d]	Precision rate[e]
High response rates	78.95%	81.08%
Low response rates	82.05%	80%

d. Precision rate is the ratio of the identified relevant information over all the information identified.

e. Recall rate is the ratio of the relevant information identified over all relevant information in the identification system.

Of all the predictors, direct invitation had the highest importance, followed by mode of data collection. The length of survey was also important. Fig6 shows the details of the decision tree. Results showed that "High" response rates were obtained when using direct invitation (70% with direct invitations vs. 17% without). Of those with direct invitations, face-to-face interview or mail survey led to "High" response rates for 74% of the studies as compared to 35% for telephone or online surveys. For telephone/online surveys, the length of survey was a key factor, with shorter surveys (20 or fewer items) leading to "High" response rates (all three studies, 100%), whereas all nine longer surveys (more than 20 items) showed "Low" response rates.

Finally, we compared our decision trees model with a prediction model based on traditional logistic regression. Results showed that the overall accuracy with the testing data set was 77.25%, which was lower than the accuracy of our model (80.25%).

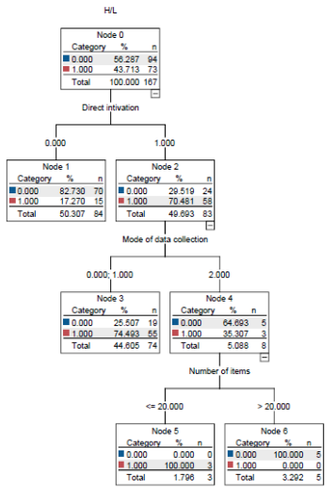


Figure 6 Decision tree and nodes

V. Discussion

Previous studies have identified a number of factors influencing participation rates in survey research, including societal factors, individual participants' characteristics, and surveys' attributes[8]. The current study aimed to improve on previous research by using a decision tree approach to predict high vs. low response rates based on surveys' attributes. After identifying 244 relevant surveys and extracting nine survey

attributes from each study, we found seven usable attributes (i.e., mode of data collection, type of survey sponsor, relevance of the topic, confidentiality, direct invitation, length of survey, and collectivism/individualism orientation of the country or region). A decision tree model was trained with 70% of the data and tested with the remaining 30% of the data. Results show that the decision tree model achieved an accuracy of 80.52% on the test data set. The most important factor was whether surveys used direct invitation. Within surveys with direct invitations, mode of data collection was also a crucial factor, favoring face-to-face or mail surveys over telephone or online surveys. Within telephone or online surveys, the length of survey became a crucial factor, with 20 items as the cutoff point.

The current study did not examine new factors affecting response rates. Instead, it used the decision tree approach that has several advantages over previous studies: automatic consideration of potential interactive effects among predictors, high tolerance of multicollinearity, intuitive guidance for application of the results in decision making (ranked priority or importance of factors, cutoff point for continuous predictors), and the standard practice of using training and testing sets. Indeed, as the results showed, three factors showed significant effects at the bivariate level (i.e., type of survey sponsors, confidentiality, individualism vs. collectivism) in accord with previous literature [60, 61, 62], but they were not of importance in the decision tree results. Similarly, one significant factor at the bivariate level that was opposite of our expectation (i.e., relevance of the topic) was also a non-contributor to the decision tree. Instead, a non-significant factor at the bivariate level (i.e., length of survey) was a crucial factor if the surveys involved direct invitation and was administered via telephone or online. The cutoff length appeared to be 20 items.

Our results can be explained by [69] extension of the classic cognitive dissonance theory [70] to survey participation. According to the cognitive dissonance theory, when people sense a dissonance in their own cognitive elements (e.g., views, thoughts, opinions, desires, or intentions), they feel an unpleasant state of tension, which would motivate them to change some of the cognitive elements in order to reduce or eliminate the dissonance-induced tension. Although [71] initially suggested to increase survey participation by creating “a dissonance that could be resolved by returning the questionnaire to the researcher”, [69] provided a detailed description of the role of cognitive dissonance in survey participation as a sequence of decisions [62] Their model is able to integrate much of the empirical literature on inducement techniques used in survey research. In terms of our results, the decision process within the potential respondents’ mind was triggered by the invitation for participation, with a direct invitation generating a greater tension (or dissonance with a person’s self-belief of being helpful) than an indirect invitation. After agreeing to the direct invitation, there was a dissonance if the potential participants were thinking of not following through and completing the survey. This dissonance seemed to be greater for face-to-face interviews and mail surveys than for telephone or online survey, perhaps due to various reasons such as direct and personalized contact for the former. Finally, after starting to respond to the survey, participants needed to decide whether to finish it. For face-to-face interviews, there would be a great tension to break off in the midst of an interview. For online and telephone surveys, however, the length of the survey was a major factor.[49] also found that page and question characteristics (e.g., number of items) had a stronger influence on survey break-off than respondent characteristics. Based on our results, the critical length was 20 items.

Although our study shed new light on important factors influencing survey response rates, two main limitations of this study need to be mentioned to guide future research. First, our study focused on a subarea of survey research (mainly related to consumer satisfaction and product loyalty and trust), so it is not clear that our findings can be generalized to broader social research, which may involve more sensitive questions, greater compensations or incentives, or longer surveys. Second, we focused on survey attributes because of they are within the control of survey researchers, but other types of factors (e.g., societal and individual participants’ characteristics[8]) may also need to be considered for particular types of surveys.

REFERENCE

[1] Hox JJ, & De Leeuw, E. D. A comparison of nonresponse in mail, telephone, and face-to-face surveys. Quality and Quantity. 1994;28(4):329-44.

[2] Groves RM. Nonresponse rates and nonresponse bias in household surveys. Public Opinion Quarterly. 2006;70(5):646-75.

[3] Tsoukatos E, & Rand, G. K. Path analysis of perceived service quality, satisfaction and loyalty in Greek insurance. Managing Service Quality: An International Journal. 2006;16(5):501-19.

[4] Luarn P, & Lin, H. H. A Customer Loyalty Model for E-Service Context. J Electron Commerce Res. 2003;4(4):156-67.

[5] Reichheld FF, & Schefter, P. E-loyalty: your secret weapon on the web. Harvard business review. 2000;78(4):105-13.

[6] Curtin R, Presser S, Singer E. Changes in telephone survey nonresponse over the past quarter century. Public opinion quarterly, 2005; 69(1): 87-98.

[7] De Leeuw E, & De Heer, W. Trends in household survey nonresponse: A longitudinal and international comparison. Survey nonresponse. 2002:41-54.

[8] Groves R M CRB, Couper M P. Understanding the decision to participate in a survey. Public Opinion Quarterly. 1992;56(4):475-95.

[9] Petrova PK, Cialdini RB, Sills SJ. Consistency-based compliance across cultures. J Exp Soc Psychol. 2007;43(1):104-11

[10] Porter S R WME, Weitzer W H. Multiple surveys of students and survey fatigue. New Directions for Institutional Research. 2004;2004(121):63-73.

[11] Busby DM, Yoshida K. Challenges with Online Research for Couples and Families: Evaluating Nonrespondents and the Differential Impact of Incentives. J Child Fam Stud. 2015;24(2):505-13.

[12] Dykema J, Stevenson J, Klein L, Kim Y, Day B. Effects of E-Mailed Versus Mailed Invitations and Incentives on Response Rates, Data Quality, and Costs in a Web Survey of University Faculty. Soc Sci Comput Rev. 2013;31(3):359-70.

[13] Patrick ME, Singer E, Boyd CJ, Cranford JA, McCabe SE. Incentives for college student participation in web-based substance use surveys. Addict Behav. 2013;38(3):1710-4.

[14] Shih TH, Fan XT. Comparing response rates from Web and mail surveys: A meta-analysis. Field Methods. 2008;20(3):249-71.

[15] Dillman DA. Presidential address: Navigating the rapids of change: Some observations on survey methodology in the early twenty-first century. Public Opinion Quarterly. 2002;66(3):473-94.

[16] Edwards PJ, Roberts, I., Clarke, M. J., DiGuiseppi, C., Wentz, R., Kwan, I., et al. Methods to increase response to postal and electronic questionnaires. The Cochrane Library. 2009.

[17] Haunberger S. Explaining Unit Nonresponse in Online Panel Surveys: An Application of the Extended Theory of Planned Behavior. J Appl Soc Psychol. 2011;41(12):2999-3025.

[18] McCambridge J KE, White I R, et al. Impact of length or relevance of questionnaires on attrition in online trials: randomized controlled trial. Journal of medical Internet research. 2011;13(4):e96.

[19] Zillmann D SA, Skopek J, et al. Survey topic and unit nonresponse. Quality & quantity. 2014;48(4):2069-88.

[20] Bruggen E, Dholakia UM. Determinants of Participation and Response Effort in Web Panel Surveys. J Interact Mark. 2010;24(3):239-50.

[21] Fan WM, Yan Z. Factors affecting response rates of the web survey: A systematic review. Comput Hum Behav. 2010;26(2):132-9.

[22] Porter SR, Whitcomb ME. Non-response in student surveys: The role of demographics, engagement and personality. Res High Educ. 2005;46(2):127-52.

[23] Marcus B SA. Who are the people reluctant to participate in research? Personality correlates of four different types of nonresponse as inferred from self-and observer ratings. Journal of Personality. 2005;73(4):959-84.

[24] Cook C, Heath F, Thompson RL. A meta-analysis of response rates in Web- or internet-based surveys. Educ Psychol Meas. 2000;60(6):821-36.

[25] Couper MP. The Future of Modes of Data Collection. Public Opinion Quarterly. 2011;75(5):889-908.

[26] De Leeuw D. To mix or not to mix data collection modes in surveys. Journal of official statistics. 2005;21(2):233.

[27] Dillman DA, Phelps G, Tortora R, Swift K, Kohrell J, Berck J, et al. Response rate and measurement differences in mixed-mode surveys using mail, telephone, interactive voice response (IVR) and the Internet. Soc Sci Res. 2009;38(1):3-20.

[28] Kaplowitz MD, Hadlock TD, Levine R. A comparison of Web and mail survey response rates. Public Opinion Quarterly. 2004;68(1):94-101.

[29] Bandilla W, Couper, M. P., & Kaczmirek, L. The mode of invitation for web surveys. Survey Practice. 2012;5(3).

[30] Beebe TJ, Rey E, Ziegenfuss JY, Jenkins S, Lackore K, Talley NJ, et al. Shortening a survey and using alternative forms of prenotification: Impact on response rate and quality. Bmc Med Res Methodol. 2010;10.

[31] Bosnjak M, Neubarth W, Couper MP, Bandilla W, Kaczmirek L. Prenotification in web-based access panel surveys - The influence of mobile text messaging versus e-mail on response rates and sample composition. Soc Sci Comput Rev. 2008;26(2):213-23.

[32] Keusch F. How to Increase Response Rates in List-Based Web Survey Samples. Soc Sci Comput Rev. 2012;30(3):380-8.

[33] Faught KS, Whitten D, Green KW. Doing survey research on the Internet: Yes, timing does matter. J Comput Inform Syst. 2004;44(3):26-34.

[34] Sauermann H, Roach M. Increasing web survey response rates in innovation research: An experimental study of static and dynamic contact design features. Res Policy. 2013;42(1):273-86.

[35] Porter SR, Whitcomb ME. Mixed-mode contacts in web surveys - Paper is not necessarily better. Public Opinion Quarterly. 2007;71(4):635-48.

[36] Fang JM, Shao PJ, Lan G. Effects of innovativeness and trust on web survey participation. Comput Hum Behav. 2009;25(1):144-52.

[37] Pan B, Woodside AG, Meng F. How Contextual Cues Impact Response and Conversion Rates of Online Surveys. J Travel Res. 2014;53(1):58-68.

[38] Church AH. Estimating the effect of incentives on mail survey response rates: a meta-analysis. Public opinion quarterly. 1993;57(1):62-79.

[39] Edwards P, Roberts I, Clarke M, DiGuiseppi C, Pratap S, Wentz R, et al. Increasing response rates to postal questionnaires: systematic review. Brit Med J. 2002;324(7347):1183-5.

[40] Edwards PJ, Roberts, I., Clarke, M. J., DiGuiseppi, C., Wentz, R., Kwan, I., et al. Methods to increase response to postal and electronic questionnaires. The Cochrane Library. 2009.

[41] Millar MM, Dillman DA. Improving Response To Web And Mixed-Mode Surveys. Public Opinion Quarterly. 2011;75(2):249-69.

[42] Patrick ME, Singer E, Boyd CJ, Cranford JA, McCabe SE. Incentives for college student participation in web-based substance use surveys. Addict Behav. 2013;38(3):1710-4.

[43] Preece M J JG, Hitchcock J. Lottery Incentives and Online Survey Response Rates. Survey Practice. 2013;3(4).

[44] Rosoff PM, Werner C, Clipp EC, Guill AB, Bonner M, Dernark-Wahnefried W. Response rates to a mailed survey targeting childhood cancer survivors: A comparison of conditional versus unconditional incentives. Cancer Epidem Biomar. 2005;14(5):1330-2.

[45] Singer E, Ye C. The Use and Effects of Incentives in Surveys. Ann Am Acad Polit Ss. 2013;645(1):112-41.

[46] Ziegenfuss J Y NBD, Kallmes D, et al. An assessment of incentive versus survey length trade-offs in a Web survey of radiologists. Journal of medical Internet research. 2013;15(3):e49.

[47] Deutskens E, De Ruyter K, Wetzels M, Oosterveld P. Response rate and response quality of Internet-based surveys: An experimental study. Market Lett. 2004;15(1):21-36.

[48] Göritz AS. Determinants of the starting rate and the completion rate in online panel studies1. Online panel research: A data quality perspective. 2014:154-70.

[49] Peytchev A. Survey Breakoff. Public Opinion Quarterly. 2009;73(1):74-97.

[50] Porter SR, Whitcomb ME. The impact of contact type on web survey response rates. Public Opinion Quarterly. 2003;67(4):579-88.

[51] Tourangeau R, Yan T. Sensitive questions in surveys. Psychol Bull. 2007;133(5):859-83.

[52] Cho YI, Johnson TP, VanGeest JB. Enhancing Surveys of Health Care Professionals: A Meta-Analysis of Techniques to Improve Response. Eval Health Prof. 2013;36(3):382-407.

[53] Manfreda KL, Bosniak M, Berzelak J, Haas I, Vehovar V. Web surveys versus other survey modes - A meta-analysis comparing response rates. Int J Market Res. 2008;50(1):79-104.

[54] Sheehan KB. E-mail survey response rates: A review. Journal of Computer-Mediated Communication. 2001;6(2):0-0.

[55] Shih TH, Fan XT. Comparing response rates from Web and mail surveys: A meta-analysis. Field Methods. 2008;20(3):249-71.

[56] Yarger J B JTA, Ashikaga T, et al. Characteristics in response rates for surveys administered to surgery residents. Surgery. 2013;154(1):38-45.

[57] Helgeson JG, Voss KE, Terpening WD. Determinants of mail-survey response: Survey design factors and respondent factors. Psychology & Marketing. 2002;19(3):303-28.

[58] Groves RM, & Lyberg, L. E. . An overview of nonresponse issues in telephone surveys. Telephone survey methodology. 1988:191-212.

[59] Keusch F. Why do people participate in Web surveys? Applying survey participation theory to Internet survey data collection. Management Review Quarterly. 2015;65(3):183-216.

[60] Bowling A. Mode of questionnaire administration can have serious effects on data quality. J Public Health-Uk. 2005;27(3):281-91.

[61] Dillman D A. Mail and internet surveys: The tailored design method. New York: Wiley, 2000.

[62] Albaum G, & Smith, S. M.. Why people agree to participate in surveys. Handbook of Survey Methodology for the Social Sciences Springer New York; 2012. p. 179-93.

[63] Goyder J. The silent minority: Nonrespondents on sample surveys. Westview Press, 1987.

[64] Singer E. Toward a Benefit-Cost Theory of Survey Participation: Evidence, Further Tests, and Implications. Journal Of Official Statistics. 2011;27(2):379-92.

[65] Singer E. Exploring the Meaning of Consent: Participation in Research and Beliefs about Risks and Benefits. Journal of Official Statistics. 2003;19:273-85.

[66] Petrova PK, Cialdini RB, Sills SJ. Consistency-based compliance across cultures. J Exp Soc Psychol. 2007;43(1):104-11.

[67] Hofstede G. National cultures in four dimensions: A research-based theory of cultural differences among nations. International Studies of Management & Organization. 1983;13(1-2):46-74.

[68] Baruch Y, Holtom BC. Survey response rate levels and trends in organizational research. Hum Relat. 2008;61(8):1139-60.

[69] Furse D H SDW. Manipulating dissonance to improve mail survey response. Psychology & Marketing. 1984;1(2):79-94.

[70] Festinger LNP. Cognitive dissonance theory. 1989) Primary Prevention of HIV/AIDS: Psychological Approaches. Newbury Park, California: Sage Publications; 1957.

[71] Hackler JC, Bourgett.P. Dollars, Dissonance, And Survey Returns. Public Opinion Quarterly. 1973;37(2):276-81.

ERP Evidence for the Relationship between Executive Function and Language Control in Bilingual Word Production

Taomei Guo, Chunyan Kang
State Key Laboratory of Cognitive Neuroscience and Learning
Beijing Normal University
Beijing, China

Fengyang Ma
School of Education
University of Cincinnati
Cincinnati, USA

Abstract—**The present study investigated the predictive effects of different components of general executive functions on bilingual language control processes. Fifty-four unbalanced Chinese-English bilinguals participated in a cued language switching task, with their event-related potentials (ERPs) and behavioral data recorded to probe into bilingual language control processes. In addition, their behavioral data during a flanker task, a task-switching task, and an n-back task were collected to tap into three relatively basic executive functions: inhibiting, shifting, and updating, respectively. ANOVA results of the language switching task showed that compared to non-switch trials, picture naming in switch trials was significantly slower and less accurate, and elicited a larger stimulus-locked N2 component. These switch effects indicate that inhibition on the non-target language occurs during the lexical selection phase. Sequential regression analyses showed that only the flanker effect robustly predicted the variability of the stimulus-locked (but not the cue-locked) N2 switch effect. Specifically, smaller flanker effects were associated with larger stimulus-locked N2 switch effects This suggests that better general interference suppression correlates with stronger inhibition exerted to regulate lexical interference from the non-target language. In conclusion, the general inhibition function could predict the intensity of real-time inhibition exerted on the lexical items in the non-target language during bilingual word production.**

Keywords-Language control; General executive functions; Inhibition; ERP; Sequential regression analysis; Bilingualism

More and more people have begun to use two languages with the globalization of economy. Some studies have shown that bilinguals performed better than their monolingual counterparts in tasks tapping into general executive functions [1]. Evidence has also shown that general inhibition or shifting function could predict language control processes.

The present study aimed to investigate the relationship between the executive function on the language control mechanism during bilingual word production. Notably, it has been corroborated that general executive functions include three relatively basic components [2], namely inhibiting, shifting, and updating. We used a flanker task, a task-switching task and an n-back task to tap into the inhibiting function, the shifting function and the updating function respectively.

In addition, a cued language switching task was adopted to investigate the language control processes during bilingual word production. This task usually requires participants to name pictures or digits in the corresponding language indicated by a cue. Previous ERP studies showed that switch trials elicited a larger frontal-central N2 (a negative-going ERP component which peaks at approximately 200-350ms post-stimulus) than non-switch trials [3]. Given that the frontal-central N2 was considered to reflect general cognitive control [4], the N2 switch effect in the language switching task suggests that cognitive control plays a role in bilingual word production. We were interested in whether participants' performance in the three executive function tasks would predict any amplitude difference in cue-locked or stimulus-locked N2 between switch and non-switch trials.

Fifty-five Chinese-English bilinguals participated in the present study. Participants were required to first complete a cued language switching task, during which both their behavioral data and EEG data were collected. Then, they were required to take the flanker task, the task-switching task and the n-back task.

We found that, compared to non-switch trials, picture naming in switch trials elicited a larger stimulus-locked N2. Moreover, only the flanker effect significantly predicted the variability of the stimulus-locked N2 switch effect. Specifically, stronger interference suppression ability, as reflected by a smaller flanker effect, facilitates inhibition on lexical items in the non-target language, as indicated by a larger N2 switch effect in the stimulus-locked ERPs. These results indicate that inhibition is exerted during bilingual word production. Furthermore, domain-general inhibiting function predicts the real-time intensity of bilingual language control.

ACKNOWLEDGMENT (HEADING 5)

The authors would like to thank Jie Lin, Junjie Wu, Di Lu, Yongben Fu for data collection and Alex Titus for proofreading.

REFERENCES

[1] M. M. Martin-Rhee, and E. Bialystok. The development of two types of inhibitory control in monolingual and bilingual children. Biling-Lang Cogn, 2008, 11, 81-93.

[2] A. Miyake, N. P. Friedman, M. J. Emerson, A. H. Witzki, A. Howerter, and T. D. Wager. The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: A latent variable analysis. Cogn Psychol, 2000, 41, 49-100.

[3] G. M. Jackson, R. Swainson, R. Cunnington, and S. R. Jackson. ERP correlates of executive control during repeated language switching. Biling-Lang Cogn, 2001, 4, 169-178.

[4] J. R. Folstein, and C. Van Petten. Influence of cognitive control and mismatch on the N2 component of the ERP: A review. Psychophysiology, 2008, 45, 152-170.

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.32

Factors influencing smartphone use in different contexts

Liang Xu
Zhejiang University
China

Rong Ma
Zhejiang University
China

Jian Han
Zhejiang University
China

Xiuying Qian*
Zhejiang University
China

Qun Wan*
Zhejiang Data Exchange Center China

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.35

Abstract

A series of studies were conducted to explore the factors influencing smartphone use in our research (as shown in Fig.1). Firstly, we analyzed the smartphone data of anonymous users and compared the participants' communication indicators in the office and at home. We found that smartphone usage behavior was significantly different in two contexts. We also found that there were similarities in some behaviors, such as the floor effect of SMS. Then we conducted semi-structured in-depth interviews. Three level coding of text from interviews and phenomenon showed that the factors were constituted by users' needs and context factors.

Introduction

Previous studies have used existing models to explain the factors that affect smartphone use in general context. Big data analysis, statistical analysis and grounded theory were used in our research to explore factors influencing smartphone use in different contexts. Three parts will be shared later: 1.results from big data analysis, 2.comparison of participants' communication indicators in different contexts, 3. factors influencing smartphone use from grounded theory.

Methods, Result and Discussion

1. Big data analysis: Smartphone data (voice, SMS and URL records) in 20 days from 1.97 million anonymous users and 47 participants was analyzed. We found, for example, that (a) more than 90% of users' records are less than 20000(Fig.2a.),(b) records accounting for 3% from 1 a.m. to 6 a.m. were the least,

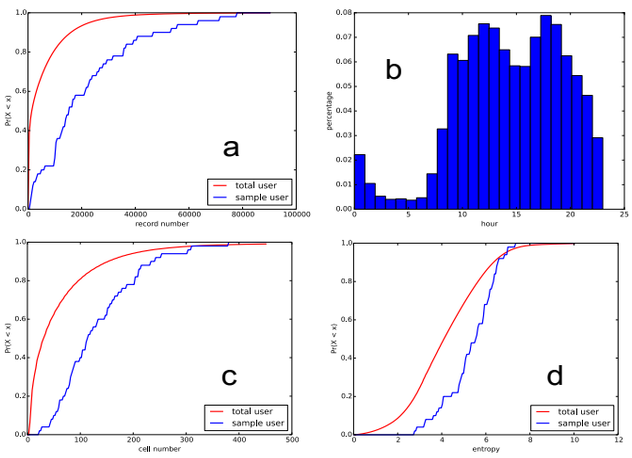


Fig.2. Results from big data analysis: (a) number of records, (b) distribution of active time, (c) distribution of cells, (d) entropy of cells.

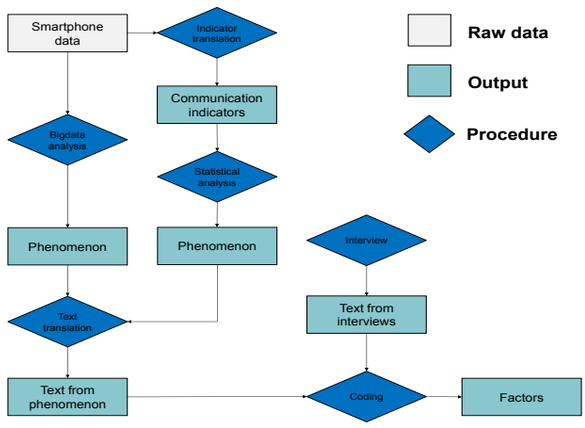


Fig.1. Research framework

while records accounting for 42% from 11 a.m. to 1 p.m. and from 5 p.m. to 7 p.m. were the most (Fig.2b.), (c) more than 90% of users' cells (base stations) were less than 250(Fig.2c.),(d)most of users' entropy of cells was between 3 to 6, which showed that most of users' records were concentrated in several important cells.

2. Comparison of indicators: 32087 records from 47 participants were translated into indicators. The differences between the communication indicators at home and in the office were compared by signed-rank test. We found that some smartphone usage behavior was different in two contexts, such as the APP categories (Fig.3e.), and some was similar, such as the floor effect of SMS (Fig.3f.).

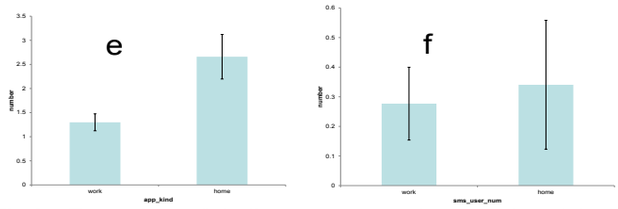


Fig.3. Examples of indicators comparing results: (e) the number of APP categories, (f) the number of people contacted by SMS.

3. Result from grounded theory: Three level coding of text from the interviews and phenomenon showed that users' smartphone usage was affected by two major factors. One was users' needs including physiological, utilitarian, security, social, hedonic, cognitive, self-actualization needs. The results also showed that the users' needs hierarchy is similar to Maslow's theoretical model. The second factors were context factors, including physical context, temporal context, social context, technical context. And they were consistent with factors found in human-computer interaction researches.

Application of Data Mining in the Automatic Evaluation of User's Psychological Needs

Zaoyi Sun
Zhejiang University
China

Pei Zhang
Zhejiang University
China

Xiuying Qian
Zhejiang University
China

Abstract

Our team conducted a series of studies on the user's psychological profile which is shown in Figure 1. First the grounded theory and machine learning algorithms were combined to automatically provide each apps and smartphones with different types of needs they satisfied. Then, based on these results, the anonymous users' App and smartphone usage record were used as preference weight to evaluate the user's needs. Finally, the results were applied to predicate the user's preference towards each brand by calculating the similarity between the user and brand's needs vectors and showed good performance. As smartphones are in increasing use in CBT, these studies could be applied to the App's design based on the user's psychological profile, which could be used to improve the individual's happiness.

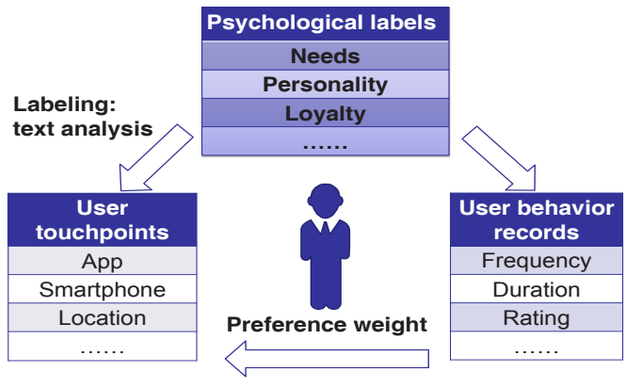


Figure 1. User's psychological profile framework

Introduction

In recent years, the analysis of the people's personal traits based on the massive and real-time big data becomes a new perspective in the psychology field. Previous studies relied on surveys, which were limited by sample size and the type of participants. Our studies combined the grounded theory and machine learning algorithms to realize the functions: 1.Labeling the Apps and smartphone with the needs they stratified. 2.Evaluating the user's satisfied needs. 3. Evaluating the user's brand preference for smartphones.

Methods, Result and Discussion

1.Combining grounded theory approach and machine learning algorithms to label the Apps with the needs they satisfied, as shown in Figure 2. The classifier showed good performance(F1>0.5).

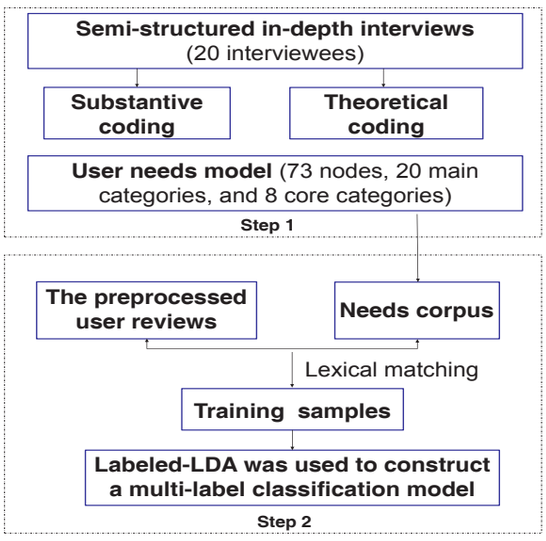


Figure 2. Framework of needs labelling

2. Using anonymous users' App and smartphone usage records as preference weights. Finally, TD-IDF algorithm was used to evaluate the user's needs.

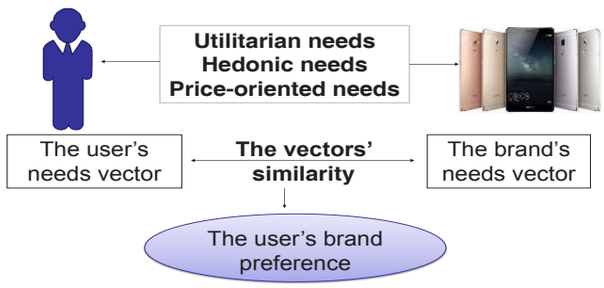


Figure 3. User's brand preference measurement

3. Based on Dastan & Gecti's research(2014), Utilitarian, Hedonic and price-oriented needs were used to measure the user's brand preference, as shown in Figure 3.

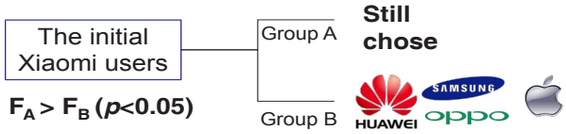


Figure 4. User's brand preference results

References

Dastan, I., & Gecti, F. (2014). Relationships among utilitarian and hedonic values, brand affect and brand trust in the smartphone industry. Journal of Management Research, 6(2), 124.

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.36

A Cross-Cultural Study about Positive and Negative Emotions and Well-being in Infertile Women

Reza Kormi-Nouri1, Shaghayegh Zahraei2 , Sofia Bergbom1
CHAMP-Center for Health & Medical Psychology School of Law, Psychology & Social work,
Örebro University, Sweden
2Department of Psychology, Alzahra University, Tehran, Iran

Abstract

Recently, Diener et al. (2010) used a new measurement to distinguish between cognitive/global and emotional components of well-being. Kormi-Nouri et al. (2013) examined this distinction among Swedish and Iranian university students and found no cultural differences in cognitive component but cultural differences in emotional component. The present study examined the distinction between global/cognitive and emotional components of well-being where the two groups of Swedish and Iranian participants were in an unpleasant situation and experience a significant amount of stress and negative emotions, namely infertility. The results showed no difference between infertile Swedish and Iranian women in flourishing. However, infertile Swedish women reported higher levels of positive and negative emotions than infertile Iranian women. In both infertile populations, the most predictive affect with regard to flourishing was the balance affect. It was concluded that, under a stressful and unpleasant situation like infertility compared to a normal situation, the same pattern of distinction between global/cognitive and emotional components of well-being can be still observable. However, negative emotions can act differently at cultural level: they become more noticeable in the Swedish population than in the Iranian population. The results are discussed with respect to individualistic-collectivistic dimension.

Keywords: Positive emotion, negative emotion, well-being, infertile women, individualistic culture, collectivistic culture

Cross-cultural studies have shown that different patterns of positive and negative emotional responses exist across different cultures. For instance, there is evidence to suggest that, in pleasant situations, Easterners have a dialectical emotionality and report more mixed emotions than Westerners, whereas there are no cultural differences in unpleasant and mixed situations (Miyamoto, Uchida, and Ellsworth, 2010). There are also studies that indicate that the large emotional differences observed between Western and Asian cultures concern positive affect rather than negative affect (Miyamoto et al., 2010; Uchida and Kitayama, 2009). Thus, Asian and Western cultures have more similarities in negative emotions than in positive emotions. In some previous research, it has been assumed that people in an individualistic-based Western culture adapt a contradictory unidirectionality perspective of happiness in which positive and negative emotions are regarded as opposite ends of a bipolar continuum. It is therefore assumed that people in Western cultures cannot feel both positive and negative emotions simultaneously and that you cannot be happy if you are experiencing unhappiness (Green, Goldman, and Salovey., 1993; Russell and Carroll, 1999). Such a view emphasizes the maximization of happiness and the minimization of unhappiness. In contrast, in Eastern cultures, the emphasis is on a dialectically experienced emotion, where there is a co-existence of positive and negative emotions (Williams and Aaker, 2002). In their research, Willams and Aaker (2002) illustrate this notion by showing that collectivist-based Asian Americans prefer advertisements that evoke mixed emotions (e.g., happy and sad) more than individualistic-based European Americans.

In a recent study of well-being and positive and negative emotions, KormiNouri, Farahani, and Trost (2013) compared Swedish university students, who were representative of an individualistic Western culture (Schimmack, Oishi, and Diener, 2005), and Iranian university students, who were representative of a collectivistic Asian culture (Fukuyama, 1992; Tamadonfar, 2001). These authors used a new well-being measurement that was designed by Diener et al. (2010) to distinguish between cognitive/global well-being (flourishing) and emotional well-being (positive versus negative), but they found no difference between Swedish and Iranian participants in their flourishing scores. However, they found different emotional patterns in these two cultures. Whereas Swedish students showed more positive emotions, Iranian participants showed more negative emotions. Further, whereas positive affect and flourishing were positively correlated in the Swedish sample, they were negatively correlated in the Iranian sample. It was also found that, in the Swedish sample, the factor most predictive of flourishing was positive affect. However, in the Iranian sample, the most predictive factor was the balance affect (a combination of both positive and negative affects together). In line with previous research (e.g., Kuppens, Realo, and Diener, 2008; Pavot and Diener, 2004; Schimack, Oishi, and Diener, 2002), it was concluded that there is a need to distinguish between the cognitive and emotional components of well-being, especially at the cultural level. Whereas culture has no impact on the cognitive component of subjective well-being, it can selectively influence different emotional components of subjective well-being. The present research was designed to follow up the study by Kormi-Nouri et al. (2013) in the same two cultures (Sweden and Iran), but in a different population, namely infertile women, who are in an unpleasant situation and might experience a significant amount of stress and negative emotions.

Infertility is the inability of a sexually active, non-contraceptive couple to achieve pregnancy in at least one year (WHO, 2004). In primary infertility, pregnancy has never occurred. In secondary infertility, one or both members of the couple have previously conceived but are unable to conceive again after a full year of trying. The term infertility may be perceived clinically as a medical condition with no inclusion of psychological and social aspects (Inhorn and Van Balen, 2002). However, there are studies indicating that infertility is experienced as a social and psychological phenomenon as well (Hreinsson, Hamberger, and Hardarson., 2005; Kormi-Nouri, 2000) and affects both social functioning (Amir, Horesh, and Lin-Stein, 1999; Onat and Beji, 2012) and psychological well-being (Lykeridou, Gourounti, and Deltsidou, 2009). Parenthood is a major transition in adult life for both men and women. Today, children are valued as a source of fulfillments and happiness (Burns & Covington, 1999).

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.39

The stress of the non-fulfilment of a wish for a child has been associated with emotional problems such as depression, anger, guilt, anxiety and feeling of worthless*ness* (Connolly, Edelmann, Cooke et al., 1991; Kormi-Nouri, Akhondi and BehjatiArdakani., 2001; Lykeridou et al., 2009). There are indeed findings to reflect a much higher prevalence and levels of psychological distress in the sample of infertility patients compared to a normative sample (Chen, Chang, Tsai, and Juang, 2004; Morrow, Thoreson, and Penney, 1995). Distress has been seen both as a cause of infertility (e.g., Sandler, 1968; Facchineti, Volpe, Mattco et al., 1997) and as a consequence of infertility (e.g., Burns and Covington, 1999; Boivin, Griffiths and Nenetis, 2011). In a review of research about consequences of infertility, Griel (1997) reported that the majority of studies have demonstrated that infertile couples are moderately different from fertile norms on some indices such as depression and interpersonal sensitivity.

Infertile women, compared to infertile men, experience more depression and distress, feel less satisfied with life and happiness, pin the blame for this problem often on themselves, and seek more treatment for their infertility. Leiblum, Kemman and Lane (1987) reported that infertile women, compared to infertile men, had more depression before and after infertility treatment and rated IVF as being very stressful. Infertile women become the focus of infertility treatment regardless of what is causing the infertility (Schmidt, 2006). For infertile women, pregnancy and motherhood are highly emphasized, and a traditional gender role is strongly identified (Miles, Keitel, Jackson et al., 2008). Infertile women reported more psychological distress when they were under strong social pressure towards motherhood (Miles et al., 2008). Childless women perceive their condition negatively depending to a negative attribute of the public to their involuntary childlessness (Lampman and Dowling-Guyer, 1995). For infertile women, social sanctions and social control are shown to be relevant to an understanding of the experience of involuntary childlessness (Mial, 1985).

Social and cultural factors such as norms, values and role expectations are considered as important factors affecting the meaning of infertility among infertile inviduals (Inhorn and Van Balen, 2002; Lykeridou et al., 2009). However, norms and standards can be valued differently in collectivistic and individualistic cultures (Triandis, 2001; Triandis, McCusker, and Hui., 1990). In a collectivistic culture, social organizations such as family and community and importance of the group are highly emphasized (Realo, 2003). Family formation can increase social and economic status of people in collectivistic cultures (Van Rooij, Van Balen, and Hermanns, 2006).

Voluntary childlessness is not socially acceptable in such a culture (Onat and Beji, 2012). On the other hand, in an individual culture, there is a high value on the freedom and happiness of an individual, self and autonomous individual are highly emphasized (Realo, Koido, Ceulemans, and Allik, 2002).In individualistic cultures, family formation may be less valued, and choosing voluntary childlessness is more respected, as family formation is not as equally strong norms as it is in collectivistic cultures (Van Balen and Bos, 2006).

Thus, stigma or being marginalized may have more negative social and psychological consequences especially for infertile women in collectivistic cultures in which social life and family formation is the center of most human interactions (Miles et al., 2008; Yağmur and Oltuluoğlu, 2011). Especially in collectivistic cultures, this may be partly due to still prevailing ideas that infertility is a woman's fault or the denial of the existence of male infertility (Van Balen and Bos, 2009). This stigmatization can result in negative community effects (e.g., isolation and exclusion) and marriage effects for childless women in collectivistic cultures, whereas positive marriage effects have been reported in studies of infertile women in western or individualistic cultures (Schmidt et al., 2005).

The aim of the present study was to examine Iranian and Swedish women's cognitive and emotional well-being while they underwent fertility treatment. The level of psychological distress caused by infertility may be affected by culturally shaped norms about family formation, leading to cultural differences in stigmatization. This may produce a cultural difference in well-being and its components, with infertile Iranian women being more stigmatized than Swedish women and displaying different emotional patterns of well-being.

The current study intended to investigate if there were any differences in the degree of positive and negative emotions in Iranian and Swedish women who were undergoing fertility treatment and how these emotions may have affected well-being differently based on culture. Based on previous research on cultural differences in the strive for emotional moderation or emotional maximization (Kitayama, Park, and Sevincer, 2009; Kormi-Nouri et al., 2013), a cultural difference would be expected to be found in the present study, with the well-being of infertile Iranian women not being affected by negative emotions as in infertile Swedish women. On the contrary, research indicates that these cultural differences are often observed in "pleasant" situations and may not be present in "unpleasant" situations (Miyamoto et al., 2010; Uchida and Kitayama, 2009), which may result in small or no differences in emotions between Iranian and Swedish women who are undergoing fertility treatment.

Methods

Participants

Participants who were included in the study were women who had received some kind of infertility-related help at fertility clinics in Iran and Sweden. The study only involved women, as women are the main focus of fertility treatment. Because the Iranian culture is regarded as a collectivistic Asian culture, and Sweden is regarded as a highly individualistic Western culture, the use of an Iranian and a Swedish sample for comparisons on cultural dimensions such as collectivism and individualism was appropriate (Berggren and Trädgårdh, 2006; Kormi-Nouri et al., 2013; Schimmack et al., 2005).

Sample characteristics. Demographic information for the two samples is presented in Table 1. It should be noted that seven

participants from the Swedish sample were excluded, due to not having a diagnosis of primary infertility or having a previous history of hospitalization for psychiatric treatment. One case was excluded from the Iranian sample, due to not having a diagnosis of primary infertility.

INSERT TABLE 1 HERE

The emotional distress of the subjects in the two samples was tested with the Hospital Anxiety and Depression Scale (HADS) (Zigmond and Snaith, 1983). The participants in both samples reported low sub-clinical levels of emotional distress (less than 11 in each subscale of depression and anxiety), but they scored higher than normative subjects in a non-clinical sample (mean (M) = 9.82, standard deviation (SD) = 5.98) (Snaith and Zigmond, 1994). The Iranian women exhibited distress scores that were 1.29 SD higher than the results from a non-clinical female sample, and the Swedish women exhibited scores that were 0.33 SD higher compared to normative data. As was expected, the Iranian participants reported higher levels than the Swedish participants of both depression (10.12 vs. 6.84) and anxiety (6.28 vs. 5.59).

Criteria for inclusion and exclusion. Inclusion criteria were a confirmed diagnosis of primary infertility (i.e., active attempts to achieve pregnancy without success, and no previous biological children) and the participation in fertility treatment at a fertility clinic. Because the study focused on the investigation of infertility-related emotional symptoms in childless women who wanted to have children, these inclusion criteria were established. There is research showing that this group experiences significant psychological distress compared to normative data (Morrow et al., 1995).

Exclusion criteria for participation in the study were a level of education lower than high school and a previous history of hospitalization for psychiatric treatment. Because the study was based on data obtained from questionnaires, it was crucial that the participants fully understood all of the written instructions to correctly fill in the questionnaires. Subjects with a severe psychological disorder were excluded on the basis of risks of disruptive third variables regarding the relationship between infertility and emotional patterns.

Procedures

Recruitment. In all, 212 participants were recruited from fertility clinics in Sweden and Iran. Staff at the clinics asked patients about their interest in participating in the study, and patients who were interested in participating received an information sheet with easily comprehensible information about the study. The information also stated that the patients' care at the clinic would not be affected by their choice to participate. Participation was anonymous and voluntarily. The participants received one movie ticket for responding to the survey.

Ethical considerations. The study was approved by ethical review boards both in Sweden and in Iran.

Data analysis. The homogeneity of variance between the Swedish and the Iranian data was analyzed by performing Levene's test. The assumption of homogeneity was supported on well-being, positive emotions, negative emotions and anxiety scales at a 0.05 significance level. The assumption of homogeneity was not supported on distress or depression at a 0.05 significance level.

Normality was assessed using Kolmogorov-Smirnov's test of normality and by the visual inspection of normal q-q-plots and histograms, which showed a mostly negatively skewed distribution of data for both the Swedish and the Iranian samples. Normality transformations were performed using reversed score transformations on Log transformations as well as Square root transformations (Field, 2009). Normality analyses were performed on both transformed and non-transformed data, in addition to Levene's test of homogeneity of variance regarding the Swedish and the Iranian data. Because the transformed and the non-transformed data did not noticeably differ, the results presented in this study are from the non-transformed data.

Materials

Demographic questionnaire. The questionnaire provided information on background variables and included questions regarding ethnicity, relationship status, education, occupation, income, social support, infertility diagnosis, medical treatment and medical history.

Flourishing Scale, FS. The term flourishing refers to a subjective experience of life going well, with an emphasis on effective functioning in combination with feeling good. By adding the construct of flourishing to the measurement of well-being, Diener has enriched the concept of well-being to comprise more than mere emotions (Huppert and So, 2013). The FS (Diener et al., 2010) includes eight items that were designed to measure subjective well-being on the basis of different important areas of human life, such as relationships, engagement, competence, optimism, self-esteem, purpose and contribution to the well-being of others. The participants responded to eight different positively phrased statements on a 7-point Likert scale (*"strongly disagree"; "disagree"; "slightly agree"; "neither agree nor disagree"; "slightly agree"; "agree"; "strongly agree"*).

The FS strongly correlates with other scales on well-being and shows good psychometric characteristics. Cronbach's alpha of the scale is good at 0.87, and the temporal reliabilities are moderately good. A principal axis factor analysis showed that

the scale is characterized by one single strong factor (Diener et al., 2010). Swedish and Persian versions of the FS showed good reliability (α for the Swedish version: 0.87; α for the Persian version: 0.85) (Kormi-Nouri et al., 2013).

Scale of Positive and Negative Experience, SPANE. The SPANE (Diener et al., 2010) measures subjective emotions and consists of 12 items that are divided into scores for positive (six items) and negative (six items) emotions. Both the negative and the positive items are divided into three general items (e.g., negative, positive) and three specific items (e.g., sad, joyful). The inclusion of general items in the SPANE undermines the possibility of cultural biases due to cultural differences in specific expressions of emotions, which enables a better cultural comparison. The SPANE assesses a wide range of negative and positive experiences and emotions, the results converge well with other measures of emotions and well-being and are consistent in different cultures (Diener et al., 2010).

The 12 items are rated on a 5-point Likert scale, ranging from one (*"very rarely or never"*) to five (*"very often or always"*), and the respondents are asked to base their answer on the amount of emotions experienced in the last month.

In the present study, the Cronbach's alpha of the scale was 0.87 (positive feelings) and 0.81 (negative feelings). Previous research also showed good reliability for the Swedish and Iranian versions of this scale, for both positive feeling (0.86 for the Iranian version and 0.82 for the Swedish version) and negative feeling (0.85 for the Iranian version and 0.84 for the Swedish version) (Kormi-Nouri et al., 2013).

Results

The descriptive findings are shown in Table 2.

INSERT TABLE 2 HERE

A multivariate analysis for national effect was conducted, and the results are shown in Table 3.

INSERT TABLE 3 HERE

As shown in Table 3, there were significant differences between dependent variables (positive, negative and balance affects and also flourishing) when the data were combined with respect to the two cultures. A univariate analysis of variance test was also conducted, and nationality was considered as an independent variable of interest. The results are shown in Table 4.

INSERT TABLE 4 HERE

The results in Table 4 show that there was no significant difference between Iranian and Swedish participants in terms of flourishing and balance affect (the difference between positive and negative emotion), but there were significant differences in both positive and negative affects separately.

It should be mentioned that the invariance hypothesis was examined by Levene's test for the equality of variances rather than Box's M test on the flourishing scale and the SPANE scale because some cells showed fewer than two nonsingular cell covariance matrices. The homogeneity of covariance across the two groups is shown in Table 5.

INSERT TABLE 5 HERE

The two groups of Iranian and Swedish samples did not show a significant difference ($F = 0.005$, $p = 0.94$) in variance on the flourishing scale and also did not show significant differences for positive affect ($F = 1.54$, $p = 0.22$), negative affect ($F = 0.223$, $p = 0.64$) and balance affect ($F = 1.67$, $p = 0.20$). Thus, the results were generalizable to the normal population for all scales

In the case of flourishing, the zero order correlations of positive, negative and balance affects for Iranian and Swedish samples are shown in Table 6.

INSERT TABLE 6 HERE

As shown in Table 6, the directions of the relationships between positive, negative, and balance affect with flourishing did not differ between the two groups, although the relationship was stronger for the Swedish sample.

In order to test whether culture was influenced by positive affect, negative affect and balance affect on flourishing, two stepwise regression models were tested. It was found that the most predictive affect with regard to flourishing was the

balance affect among Swedish samples (b = 0.69, SE = 0.09, p < 0.0001) and Iranian samples (b = 0.31, SE = 0.13, p < 0.0001). For the two groups, an increase in balance affect, a decrease in negative affect and an increase in positive affect were associated with greater flourishing. Tables 7 and 8 show the stepwise regression analyses in Iranian and Swedish samples respectively.

INSERT TABLE 7 HERE

INSERT TABLE 8 HERE

As discussed by Stevens (2009), multicollinearity can be a problem for multiple regressions for at least three reasons: a) it reduces the size of the multiple regression, b) it confounds the results because of high intercorrelations between the independent variables, and c) it increases the regression coefficient variance and results in a more unstable regression equation. Hence, the multicollinearity issue was tested. A tolerance level less than 1 was found for both samples, which ruled out the problem of multicollinearity for our results.

Discussion

In line with the findings of Diener et al. (2010), Kormi-Nouri et al. (2013) found different patterns of cognitive and emotional well-being at the cultural level. Whereas there was no difference between Swedish university students (as members of an individualistic culture) and Iranian university students (as members of a collectivistic culture) concerning the cognitive component of well-being (flourishing), the subjects differed concerning the emotional components of well-being (i.e., positive and negative affect). Swedish students reported higher levels of positive emotions, and positive emotions predicted their flourishing to a larger extent. However, in Iranian students, there were more negative emotions, and the negative emotions more strongly predicted their flourishing. The main aim of this study was to investigate whether similar cultural patterns could also be observed in infertile women, thus extending earlier findings to subjects in more unpleasant and stressful situations.

The main important finding of the present study, in line with the findings of the Kormi-Nouri et al. (2013) study, was that there was no difference between the two cultures concerning the cognitive components of well-being. That is, once again, Swedish and Iranian participants, who belong to individualistic and collectivistic cultures, respectively, were similar with respect to the general evaluation of their life satisfaction. This similarity was therefore not affected by being in an unpleasant and stressful situation. Infertility has usually been considered a powerful stressor that involves emotional changes (e.g., Ridner, 2004), and infertile women experience strong psychological distress and negative feelings related to infertility (e.g., Miles et al., 2008). There is also research showing that social pressure towards family formation and having a child (e.g., Triandis, 2001; VanRooij et al., 2006) and stigmatization in infertility (e.g., Miles et al., 2008; Yağmur and Oltuluoğlu, 2011) are observed to a greater extent in collectivistic cultures than in individualistic cultures. However, the results of the present study showed that this unpleasant and stressful situation had no effect on flourishing at a cultural level. Interestingly, the scores of flourishing for the infertile women in the present study and for university students in the Kormi-Nouri et al. (2013) study were comparable, and both studies showed high general life satisfaction in these two cultures.

However, like the Kormi-Nouri et al. (2013) study, cultural differences were observable in the emotional components of well-being, namely positive and negative emotions. Infertile Swedish women reported higher levels of positive affect than infertile Iranian women. However, unlike the university student population in the Kormi-Nouri et al. (2013) study, infertile Swedish women in this sample also reported higher levels of negative emotions than infertile Iranian women. Moreover, in both infertile groups, the same pattern of prediction was observed: the most predictive affect with regard to flourishing was the balance affect, and negative and positive affects were in the second and third places, respectively. Thus, it appears that, under a stressful and unpleasant situation like infertility, negative emotions act differently in these two cultures: they become more noticeable in the Swedish population than in the Iranian population.

A comparison between the two studies showed that while the balance affect was the most predictive variable for flourishing in the Iranian group in the Kormi-Nouri et al. (2013) study, this was the case for both cultural groups in the present study. Additionally, whereas the results of the Swedish groups in terms of positive and negative emotions were comparable in these two studies, the results were different for Iranian groups: infertile Iranian women, compared to Iranian university students, scored higher in positive emotions but scored lower in negative emotions. That is, infertility as a stressful and negative situation can change the emotional pattern at a cultural level. First, in a stressful and unpleasant situation such as infertility, the balance affect (where both positive and negative emotions are taken into account) becomes an important factor even for individuals in an individualistic culture like Sweden, although this factor was still important for individuals in a collectivistic culture like Iran. Thus, it is important to take into consideration the combination of these two types of emotions especially under stressful and negative situations. Second, in contrast with our expectation, infertility was not associated with a more negative outcome in Iran than in Sweden. There are studies that show that infertility (especially for women) is more stressful and is more negatively experienced in a collectivistic culture than in an individualistic culture (e.g., Van Rooij et al., 2006; Yağmur and Oltuluoğlu, 2011). Thus, the expectation was to see more

negative emotions and/or fewer positive emotions in infertile Iranian women than in infertile Swedish women. However, the between-studies comparison showed the opposite results. Compared to Iranian university students, infertile Iranian women experienced more positive emotions and, even more notably, less negative emotions. In addition, the within-study comparison that is presented in the present study showed that infertile Swedish women experienced more emotions (both positive and negative) compared to their counterparts in the Iranian group. This result can be explained by findings showing that social support (especially from family and friends) is more observable in a collectivistic culture than in an individualistic culture, and social support is a stronger predictor of well-being in collectivistic cultures than in individualistic cultures (Kitayama, Markus, and Kurokawa., 2000; Kwan, Bond, and Singelis., 1997; Uchida and Kitayama, 2009). In an infertility situation, women might be in need of more emotional support, which can be provided more by family and friends and not by medical care services alone. Such women may express more negative feelings with significant others and receive more attention from close family members and friends, which may influence their well-being. More specifically, when infertile women are undergoing in vitro fertilization (IVF) treatment, they may experience additional stress and emotional disappointments because IVF treatments are highly technological and can be difficult both physically and emotionally (e.g., Eugster and Vingerhotes, 1999; WHC, 2009). To examine the differential effects of social support in the two cultures, we analyzed data related to social support that had been collected in the demographic information for the present study. Although the results demonstrated no significant differences between Iranian and Swedish participants with respect to social support received from their family, friends and significant others, social support had different meanings for the Iranian and Swedish women. Social support (in general) significantly predicted distress (i.e., more social support was associated with less distress) in the Iranian subjects and explained a significant proportion of the variance in their well-being. However, in the Swedish subjects, social support did not significantly predict well-being or distress. The finding that social support is a buffer against distress and a mechanism that influences wellbeing in a collectivistic context indicates that social support can have a beneficial effect on a stressful condition such as infertility, and it therefore should be included in the treatment of infertility in such contexts. Further research is needed on how to implement such elements in psychological treatment; there are examples in the literature of psychological interventions that include training in validation for partners (e.g., Fruzzetti and Worrall, 2010; Shenk and Fruzzetti, 2011). Similar interventions have been implemented in medical contexts, in which people who were suffering from medical conditions such as long-term pain showed more favorable emotional outcomes when their partners received training in validation (e.g., Edlund, Carlsson, Linton et al.,

2015). Hence, training partners in emotional communication and possibly implementing communication training to an extended social network and even medical professionals might be helpful for infertile women and might influence their sense of social support.

Regardless of culture, the present study indicates that infertility is a stressor that results in psychological suffering. This finding emphasizes the importance of psychological interventions as complements to the conventional medical treatment of infertility in order to minimize infertility-related distress and prevent the discontinuation of treatment due to treatment-induced strain.

There were some limitations in the present study. First, the measurement of *subjective well-being* is linked to several difficulties. For example, the level of satisfaction with one's life in individualistic cultures is, to a greater extent, determined by the individual's emotions and moods, while in collectivistic cultures, the level of satisfaction with one's life is determined by the individual's social life (Diener, 2012; Suh, Diener, and Updegraff., 2008). Since most well-being measures are designed in individualistic Western societies, the meaning of well-being in other cultures may not be properly captured (Uchida and Ogihara, 2012). Additionally, there may be technical biases due to culture-specific social norms about a condition or circumstance, such as infertility, that may affect the individual's responses on questions regarding this condition and the individual's well-being (Schimmack et al., 2005; WHO, 2012). These issues were considered in the process of choosing instruments to measure well-being and emotions in the present study.

Second, there is a need for a better control group for infertile participants other than the university participants included in the Kormi-Nouri et al. (2013) study. Although in the aforementioned study, the majority of students were females, and no significant gender differences were found, there were still age differences between these two studies, and the subjects in the student population were not asked about their fertility status. Thus, the comparison of these two studies should be considered with caution. In spite of these limitations, this work provides an important message that is worth developing further: infertility is indeed related to psychological distress, and the findings help to identify approaches that we can and should take in terms of supporting women who are suffering from the negative emotionality related to infertility.

Acknowledgements

Thanks to all of the participants in this project who shared with us their experiences of infertility.

We would like to thank Emelia Mellergård and Liza Trulsson for their valuable efforts and work during their master theses related to this project in the psychology program at Örebro University.

We would also like to thank Mikael Lood and Lise-Lott Persson at Fertilitetsenheten, Örebro Universitetssjukhus, for their integral help in the development and distribution of the survey materials.

Thank you also to Irene Leijonhufvud at Reproduktionsmedicinskt Centrum, Malmö, for her valuable cooperation and distribution of materials in Malmö.

Funding

This research was supported by the psychology program and CHAMP (Center for Health and Medical Psychology) at Örebro University in Sweden and Department of Psychology at University of Tehran in Iran.

Declaration of conflicting interests

The authors have no conflicts of interest to declare.

References

Amir M, Horesh N and Lin-Stein T (1999) Infertility and adjustment in women: the effects of attachment style and social support. *Journal of Clinical Psychology in Medical Settings* 6(4): 463–479.

Berggren H and Trägårdh L (2006) *Är Svensken Människa? Gemenskap och Oberoende i det Moderna Sverige.* Stockholm: Norstedts.

Boivin J, Griffiths E, Nenetis CA (2011) Emotional distress in infertile women and failure of assisted reproductive technologies: Meta-analysis of prospective psychological studies. *BMJ*, 342: d223. doi: https:// doi.org/10.1136/bmj.d223

Burns LH and Covington S (1999) *Psychology of infertility*. In Burns & Covington (eds), Infertility counseling: A comprehensive handbook for clinicians, New York: Parthenon. Pp 3-25.

Chen TH, Chang SP, Tsai CF, and Juang KD (2004) Prevalence of depressive and anxiety disorders in an assisted reproductive technique clinic. *Human Reproduction, Journal of Fertilization*, 19: 2313.

Connolly KJ, Edelmann RJ, Cooke ID, et al. (1992) The impact of infertility on psychological functioning. *Journal of Psychosomatic Research* 36(5): 459–468.

Diener E (2012) New findings and future directions for subjective well-being research.

American Psychologist 67(8): 590–597.

Diener E, Wirtz D, Tov W, et al. (2010) New well-being measures: short scales to assess flourishing and positive and negative feelings. *Social Indicators Research* 97(2): 143–156.

Edlund SM, Carlsson ML, Linton SJ, et al. (2015) I see you're in pain – the effects of partner validation on emotions in people with chronic pain. *Scandinavian Journal of Pain* 6: 16–21.

Eugster A and Vingerhoets AJJM (1999) Psychological aspects of in vitro fertilization: a review. *Social Science & Medicine* 48(5): 575–589.

Facchineti F, Volpe A, Mattco M et al. (1997) An increased vulnerability to stress with a poor outcome of in vitro fertilization and embryo transfer treatment. *Fertility and Sterility*, 67: 309-315.

Field A (2009) *Discovering Statistics Using SPSS* (3rd ed.). London: Sage Publications.

Fruzzetti AE and Worrall JM (2010) Accurate expression and validating responses: a transactional model for understanding individual and relationship distress. In: Sullivan K and Davila J (eds) *Support Processes in Intimate Relationships.* New York: Oxford University Press (OUP), pp.121–150.

Fukuyama F (1992) *The End of History and the Last Man.* New York, NY: Avon.

Green DP, Goldman SL and Salovey P (1993) Measurement error masks bipolarity in affect ratings. *Journal of Personality and Social Psychology* 64(6): 1029–1041.

Greil A (1997) Infertility and psychological distress: A critical review of the literature.

Social Science and Medicine, 45: 1679-1704.

Hare-Mustin RT and Broderick PC (1979) The myth of motherhood: a study of attitudes toward motherhood. *Psychology of Women Quarterly* 4(1): 114–128.

Hreinsson J, Hamberger L and Hardarson T (2005) *Infertilitet: Utredning och Behandling Genom Assisterad Befruktning.* Lund: Studentlitteratur.

Huppert FA and So TTC (2013) Flourishing across Europe: application of a new conceptual framework for defining well-being. *Social Indicators Research* 110(3): 837–861.

Inhorn MC and van Balen F (2002) *Infertility Around the Globe: New Thinking on Childlessness, Gender,*

and Reproductive Technologies, Berkeley: University of California Press.

Kitayama S, Markus HR and Kurokawa M (2000) Culture, emotion, and well-being:

good feelings in Japan and the United States. *Cognition & Emotion* 14(1): 93– 124.

Kitayama S, Park H, Sevincer AT, et al. (2009) A cultural task analysis of implicit independence: comparing North America, Western Europe, and East Asia.

Journal of Personality and Social Psychology 97(2): 236–255.

Kormi-Nouri R (2000) Infertility and psycho-social aspects. *Medical Journal of Reproduction & Infertility* 2: 57–68.

Kormi-Nouri R, Akhondi M-M and Behjati-Ardakani Z (2001) Psychological aspects of infertility from viewpoint of infertility treating physicians. *Medical Journal of Reproduction & Infertility* 2(7): 13–26.

Kormi-Nouri R, Farahani M-N and Trost K (2013) The role of positive and negative affect on well-being amongst Swedish and Iranian university students. *The Journal of Positive Psychology* 8(5): 435–443.

Kuppens P, Realo A and Diener E (2008) The role of positive and negative emotions in life satisfaction judgment across Nations. *Journal of Personality and Social Psychology* 95(1): 66–75.

Kwan VSY, Bond MH and Singelis TM (1997) Pancultural explanations for life satisfaction: adding relationship harmony to self-esteem. *Journal of Personality and Social Psychology* 73(5): 1038–1051.

Lampman C and Dowling-Guyer S (1995) Attitudes toward voluntary and involuntary childlessness. *Basic and Applied Social Psychology* 17(1): 213–222.

Leilum S, Kemman E, and Lane M (1987) The psychological concomitants of in vitro fertilization. *Journal of Psychosomatic Obstetrics and Gynecology*, 6: 165-178.

Lykeridou K, Gourounti K, Deltsidou A, et al. (2009) The impact of infertility diagnosis on psychological status of women undergoing fertility treatment. *Journal of Reproductive and Infant Psychology* 27(3): 223–237.

Mial CE (1985) Perception of informal sanctioning and the stigma of involuntary childlessness. *Deviant Behavior*, 6 (4): 383-403.

Miles LM, Keitel M, Jackson M, et al. (2008) Predictors of distress in women being treated for infertility. *Journal of Reproductive and Infant Psychology* 27(3):

238–257.

Miyamoto Y, Uchida Y and Ellsworth PC (2010) Culture and mixed emotions: cooccurrence of positive and negative emotions in Japan and the United States.

Emotion 10(3): 404–415.

Morrow KA, Thoreson RW and Penney LL (1995) Predictors of psychological distress among infertility clinic patients. *Journal of Consulting and Clinical Psychology* 63(1): 163–167.

Onat G and Beji NK (2012) Marital relationship and quality of life among couples with infertility. *Sexuality and Disability* 30(1): 39–52.

Pavot W and Diener E (2004) The subjective evaluation of well-being in adulthood:

findings and implications. *Ageing International* 29(2): 113–135.

Realo, A. (2003). Comparison of public and academic discourses: Estonian individualism and collectivism revisited. *Culture & Psychology*, 9: 47–77.

Realo, A., Koido, K., Ceulemans, E., & Allik, J. (2002). Three components of individualism. *European Journal of Personality*, 16: 163–184. doi:10.1002/per.437

Ridner SH (2004) Psychological distress: concept analysis. *Journal of Advanced Nursing* 45(5): 536–545.

Russell JA and Carroll JM (1999) On the bipolarity of positive and negative affect.

Psychological Bulletin 125(1): 3–30.

Sandler S (1968) Emotional stress and infertility. *Journal of Psychosomatic Research*, 12: 51-59.

Schimmack U, Oishi S and Diener E (2002) Cultural influences on the relation between pleasant emotions

and unpleasant emotions: Asian dialectic philosophies or individualism-collectivism? *Cognition and Emotion* 16(6): 705–719.

Schimmack U, Oishi S and Diener E (2005) Individualism: a valid and important dimension of cultural differences between Nations. *Personality and Social Psychology Review* 9(1): 17–31.

Schmidt L (2006) Psychosocial burden of infertility and assisted reproduction. *The Lancet* 367(9508): 379–380.

Schmidt L, Holstein B, Christensen U, Boivin J (2005) Does infertility cause marital

benefit? An epidemiological study of 2250 women and men in fertility treatment. Patient Educaction and Counseling, 59: 244–251.

Shenk CE and Fruzzetti AE (2011) The impact of validating and invalidating responses on emotional reactivity. *Journal of Social and Clinical Psychology* 30(2): 163– 183.

Snaith RP and Zigmond AS (1994) *The Hospital Anxety and Depression Scale with theIrritability Depression-Anxiety Scale and the Leeds Situational Anxiety Scale.*

Windsor, Berkshire, UK: NFER-NELSON Publishing Company Ltd.

Stevens, J. P. (2009). Applied multivariate statistics for the social science (5th ed.).

New York, NY: Taylor & Francis.

Suh EM, Diener E and Updegraff JA (2008) From culture to priming conditions: selfconstrual influences on life satisfaction judgments. *Journal of Cross-Cultural Psychology* 39(1): 3–15.

Tamadonfar M (2001) Islam, law, and political control in contemporary Iran. *Journal for the Scientific Study of Religion* 40(2): 205–220.

Triandis HC (2001) Individualism-collectivism and personality. *Journal of Personality* 69(6): 907–924.

Triandis HC, McCusker C and Hui CH (1990) Multimethod probes of individualism and collectivism. *Journal of Personality and Social Psychology* 59(5): 1006– 1020.

Uchida Y and Kitayama S (2009) Happiness and unhappiness in east and west: themes and variations. *Emotion* 9(4): 441–456.

Uchida Y and Ogihara Y (2012) Personal or interpersonal construal of happiness: a cultural psychological perspective. *International Journal of Wellbeing* 2(4): 354–369.

van Balen F and Bos HMW (2006) Infertility, culture, and psychology in worldwide perspective. *Journal of Reproductive and Infant Psychology* 22(4): 245–247. van Balen F, Bos HMW (2009) The social and cultural consequences of being childless in poor-resource areas. *Facts Views and Visions in ObGyn,* 1 (2): 106-121.

van Rooij FB, van Balen F and Hermanns JM (2006) Migrants and the meaning of parenthood: involuntary childless Turkish migrants in The Netherlands. *Human Reproduction* 21(7): 1832–1838.

WHC (2009) *Infertility and its Treatments: A Review of Psycho-Social Issues.* The Women's Health Council. Department of Health. Ireland.

WHO (2004) Infecundity, infertility, and childlessness in developing countries. In:

Demographic and health surveys, 9. Available at:

http://www.measuredhs.com/pubs/pdf/CR9/CR9.pdf (accessed 10 March 2013).

WHO (2012) Measurement of and target-setting for well-being: an initiative by the

WHO Regional Office for Europe. In: *Second meeting of the expert group*,

Paris, France, 25–26 June 2012. Copenhagen, WHO Regional Office for Europe. Available at: http:// www.euro.who.int/data/assets/pdf_file/0009/1 81449/ e96732.pdf (accessed 23 April 2012).

Williams P and Aaker JL (2002) Can mixed emotions peacefully coexist? *Journal of Consumer Research* 28(4): 636–649.

Yağmur Y and Oltuluoğlu H (2011) Social support and hopelessness in women undergoing infertility treatment in Eastern Turkey. *Public Health Nursing* 29(2): 99–104.

Zigmond AS and Snaith RP (1983) The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica* 67(6): 361–370.

Tables

Table 1. Demographic information for Swedish and Iranian subjects.

	Sweden	Iran
N	94	118
Age-range (years)	19-41 (M = 31.33)	18-45 (M = 29.13)
Native born	90%	100%
Occupation	69% employed	25% employed
Income	Low (5%) Average (20%) High (71%)	Low (19%) Average (80%) High (0%)
Education	Secondary school (2%) High school degree (42%) University degree (54%)	Secondary school (31%) High school degree (50%) University degree (18%)
Main cause of infertility	Female (29%), Male (21%), Both (25%), Unknown (25%)	Female (34%), Male (23%), Both (22%), Unknown (21%)
Duration of treatment (years)	1-6 (M = 1.23)	1-15 (M = 3.62)
Duration of diagnosis (years)	1-15 (M = 2.19)	1-20 (M = 5.46)
Satisfaction with partner relationship	78%	83%
Duration of relationship (years)	2-18 (M = 6.88)	1-20 (M = 6.87)

Table 2. Means (M), standard deviations (SD) and alpha values for positive affect, negative affect and balance affect and well-being in relation to the nationality of participants.

	Nationality	N	M	SD	Alpha
Balance affect	Iranian	118	2.77	4.66	0.87
	Swedish	94	3.85	5.26	0.86
Positive affect	Iranian	118	11.70	3.68	0.90
	Swedish	94	15.56	2.89	0.82
Negative affect	Iranian	118	8.93	3.24	0.79
	Swedish	94	11.71	3.10	0.85
Flourishing	Iranian	118	45.61	6.83	0.82
	Swedish	94	47.16	6.50	0.88

Table 3. A multivariate analysis of variance of dependent and independent variables,

Test	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared (η^2)
Pillai's Trace	0.38	32.10	4.00	207	0.00	0.38
Wilks' Lambda	0.61	32.10	4.00	207	0.00	0.38
Hotelling's Trace	0.62	32.10	4.00	207	0.00	0.38
Roy's Largest Root	0.62	32.10	4.00	207	0.00	0.38

Table 4. A univariate analysis of variance of dependent and independent variables.

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared (η^2)
Nationality	Flourishing	124.56	1	124.56	2.77	0.09	0.01
	Positive affect	779.77	1	779.77	69.22	0.00	0.24
	Negative affect	404.45	1	404.45	39.88	0.00	0.16
	Balance affect	65.41	1	65.41	2.68	0.10	0.01
Error	Flourishing	9412.33	210	4482			
	Positive affect	2365.66	210	11.26			
	Negative affect	2129.66	210	10.14			
	Balance affect	5116.47	210	24.36			
Total	Flourishing	464077.25	212				
	Positive affect	41307.77	212				
	Negative affect	24448.08	212				
	Balance affect	7444.88	212				

Table 5. Levene's test for equality of variance on flourishing and SPANE scales.

Dependent Variable	F	df1	df2	Sig.
Flourishing	0.05	1	210	0.94
Positive affect	1.54	1	210	0.22
Negative affect	.22	1	210	0.64
Balance affect	1.67	1	210	0.20

Table 6. Correlation matrix for flourishing, positive affect, negative affect and balance affect in Swedish and Iranian participants.

		Flourishing	Positive affect	Negative affect	Balance affect
Flourishing	Pearson Correlation	1	0.18*	-0.24**	0.31**
	Sig. (2-tailed)		0.026	0.004	0.000
	N	94	118	118	118
Positive affect	Pearson Correlation	0.61**	1	0.100	0.72**
	Sig. (2-tailed)	0.000		0.140	0.000
	N	94	118	118	118
Negative affect	Pearson Correlation	-0.59**	-0.55**	1	-0.61**
	Sig. (2-tailed)	0.000	0.000		0.000
	N	94	94	94	118
Balance affect	Pearson Correlation	0.69**	0.87**	-0.88**	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	94	94	94	118

Note 1: Correlation is significant at the 0.01 level (2-tailed).

Note 2: Iranian students are at the top of the table, and Swedish students are at the bottom.

Table 7. A stepwise regression analysis for flourishing through positive, negative and balance affects in Iranian subjects.

	Standardized Coefficients			Unstandardized Coefficients	
Predictor (s)	Beta	t	Sig.	B	Std. Error
Constant		63.35	0.000	44.36	0.70
Balance affect	0.31	3.50	0.001	0.45	0.13

Table 8. A stepwise regression analysis for flourishing through positive, negative and balance affects in Swedish subjects.

	Standardized Coefficients			Unstandardized Coefficients	
Predictor (s)	Beta	t	Sig.	B	Std. Error
Constant		71.99	0.000	43.84	0.60
Balance affect	0.69	9.13	0.000	0.85	0.09

Who Takes Losses Harder?

Gender Differences in Loss Aversion

Diego Flores, Frank Robertson, Mike Seeley, Marcia Ventura, and Harold L. .Miller, Jr.

Department of Psychology
Brigham Young University, Provo, UT, USA

Abstract— A pivotal concept in behavioral economics is loss aversion, that is, the differentially greater effects of losses when compared to gains. We examined whether males and females experienced different levels of loss aversion when encountering monetary gains and losses. Using a novel video game based on a 6-ply concurrent VI VI schedule of reinforcement and punishment, we tested 26 college-age students (15 females). We found that, on average, participants valuated losses 2.5 times more punishing than corresponding gains were reinforcing. We also found that women valuated losses 1.9 times more punishing than gains were reinforcing than men did.
Keywords: Loss aversion, loss/gain asymmetry ratio, concurrent VI VI schedules of reinforcement and punishment, video game, humans, matching law, generalized matching, gender difference

Introduction

Everyday experience brings losses and gains—money earned at a job, then lost in a bad investment; items purchased then misplaced. It is not uncommon for people to report that the loss was more impactful than the gain had been. In behavioral economics, the idea that losses have a differentially greater effect compared to equivalent gains may help to explain the anecdotal reports. The effect is called *loss aversion*. Rasmussen and Newland (2008) reported a significant bias in favor of an unpunished alternative over a punished one. Using concurrent independent variable-interval (VI) schedules of reinforcement and punishment, they found that losing a penny is about three times more punishing than earning a penny is reinforcing.

Kahneman and Tversky (2000) asserted that most people prefer a sure gain over a risky prospect of a greater gain, an outcome they called *risk aversion*. By contrast, they also found that people prefer risky losses over smaller but sure losses, an outcome they termed loss aversion. They further indicated that a loss was about twice as punishing as an equivalent gain was reinforcing.

Loss aversion can be measured using variations of Herrnstein's (1961) matching law, which states that the ratio of responses directed to two alternative sources of reinforcers will be equal to the ratio of reinforcers the alternatives provide. Applying punishment to one alternative creates a bias toward the other one, as Rasmussen and Newland (2008) and others have found. In other words, because of loss aversion, the bias introduced by a punisher is greater than that introduced by a numerically equivalent gain (for example, lose USD0.10 versus gain USD0.10). The difference between the two can be measured as the loss-gain asymmetry ratio. The question of gender differences in risk aversion has been studied previously. Lighthall and Mather (2009) found that men had a lower level of risk aversion than women did and that the differences in risk aversion were exacerbated by stress. Ekel and Grossman (2008) reported a literature review showing that, on average, women were twice as risk-averse as men were.

In the current study, we examined the gender difference in loss aversion. We measured the loss-gain(asymmetry ratio using a novel computerized task and compared our findings to those of previous researchers. In effect, our procedure resulted in an approximate ratio of loss aversion to risk aversion.

Method

Participants

Twenty-six college students (15 females), between the ages of 19 and 25, at Brigham Young University (BYU; Provo, UT, USA) participated in the study. As per the formal agreement with the BYU Institutional Review Board, participants signed a Consent Form for Voluntary Participation prior to the initial session.

Procedure

Participants played a novel video game ("SubSearch") that was created for the experiment. They used a computer mouse to move a submarine around undersea barriers in order to collect submerged objects. Occasionally, if they retrieved an object by clicking the mouse when the submarine was in contact with it, they sometimes received a reinforcer (USD0.10) or, at other times, an equivalent punisher (USD$0.10). They could switch between identical submarines located on either the right or the left side of the computer screen. When a switch occurred, the other side was dimmed (see Figure 1). Switching between the sides produced a 2second changeover delay.

A 6-ply interdependent conjoint concurrent variableinterval (VI) variable-interval (conc VI VI) schedule of reinforcement and punishment operated during each session and changed from one component to the next every 6 minutes (see Table 1). During each component, the overall rate of reinforcement and the overall rate of punishment (if applicable) were maintained at 6 per minute, respectively. In the interdependent conc VI VI

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.40

schedule, 20 different intervals could be assigned randomly, one at a time, without replacement until all 20 had been assigned, and the original list was reintroduced. However, whether an interval was assigned to the left side of the screen or to the right was determined probabilistically. That is, a random generator assigned the next interval to the left side with a predetermined probability, for example, 0.33. In this case, twice as many reinforcers would be assigned to the right side than to the left, producing a left:right ratio of 1:2. The same operation occurred for schedules of punishment. However, punishers were delivered only on the left side of the screen and at a rate equivalent to the rate of reinforcers on that same side. In other words, the punishment schedule in those conditions that included it was conc VI ext (extinction).

The advantage of interdependent conc VI VI schedules lies in that fact that, once assigned, a reinforcer (or a punisher) must be obtained ln the side to which it was assigned before the next interval can be assigned. That is, the obtained ratio of reinforcers (or punishers) to the two sides remains close to the programmed ratio. This feature is not found in independent conc VI VI schedules, wherein the two ratios may be discrepant, sometimes widely so.

Each component was accompanied by its own background color. Each session lasted 36 minutes. Participants played the game during eight consecutive sessions, with two sessions sometimes occurring on the same day.

The delivery of reinforcers and punishers was accompanied by an on-screen message, either "Gain 10¢" or "Lose 10¢", respectively. The participant was required to click the message off before the game continued. In addition, cumulative gains and losses appeared in windows at the bottom of the screen. Participants were paid according to their net winnings at the end of each session. Following completion of the eighth session, participants were further compensated with a $30 bonus.

Results

Least-squares regression equations (one for responding during the three non-punished conditions and one for the three punished conditions) were produced. We calculated the loss/gain asymmetry ratios using the following equation based on Herrnstein's (1961) matching law:

$$B_L/B_R = b(R_L/R_R)^s, \qquad (1)$$

where B_L and B_R were total mouse clicks on the left side and right side of the screen, respectively. R_L and R_R were the reinforcer totals on each side of the screen. The coefficient b and the exponent s were fitted constants corresponding to the y-intercept and the slope or, in terms of the generalized matching law (Baum, 1964), to bias and sensitiviy parameters, respectively. That equation was a logarithmized, and therefore linear, version of Equation 1 namely:

$$\log (B_L/B_R) = \log b + s \log (R_L/R_R) . \qquad (2)$$

Deluty1976) used a competitive-suppression model that assumed that punishers presented for responding to the left alternative supplemented the reinforcement rate on the right alternative. In de Villiers's (1977, 1980) model, punishers were subtracted from reinforcers. We used a different approach to modeling the relationship between reinforcers and punishers. The logic of the model is that the effect of punishers may be measured indirectly by any displacement of the effects of reinforcers. In other words, it is not necessary to conjoin reinforcers and punishers mathematically in order to measure their asymmetry. This model eliminates the problem of negative ratio values. The data were those from the final three sessions for each participant, sessions across which there were no visible trends in the response ratios, and thus stability of responding between the two sides of the screen was assumed.

Table 2 contains a summary of the results in the nopunishment conditions (1, 3, and 5) and the punishment conditions (2. 4. and 6). The parameter values for the yintercept (log b) and slope (s) also appear, as do the antilogs of the former. The loss/gain asymmetry ratios were calculated using the antilogs from the punishment and the no-punishment conditions, respectively. In other words, the ratio was a quantitative expression of the hedonic impact of loss relative to gain. Accordingly, losing USD0.10 was 1.9 times as punishing as gaining USD0.10 was reinforcing for males but was 2.5 times as punishing for females. When controlled for gender, we found that a punisher had 2.23 times the hedonic impact of a reinforcer.

We also conducted a linear mixed-model analysis of variance (ANOVA) using mouse clicks as the dependent variable, with gender and reinforcer (or reinforcer-pluspunisher) as independent factors and found a significant difference between males and females. The results of the mixed-model analyses were that the difference between male and female participants' ressponses to the inclusion of punishers was significant: Gender F (1.460) = 3.954, p = .047, Punishment F (1.460) = 91.566, p = .000. Table 3 displays the means, SEs, df, and 95% confidence interval (CI) for the interaction between punishment and gender. The means did not substantially differ from the y-intercepts (b) in the linear regressions that were used to calculate the loss/gain ratios.

Discussion

That men and women respond differently to losses than they do to gains has been substantiated by past research. However, how much they differ was the focus of the research we have reported here.

Behavioral economists have found that women are more risk averse than men are (Ekel & Grossman, 2008; Lighthall & Mather, 2009). We confirmed this finding. Previous studies that did not investigate gender differences found that losses

were two to three times as behaviorally impactful as numerically equivalent gains were. Our mean results in terms of loss/gain asymmetry ratios fell between those found by Rasmussen and Newland (2008) and by Kahneman and Tversky (2000). Additionally, we found that women twice as loss averse as men were.

The SubSearch Game used in this study is a new method for studying loss/gain asymmetry. Rasmussen and Newland (2008) used a specific conc VI VI reinforcement schedule in each session and waited for participants to reach a stability criterion before going on to the next schedule. By contrast, we used six-ply conc VI VI schedules for reinforcers and punishers so that participants were exposed to the same sequence of components during each session. Separate components were signaled by their own background color on the monitor screen.

In their work, Kahneman and Tversky (2000) used hypothetical scenarios that often involved pairs of gambles or bets and asked participants to indicate their preference between the alternatives in several consecutive gambles in which the stakes were incremented or decremented systematically. No actual money was paid to participants according to the outcomes. Nor was there any explicit effort to measure the gender-specific outcomes. By contrast, our research employed a deliberately behavioral rather than a cognitive task and did so in order to exploit properties of the matching law (Herrnstein, 1961) and especially the generalized matching law (Baum, 1974) in order to produce the quantitative scaling of loss aversion generally and by gender.

Further research might examine whether the difference in loss/gain asymmetry ratios between men and women changes as the ratio of reinforcers and punishers is varied over a wider range than in the present study. It also may examine the predictive validity of the ratios obtained (see Miller, 1976).

References

Baum, W. M. (1974). On two types of deviation from the matching law: Bias and sensitivity, *Journal of the Experimental Analysis of Behavior*, *22*, 231-342.

Deluty., M. (1976). Choice and the rate of punishment in concurrent schedules. *Journal of the Experimental Analysis of Behavior*, *25*, 75-80.

de Villiers, P. (1980). Toward a quantitative theory of punishment. *Journal of the Experimental Analysis of Behavior*, *33*, 15-25.

Eckel, C. C., & Grossman, P. J. (2008). Men, women and risk aversion: Experimental evidence. *Handbook of Experimental Economics Results*, 1061-1073.

Gray, L. N., Stafford, M, C., and Tallman, I. (1991). Rewards and punishments in complex human choices. *Social Psychology Quart*erly, *54*(4), 318-329.

Herrnstein, R. J. (1961). Relative and absolute strength of response as a function of frequency of reinforcement. *Journal of the Experimental Analysis of Behavior*, *4*(3), 267-272. doi:10.1901/jeab.1961.4-267

Kahneman, D., & Tversky, A. (Eds.). (2000). *Choices, values, and frames*. Cambridge, UK: Cambridge University Press.

Lighthall, N. R, Mather, M., & Gorlick M. A. (2009). Acute stress increases sex differences in risk seeking in the balloon analogue risk task. *PLoSONE 4*(7): e6002. doi:10.1371/journal.pone.0006002

Miller, Jr., H. L. (1976). Matching-based hedonic scaling in the pigeon. *Journal of the Experimental Analysis of Behavior*, *26*(3), 335-347.

Rasmussen, E. B., & Newland, M. C. (2008). Asymmetry of reinforcement and punishment in human choice. *Journal of the Experimental Analysis of Behavior*, *89*(2), 157-167. doi:10.1901/jeab.2008.89-157

4

Table 1
*Concurrent VI VI schedule values for reinforcement and punishment in each component of the components used during the experiment (*ext *refers to extinction, that is, to the absence of punishers). For each* conc *schedule, the first schedule value was assigned to the left side of the screen and the second schedule value to the right side.Schedule values appear in seconds.*

Component	Reinforcement Schedule	Punishment Schedule
1	conc VI 40 VI 13.3	None
2	conc VI 40 VI 13.3	conc VI 40 ext
3	conc VI 20 VI 20	None
4	conc VI 20 VI 20	conc VI 20 ext
5	conc VI 13.3 VI 40	None
6	conc VI 13.3 VI 40	conc VI 13.3 ext

Table 2.
Results from the linear regression

Punishment		No Punishment						Loss/Gain
Gender		Slope (s)	Intercept Log b	Antilog Log b	Slope (s)	Intercept Log b	Antilog Log b	Ratio
Male	*M*	0.064	-0.039	0.014	0.915	0.061	-0.321	0.477	1.92
	SE	0.027				0.096	0.047		
Female	*M*	-0.053	-0.053		0.886	0.035	-0.448	0.356	2.49
	SE	0.051	0.03			0.074	0.039		
Male andFemale	*M*	0.057	-0.047		0.898	0.049	-0.394	0.403	2.23
	SE	0.037	0.018			0.059	0.03		

6

T*able 3*

Results from the linear mixed-model analysis (df = 460)

				95% CI	
Category	Gender	*M*	*SE*	Lower Bound	Upper Bound
No punishment	Male	-0.040	0.038	-0.114	0.035
	Female	-0.053	0.033	-0.118	0.011
Punishment	Male	-0.322	0.038	-0.397	-0.248
	Female	-0.449	0.033	-0.513	-0.385

7

Figure 1. A screen shot from the SubSearch Game

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)
Copyright © GSTF 2018
ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.46

A study on Time Perception in Smokers and Non Smokers

Aderinwale Adedoyin
KAIST
Korea

Pouya Ghasemlou
KAIST
Korea

Prof. Jaeseung Jeong
Kaist
Korea

Abstract

The perception of time is an essential feature that underlies numerous cognitive and decision making processes. However, the exact nature of the mechanism of timing, and differences in the timing behaviors of individuals have not been thoroughly studied. Our work goes deep into time perceptive behaviors of smokers even whilst they are smoking, in order to establish the presence of fundamental differences amongst smoker groups under different conditions, and a control group. Our findings show a strong group-level correlation between nicotine levels and both underestimation and overestimation error tendencies in the prospective time domain. We also found similar strong group-level correlations in the magnitude of errors made in the retrospective time domain. These two findings suggest that there are potentially interesting differences between smokers and non-smokers which might be mediated by nicotine.

Introduction

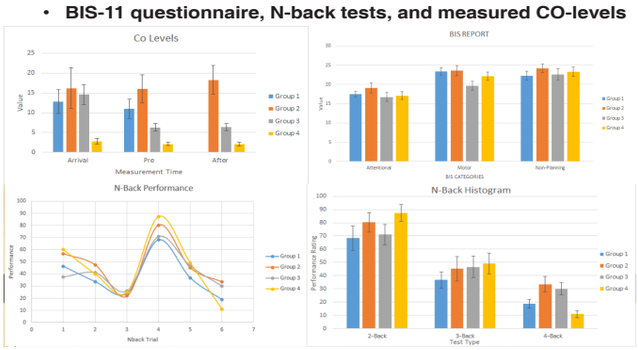
The perception of time is a phenomenon that is familiar to all of us. Especially as it is one that we simply cannot do without. Timing, and the perception of time mediate so much of behavior in decision making, and in stimulus response as well. There have been a serious of studies launched, with the goal of understanding more about the neural basis of how we perceive time. The implications of time perception in temporal discounting are a common talking point in impulsivity research[2], and the expression of impulsivity in smokers has also been reported by a number of studies[3]. With this experiment, we wanted to see if we would have any behavioral results that relate timing behavior to impulsivity behaviors, and to do this we decided to work on smokers, as smokers have been reported to be more impulsive in a number of studies as well[3]. In addition to this, smokers represent what can be considered as a substance addicted sub-group of the population, and understanding more about their behavioral traits could be an avenue into exploring addictive behavior in general. Finally, being able to establish tangible results in this behavioral study sets up continued, ad more detailed work in an fMRI environment, or with computational modelling, in attempts to capture the dynamics of the observed behavioral results.

Methods

To perform our experiment, participants were required to fill out a BIS-11 questionnaire before the experiment. During the experiment, participants first performed an N-back test, combined with a prospective measure of time perception that occurred once per run, in which participants gave responses after 30-seconds had passed during the N-back test. The n-back test varied from 2 back to 4 back, and was repeated twice for each case, for a total of 6 trials. Additionally, at the end of some of the runs, participants were randomly asked to estimate the elapsed time duration of the current session. This served as a measure for retrospective time perception. Finally, participants were all subjected to a temporal bisection task, in which they were trained and tested on millisecond durations.

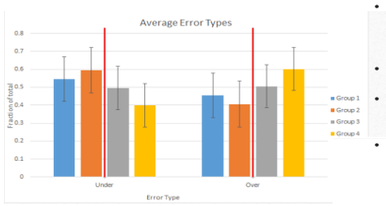
Results and Discussion

- **BIS-11 questionnaire, N-back tests, and measured CO-levels**



Group 1 (*Smokers not allowed to smoke during the experiment testing phase*),
Group *2 (smokers allowed to smoke during experiment testing phase),*
Group 3(Abstinent Smokers),
Group 4(Non-Smokers).

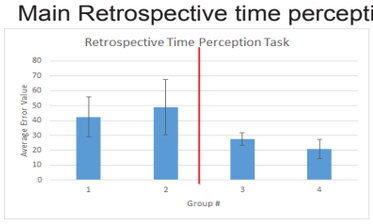
- Main Prospective time perception result



- Group level correlation of nicotine level to underestimation error was 0.983
- Individual level correlation was 0.27
- Vertical thin red line divides “High nicotine” and “low nicotine” groups
- Groups 1 & 2 tended to underestimate more, whilst groups 3 and 4 tended to overestimate more. and it suggested a relationship between nicotine and underestimation.

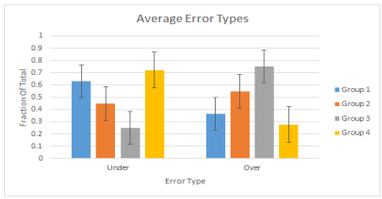
Group 1 (*Smokers not allowed to smoke during the experiment testing phase*),
Group *2 (smokers allowed to smoke during experiment testing phase),*
Group 3(Abstinent Smokers),
Group 4(Non-Smokers).

- Main Retrospective time perception results



- Group level correlation of nicotine level to underestimation error was 0.983
- Individual level correlation was 0.38
- Vertical thin red line divides “High nicotine” and “low nicotine” groups
- Groups 1 & 2 tended to underestimate more, whilst groups 3 and 4 tended to overestimate more. and it suggested a relationship between nicotine and underestimation.

Group 1 (*Smokers not allowed to smoke during the experiment testing phase*),
Group *2 (smokers allowed to smoke during experiment testing phase),*
Group 3(Abstinent Smokers),
Group 4(Non-Smokers).



- Since group 2 has the highest original nicotine levels on average because they are the group that smokes during the experiment, one might assume that smokers in group 1 may have no difference with the control group, but that whilst they smoke, their perception of time in this domain is affected, and it would seem that abstinent smokers suffer a similar effect but to a higher degree

- Weber Fractions from temporal bisection task

	Short	Mid-Short	Mid-Long	Long
Group 1	-0.47	0.4	-0.27	0.24
Group 2	-0.29	0.27	-0.15	0.13
Group 3	-0.36	0.68	-0.09	0.11
Group 4	-0.35	0.34	-0.30	0.27

- The results suggest the Group 2 are the best performers in this domain, with groups 1 and 4 interchanging across the ranges. The high performance of group 2 here in spite of their high nicotine level, might support the theory of differential time processing at the sub-second timescale.
- Group 3’s results are not meaningful in these conclusions because most of them were unable to complete the task, and thus yielded no data.

Conclusion

- The results from prospective and retrospective tasks, seem to suggest that there are potent relationships between nicotine intake, and time perceptive performance, across both domains
- Underestimation tendencies associated with nicotine in the prospective domain, might support internal clock and pacemaker models for explaining time perceptive behaviors, especially in impulsivity cases.
- The fact that our BIS test results were inconclusive, might suggest that the time perceptive differences brought about by nicotine are independent of impulsivity, or at least not heavily reliant on it.
- The temporal bisection task results contradict the retrospective, and prospective time perception tasks, but this might support theories that there are different mechanisms for processing time intervals that are on a sub-second scale.
- We were also eble to gain insight into time perceptive tendencies and biases in the control group, which many studies have not reported

References

[1] Rubia, Katya, et al. "Impulsiveness as a timing disturbance: neurocognitive abnormalities in attention-deficit hyperactivity disorder during temporal processes and normalization with methylphenidate." *Philosophical Transactions of the Royal Society of London B: Biological Sciences* 364.1525 (2009): 1919-1931.

[2] Wittmann, Marc, et al. "Neural substrates of time perception and impulsivity." *Brain research* 1406 (2011): 43-58.

[3] Mitchell, Suzanne H. "Measures of impulsivity in cigarette smokers and non-smokers." *Psychopharmacology* 146.4 (1999): 455-464.

How Do We Ensure Users Engage in Secure Online Behavior?

A Psychological Perspective

Emma J Williams
School of Experimental Psychology
University of Bristol
Bristol, UK

Jan M Noyes
School of Experimental Psychology
University of Bristol
Bristol, UK

Bogdan Warinschi
Cryptography Research Group
Department of Computer Science
University of Bristol
Bristol, UK

***Abstract*— In the digital age, understanding the factors that determine whether humans engage in secure online behavior is increasingly important. The costs of not doing this are extremely high, in particular on user well-being. Unfortunately, theoretical understanding of this issue remains extremely limited. This paper considers current approaches to human aspects of cyber security and proposes future research directions to move this complex and continually evolving field forward.**

Keywords: cyber security; risk perception; decision-making; cognitive modeling; user behavior.

I. Introduction

Cyber-attacks are increasing worldwide, with a recent survey of more than 500 information security professionals highlighting that approximately 75% of their organizations had been the victim of a phishing attack in 2016 [1]. Continuing media reports of security breaches by users, such as a spear-phishing attack that targeted employees within the Ukrainian power grid in 2015, highlight the importance of understanding the factors that influence secure human behavior in cyberspace. This paper provides an overview of several factors that are likely to determine whether humans engage in secure online behavior and proposes a future research agenda that will allow the development of theoretically-based psychological models of user decision-making in the future. A sound theoretical understanding of these primary psychological mechanisms will inform and serve as foundation for more effective and targeted interventions to encourage secure behavior in online environments.

II. Making Decisions About Online Security

A. Understanding the Context of Secure Online Behavior

From online banking to health information, an individual's work and home life is increasingly governed by the online space. New encryption and authentication technologies offer an ever-increasing range of cyber security products that help users keep their online data secure. However, if emerging security products are to be effective within this setting, then individuals must feel both able and willing to use them. Despite the substantial amount of work that has been conducted regarding people's online security behavior [e.g., 2,3,4,5,6] the field still lacks a theoretical treatment which, in turn, precludes a more nuanced understanding regarding why people choose to engage in secure behavior or, more importantly, why they choose not to do so.

Engaging in secure online behavior takes resources, whether that is increased time or effort. For instance, it can take additional time to understand the protective technologies that are available and to implement them. It can also take time and effort to create and remember multiple complex passwords for an ever-growing number of online accounts. As early as the 1980s, the link between password selection and limitations in the structure of long-term memory was highlighted [7]. This increased effort, combined with the fact that security is often not people's primary goal when completing a task, can mean that secure online behavior can move down the priority list. To minimize the perceived costs to the individual of engaging in secure online behavior, it has been suggested [8] that information systems, and the protective mechanisms that they use, must engender psychological acceptability in users, which is turn will make the use of such protective mechanisms more likely to be considered routine.

When people are under pressure or distracted with other activities, their ability to engage in more resource-intensive, systematic forms of cognitive processing is also reduced. This can lead to a reliance on relatively automatic decision rules (known as heuristics) when making decisions, whereby an in-depth consideration of the potential costs and benefits of various decision options is not undertaken [9]. Recent experimental work conducted by one of the authors [10] investigated the impact of these processing strategies on whether participants chose to accept fraudulent and genuine computer updates in the form of 'pop-ups'. Overall, findings demonstrated that when updates interrupt participants during a challenging primary computer task, their ability to differentiate between fraudulent and genuine messages is reduced compared to when they are not completing any other tasks at the time that the message is viewed. Whereas the situational context was, therefore, found to have an impact on security-related decisions in this study, the potential role of individual differences in sensation seeking and other personality traits were found to be

This work is supported by a Vice Chancellor's Fellowship granted to the first author by the University of Bristol.

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.49

limited. The use of more resource-intensive, systematic processing strategies have also been linked with an increased ability to detect fraudulent emails, known as phishing emails, with the heuristic processing that people typically rely on when they are under cognitive pressure diminishing their ability to spot suspicious cues online [11]. It is likely, therefore, that decisions to engage in secure online behavior will be heavily influenced by the cognitive context in which individuals find themselves.

The importance of developing a thorough understanding of the role of cognition in online security behavior has been recently highlighted by [12]. In their consideration of the contribution that cognitive science can make to understanding human aspects of cyber security, the authors advocate for the use of cognitive modeling approaches within the cyber security domain, basing theoretical development on general principles of cognition that can be applied across various contexts. Such approaches have recently been used to explore the challenge of recalling and associating multiple passwords with different accounts [13], as well as understanding the impact of user mental models on security behaviors [14].

Finally, perceptions of risk related to the online world have also been shown to relate to user intentions to engage in secure behavior online. Protection Motivation Theory [15] examines how individual perceptions of threat and coping may impact decisions to engage in a protective behavior and is a well-established approach in the health behavior domain, providing a useful framework to identify areas where interventions can be targeted. The primary facets of Protection Motivation Theory include:

a. The perceived severity of a threatening scenario;

b. An individual's perceived vulnerability to that scenario;

c. The perceived efficacy of the protective behavior in reducing vulnerability to that scenario (response efficacy);

d. The perceived ability of the individual to engage in the relevant protective behavior (self-efficacy).

Protection Motivation Theory has recently been applied to individual intentions to engage in a range of cyber security behaviors, with these facets found to influence intentions to various degrees across a range of contexts, including the use of home wireless security [16], the adoption of anti-spyware software [17] and the use of anti-virus software on mobile phones [18].

B. Applying Psychological Frameworks

Both situational factors and individual factors are likely to impact whether people engage in secure online behavior. For instance, increased perceptions of online threats may motivate people to engage in protective actions, such as using encryption software or making their password stronger. However, higher perceived costs regarding the time and effort involved in understanding and accessing such software may suppress this motivation. Similarly, when faced with the potential option of activating stronger authentication processes on an email account, such as providing a phone number to enable 2-factor authentication, individuals who are currently operating under a high degree of stress, who have competing demands that are considered to be of a higher priority or who find the action itself to be too complex, may all be deterred.

The importance of understanding how users perceive a situation at any given point in time is highlighted in the development of recent frameworks for measuring these issues, such as the CAPTION framework [19]. CAPTION is a recently developed taxonomy of psychological situation characteristics, whereby situations are divided into seven primary categories that differentiate how a situation is subjectively perceived and experienced by individuals. These categories include:

1. How complex the situation is perceived to be (Complexity)
2. How stressful the situation is perceived to be (Adversity)
3. How typical the situation is perceived to be (Typicality)
4. How important the situation is perceived to be (Importance)
5. The positive emotions associated with the situation (Positive valence)
6. The negative emotions associated with the situation (Negative valence)
7. How amusing the situation is perceived to be (humor)

By combining an understanding of user perceptions of risk with an awareness of the situational constraints when an opportunity to enact a particular online security behavior is presented, it will be possible to tease apart the relative impact of these various factors on online security decisions. This will further our understanding and enable the design of more appropriate interventions.

Within the health behavior domain, models such as Protection Motivation Theory provide the basis for tailoring intervention messages to maximize the likelihood that a user will be encouraged to engage in a protective behavior. Message framing approaches, whereby messages that emphasize potential gains of engaging in a protective behavior are compared to messages that emphasize potential losses of not engaging in that behavior, have shown some success, particularly when they are matched with congruent personality types (i.e., people who are more sensitive to losses view loss-framed messages and those who are more sensitive to gains view gain-framed messages) [20]. The use of message framing, however, is thought to be limited when considering cyber security behavior [21,22,23]. This needs further investigation.

Work within the risk communication domain also has suggested that designing interventions in line with the primary constructs of Protection Motivation Theory can be effective. For instance, providing specific information related to the severity of a potential threat has been found to motivate information seeking about that threat, although interventions

based on other facets of Protection Motivation Theory have not been as successful [24].

Current understanding of what motivates people to seek protective information and follow this advice is extremely limited, even though accessing information about protective technologies is likely to be a crucial first step if users are to be persuaded to engage in secure behavior and use appropriate security products. For instance, understanding why it is important to encrypt a computer hard disk and how an individual can easily do this is a likely requirement in choosing to use encryption in the future. In this way, the decision to engage in secure online behavior at any single point in time can be broken down into several decision stages, each influenced by situational characteristics and individual perceptions of risk, which may itself present a 'pre-requisite' for the next decision option. Exploring this possibility is a key aim of our research agenda.

It can be seen, therefore, that further work is needed to determine: (a) the likely barriers of use to emerging security products at particular points in time; (b) whether tailoring messaging and other interventions according to these barriers would be effective in cyber security domains, and (c) at what stage in the decision process these interventions would be most effectively targeted. If individuals do not engage in a protective security behavior because they perceive themselves not to be vulnerable to online threats, for example, are interventions focused on increasing their perceived vulnerability likely to be more effective compared to those focused on reducing the perceived costs of engaging in a protective behavior? And if so, where in the decision cycle should these interventions be targeted?

III. Setting The Research Agenda

Progressing current understanding of secure online behavior remains a key challenge within the field of cyber security. It is, therefore, essential that a rigorous and multi-faceted approach is taken that will facilitate greater theoretical understanding of when people are likely to engage in secure behavior and why that may be, identifying the primary psychological mechanisms that influence these decisions at both the individual difference and situational level. To achieve this objective, the following research agenda is proposed.

A. Establishing Primary Research Principles

1) An Embedded Multidisciplinary Approach

It is increasingly recognized that cyber security is a complex issue that cannot be solved by one discipline alone. Taking a multidisciplinary approach, whereby computer scientists and psychologists/social scientists work in close collaboration, provides an opportunity to develop robust, theoretically based models of human behavior that are relevant to emerging technical challenges. As new technical cyber security solutions emerge, psychological insight and testing can be applied at an early stage. The combination of rigorous experimental psychology methods and human-computer interaction approaches will allow more comprehensive modeling of the decision-making scenario, whereby small changes in likely situational parameters can be explored and relevant improvements to technical systems made in line with these findings. Such an approach would maximize the likelihood that emerging technical solutions will be usable at both the cognitive and behavioral level.

2) Engaging with Data Science Opportunities

The growing field of data science provides a unique opportunity to exploit the vast amounts of data being produced daily regarding online interactions. The extent to which awareness campaigns and other interventions are shared on social media, the proportion of users who 'click-through' for further protective information following online training, and the number of those who choose to download and use security products, all present opportunities for researchers. Collaborating with data scientists and organizations that have access to such data provides an opportunity to test further and refine decision-making models that have been developed in laboratory settings, particularly if such platforms can also be used as a future test bed to examine potential impacts of various awareness and training interventions.

B. Prioritizing Future Research Directions

1) The Development of Evidence-Based Theoretical Models

Focusing on the development of theoretical models based on existing psychological mechanisms and principles will provide a robust theoretical basis for understanding secure online behavior. This will also provide an effective means to explore the impact of various factors on decision-making. Model parameters can be altered to understand the resultant impact on likely behavior and interventions targeted accordingly. By combining laboratory scenarios with field-based studies, predictions developed in more constrained laboratory conditions can then be tested and refined in so-called 'real world' contexts. The development of such models is vital if our understanding of human aspects of cyber security is to become more comprehensive, increasing the possibility that predictive approaches can be developed and exploited.

2) Addressing the Impact of Context

Individual decisions regarding whether to engage in secure behavior at a particular point in time is likely to be influenced by factors related both to the individual and the wider context in which they are operating at the time. Understanding the potential impact of this wider situational context is particularly relevant given that our interactions online are increasingly conducted on the move and via a range of different devices. A 2017 paper by one of the authors [25] provides an initial framework for exploring the interactions between individual differences and context in guiding online behavior, whereas the emergence of situational frameworks, such as CAPTION, provides a means through which these aspects can be further explored and assessed in a cyber security context [19]. By understanding the potential impact of situational factors on cyber security decisions, including how these may interact with individual differences, it may be possible to develop adaptive user interfaces that can adjust both how and when cyber security-related decision scenarios are presented to users in various contexts.

IV. Our Approach

In line with this agenda, our approach aims to identify the primary factors that determine whether humans engage in secure behavior online, investigating the situational and individual factors that have an impact on decision-making through a combination of experimental and field studies. These findings will then be used to develop and advance psychological theory on the primary drivers of secure online behavior, providing guidance on the design of future interventions and contributing to the potential future development of adaptive user interfaces that can effectively encourage secure online behavior in various contexts.

This will be achieved primarily by:

1. Close collaboration between experimental psychology and information security disciplines to identify cyber security scenarios that are directly relevant to current critical issues in cyber security (e.g., when do people choose to use more versus less secure passwords, or to reuse existing ones? When do people consider it worthwhile to use secure authentication processes and encryption?). These scenarios provide the basis for systematic investigation in experimental, laboratory-based studies, allowing various situational factors to be manipulated to examine the resultant impact on behavior.
2. Collaboration with data science disciplines and organizations to develop methods that utilize real-time data to add further insight to the findings of experimental work. For example, the potential to examine how people respond to security updates during real-time tasks in the digital health and smart city research space, or exploiting current data on responses to online cyber security training (such as engagement with materials and 'click-throughs' to further protective information).
3. Engagement with relevant organizations in the public and private sector to disseminate findings and develop collaboration opportunities that may assist in the development and testing of practical interventions.

This research agenda has relevance for the development of secure behavior within both organizations (i.e., the behavior of employees) and the public (i.e., engaging in online activities at home) and will serve as foundations for a rigorous understanding of human aspects of cyber security.

V. Primary Implications

This paper has considered the importance of understanding the context in which secure online behaviour takes place, including how this can be integrated within existing research approaches in this area. Specifically, we suggest that current methods for understanding how individuals perceive particular situations should be adapted and applied to better understand how people make decisions regarding online security. By combining these more subjective measures of situational characteristics with methods that aim to objectively manipulate or measure such aspects (e.g., competing priorities, time available), a thorough understanding of how secure online behaviour varies across contexts, and how this effect is best managed, can be developed.

Overall, this paper aims to stimulate a more theoretically-based research approach, while simultaneously focusing on the development of practical insights. This will ensure that emerging digital innovations can continue to be fully exploited by society in the future, with any emerging safety and security risks effectively managed.

References

[1] Wombat Security Technologies, "State of the Phish Report," accessed from https://info.wombatsecurity.com/ on 20th October 2017, 2017.

[2] M.W. Boyce, K.M. Duma, L.J. Hettinger, T.B. Malone, D.P. Wilson, and J. Lockett-Reynolds, "Human performance in cybersecurity: A research agenda," In Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 2011, pp. 1115-1119.

[3] H. Rosoff, J. Cui, and R.S. John, "Heuristics and biases in cyber security dilemmas," Environ Sys & Dec, 2013, vol. 33, pp. 517-529.

[4] A. Vishwanath, "Examining the distinct antecedents of e-mail habits and its influence on the outcomes of a phishing attack," Journal of Computer Mediated-Communication, 2015, vol. 5, pp.570-584.

[5] S. Sheng, M. Holbrook, P. Kumaraguru, L. Cranor, and J. Downs, "Who falls for a phish?: a demographic analysis of phishing susceptibility and effectiveness of interventions," In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2010, pp. 373-382.

[6] S. Egelman, and E. Peer, "Scaling the security wall: Developing a security behavior intentions scale (SeBIS)," In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2015, pp. 2873-2882.

[7] B.F. Barton, and M.S. Barton, "User-friendly password methods for computer-mediated information systems," Computers & Security, 1984, vol. 3, pp. 186–195.

[8] J.H. Saltzer, and M.D. Schroeder, "The protection of information in computer systems," Proceedings of the IEEE, 1975, vol. 63, 9, pp. 1278–1308.

[9] D. Kahneman, Thinking Fast and Slow. London, UK: Penguin, 2011.

[10] E.J. Williams, P. Morgan, and A.N Joinson, "Press accept to update now: individual differences in susceptibility to malevolent interruptions," Decision Support Systems, 2017, vol. 96, pp. 119–129.

[11] A. Vishwanath, B. Harrison, and Y.J. Ng, "Suspicion, cognition, and automaticity model of phishing susceptibility," Communication Research, online pre-print, 2016, pp. 1-21.

[12] I.X. Domínguez, P.R. Goodwin, D.L. Roberts, and R. St. Amant, "Human subtlety proofs: using computer games to model cognitive processes for cybersecurity," International Journal of Human–Computer Interaction, 2017, vol. 33, pp. 44-54.

[13] J. Zhang, X. Luo, S. Akkaladevi, and J. Ziegelmayer, "Improving multiple-password recall: An empirical study," European Journal of Information Systems, 2009, vol. 18 pp. 165–176.

[14] J. Blythe, and L.J. Camp, "Implementing mental models," In Proceedings of 2012 IEEE symposium on Security and privacy workshops, pp. 86–90, San Francisco, CA, 2012.

[15] R.W. Rogers, "A protection motivation theory of fear appeals and attitude change," Journal of Psychology, 1975, vol. 91, pp. 93–114.

[16] I.MY. Woon, G.W. Tan, and R.T. Low, "A protection motivation theory approach to home wireless security." In Proceedings of 26th International Conference on Information Systems, p. 31, 2005.

[17] T. Chenoweth, R. Minch, and T. Gattiker, "Application of protection motivation theory to adoption of protective technologies," In

Proceedings of the 42nd Hawaii International Conference on System Sciences, 2009.

[18] W. Al-Ghaith, "Extending protection motivation theory to understand security determinants of anti-virus software usage on mobile devices," International Journal of Computers, 2016, vol. 10, pp. 125-138.

[19] S. Parrigon, S.E. Woo, L. Tay, and T. Wang, "CAPTION-ing the situation: a lexically-derived taxonomy of psychological situation characteristics," Journal of Personality and Social Psychology, 2017, vol. 112, pp. 642-681.

[20] A.J. Rothman, and A.S. Baldwin, "A person x intervention strategy approach to understanding health behavior," In K. Deaux and M. Snyder (Eds.), The oxford handbook of personality and social psychology, pp.729-752, New York, NY: Oxford University Press, 2012.

[21] D.D. Caputo, S.L. Pfleeger, J.D. Freeman, and M.E. Johnson, "Going spear phishing: Exploring embedded training and awareness," IEEE Security & Privacy, 2014, vol. 12, pp. 28-38.

[22] K. Ivaturi, C. Chua, and L. Janczewski, "Impact of information seeking and warning frames on online deception: A quasi-experiment," Journal of Comp Inf Systems, 2017, vol. 57, pp. 139-147.

[23] M. Kajzer, J. D'Arcy, C.R. Crowell, A. Striegel, and D. Van Bruggen. "An exploratory investigation of message-person congruence in information security awareness campaigns," Computers & Security, 2014, vol. 43, pp. 64-76.

[24] K. Neuwirth, S. Dunwoody, and R.F. Griffin, "Protection motivation and risk communication," Risk Analysis, 2000, vol. 20, pp. 721-734.

[25] E.J. Williams, A. Beardmore, and A.N. Joinson, "Individual differences in susceptibility to malevolent influence online: a theoretical review," Computers in Human Behavior, 2017, vol.72, pp. 412-421.

Child Maltreatment in Singapore: An Analysis of Familial Factors

Keong Yuhan Melissa
Department of Psychology
National University of Singapore
Singapore

Grace S. Chng
Centre for Research on Rehabilitation and Protection
Ministry of Social and Family Development
Singapore

Clare Henn-Haase
Department of Psychology
National University of Singapore
Singapore

***Abstract*—Current literature on child maltreatment in Singapore is relatively limited. This study aims to contribute to our understanding of the associations between risk factors and child maltreatment outcomes. By utilising secondary retrospective data of 580 children who entered the child protection system in the Ministry of Social and Family Development (MSF), associations and predictive relationships between risk factors and maltreatment outcomes were analysed based on an ecological framework. The study examined patterns of associations across four types of maltreatment: physical abuse, sexual abuse, emotional abuse, and neglect, and the outcomes of recurrence of maltreatment and re-entry into the child protection system. Results indicated that a higher proportion of caregiver factors had significant associations with the different types of maltreatment as compared to household and child factors. Additionally, two caregiver factors and two child factors surfaced as significant predictors of recurrence of harm in the emotionally abused sub-sample. These results revealed that applicability of ecological models to Singapore, while results that differed from findings in Western literature highlighted the need for more locally-based research. The study's limitations and future recommendations are discussed.**

Keywords-Child Maltreatment; Family Factors; Singapore

I. INTRODUCTION

Child maltreatment is defined as an act of commission or omission by caregivers of children under 16 years of age [1]. The term encompasses physical, psychological and sexual abuse, as well as neglect [2]. Throughout the years, child maltreatment has been a common occurrence that transcends geographical boundaries. The World Health Organisation (WHO) estimates that rates of child physical abuse range from 25-50% of all children globally [3]. WHO also reported that approximately 41,000 children die each year due to maltreatment [4]. These statistics highlight the need to address this issue.

A. Importance of addressing repeated child maltreatment

The issue of child maltreatment is especially concerning as it occurs during a child's early developmental stages. This adversely affects areas such as the formation of attachment to caregivers, and social information processing patterns [5, 6, 7, 8, 9]. Children who are maltreated are also more likely to adopt maladaptive coping techniques in response to the resulting trauma [10]. These consequences of child maltreatment may then result in long-term problems in adaptation, behaviour and the development of psychopathology [7, 11, 12, 13, 14, 15].

These adverse outcomes are amplified when there are repeated episodes of maltreatment. There are two types of repeated maltreatment. Recurrence of maltreatment refers to repeated incidents while a case is still undergoing investigation by relevant authorities. In contrast, re-entry refers to repeated incidents of maltreatment that occur after a case's investigation has been concluded. The former usually refers to more immediate incidents, while the latter, more chronic maltreatment [16, 17]. Both types of repeated maltreatment have been directly associated with amplified adverse outcomes such as an increase in behavioural problems, higher risk of suicidal ideations, and continuation of subsequent episodes of maltreatment [1, 16, 18].

B. Theoretical models

Two models have surfaced as the basis of numerous studies on child maltreatment [17, 19, 20, 21, 22]. Belsky's ecological model and the ecological-transactional model share the key similarity of acknowledging that risk factors, henceforth referred to as potentiating factors, exist in multiple systems of varying proximity to the child [23, 24]. Four levels of potentiating factors are identified—individual characteristics of the adult perpetrator, family setting in which the maltreatment occurs, formal and informal social structures that surround the family setting, and cultural values and beliefs. Studies have identified strong associations between potentiating factors across all levels and the risk of child maltreatment. Examples of such factors include household size, caregivers with a history of maltreatment, and a child's behavioural issues [25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38].

C. Present study

This study seeks to extrapolate prior findings of potentiating factors of maltreatment to the risk of repeated maltreatment, due to the limited range of literature currently available on repeated maltreatment. Many studies on repeated maltreatment have only focused on specific potentiating factors such as placement in foster care [39, 40, 41, 42]. A further aim is to identify associations between potentiating

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.50

TABLE I. DISTRIBUTION OF RISK VARIABLES

Risk variable	*Sample with Risk Variable (N=580)*	
	n	*%*
Household		
Living with extended family	195	34
Multigenerational household	160	28
Unrelated adults in household	124	21
Caregiver		
Caregiver's mental health condition	115	20
Arrest history for violent/aggressive offences	15	3
Significant incarceration history	65	11
History of child maltreatment	127	22
Justifies maltreatment	173	30
Denial of current report allegations	133	23
Blames child for maltreatment	121	21
Employs excessive/inappropriate discipline	129	22
Unrealistic expectations of child	50	9
Incidence of family violence	311	54
Child		
Developmental disability	26	5
Learning disability	39	7
Child's mental health condition	40	7
Medical needs	58	10
Academic difficulties	132	23
Behavioural problems	173	30

factors of repeated maltreatment and other maltreatment variables and outcomes in Singapore's context. Most studies on child maltreatment were conducted in Western countries, with only two studies involving participants from Singapore and Japan [17, 43, 44].

The following research question and hypotheses are addressed:

1. Are there significant associations between the identified potentiating factors and each type of maltreatment?

2. Potentiating household factors will significantly predict re-entry and recurrence outcomes.

3. Potentiating caregiver factors will significantly predict re-entry and recurrence outcomes.

Potentiating child factors will significantly predict re-entry and recurrence outcomes.

II. METHODS

A. Sample

The sample consisted of 580 children (54% male; 46% female) who entered Child Protective Services (CPS) at MSF between March 2014 and December 2015. These children entered CPS due to reports of abuse and/or neglect, with ages ranging from 0 to 15 years old (M=8.98, SD=4.69). At entry into CPS, all children and their families were assessed by Child Protection Officers (CPO) for care and protection purposes.

B. Procedure

This study was reviewed and approved by the National University of Singapore Institutional Review Board. As all data used in this study belong to CPS of MSF, approval was obtained from the Director of Child Protective Services for its use.

1) Risk variable data: From 2014 to 2015, information regarding the type of maltreatment, and all potentiating factors across the three ecological levels were collected by the CPOs from MSF using the SDM Family Risk Assessment tool developed by the National Council for Crime and Delinquency's (NCCD) Children's Research Centre. This risk assessment tool has been applied and validated in numerous countries [45], and is being piloted by MSF in Singapore. Through a series of closed questions, this tool aims to enhance the accuracy of case management and assessment; creating more effective and targeted interventions, and reducing rates of referrals or allegations regarding child maltreatment.

2) Child maltreatment outcomes data: The outcomes of recurrence and re-entry were obtained from MSF's internal client management system. The occurrences of both outcomes were tracked from March 2014 to December 2016. Recurrence was defined to only include cases of repeated maltreatment that occurred prior to the closure of a child's investigative case file with CPS. In contrast, re-entry only consisted of repeated incidents of maltreatment that occurred after a child's investigative case file with CPS was closed.

Additional demographic data of the children, such as age, gender and race, were also obtained from the client management system.

3) Measures: The SDM Family Risk Assessment tool and MSF's internal client management system were the two key sources of data for this study.

In addition to the demographic information of each child, 3 household, 10 caregiver-level and 6 child-level factors were captured under the Family Risk Assessment tool of the Singapore Structured Decision Making System by CPOs at the child's entry into CPS. The household factors included *living with extended family*, *multigenerational household*, and *unrelated adults in household*. The group of caregiver factors

TABLE II. FREQUENCY OF MALTREATMENT TYPES AND BREAKDOWN BY GENDER AND MALTREATMENT OUTCOMES

Type of maltreatment	Total (*N*=580)		Female (*n*= 312)		Male (*n*= 268)		Recurrence (*n*=71)		Re-entry (*n*=15)	
	n	*%*[a]	*n*	*%*[b]	*n*	*%*[b]	*n*	*%*[c]	*n*	*%*[c]
Physical	289	50	123	43	166	57	44	15	10	3
Sexual	105	18	80	76	25	24	6	6	3	3
Emotional	151	26	80	53	71	47	26	17	3	2
Neglect	266	46	146	55	120	45	36	14	5	2

[a] Percentage of all children
[b] Percentage of children within each type of maltreatment
[c] Percentage of each type of maltreatment

TABLE III. CHI -SQUARE RESULTS FOR RISK VARIABLES AND TYPE OF MALTREATMENT

Risk variable	*Physical Abuse (n=289)*			*Sexual Abuse (n=105)*			*Emotional Abuse (n=151)*			*Neglect (n=266)*		
	n	*%*	χ^2	*n*	*%*	χ^2	*n*	*%*	χ^2	*n*	*%*	χ^2
Household												
Extended family	101	35	0.46	44	42	**3.94***	47	31	0.57	85	32	0.61
Multigenerational	83	29	0.37	32	31	0.54	38	25	0.60	75	28	0.09
Unrelated adults	65	23	0.42	29	28	2.97	38	25	1.74	67	25	**4.24***
Caregiver												
Caregiver's mental health condition	47	16	**4.60***	11	11	**7.05****	36	24	2.07	64	24	**5.54***
Arrest history	3	1	-	2	2	-	7	5	3.40	4	2	-
Incarceration history	30	14	**4.02***	10	10	0.37	13	9	1.38	37	14	3.61
History of child maltreatment	71	25	2.40	15	14	**4.34***	34	23	0.46	60	23	0.13
Justifies maltreatment	103	36	**9.30****	22	21	**4.83***	47	31	0.16	82	31	0.24
Denial of current report allegations	72	25	1.28	37	35	**10.99****	23	15	**6.85****	59	22	0.16
Blames child	76	26	**10.31****	14	13	**4.40***	27	18	1.10	46	17	3.79
Excessive/inappropriate discipline	115	40	**102.60****	12	11	**8.67****	39	26	1.52	36	14	**21.54****
Unrealistic expectations	43	15	**28.64****	6	6	1.38	16	11	1.01	16	6	**4.24***
Family violence	171	59	**7.13****	50	48	1.86	105	70	**20.79****	122	46	**11.89****
Child												
Developmental disability	18	6	**4.10***	1	1	-	7	5	0.01	11	4	0.14
Learning disability	22	8	0.73	4	4	-	8	5	0.66	18	7	0.00
Child's mental health condition	14	5	3.78	4	4	-	13	9	0.93	22	8	1.45
Medical needs	25	9	1.17	4	4	-	9	6	3.70	35	13	**5.44***
Academic difficulties	66	23	0.00	21	20	0.56	34	23	0.01	60	23	0.01
Behavioural problems	93	32	1.52	27	26	1.04	40	27	1.09	76	29	0.37

Note: *p<.05. **p<.01.

consisted of *caregiver's mental health condition*, *arrest history for violent/aggressive offences*, *significant incarceration history*, *history of child maltreatment*, *justifies maltreatment*, *denial of current report allegations*, *blames child for maltreatment*, *employs excessive/inappropriate discipline*, *unrealistic expectations of child*, and *incidence of family violence*. Lastly, child-level factors included *developmental disability*, *learning disability*, *child's mental health condition*, *medical needs*, *academic difficulties*, and *behavioural problems*. Responses to all 19 factors were coded as "yes", indicating the presence of the potentiating factor, or "no", indicating the absence of the potentiating factor. Factors which included the options of "high" or "low" for the presence of a variable were coded as "yes", while the options of "unknown" and "no" were coded as "no". Factors which distinguished between past and present occurrences were collapsed into a single variable. The definitions of variables were based on manualized definitions provided by NCCD for the SDM Family Risk Assessment tool, unless stated otherwise.

Four types of maltreatment were identified. Each type was not mutually exclusive, as there was a proportion of the sample who experienced more than one type of maltreatment. The definitions of each maltreatment type were taken from the National Standards for Protection, a document published specifically for Singapore [46].

Physical abuse referred to any act involving a child being physically injured by non-accidental means. *Sexual abuse* referred to any act that exploits a child for sexual gratification, or any sexual act committed between an adult and child. *Emotional abuse* referred to any act, such as persistent hostility, or outright rejection of the child, which led to significant impairment in the social, emotional, cognitive and intellectual development and/or disturbances in the child's behaviour. *Neglect* referred to an act of deliberately denying a child of basic needs, such as food, shelter, clothing, and medical care. Inadequate supervision and forcing a child to do developmentally inappropriate acts were also included.

Data on the two maltreatment outcomes of recurrence of harm and re-entry into CPS of MSF were obtained from individual child records of the internal client management system. If the child was found to have an incident of recurrent harm or re-entered CPS from the case opening date up to December 2016, the respective maltreatment outcomes were coded as 'yes'.

TABLE IV. CHI-SQUARE RESULTS FOR RISK VARIABLES AND MALTREATMENT OUTCOMES

Variables	Total	Recurrence			Re-entry		
		n	%	χ^2	*n*	%	χ^2
Household							
Living with extended family	195	21	10.78	0.59	2	1.03	-
Multigenerational household	160	18	11.25	0.20	2	1.25	-
Unrelated adults in household	124	15	12.1	0.00	5	4.03	-
Caregiver							
Caregiver's mental health condition	115	17	14.78	0.86	3	2.61	-
Arrest history for violent/aggressive offences	15	1	6.67	-	0	0	-
Significant incarceration history	65	11	16.92	1.49	2	3.08	-
History of child maltreatment	127	17	13.39	0.20	2	1.57	-
Justifies maltreatment	173	30	17.34	**5.97***	1	0.58	-
Denial of current report allegations	133	16	12.03	0.01	5	3.76	-
Blames child for maltreatment	121	20	16.53	2.62	0	0	-
Employs excessive/inappropriate discipline	129	18	13.95	0.45	5	3.88	-
Unrealistic expectations of child	50	11	22	**4.85***	5	10	-
Incidence of family violence	311	42	13.5	0.10	9	2.89	-
Child							
Developmental disability	26	1	3.85	1.79	1	3.85	-
Learning disability	39	4	10.26	0.15	2	5.13	-
Child's mental health condition	40	9	22.5	**4.21***	1	2.5	-
Medical needs	58	9	15.52	0.64	2	3.45	-
Academic difficulties	132	20	15.15	1.35	5	3.79	-
Behavioural problems	173	24	13.87	0.61	5	2.89	-

Note: *p<.05.

III. RESULTS

A. Descriptive statistics

Table I shows the frequencies of each risk variable as a proportion of the whole sample. Table II presents the distribution of data across the types of maltreatment, with further breakdowns by gender and maltreatment outcomes.

B. Associations between potentiating factors and type of maltreatment

Chi-square tests and logistic regression analyses were conducted. Variables with cell counts lower than five were excluded.

Sexual abuse and neglect were the only types of maltreatment to show significant associations with potentiating factors from all three ecological levels (Table III). The latter was significantly associated with six factors—unrelated adults in the household, caregiver's mental health condition, use of excessive or inappropriate discipline, unrealistic expectations of a child, involvement in family violence, and a child's medical condition. In contrast, emotional abuse was only associated with caregiver potentiating factors, and physical abuse was only associated with caregiver and child potentiating factors. For the latter, these included caregiver's history of maltreatment, denial of current allegations, and a child's developmental disability.

C. Potentiating factors as predictors of maltreatment outcomes

Two sets of chi-square tests were conducted to examine associations between potentiating factors and maltreatment outcomes. The first set showed an overview of these associations (Table IV). The subsequent set provided a more nuanced analysis by examining these associations within each type of maltreatment (Table V-VII). No analysis was conducted for re-entry as the rate was low at 3% (*n*=15). No chi-square tests were conducted for sexually abused children as cell counts were five and under.

4 models were then tested using logistic regression analyses. The first model tested potentiating variables on recurrence with the full sample, while controlling for age, gender and race of the child. Three other models tested potentiating variables on recurrence with sub-samples of all maltreatment types, except for sexual abuse which had a low cell count for this outcome (see Table II).

TABLE V. CHI-SQUARE RESULTS FOR RISK VARIABLES AND MALTREATMENT OUTCOMES (PHYSICAL ABUSE)

Variables	Total	Recurrence			Re-entry		
		n	%	χ^2	*n*	%	χ^2
Household							
Living with extended family	101	16	16	0.05	1	1	-
Multigenerational household	83	14	17	0.24	1	1	-
Unrelated adults in household	65	6	9	2.34	3	5	-
Caregiver							
Caregiver's mental health condition	47	7	15	0.01	1	2	-
Arrest history for violent/aggressive offences	3	0	0	-	0	0	-
Significant incarceration history	40	10	25	3.44	2	5	-
History of child maltreatment	71	12	17	0.21	0	0	-
Justifies maltreatment	103	18	17	0.63	1	1	-
Denial of current report allegations	72	8	11	1.26	4	6	-
Blames child for maltreatment	76	13	17	0.28	0	0	-
Employs excessive/inappropriate discipline	115	17	15	0.03	5	4	-
Unrealistic expectations of child	43	11	26	**4.20***	4	9	-
Incidence of family violence	171	25	15	0.12	7	4	0.50
CYP							
Developmental disability	18	0	0	-	1	6	-
Learning disability	22	3	14	-	2	9	-
Child's mental health condition	14	4	29	-	0	0	-
Medical needs	25	6	24	1.63	1	4	-
Academic difficulties	66	11	17	0.14	3	5	-
Behavioural problems	93	12	13	0.57	4	4	-

*Note: *p<.05.*

TABLE VI. CHI-SQUARE RESULTS FOR RISK VARIABLES AND MALTREATMENT OUTCOMES (EMOTIONAL ABUSE)

Variables	Total	Recurrence			Re-entry		
		n	%	χ^2	*n*	%	χ^2
Household							
Living with extended family	47	8	17	0.00	0	0	-
Multigenerational household	38	6	16	0.07	0	0	-
Unrelated adults in household	38	8	21	0.52	2	5	-
Caregiver							
Caregiver's mental health condition	36	4	11	-	1	3	-
Arrest history for violent/aggressive offences	7	0	0	-	0	0	-
Significant incarceration history	13	3	23	-	0	0	-
History of child maltreatment	34	7	21	0.35	2	6	-
Justifies maltreatment	47	13	28	5.22*	0	0	-
Denial of current report allegations	23	2	9	-	0	0	-
Blames child for maltreatment	27	4	15	-	0	0	-
Employs excessive/inappropriate discipline	39	6	15	0.12	0	0	-
Unrealistic expectations of child	16	2	13	-	1	6	-
Incidence of family violence	105	16	15	.95	2	2	-
CYP							
Developmental disability	7	1	14	-	0	0	
Learning disability	8	2	25	-	0	0	-
Child's mental health condition	13	6	46	8.36**	0	0	-
Medical needs	9	3	33	-	0	0	-
Academic difficulties	34	11	32	7.05**	1	3	-
Behavioural problems	40	8	20	0.30	1	3	-

Note: *p<.05.

The model for the emotionally-abused sub-sample was the only statistically significant model. Nine variables were excluded as their cell counts were lower than five. The test for this model with 10 predictors with the outcome of recurrence was significant, χ^2 (15, *N*=151)=30.79, *p*<.01 (Table VII). This indicated that the model could distinguish between emotionally abused children who did and did not experience a recurrence of maltreatment. Two caregiver characteristics and two child characteristics surfaced as statistically significant predictors of recurrence amongst emotionally abused children. Children with caregivers who justified emotional abuse were 5.94 times as likely as children without such caregivers to experience recurrent harm. Similarly, children with mental health conditions or academic difficulties were 8.01 times and 3.65 times as likely as children without such characteristics to experience recurrent harm. Conversely, children with caregivers who employed excessive/inappropriate forms of discipline were 0.15 times less likely than children without such caregivers to experience recurrent harm.

IV. DISCUSSION

This study aimed to contribute to the current literature of child maltreatment in Singapore by identifying key associations between potentiating factors, types of maltreatment and risk of repeated incidents of maltreatment. Consistent with current literature, there were significant associations between potentiating factors and each type of maltreatment, with the pattern of associations varying across maltreatment types. The results also highlighted the possibility of expanding the literature on repeated child maltreatment, as four potentiating caregiver and child factors were shown to predict recurrent maltreatment amongst emotionally abused children.

A. Implications for educational campaigns

Consistent with current literature, caregiver's use of inappropriate or excessive discipline was significantly associated with physical abuse [26,47]. This association could stem from the existence of both factors on a continuum, with physical abuse being a more extreme form of corporal punishment [47]. Additionally, discrepancies in the official and public definition of physical abuse in Singapore may have contributed to the significant association between caregiver's justification of maltreatment and physical abuse [46, 48]. To address these associations, public education

TABLE VII. CHI-SQUARE RESULTS FOR RISK VARIABLES AND MALTREATMENT OUTCOMES (NEGLECT)

Variables	Total	Recurrence			Re-entry		
		n	%	χ^2	*n*	%	χ^2
Household							
Living with extended family	85	12	14	0.04	1	1	-
Multigenerational household	75	11	15	0.12	1	1	-
Unrelated adults in household	67	12	18	1.47	1	1	-
Caregiver							
Caregiver's mental health condition	64	9	14.	0.02	3	5	-
Arrest history for violent/aggressive offences	4	1	25	-	0	0	-
Significant incarceration history	37	6	16	0.26	0	0	-
History of child maltreatment	60	10	17	0.65	1	2	-
Justifies maltreatment	82	16	20	3.62	0	0	-
Denial of current report allegations	59	11	19	1.69	1	2	-
Blames child for maltreatment	46	5	11	-	0	0	-
Employs excessive/inappropriate discipline	36	5	14	-	0	0	-
Unrealistic expectations of child	16	2	13	-	0	0	-
Incidence of family violence	122	23	19	5.45*	2	2	-
CYP							
Developmental disability	11	0	0	-	0	0	-
Learning disability	18	2	11	-	1	6	-
Child's mental health condition	22	5	23	-	1	5	-
Medical needs	35	5	14	-	1	3	-
Academic difficulties	60	10	17	0.65	1	2	-
Behavioural problems	76	10	13	0.01	1	1	-

Note: *p<.05.

TABLE VIII. LOGISTIC REGRESSION FOR CASES OF EMOTIONAL ABUSE AND RECURRENCE OF HARM

Variables	B	S.E.	Wald	df	Exp(B)	95% C.I. for Exp(B)	
						Lower	*Upper*
Household							
Living with extended family	1.15	1.05	1.20	1	3.14	0.41	24.36
Multigenerational household	-0.72	1.21	0.36	1	0.49	0.05	5.19
Unrelated adults in household	0.72	0.63	1.30	1	2.05	0.60	7.02
Caregiver							
History of child maltreatment	0.70	0.69	1.03	1	2.01	0.52	7.71
Justifies maltreatment	1.78	0.70	6.42	1	5.94*	1.50	23.57
Employs excessive/inappropriate discipline	-1.93	0.85	5.25	1	0.15*	0.03	0.77
Incidence of family violence	-0.97	0.61	2.51	1	0.38	0.11	1.26
Child							
Child's mental health condition	2.08	0.91	5.26	1	8.01*	1.35	47.36
Academic difficulties	1.30	0.64	4.13	1	3.65*	1.05	12.72
Behavioural problems	-0.58	0.70	0.67	1	0.56	0.14	2.23

Note: *p<.05.

campaigns could address these associations between corporal punishment and physical abuse, as well as the definition of the latter. Concurrently, boundaries of physical abuse would have to be clearly demarcated.

Similarly, a lack of consensus on what constitutes emotional abuse in Singapore may partially account for caregiver's justification of maltreatment being a predictor of recurrent harm amongst emotionally abused children [48]. The local study showed that most participants deemed potential cases of emotional abuse as either non- or only possible incidents of abuse. Educating the public on the definition of emotional abuse may prevent caregivers from unintentionally carrying it out, as it was shown that perpetrators of emotional abuse lack a clear intention to harm the child [49]. The need for such campaigns may be especially important in Singapore, as a child's academic difficulties were shown to significantly predict emotional abuse. This may in part be attributed to the emphasis on academic success and qualifications. Parents may experience elevated levels of frustration if their child experiences academic difficulties, hence placing them at a higher risk of unintentionally perpetrating emotional abuse due to the emphasis on academic achievement.

B. Implications for parenting workshops

Mental health conditions of children and caregivers were identified as factors that should be addressed. The former predicted recurrent harm amongst emotionally abused children, while the latter was significantly associated with neglect. As caregivers of children with mental health conditions are more likely to experience anger and resentment, it is important to equip them with effective strategies to meet their unique caregiving needs [50]. Parenting workshops, such as the Positive Parenting Programme piloted by MSF, may be a key avenue to educate these caregivers, and reduce risk of recurrent harm [51]. A similar strategy could be used to address the association between caregiver's mental health condition and neglect. Parenting workshops could cover topics regarding mental resilience and effective parenting strategies for the general population of children. These could reduce caregiver stress, thereby lowering their risk of developing mental health conditions.

C. Understanding cultural contexts

The discrepancies between the results acquired in this study and those in the current literature highlight the importance of testing theoretical models in various cultural contexts. It is possible that culture affects a society's definitions of abuse, and their beliefs regarding the treatment of children. These variations could in turn result in differences across contexts in the factors associated with child maltreatment, and the observed patterns and trends of child maltreatment. Therefore, one must be careful with making generalisations from results. By interpreting findings in the light of cultural contexts, authorities could craft interventions that are better tailored to the specific cultural context. This nuanced approach could allow for more effective strategies in addressing child maltreatment.

D. Limitations and future directions

There were two key limitations in the study. Firstly, as the data of the first incidents of maltreatment for each child and the characteristics were recorded at the same time, no causal inferences could be drawn. Future studies could adopt a prospective longitudinal approach. It will allow for causal inferences to be made, and provide a picture of how characteristics and family situations evolve over time. Secondly, analyses for re-entry could not be conducted as there were insufficient cases. As a previous study acquired higher re-entry rates after tracking maltreatment for eight years, future studies could ensure that re-entry is tracked over a sufficiently long period of time.

Future studies could include additional variables to provide a more nuanced picture of repeated child maltreatment. These variables include the number of types of maltreatment experienced by each child, number of potentiating factors, and type of recurrent maltreatment. It may also be valuable to test the aspect of the ecological-transactional model regarding the balance between potentiating and protective factors. This may

aid in the identification of protective factors that could reduce the risk of repeated maltreatment. CPS could then expand their focus beyond reducing risk factors, to also include bolstering protective factors.

Conclusion

A caregiver's justification of maltreatment, his/her use of harsh discipline, a child's mental health condition and a child's academic difficulties significantly predicted recurrence of maltreatment amongst emotionally abused children in Singapore. Additional caregiver- and child-level potentiating factors were also significantly associated with the type of maltreatment and the recurrence of harm. The involvement of household, caregiver and child variables in this study reinforced the applicability of ecological models in Singapore. By expanding local literature on child maltreatment and its risk and protective factors, children in Singapore may then be better protected against it.

References

[1] Gilbert, R., Widom, C. S., Browne, K., Fergusson, D., Webb, E., & Janson, S. (2009). Burden and consequences of child maltreatment in high-income countries. *The lancet, 373*(9657), 68-81.

[2] Rehabilitation and Protection Group. (2016). *Protecting children in Singapore*. Singapore: Ministry of Social and Family Development.

[3] World Health Organisation. (2017). Violence and injury prevention: Child maltreatment. Retrieved from http://www.who.int/violence_injury_prevention/violence/child/en/

[4] World Health Organisation. (2016). Media Centre: Child maltreatment. *Fact Sheets.* Retrieved from http://www.who.int/mediacentre/factsheets/fs150/en/

[5] Barnett, D., Ganiban, J., & Cicchetti, D. (1999). Maltreatment, Negative Expressivity, and the Development of Type D Attachments from 12 to 24 Months of Age. *Monographs of the Society for Research in Child Development, 64*(3), 97-118. Retrieved from http://www.jstor.org.libproxy1.nus.edu.sg/stable/3181560

[6] Carlson, V., Cicchetti, D., Barnett, D., & Braunwald, K. (1989). Disorganized/disoriented attachment relationships in maltreated infants. *Developmental psychology, 25*(4), 525.

[7] Dodge, K. A., Bates, J. E., & Pettit, G. S. (1990). Mechanisms in the Cycle of Violence. *Science, 250*(4988), 1678-1683. Retrieved from http://www.jstor.org.libproxy1.nus.edu.sg/stable/2878540

[8] Dodge, K. A., & Price, J. M. (1994). On the relation between social information processing and socially competent behavior in early school-aged children. *Child development, 65*(5), 1385-1397.

[9] Schneider-Rosen, K., Braunwald, K. G., Carlson, V., & Cicchetti, D. (1985). Current Perspectives in Attachment Theory: Illustration from the Study of Maltreated Infants. *Monographs of the Society for Research in Child Development, 50*(1/2), 194-210. doi:10.2307/3333833

[10] Carlson, E. B., Furby, L., Armstrong, J., & Shlaes, J. (1997). A conceptual framework for the long-term psychological effects of traumatic childhood abuse. *Child Maltreatment, 2*(3), 272-295.

[11] Chen, L. P., Murad, M. H., Paras, M. L., Colbenson, K. M., Sattler, A. L., Goranson, E. N., . . . Prokop, L. J. (2010). *Sexual abuse and lifetime diagnosis of psychiatric disorders: systematic review and meta-analysis.* Paper presented at the Mayo Clinic Proceedings.

[12] Keiley, M. K., Howe, T. R., Dodge, K. A., Bates, J. E., & Pettit, G. S. (2001). The timing of child physical maltreatment: A cross-domain growth analysis of impact on adolescent externalizing and internalizing problems. *Development and psychopathology, 13*(4), 891-912. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2769082/

[13] Mullen, P. E., Martin, J. L., Anderson, J. C., Romans, S. E., & Herbison, G. P. (1996). The long-term impact of the physical, emotional, and sexual abuse of children: A community study. *Child Abuse & Neglect, 20*(1), 7-21. doi:http://dx.doi.org/10.1016/0145-2134(95)00112-3

[14] Romans, S. E., Gendall, K. A., Martin, J. L., & Mullen, P. E. (2001). Child sexual abuse and later disordered eating: A New Zealand epidemiological study. *International Journal of Eating Disorders, 29*(4), 380-392.

[15] Wonderlich, S. A., Brewerton, T. D., Jocic, Z., Dansky, B. S., & Abbott, D. W. (1997). Relationship of childhood sexual abuse and eating disorders. *Journal of the American Academy of Child & Adolescent Psychiatry, 36*(8), 1107-1115.

[16] Hindley, N., Ramchandani, P. G., & Jones, D. P. (2006). Risk factors for recurrence of maltreatment: a systematic review. *Archives of disease in childhood, 91*(9), 744-752.

[17] Li, D., Chu, C. M., Ng, W. C., & Leong, W. (2014). Predictors of re-entry into the child protection system in Singapore: A cumulative ecological–transactional risk model. *Child Abuse & Neglect, 38*(11), 1801-1812. doi:http://dx.doi.org/10.1016/j.chiabu.2014.08.017

[18] Manly, J. T., Cicchetti, D., & Barnett, D. (1994). The impact of subtype, frequency, chronicity, and severity of child maltreatment on social competence and behavior problems. *Development and psychopathology, 6*(01), 121-143.

[19] Kohrt, H. E., Kohrt, B. A., Waldman, I., Saltzman, K., & Carrion, V. G. (2004). An Ecological–Transactional Model of Significant Risk Factors for Child Psychopathology in Outer Mongolia. *Child Psychiatry and Human Development, 35*(2), 163-181. doi:10.1007/s10578-004-1883-4

[20] Lutenbacher, M. (2000). Perceptions of health status and the relationship with abuse history and mental health in low-income single mothers. *Journal of Family Nursing, 6*(4), 320-340.

[21] Masten, A. S., & Wright, M. O. D. (1998). Cumulative risk and protection models of child maltreatment. *Journal of Aggression, Maltreatment & Trauma, 2*(1), 7-30.

[22] Thornberry, T. P., Knight, K. E., & Lovegrove, P. J. (2012). Does maltreatment beget maltreatment? A systematic review of the intergenerational literature. *Trauma, Violence, & Abuse, 13*(3), 135-152.

[23] Belsky, J. (1980). Child maltreatment: an ecological integration. *American psychologist, 35*(4), 320.

[24] Cicchetti, D., & Rizley, R. (1981). Developmental perspectives on the etiology, intergenerational transmission, and sequelae of child maltreatment. *New Directions for Child and Adolescent Development, 1981*(11), 31-55.

[25] Baldwin, J. A., & Oliver, J. (1975). Epidemiology and family characteristics of severely-abused children. *British journal of preventive & social medicine, 29*(4), 205-221.

[26] Black, D. A., Heyman, R. E., & Slep, A. M. S. (2001a). Risk factors for child physical abuse. *Aggression and Violent Behavior, 6*(2), 121-188.

[27] Black, D. A., Heyman, R. E., & Slep, A. M. S. (2001b). Risk factors for child sexual abuse. *Aggression and*

Violent Behavior, 6(2–3), 203-229. doi:http://dx.doi.org/10.1016/S1359-1789(00)00023-9

[28] Chaffin, M., Kelleher, K., & Hollenberg, J. (1996). Onset of physical abuse and neglect: Psychiatric, substance abuse, and social risk factors from prospective community data. *Child Abuse & Neglect, 20*(3), 191-203. doi:http://dx.doi.org/10.1016/S0145-2134(95)00144-1

[29] Hornor, G. (2002). Child sexual abuse: Psychosocial risk factors. *Journal of Pediatric Health Care, 16*(4), 187-192. doi:http://dx.doi.org/10.1067/mph.2002.122223

[30] Knutson, J. F. (1995). Psychological characteristics of maltreated children: putative risk factors and consequences. *Annual review of psychology, 46*, 401.

[31] Milner, J. S., & Chilamkurti, C. (1991). Physical Child Abuse Perpetrator Characteristics: A Review of the Literature. *Journal of Interpersonal Violence, 6*(3), 345-366. doi:10.1177/088626091006003007

[32] Morantz, G., Cole, D., Vreeman, R., Ayaya, S., Ayuku, D., & Braitstein, P. (2013). Child abuse and neglect among orphaned children and youth living in extended families in sub-Saharan Africa: What have we learned from qualitative inquiry? *Vulnerable children and youth studies, 8*(4), 338-352.

[33] Romero-Martínez, A., Figueiredo, B., & Moya-Albiol, L. (2014). Childhood history of abuse and child abuse potential: The role of parent's gender and timing of childhood abuse. *Child Abuse & Neglect, 38*(3), 510-516. doi:http://dx.doi.org/10.1016/j.chiabu.2013.09.010

[34] Schnitzer, P. G., & Ewigman, B. G. (2005). Child Deaths Resulting From Inflicted Injuries: Household Risk Factors and Perpetrator Characteristics. *Pediatrics, 116*(5), e687. Retrieved from http://pediatrics.aappublications.org/content/116/5/e687.abstract

[35] Sweet, J. J., & Resick, P. A. (1979). The maltreatment of children: A review of theories and research. *Journal of Social Issues, 35*(2), 40-59.

[36] Webster, R. L., Goldstein, J. A. Y., & Segall, A. (1985). A Test of the Explanatory Value of Alternative Models of Child Abuse. *Journal of Comparative Family Studies, 16*(3), 295-317. Retrieved from http://www.jstor.org.libproxy1.nus.edu.sg/stable/41601556

[37] Whitaker, D. J., Le, B., Karl Hanson, R., Baker, C. K., McMahon, P. M., Ryan, G., . . . Rice, D. D. (2008). Risk factors for the perpetration of child sexual abuse: A review and meta-analysis. *Child Abuse & Neglect, 32*(5), 529-548. doi:http://dx.doi.org/10.1016/j.chiabu.2007.08.005

[38] Youssef, R. M., Attia, M. S.-E.-D., & Kamel, M. I. (1998). Children experiencing violence I: parental use of corporal punishment. *Child Abuse & Neglect, 22*(10), 959-973. doi:http://dx.doi.org/10.1016/S0145-2134(98)00077-5

[39] Connell, C. M., Vanderploeg, J. J., Katz, K. H., Caron, C., Saunders, L., & Tebes, J. K. (2009). Maltreatment following reunification: Predictors of subsequent Child Protective Services contact after children return home. *Child Abuse & Neglect, 33*(4), 218-228. doi:http://dx.doi.org/10.1016/j.chiabu.2008.07.005

[40] Drake, B., Jonson-Reid, M., & Sapokaite, L. (2006). Rereporting of child maltreatment: Does participation in other public sector services moderate the likelihood of a second maltreatment report? *Child Abuse & Neglect, 30*(11), 1201-1226. doi:http://dx.doi.org/10.1016/j.chiabu.2006.05.008

[41] Inkelas, M., & Halfon, N. (1997). Recidivism in child protective services. *Children and Youth Services Review, 19*(3), 139-161. doi:http://dx.doi.org/10.1016/S0190-7409(97)00011-X

[42] Jonson-Reid, M. (2003). Foster Care and Future Risk of Maltreatment. *Children and Youth Services Review, 25*(4), 271-294. doi:http://dx.doi.org/10.1016/S0190-7409(03)00012-4

[43] Baba, K., & Kataoka, Y. (2014). Identifying child abuse and neglect risk among postpartum women in Japan using the Japanese version of the Kempe Family Stress Checklist. *Child Abuse & Neglect, 38*(11), 1813-1821. doi:http://dx.doi.org/10.1016/j.chiabu.2014.08.012

[44] Back, S. E., Jackson, J. L., Fitzgerald, M., Shaffer, A., Salstrom, S., & Osman, M. M. (2003). Child sexual and physical abuse among college students in Singapore and the United States. *Child Abuse & Neglect, 27*(11), 1259-1275.

[45] Dankert, E. W., & Bogie, A. (2015). *Preliminary risk assessment fit analysis of the SDM® Family Risk Assessment*. New York, NY.

[46] Ministry of Community Development and Sports. (2002). *National standards for protection of children*. Retrieved from http://app.msf.gov.sg/portals/0/Summary/publication/Resource_Materials_Standards_Protection_Children.pdf.

[47] Gershoff, E. T. (2002). Corporal punishment by parents and associated child behaviors and experiences: a meta-analytic and theoretical review. *Psychological bulletin, 128*(4), 539.

[48] Elliott, J., Tong, C. K., & Tan, P. M. (1997). Attitudes of the Singapore public to actions suggesting child abuse. *Child Abuse & Neglect, 21*(5), 445-464.

[49] Glaser, D. (2002). Emotional abuse and neglect (psychological maltreatment): A conceptual framework. *Child Abuse & Neglect, 26*(6), 697-714.

[50] Karp, D. A., & Tanarugsachock, V. (2000). Mental illness, caregiving, and emotion management. *Qualitative Health Research, 10*(1), 6-25.

[51] Ministry of Social and Family Development. (2016). Factsheet on Positive Parenting Programme (Triple P) pilot. Retrieved from https://www.msf.gov.sg/media-room/Pages/Factsheet-on-Positive-Parenting-Programme-(Triple-P)-Pilot.aspx

Exploring the Challenges Faced and Measure the Level of Depression Among Zimbabwean Family Caregivers of Persons Living with HIV/AIDS Who are on Antiretroviral Medications

Evadne E Ngazimbi
Counselor Education and Family Therapy Central
Connecticut State University
New Britain, CT 06050, U.S.A.

Research has demonstrated that family caregivers suffer from anxiety and depression. In Zimbabwe, family caregivers of People Living with HIV/AIDS carry the psychological, emotional, and physical burdens of doing this work, as the country has been devastated by the HIV/AIDS pandemic. Family caregivers provide the social capital to care for their family members at home. The researcher conducted a mixed methods study among 154 family caregivers of People Living with HIV/AIDS in south-western Zimbabwe. The purpose of the study was to measure the level of depression among family caregivers of People Living with HIV/AIDS who are on antiretrovirals; and to identify the duties caregivers perform as they care for the family members. This extended abstract focuses on the demographics of the sample and the results of the Beck Depression Inventory.

Ethical Considerations

The researcher obtained Institutional Review Board approval from the Human Subjects Council of the relevant university in the North Eastern United States, and from relevant health authorities in Zimbabwe before conducting the research. The researcher gave participants bus fare to travel to the central sites where they completed questionnaires. Participants read the informed consent forms, and the researcher and the research assistant explained the consent form. After reading the forms participants gave verbal consent and kept the forms for future reference. The researcher kept the completed questionnaires (Beck Depression Inventory II and Family Caregivers Questionnaire) in a locked box while in the field, and also kept the data in a laptop with encrypted passwords. This ensured that the researcher kept data private and confidential.

Sample

The sample consisted of rural and urban participants; males and females aged between 18 and 70 years. Participants completed the Beck Depression II (BDI-II) Inventory, and also responded to two open-ended questions which asked about their relationship to the family member and the type of duties they perform during caregiving.

Preliminary Analysis of Data

This extended abstract focuses on demographics of the participants, and on the results of the Beck Depression Inventory. 154 participants completed the Beck Depression Inventory II

(BDI-II). They also completed the Family Caregivers Questionnaire.

Demographics of Participants

There were 154 participants. Seventy-five per cent of the participants were females, while 25% were males. Married participants constituted 78% of the sample, 15% were single, and seven per cent were separated or divorced. The age groups consisted of the following: 0.07% were18 – 24 year olds; 65% were 25-34 year olds; 25% were 35 – 44 year olds; 0.07% were 45 – 54 year olds; and 0.04% were over 55 years old. The relationship between the recipients of care and caregivers varied from husbands (30%), children, including infants to adults (33%), self (30%), wives (3%) and other relatives (4%). All the family

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.51

caregivers cared for family members who were on anti-retroviral medications, including some of the caregivers.

Beck Depression Inventory II Results

Participants completed questionnaires in this order: a) Family Care Givers Questionnaire – they answered the three open-ended questions first, then the demographic section; b) Beck Depression Inventory II. All participants were literate and spoke English well, therefore they answered the English version of the BDI-II.

Preliminary analysis of results showed that over 50% of the sample exhibited moderate depression (scores 21-30), while 10% exhibited severe depression (scores 31-40), which were the highest scores.

Discussion

The researcher was born in Zimbabwe. In Zimbabwean society family members care for each other during difficult times, such as orphaned children, the elderly, and the chronically ill. Sometimes it might not be a member of the nuclear family who takes on these duties, but sometimes it might be an extended family member. Generally, families do not distinguish between nuclear and extended family.

HIV/AIDS in Zimbabwe

Seventy-five per cent of people living with HIV/AIDS globally live in sub-Saharan

Africa (UNAIDS, 2013). Zimbabwe has been at the center of this global pandemic. The

UNAIDS has one of the goals related to HIV/AIDS being to reach15 million people living with HIV with lifesaving antiretroviral treatment by 2015. To achieve this goal Zimbabwe has conducted voluntary counseling and testing for HIV, especially in pregnant and breastfeeding mothers, and young children, and provided antiretroviral (ART) medications (Skovdal et al., 2011) . In 2012 Zimbabwe reached over 80% coverage of with antiretroviral medications for pregnant women living with HIV/AIDs (UNAIDS, 2013).

Since 1997 the economy of Zimbabwe has plummeted, with unemployment rates reaching 90% (UNAIDS, 2013). Although the country has instituted an AIDS levy of 1% for wage earners to support HIV/AIDS programs, this falls far short of the goal as the unemployment rate is 90% (Campbell et al., 2011). Zimbabwe relies on international donor aid 90 to 100% to fund antiretroval (ART) programs to prolong the lives of people living with HIV/AIDS (UNAIDS, 2013). Zimbabwe relies on social capital, the family caregivers of persons living with HIV/AIDS (Campbell et al., 2011). They constitute the backbone of the HIV/AIDS programs in sub-Saharan Africa, and in Zimbabwe. Researchers showed that family caregivers of persons with HIV/AIDS suffer from physical and mental health problems including depression and anxiety (Baumann et al., 2006). The author explored the challenges family caregivers face, and measured the level of depression among them. This research is important because Zimbabwe depends on international aid about 90% to provide antiretroviral medications to pregnant women, breast feeding mothers, young children, adolescents and adults.

Depression Among Family Caregivers

Preliminary analysis of data showed that over 50% of the sample had moderate depression, while 10% exhibited severe depression. The majority of family caregivers were in the age group 25-34 years (65%), and the next group being the 35-44 year olds (25%). These two groups consist of caregivers who are also responsible for earning a living for their families. Caregiving thus interferes with the ability to fulfil other roles. A sobering fact was that some of these family caregivers were also caring for themselves as they were living with HIV/ AIDS, were taking anti-retroviral medications, as well as taking care of either a spouse and/or a child.

This increased the burden of caregiving.

Duties family caregivers undertook included help with activities of daily living (e.g. bathing, toileting, feeding for the very ill) to escorting family members to the nearest health center to obtain medications and for medical check-ups, to supervising them to correctly administer medications, and to ensure they eat as healthy a diet as possible. All these responsibilities lead to feelings of depression as shown in this sample.

Implications for Mental Health Counselors

The researcher will lead a discussion on the implications of the findings for mental health counselors. The researcher will share ideas regarding future research with this population.

Keywords: Family caregivers, People Living with HIV/AIDS, Zimbabwe, social capital,

Beck Depression Inventory II, Depression

References

Akintola, O. (2004). A gendered analysis on the burden of care on family and volunteer caregivers in Uganda and South Africa. University of Kwa Zulu Natal, Durban South Africa.

Campbell, C., Skovdal, M., Madanhire, C., Mugurungi, O., Gregson, S., & Nyamukapa, C. (2011). "We the AIDS people…". How antiretroviral therapy enables Zimbabweans living with HIV/AIDS to cope with stigma. American Journal of Public Health, 101(6), 1004 – 1010.

Evans, R. & Thomas, F. (2009). Emotional interactions and an ethics of care: Caring relations in families affected by HIV and AIDS. Emotion, Space and Society, 2(2), 111 – 119.

Kagee, A. & Martin, L. (2010). Symptoms of depression and anxiety among a sample of South African patients living with HIV. AIDS Care, 22(2).

Kagotho, N. & Ssewamala, F. M. (2012). Correlates of depression among caregivers of children affected by HIV/AIDS in Uganda: Findings from the Suubi-Maka Family Study. AIDS Care, 24(10).

Kipp, W., Matukala Nkosi, T., Laing, L., & Jhangri, G. (2006). Care burden and self-reported health status of informal women caregivers of HIV/AIDS patients in Kinshasa, Democratic Republic of Congo. AIDS Care. 18(7), 694-697.

Merten, S., Kenter, E., McKenzie, O., Musheke, M., Ntalasha, H. and Martin-Hilber, A. (2010), Patient-reported barriers and drivers of adherence to antiretrovirals in sub-Saharan Africa: a meta-ethnography. Tropical Medicine & International Health, 15, 16–33. doi:10.1111/j.1365-3156.2010.02510.x

Moore, A. R., Vosvick, M., & Amey, F. K. (2006). Stress, social support and depression in informal caregivers to people with HIV/AIDS in Lomé, Togo. International Journal of Sociology and Social Policy, 26(1/2), 63-73.

Robson, E. (2004). Hidden child workers: Young carers in Zimbabwe. Editorial Board of Antipode, 227 – 248.

Ssewamala, F. M., Han, C., & Neilands, C. B. (2009). Asset ownership and health and mental health functioning among AIDS-orphaned adolescents: Findings from a randomized clinical trial in Uganda. Social Science & Medicine, 69, 191 – 198.

Robson, E., Ansell, N., Huber, U. S., Gould, W. T. S. & van Blerk, L. (2006), Young caregivers in the context of the HIV/AIDS pandemic in sub-Saharan Africa. Popul. Space Place, 12 93–111. doi:10.1002/psp.392

Skovdal, M., Campbell, C., Nhongo, K., Nyamukapa, C., & Gregson, S. (2011). Contextual and psychosocial influences on antiretroviral therapy adherence in rural Zimbabwe: Towards a systematic framework for programme planners. Int J Health Plann Mgmt, 26, 296–318.

Skovdal, M. & Daniel, M. (2012). Resilience through participation and coping-enabling social environments: The case of HIV-affected children in sub-Saharan Africa. African Journal of AIDS Research, 11(3), 153 – 164.

Skovdal, M. & Ogutu, V. O. (2009). "I washed and fed my mother before going to school": Understanding the psychosocial well-being of children providing chronic care for adults affected by HIV/AIDS in Western Kenya. Globalization and Health, 5(8), 1 – 10.

Streid, J., Harding, R., Agupio, G., Dinat, N., Downing, J., Gwyther, L. ,… & Selman, L. (2014).

Stressors and resources of caregivers of patients with incurable progressive illness in sub-Saharan Africa. Qualitative Health Research, 24(3), 317 – 328.

UNAIDS report on the global AIDS epidemic 2013 (2013). Geneva:
UNAIDS 2013.

Zachariah, R., Ford, N., Philips, M., Lynch, S., Massaquoi, M., Janssens, V., Harries, A.D. (2009). Task Shifting in HIV/AIDS: Opportunties, challenges and proposed actions for sub-Saharan Africa. Transation of the Royal Society of Tropical Medicine and Hygiene, 10(3), 549 – 558.

Punishment and Reward Learning in Young Adults with Depression Symptoms Positive vs. Negative Feedback in Depression

A. Antonesei[1], K. Murayama[1], C.McCabe[1]
[1]Dept. of Psychology
University of Reading
Reading, UK

***Abstract*—Young adults with high levels of depression showed similar responsiveness to immediate and primary taste rewards compared to those with low levels of depression in a reinforcement learning task. However, the participants with high relative to those with low levels of depression showed an avoidance bias to punishing outcomes.**

Keywords - depression, anhedonia, reward, punishment, learning.

I. Introduction

Poor treatment efficacy in major depression might be related to our limited understanding of the core symptoms of depression, such as anhedonia, the inability to experience reward and pleasure [1]. Studies have found that both clinically depressed patients and those with elevated levels of depression show less responsiveness to positively reinforced stimuli compared to healthy controls in reinforcement learning, decision-making and effort-based behavioral tasks [2], [3], [4], [5], [6]. Studies also found that depressed patients respond inappropriately to punishment [7]. Interestingly, [8] found that depressed patients had improved task performance in a learning task using negative yet accurate feedback. However, most of these results come from experimental paradigms that have tested for the effects of incentives separately or using a between-subject design.

Therefore, the main aim of the study was to directly compare the effects of reward and punishment in informing behavioral choices in a reinforcement learning task in participants with high vs. low depression levels. This integrated experimental setup allows us to gain a better understanding of the importance of different incentives to guide behavior in relationship to depression and anhedonia severity. To this end, we have adjusted a probabilistic learning task by Pizzagalli's group by replacing the abstract monetary outcome with primary neutral and reward tastes for correct responses; we additionally introduced an unpleasant taste for incorrect responses [5]. We have shown previously that rewarding and aversive tastes can robustly modulate the brain and behavior [9] and that these processes are dysfunctional in those at increased risk of depression [10], [11], [12], [13].

In line with previous reports, we hypothesized that those with elevated levels of depression relative to those with low levels of depression would respond less to reward reinforcement but improve performance after punishment and that these responses would correlate with anhedonia.

II. Methods

A. Participants

46 participants who scored between 0 - 7 on the Beck Depression Inventory II, BDI-II [14] were included in the low depression group (LD) group. 37 participants who scored between 14 - 44 on the BDI-II were included in the high depression (HD) group. The BDI-II shows high internal consistency and retest reliability for assessing the depression severity in both clinical and non-clinical populations [15]. A score between 0 - 13 is considered within the normal mood range, while a score of at least 14 is an index of mild depression. Participants also evaluated the pleasant and unpleasant tastes before and after each task.

B. Task and procedure

Across 150 trials, split into three blocks, participants had to decide, by button press as fast as possible, if they saw the bigger or the smaller line. In each block, both lines were shown an equal number of times. The target was paired with increased probability of reward outcome (pleasant taste) and low probability of neutral outcome (control taste) in a 4:1 ratio. Similarly, the non-target was paired with an increased probability of neutral outcome and low probability of reward

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-18658
doi: 10.5176/2251-1865_CBP18.56

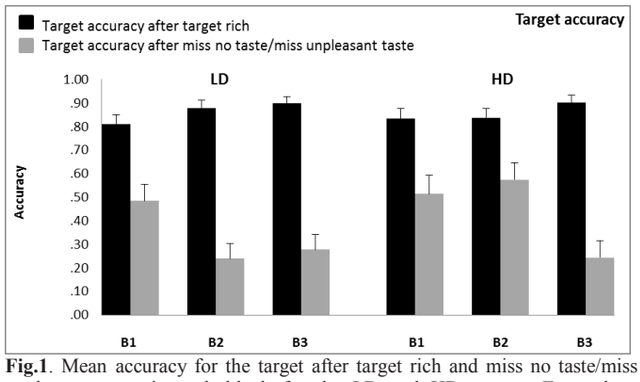


Fig.1. Mean accuracy for the target after target rich and miss no taste/miss unpleasant taste in each block for the LD and HD groups. Errors bars represent standard errors.

outcome in a 4:1 ratio. Critically, unequal frequency of reward between two types of correct responses typically produces a systematic preference for the response paired with the more frequent (or larger) reward [16]. Missing the target in block one led to no outcome (no taste) while missing the target in block two and three led to punishment outcome (unpleasant taste). This negative yet corrective outcome is expected to diminish the rate of missing the target, therefore increasing the reward intake and improving the participants' performance. While incorrectly reporting the target when the non-target was displayed (false alarm: FA) led to no outcome. Participants were instructed to get as much of the pleasant taste as possible, and so they could benefit from reporting the target rather than the non-target when in doubt.

C. Statistical analyses

Data reduction used Excel 2010, while statistical analyses used SPSS. Prior to analyses, trials with reaction time (RT) ≥150ms and ≤1500 were excluded.

To investigate the possible reinforcing effects of reward and punishment outcomes on current choice of line, for each participant, we summed the number of trials in which the target was followed by the pleasant taste (referred to as 'target rich') and the number of trials in which missing the target was followed by no taste in block one (referred to as 'miss no taste') and unpleasant taste in block two and three (referred to as 'miss unpleasant taste'). Furthermore, we calculated the target accuracy by considering separately the correct identification of the target after previous target rich and miss no taste/miss unpleasant taste. Similarly, we calculated the rate of false alarms (probability of incorrectly defining the target) after previous target rich and miss no taste/miss unpleasant taste. The false alarms prompted by previous reward might show a *reward bias* towards the target, while the false alarms prompted by previous punishment might show an *avoidance bias* away from missing the target. Accuracy of the target and the rate of false alarms were entered in mixed ANOVA models.

Finally, to test the relationship between depression severity (BDI-II) and anhedonia on reward and punishment outcomes, we ran Pearson correlations. Anhedonia severity was derived as the sum of four items from BDI-II associated with anhedonic symptoms, i.e., loss of pleasure (item 4), loss of interest (item 12), loss of energy (item 15), loss of interest in sex (item 21) [5].

III. Results

Groups did not differ with respect to gender ratio, age, BMI, chocolate craving and likeness, ratings of pleasant and unpleasant tastes before and after the task, all t (81) < 1.25, all p > .21. As expected, there were significant differences in depression and anhedonia measurements, all t (81) < 13.06, all p < .001.

A. Target accuracy after punishment (target rich vs. miss no taste/miss unpleasant taste)

A 2 X 3 X 2 mixed ANOVA was run on target accuracy with within-subject factor, Condition (with two levels: target rich and miss no taste/miss unpleasant taste), within-subject factor, Block, and between-subject factor, Group. We found a significant Condition X Block X Group interaction, F (2, 162) = 4.18, p = .01, η_p^2=.05. Further mixed ANOVAs showed a significant Condition X Group interaction in block two, F (1, 81) = 9.40, p = .003, η_p^2 = .10, (but not in block one, p = .96 and 3, p = .75), with simple main effects analysis showing a Group effect for target accuracy after miss unpleasant taste. Pairwise comparisons indicated, as expected, that the HD group improved their target accuracy after miss unpleasant taste in block two (M = .57, SE = .07) relative to the LD group (M = .23, SE = .06). Within the LD and the HD group each, repeated measures ANOVA showed a Condition X Block interaction, F (2, 90) = 5.94, p = .004, η_p^2 = .12 and F (1.72, 61.91) = 6.19, p = .003, ε = .88, η_p^2 = .15, respectively. Simple main effects analysis showed an improvement in target accuracy after target rich (LD group, block one : M = .81, SE = .04; block two : M = .88, SE = .03; block three : M = .90, SE = .02; HD group, block one: M = .83, SE = .04, block two : M = .84, SE = .04, block three : M = .90, SE = .04) vs. miss no taste/miss unpleasant taste (LD group, block one : M = .48, SE = .07; block two : M = .24, SE = .06; block three : M = .28, SE = .06; HD group, block one : M = .51, SE = .08, block two : M = .57, SE = .08; block three : M = .24, SE = .07) in each block, for the LD group: F (1, 45) = 12.83, p = .001, η_p^2 = .22, F (1, 45) = 68.23, p < .001, η_p^2 = .60, and F (1, 45) = 69.0, p < .001, η_p^2 = .6; for the HD group: F (1, 36) = 11.73, p = .002, η_p^2 = .25, F (1, 45) = 7.26, p = .01, η_p^2 = .17, F (1, 36) = 57.75, p < .001, η_p^2 = .62 (Fig. 1).

B. False alarm rate after punishment (target rich vs. miss no taste/miss unpleasant taste)

A 2 X 3 X 2 mixed ANOVA was run on the false alarm rate with within-subject factor, Condition (with two levels: target rich and miss no taste/miss unpleasant taste), within-subject factor, Block, and between-subject factor, Group. We found a significant Condition X Group interaction effect, F (1, 81) = 12.66, p = .001, η_p^2 = .13, with simple main effect analysis showing an increase in false alarm rate after miss

This project was sponsored by MRC as part of a Ph.D. funding scheme.

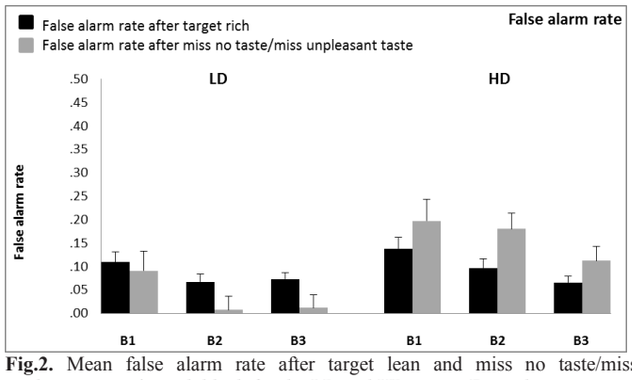


Fig.2. Mean false alarm rate after target lean and miss no taste/miss unpleasant taste in each block for the LD and HD group. Errors bars represent standard errors.

no taste/miss unpleasant taste in the HD group (M = 16, SE = .02) compared to the LD group (M = .04, SE = .02), F (1, 81) = 16.79, $p < .001$, $\eta_p^2 = .17$, but no Group differences in false alarm rate after target rich, $p = .38$ (Fig. 2).

C. Relationship between depression and anhedonia scores and task performance

We found significant Pearson correlations between target accuracy after punishment and depression severity in block two, r (102) = .27, $p = .006$ and anhedonia severity in block two, r (102) = .27, $p = .007$ in all participants. We also found significant Pearson correlations between false alarm rate after miss unpleasant taste and depression severity in block two, r (102) = .31, p = .001, and block three, r (102) = .23, p = .02, and anhedonia severity in block two, r (102) = .34, p = .001, and block three, r (102) = .26, p = .008 in all participants.

IV. Discussion

The main goal of the present study was to examine how young people with elevated vs. low levels of depression and anhedonia respond to rewards and punishers during a probabilistic learning task, relative to healthy controls.

Each group improved their accuracy for the more reinforced stimulus if the preceding trial was a rewarding outcome compared to a punishing outcome. These results are rather surprising since there is common agreement in the literature for blunted reward responsiveness in participants with depression [6]. For example, across a wide range of learning-cue reward and action-reward contingencies [17], participants with depression show deficits in reinforcement learning, i.e., limited capacity of extrapolating/generalizing contingency rules. However, the lack of reduced reward responsiveness in those with depression symptoms in our study may be due to our analysis focusing on the effects of immediate rewards on a trial-by-trial basis. Furthermore, we used a primary reward such as food which could be argued to be more salient than rewards such as money used in previous studies and food rewards have also previously been shown to be less susceptible to contextual framing [18].

As anticipated and in line with previous findings [8], [14], the HD group relative to the LD group improved their task accuracy after previous punishment. Moreover, the modulation of behavior based on previous punishment, but not reward, was mainly associated with depression and anhedonia severity.

The HD group had more false alarms after punishment compared to the LD group whilst there were no group differences in false alarm rate after reward. Similar to previous data, finding hypersensitivity to punishment in depression [17], our results suggest that punishment can induce an avoidance bias. Moreover, the tendency to avoid the option associated with previous punishment was higher in those with increased depression and anhedonia levels.

Taken together, these results suggest that pre-clinical depression might not be characterized by an overall blunted response to rewards. However, processing of negative events might have a detrimental effect on choices that young adults with depression symptoms make and might be a risk factor in this population.

REFERENCES

[1] Nutt, D., Demyttenaere, K., Janka, Z., Aarre, T., Bourin, M., Canonico, P. L., . . . Stahl, S. (2007). The other face of depression, reduced positive affect: the role of catecholamines in causation and cure. *Journal of psychopharmacology, 21*(5), 461-471. doi: 0269881106069938 [pii]

[2] Henriques, J. B., & Davidson, R. J. (2000). Decreased responsiveness to reward in depression. Cognition & Emotion, 14(5), 711-724.

[3] Henriques, J. B., Glowacki, J. M., & Davidson, R. J. (1994). Reward fails to alter response bias in depression. Journal of abnormal psychology, 103(3), 460-466. K. Elissa, "Title of paper if known," unpublished.

[4] Pizzagalli, D. A., Iosifescu, D., Hallett, L. A., Ratner, K. G., & Fava, M. (2008). Reduced hedonic capacity in major depressive disorder: evidence from a probabilistic reward task. Journal of psychiatric research, 43(1), 76-87. doi: 10.1016/j.jpsychires.2008.03.001

[5] Pizzagalli, D. A., Jahn, A. L., & O'Shea, J. P. (2005). Toward an objective characterization of an anhedonic phenotype: A signal detection approach. Biological psychiatry, 57(4), 319-327. doi: 10.1016/j.biopsych.2004.11.026M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[6] Rizvi, S. J., Pizzagalli, D. A., Sproule, B. A., & Kennedy, S. H. (2016). Assessing anhedonia in depression: Potentials and pitfalls. *Neurosci Biobehav Rev, 65*, 21-35. doi: 10.1016/j.neubiorev.2016.03.004

[7] Wachter, T., Lungu, O. V., Liu, T., Willingham, D. T., & Ashe, J. (2009). Differential Effect of Reward and Punishment on Procedural Learning. *Journal of Neuroscience, 29*(2), 436-443. doi: 10.1523/Jneurosci.4132-08.2009

[8] Murphy, F. C., Michael, A., Robbins, T. W., & Sahakian, B. J. (2003). Neuropsychological impairment in patients with major depressive disorder: the effects of feedback on task performance. *Psychological Medicine, 33*(3), 455-467. doi: 10.1017/S0033291702007018

[9] Rolls, E. T., & McCabe, C. (2007). Enhanced affective brain representations of chocolate in cravers vs. non-cravers. *Eur J Neurosci, 26*(4), 1067-1076. doi: 10.1111/j.1460-9568.2007.05724.x

[10] McCabe, C. (2014). Neural correlates of anhedonia as a trait marker for depression Anhedonia: A Comprehensive Handbook Volume II (pp. 159-174): Springer.

[11] McCabe, C. (2016). Neural signals of 'intensity'but not 'wanting'or 'liking'of rewards may be trait markers for depression. Journal of psychopharmacology, 0269881116653079.

[12] McCabe, C., Cowen, P. J., & Harmer, C. J. (2009). Neural representation of reward in recovered depressed patients. Psychopharmacology, 205(4), 667-677. doi: 10.1007/s00213-009-1573-9.

[13] McCabe, C., Woffindale, C., Harmer, C. J., & Cowen, P. J. (2012). Neural Processing of Reward and Punishment in Young People at Increased Familial Risk of Depression. Biological psychiatry. doi: 10.1016/j.biopsych.2012.04.034.

[14] Beevers, C. G., Worthy, D. A., Gorlick, M. A., Nix, B., Chotibut, T., & Maddox, W. T. (2013). Influence of depression symptoms on history-independent reward and punishment processing. Psychiatry research, 207(1), 53-60.

[15] Wang, Y.-P., & Gorenstein, C. (2013). Psychometric properties of the Beck Depression Inventory-II: a comprehensive review. Revista Brasileira de Psiquiatria, 35, 416-431.

[16] Sutton, R. S., & Barto, A. G. (1998). Introduction to Reinforcement Learning: MIT Press.

[17] Eshel, N., & Roiser, J. P. (2010). Reward and punishment processing in depression. Biological psychiatry, 68(2), 118-124.

[18] McClure, S. M., Ericson, K. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2007). Time discounting for primary rewards. Journal of Neuroscience, 27(21), 5796-5804.

Assessing EEG Resting State Connectivity using Independent Component Analysis

Rachel C. Nethery[1], Alana M. Campbell[2] and Young Truong[1]

[1]Department of Biostatistics, Gillings School of Global Public Health

[2]Department of Psychiatry and CIDD

The University of North Carolina at Chapel Hill

Abstract

Blind source separation (BSS) is applied to study brain connectivity. The conventional methods such as independent component analysis (ICA) address the problem by utilizing only the marginal information. An improvement has been suggested by exploiting the temporal or spatial correlation structure and has been demonstrated to be very important for extracting brain networks. A challenge for ICA has been the problem of assessing the significance of the independent components (IC) or latent sources. We propose to examine this problem by using a bootstrap method to resample the data. The procedure allows one to set confidence intervals for parameters or features related to the latent sources. An application based on EEG data will be illustrated to test if the source is truly a signal or noise.

Keywords. Independent component analysis, blind source separation, power spectrum, maximum likelihood, resting state, EEG, fMRI, connectivity, networks.

1 Introduction

Human brain imaging data are often modeled using multichannel or sensor biological observations with each sensor receiving different mixed source signals. Both the sources (neural physiological progresses) and the mixing mechanism (brain networks) are usually not available, but are related to the sensor observations. The main objective of the *blind source separation* (BSS) problem is to recover the sources and the mixing process through the observations. A popular approach to solving this problem is to model the sources as independent components and hence *independent component analysis* (ICA) has found many applications in human brain research based on, for example, functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG) (Truong, 2017).

It is important to know that ICA is an *unsupervised learning* problem and has many interesting useful applications ranging from medical signal analysis to text mining. The method has been used as *dimension reduction* and *feature transformation* techniques. Let **X** and **S** denote the matrices constructed from the observation and source vectors, respectively.

Then ICA can be viewed as a matrix factorization method given by

$$\mathbf{X} = \mathbf{AS}.$$

Many important features can be extracted by interpreting the matrix multiplication in the form of an *outer product*. That is, the matrix **X** is viewed as the sum of columns of **A** times rows of **S**. This viewpoint is very useful for temporal and spatial feature extraction in neuroimaging data analyses. Based on some biological observations or medical image data, there have been several books discussing algorithms for the separation of independent sources (Hyva¨rinen et al., 2001; Stone, 2004; Cichocki et al., 2009; Comon and Jutten, 2010; Yu et al., 2014).

Note that most of these algorithms have been developed by ignoring the auto-correlated or temporal structures of the latent sources. Some have referred to them as *instantaneous ICA* (Comon and Jutten, 2010). From the viewpoint of statistical theory, these methods can be synthesized as an application of *maximum likelihood estimation* (MLE) to the problem of estimating the *probability density function* (pdf) of each latent source. The aforementioned algorithms all employed various parametric functional forms of the source pdf. The desire to estimate these densities with greater flexibility has led to the problem of *nonparametric density estimation* (see Kawaguchi and Truong (2011) and the references therein). Using pdf, however, is not the only way to characterize the sources. In fact, some sources

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.60

may be better described using their physiological or biological temporal or spatial features.

For example, in *electroencephalogram (EEG)* data, various rhythms have distinct spectral characteristics that are easier to identify than their counterparts using pdf. These types of sources will be referred to as colored sources and the process of separating them is called the *independent colored source analysis* (ICSA). R-package coloredICA is available for extracting the IC, but the problem of assessing the features, including some statistical inference about the underlying sources is still not widely accessible.

In this paper, we propose a semi-parametric bootstrapping algorithm which invokes ICA estimates in order to create bootstrap samples of either single subject or group EEG scalp data. By bootstrapping from the independent auto-regressive (AR) time series residuals of each estimated IC and reconstructing the data using the ICA parameter estimates, we are able to preserve the cross-correlation between EEG channels and the auto-correlation within EEG scalp channels, critical features for assessing connectivity, in these bootstrap samples. Bootstrapping from the ICs in a manner that preserves temporal structure was proposed by Meinecke et al. (2002) to gauge the separation performance of the ICA algorithm. We introduce a new method for bootstrapping from the ICs, which preserves their temporal structure, and we demonstrate that the bootstrap samples of EEG data produced by remixing the bootstrapped ICs can be used to form confidence intervals and perform hypothesis tests on connectivity-related parameters.

The rest of the paper is organized as follow. Method of ICSA is described in Section 2, which includes some more models for the latent sources. Method for assessing the sources is given in Section 3. Section 4 illustrates the proposed procedure to a resting state EEG data analysis. The final section contains some discussions, remarks and thoughts for further studies.

2 Colored Independent Component Analysis

Suppose that $\mathbf{X}(t)$ and $\mathbf{S}(t)$, $t = 0,1,...,T-1$, are the M channel observed time series and the latent sources. Suppose that the sources can be extracted so that the ICA equation can be written as

$$\mathbf{S}_{M\times T} = \mathbf{W}_{M\times M}\mathbf{X}_{M\times T}, \qquad \text{where} \qquad \mathbf{W} = \mathbf{A}^{-1}.$$

The ICA problem will be solved by finding the unmixing matrix $\mathbf{W}$. The method we employ is based on the statistical sampling properties of the discrete Fourier transform (DFT) of $\mathbf{X}$. Before describing this further, we make a digression to discuss some models to be considered for the latent sources.

2.1 Models for the Latent Sources

Our discussion will be based on a general stationary time series Y_t, $t \in Z \equiv \{0,\pm1,\pm2,...\}$. See also books on time series analysis (Brillinger, 2001; Brockwell and Davis, 1991). In the case of the source signal, simply replace Y by S.

2.1.1 White Noise

The time series Y is said to be a *white noise* series if Y_t, $t \in Z$, are stochastically independent. If each Y_t has a Guassian distribution, we say Y is a Gaussian white noise.

In defining more general time series models, it is convenient to denote the white noise by

ϵ_t, $t \in \mathbb{Z}$. This is also referred to as the *innovation*. Moreover, we will assume the innovation $_t$ is stationary with mean zero and variance σ^2.

2.1.2 Moving-Average Processes

The time series Y is said to be a *moving-average process* of order q, abbreviated by MA(q), if

$$Y_t = \epsilon_t + \theta_1\epsilon_{t-1} + \cdots + \theta_q\epsilon_{t-q}, \quad t = 0, \pm1, \ldots, \tag{1}$$

where

q ⎮ is a non-negative integer,
$\theta_1, \theta_2, \ldots, \theta_q$: are real numbers,
ϵ_t : is the innovation.

2.1.3 Autoregressive Processes

The time series Y is said to be an *autoregressive process* of order p, abbreviated by AR(p), if Y can be written as

$$Y_t - \phi_1 Y_{t-1} - \cdots - \phi_p Y_{t-p} = \epsilon_t, \quad t = 0, \pm1, \ldots, \tag{2}$$

where

p : is a non-negative integer,
$\phi_1, \phi_2, \ldots, \phi_p$: are real numbers,
ϵ_t : is the innovation.

Before describing the next process, it will be convenient to introduce a more general way to express the above processes. Let $\theta(\cdot)$ and $\varphi(\cdot)$ denote, respectively qth and pth polynomials

$$\theta(z) = 1 + \theta_1 z + \theta_2 z^2 + \cdots + \theta_q z^q, \tag{3}$$

and

$$\phi(z) = 1 - \phi_1 z - \phi_2 z^2 - \cdots - \phi_p z^p, \qquad z \in \mathbb{C}. \tag{4}$$

Let B be the backward shift operator defined by

$$B^j Y_t = Y_{t-j}, \qquad j \in \mathbb{Z}. \tag{5}$$

Thus the MA(q) process can be represented by

$$Y_t = \theta(B)\epsilon_t, \qquad t \in \mathbb{Z}. \tag{6}$$

Similarly, the AR(p) process is given by

$$\phi(B)Y_t = \epsilon_t, \qquad t \in \mathbb{Z}. \tag{7}$$

2.1.4 Autoregressive and Moving-Average Processes

The time series Y is said to be an autoregressive and moving-average process of orders p and q, abbreviated as ARMA(p), if

$$\begin{aligned} &\phi(B)Y_t = \theta(B)\epsilon_t, \\ &Y_t - \phi_1 Y_{t-1} - \cdots - \phi_p Y_{t-p} = \epsilon_t + \theta_1 \epsilon_{t-1} + \cdots + \theta_q \epsilon_{t-q}, \quad t \in \mathbb{Z}, \end{aligned} \tag{8}$$

where p, q, ϕ's, θ's and ϵ_t are given as before. Also, Y_t is an ARMA(p,q) with mean $\mu \in \mathbb{R}$ if $Y_t - \mu$ is ARMA(p,q).

An ARMA(p,q) process is *causal* iff the polynomial $\phi(z)$ does not admit any roots inside the unit disc of the complex plane (Brockwell and Davis, 1991):

$$\phi(z) \neq 0, \qquad |z| \leq 1. \tag{9}$$

2.1.5 Harmonic Processes

The time series Y_t, $t \in \mathbb{Z}$ is a harmonic process if

$$Y_t = A\cos(\lambda t + \phi) + \epsilon_t, \qquad t \in \mathbb{Z}, \tag{10}$$

where A is the amplitude, λ is the frequency, and ϕ is the phase.

2.1.6 Spectral Properties of the Sources

In EEG signals as well as the neuronal activity inside the brain, an effective way to describe the latent sources is based on their frequency or spectral properties. The dynamics of the above models can also be examined this way. Specifically, the parameters included in the above models become an integral part of the so called power spectral density, which is the Fourier transform of the auto-covariance function of the time series. For example, the power spectrum of the ARMA(p,q) is

$$f(\lambda) = \frac{\sigma^2}{2\pi}\left|\frac{\theta(e^{-i\lambda})}{\phi(e^{-i\lambda})}\right|^2, \qquad \lambda \in \mathbb{R} \tag{11}$$

Another useful feature of the frequency interpretation of the signal is it becomes very easy to identify the harmonic processes. For instance, the power spectrum of the harmonic process is

$$f(\omega) = \frac{A^2}{4}[\eta(\omega - \lambda) + \eta(\omega + \lambda)], \qquad \omega \in \mathbb{R} \tag{12}$$

where $\eta(\cdot)$ is the delta comb function. This type of power spectra is called the *line spectra* and is very useful for modeling brain rhythms or waveforms in EEG data analysis.

2.2 Colored Source Models

It is now ready to model the latent colored sources. For example, if the jth source follows some stationary ARMA(p_j,q_j) model so that $\Phi_j(B)S_j(t) = \Theta_j(B)\epsilon_j(t), \quad \epsilon_j(t) \sim WN(0, \sigma_j^2)$, where B is the backshift operator described above, $\Phi_j(z) = 1 - \varphi_{j,1}z - \cdots - \varphi_{j,pj}z^{pj}$, and $\Theta_j(z) = 1 + \theta_{j,1}z + \cdots + \theta_{j,qj}z^{qj}$. Then the power spectrum of this source is given by

$$f_{jj}(\lambda) = \frac{\sigma_j^2}{2\pi}\frac{|\Theta_j(e^{-i\lambda})|^2}{|\Phi_j(e^{-i\lambda})|^2}, \quad \lambda \in \mathbb{R} \tag{13}$$

A very useful model for the sources will the AR(p) processes described above. In this case, the polynomial $\Theta_j \equiv 1$. The likelihood function in our method has fewer parameters to estimate, and that is the leading case in our software implementation. Another important feature is the automatic selection of the order p for each hidden source. Thus, this approach is flexible in modeling the sources, auto-correlation structures. Moreover, in our EEG analysis, it will be extremely useful to model the periodic activity as part of the latent sources by adding the line spectra to the AR ones, which will be further discussed in the application later in the chapter.

2.3 Whittle Likelihood Function

A key element in many statistical data analyses is the estimation of some parameters in the model. An efficient method is based on the likelihood function which, from the conventional approach, is obtained through some specification of probability distributions of the random processes. We consider that is inadequate as the results can be biased if the distributional models are misspecified.

To see how this works, we begin by computing the DFT of $\mathbf{X}(t)$ and its second-order periodogram according to

$$\tilde{\mathbf{X}}_k = \sum_{t=0}^{\cdot}{}^{\cdot}\mathbf{X}(t)\exp(-i2\pi kt/T), \qquad \tilde{\mathbf{p}}_k = \frac{1}{2\pi T}|\tilde{\mathbf{X}}_k|^2, \qquad k = 0, 1, \ldots, T-1.$$

Set $\mathbf{f_{SS}} = \text{diag}\{f_{11},...,f_{MM}\}$, where f_{jj} is the spectral density of the jth source. Using the fact that each component of the periodogram $\tilde{\mathbf{p}}$ is a chi-square random variable distributed according to $f_{jj}(2\pi k/T)\chi^2_2/2$, independently of the other variates for $k = 0,1,...,T-1$ and $j = 1,...,M$, the latent spectral densities and the unmixing matrix will be estimated by maximizing the *Whittle likelihood* (Whittle, 1952):

$$L(\mathbf{W},\mathbf{f_{SS}};\mathbf{X}) = -\frac{1}{2}\sum_{j=1}^{M}\sum_{k=0}^{T-1}\left\{\frac{\mathbf{e}_j^\top \mathbf{W}_j^\top \tilde{\mathbf{p}}_k \mathbf{W}_j \mathbf{e}_j}{f_{jj}(2\pi k/T)} + \ln f_{jj}(2\pi k/T)\right\} + T \ln$$

where $\mathbf{W}_j$ is the j-th column vector of $\mathbf{W}$ and $\mathbf{e}_j$ is the j-th M-dimensional unit vector.

We will illustrate how to extract the latent source spectral information (such as the EEG waveforms) using the ARMA type models described previously.

2.4 Maximum Likelihood Estimation

The unmixing matrix and nuisance parameters related to spectral densities are estimated iteratively by maximizing (14) (Lee et al., 2011). The orthogonality of the unmixing matrix $\mathbf{W}$ can be imposed in two different ways: 1) performing the minimization of the objective function according a Newton–Raphson method with Lagrange multiplier (Lee et al., 2011); and 2) performing eigenvalue decomposition on $\sum_{k=0}^{T-1}\left\{\frac{\tilde{\mathbf{p}}_k}{f_{jj}(2\pi k/T)}\right\}$ and the eigenvector corresponds to the smallest eigenvalue is the estimates of $\mathbf{W}_j$. Both methods have been implemented in the coloredICA R-package (R Core Team, 2016; Lee and Zanini, 2015). To determine convergence, Amari's distance (Amari et al., 1996) is used as the convergence criterion due to this scale and permutation invariance.

3 Bootstrap Methods

While the conventional ICA algorithms assume that the ICs contain no auto-correlation (Bell and Sejnowski, 1995; Cichocki et al., 2009; HyvÂ¨arinen et al., 2001), Lee et al. (2011) developed a semi-parametric colorICA (CICA) algorithm that models the ICs as AR time series processes which was described in Section 2. The R coloredICA package will produce estimates of the mixing matrix and ICs, AË† and SË†, a collection of estimated AR coefficients and the time series variances for each IC. It will also provide a matrix of smoothed power spectra estimates for each IC, GË† . Allowing for auto-correlation within ICs is critical in the analysis of resting state EEG data, because the electrical signals emitted by resting state brain activity are known to be cyclic processes. Hence, we focus the development of our bootstrapping algorithm around CICA.

The data, such as the recorded EEG scalp channels, contain both cross-correlation and auto-correlation, and each of these features are critical to properly characterizing connectivity. Thus, any useful bootstrapping algorithm must preserve both the channel crosscorrelation and auto-correlation in the bootstrapped datasets. In order to do so, our algorithm must take into consideration both the mixing of signals, which induces the crosscorrelation between the channels, and the temporal correlation in these signals, which induces the auto-correlation within the channels.

The following semi-parametric ICA-based procedure for creating a bootstrapped dataset is similar to the semi-parametric procedure recommended for bootstrapping in a linear model framework. First, CICA should be applied to the matrix of resting state EEG data, say $\mathbf{X}$. Because the ICs are independent, we can construct a bootstrap sample of each of one and mix them to obtain a bootstrap sample of the original data that preserves the channel crosscorrelations. To create a bootstrap sample of each IC that retains its time series structure, its estimated AR model residuals should be resampled with replacement and plugged into the estimated AR model (Efron and Tibshirani, 1986), initializing the bootstrapped time series using the block initialization method (Stine, 1987). Finally, to construct the bootstrap sample of the data, $\mathbf{X}^*$, the bootstrapped ICs should be concatenated into a matrix $\mathbf{S}^*$ and multiplied by $\hat{\mathbf{A}}$, i.e. $\mathbf{X}^* = \mathbf{A}\hat{\mathbf{S}}^*$. A large number, B, of bootstrapped datasets can be constructed by repeating this process B times. A summary of this method can be found in Table 1.

After constructing B bootstrap samples in this manner, direct connectivity statistics, such as the squared coherence between channels, may be estimated for each bootstrap sample. The standard deviation of these bootstrap estimates can be used as SEs for each connectivity statistic, and CIs can be formed by applying the percentile method (Efron and Tibshirani, 1986).

To compute SEs and CIs for the ICA parameters, which are needed for the ICA approach to connectivity, more involved computations using the bootstrap samples are needed. In particular, CICA must be performed on each bootstrapped dataset, to obtain B bootstrap estimates for each CICA parameter. This yields the bootstrap parameter estimates: $\mathbf{A}^*_1, \ldots, \mathbf{A}^*_B$,

$\mathbf{S}^*_1, ..., \mathbf{S}^*_B$, $\phi^*_1, ..., \phi^*_B$, $\sigma^{*2}_1, ..., \sigma^{*2}_B$, and $\mathbf{G}^*_1, ..., \mathbf{G}^*_B$. One final complication obstructs the computation of SEs and CIs for the ICA parameters from these bootstrap estimates – namely, the IC permutation ambiguity in ICA.

In ICA, the ICs are not estimated in any consistent order (unlike principal component analysis, in which the components are estimated in order of the amount of the variability in the observed data they explain). Thus, due to the jittering of the observed data through bootstrapping, the ordering of the ICs may be different in the bootstrap estimates from each bootstrapped dataset. Then, the ICs estimated from all the bootstrapped datasets (and their corresponding parameters) must be aligned or matched prior to computing SEs or CIs to ensure that bootstrap parameters estimates for corresponding ICs are being summarized. To achieve a common permutation of the ICs in all the bootstrap estimates, the bootstrap estimated ICs (and their corresponding parameters) should be placed in the same order as the original estimated ICs.

Although the cross-correlation between the original estimated ICs ($\hat{\mathbf{S}}$) and the bootstrap estimated ICs ($\mathbf{S}^*_1, \ldots, \mathbf{S}^*_B$) might seem like a natural measure to use to perform this permutation, the cross-correlation between these time series may not, in fact, be a relevant measure of their similarity. This is a result of the fact that there may be little to no cross-correlation between a time series and a bootstrap sample of it, due to differences in the starting values of the two series. Instead, the permutation of the bootstrap estimates should be performed based on the magnitude of the correlation between the original estimated power spectra of the ICs ($\hat{\mathbf{G}}$) and the bootstrap estimated power spectra of the ICs ($\mathbf{G}^*_1, ..., \mathbf{G}^*_B$), as the power spectra of a time series is unaffected by its starting value.

Then, the permutation of the bootstrap estimates should proceed as follows. For each set of bootstrap estimates, choose the row of $\mathbf{G}^*$ with the highest magnitude of correlation with the first row of $\hat{\mathbf{G}}$, say row i, and make row i of $\mathbf{G}^*$ the first row of the new permuted power spectra matrix, $\mathbf{G}^{*perm}$. Repeat this matching process for the second row of $\hat{\mathbf{G}}$, removing row i of $\mathbf{G}^*$, which was chosen in the first iteration, from consideration, and now placing the most highly correlated row of $\mathbf{G}^*$ into the second row of $\mathbf{G}^{*perm}$. Continue this process for each of the k rows of $\hat{\mathbf{G}}$, removing a row of $\mathbf{G}^*$ from consideration in all future repetitions after it has been chosen, so that each row of $\mathbf{G}^*$ appears as exactly one row of $\mathbf{G}^{*perm}$. Upon completion of this process, the estimated power spectrum for a given IC should be in the same row in $\hat{\mathbf{G}}$ and $\mathbf{G}^{*perm}$. Of course, all other bootstrap parameter estimates in the set must be permuted accordingly.

After each set of bootstrap estimates has been permuted in this way, SEs may be computed for the IC AR parameters by taking the standard deviation of the bootstrap estimates, and CIs may be formed using the percentile method (Efron and Tibshirani, 1986). These uncertainty measures can be computed pointwise for the IC power spectra in $\mathbf{G}$. This procedure is summarized in Table 2. Finally, the SEs and CIs can be used to test statistical hypotheses about the ICs.

In particular, to form a test for the presence of a certain type of brain activity in an IC, we adapt a method commonly used in the time series literature to test whether a peak in a power spectrum is significant. In this method, a lower 95% confidence limit is computed for the power spectrum in the frequency range around the peak, and if that confidence limit exceeds a chosen "baseline" value for the power spectrum, the null hypothesis of no significant peak is rejected (Shumway and Stoffer, 2011). This method, to our knowledge, has not previously been applied in the EEG setting.

In resting state EEG data, we want to know whether the power spectrum for a given IC contains a significant peak in the frequency range of a certain type of brain activity.

Thus, we will test whether the IC's power spectrum significantly exceeds its AR noise level (our chosen baseline value) anywhere in the frequency range of that activity type. This is equivalent to testing whether the difference in the power spectrum and the AR model noise is significantly greater than zero anywhere in that frequency range. Thus, for j-th IC with AR variance σ_j^2 and spectrum value $g_j(r_h)$ at frequency r_h, we test the hypothesis

$$H0 : gj(rh) \leq \sigma j2 \quad (15)$$

$$g_j(r_h) - \sigma_j^2 \leq 0 \quad (16)$$

To perform this test, we can compute a one-sided lower 95% bootstrap confidence limit for the difference in the estimated power spectrum (at each frequency of interest) and the AR noise, and, using zero as our critical value, we reject the null only if this lower confidence limit exceeds zero. The significance level can be Bonferroni corrected for multiple comparisons if many frequencies are being considered. A rejected null hypothesis

implies that the IC under consideration exhibits "significant" brain activity of the tested type.

4 Resting State EEG Analysis

Since the early 2000s, following a series of publications providing a theoretical justification for the study of the brains at-rest network, known as its default network (Gusnard et al., 2001; Gusnard and Raichle, 2001; Raichle et al., 2001), the study of resting state brain connectivity has exploded (Buckner et al., 2008). The resulting body of literature has demonstrated that not only is the characterization of resting state networks integral to the understanding of how tasks impact the brains functioning, but also that alterations in resting state networks are associated with a number of diseases, suggesting that resting state research will bring us closer to understanding some of the most perplexing psychological and neurological conditions (Buckner et al., 2008). For instance, autism (Assaf et al., 2010; Kennedy et al., 2006), attention deficit hyperactivity disorder (Tian et al., 2006), schizophrenia (Bluhm et al., 2007; Garrity et al., 2007), dementia (Greicius et al., 2004), and a number of other disorders, as described by Broyd et al. (2009), have been associated with default network abnormalities.

Resting state connectivity research has historically been dominated by functional magnetic resonance imaging (fMRI) studies (Broyd et al., 2009), a natural choice for identifying functionally connected brain region thanks to the fMRI's high spatial resolution. However, fMRIs suffer from low temporal resolution, and, as a consequence, high frequency resting state connectivity is likely to be missed by such studies. Electroencephalogram (EEG) recordings, which use metal electrodes to record scalp electrical activity at lower spatial resolution but very high temporal resolution, have more recently been recognized as a means to obtain insight into high frequency changes in resting state network activity (Britz et al., 2010; Laufs, 2010; Musso et al., 2010; Yuan et al., 2012). The default network for the brain's electrical activity, as characterized by EEG, was first proposed by Chen et al. (2008).

During rest, EEG scans record electrical signals produced by a variety of different types of brain activity, and these different activity types are distinguishable by the unique frequencies prominent in the resulting signals (Chen et al., 2008; Lusted and Knapp, 1996). Delta (0.53.5Hz), theta (4-7Hz), alpha (7.5-12Hz), beta (13-34Hz), and gamma (35-45Hz) activity have all been found to be present during rest (Chen et al., 2008). The goal of resting state EEG connectivity analyses is often to characterize the default networks for these different types of activity (Chen et al., 2008, 2013; Congedo et al., 2010).

The first step of an EEG connectivity analysis to apply ICA to the channel data. Following the application of ICA, one challenge to characterizing resting state connectivity is identifying the type(s) of resting state brain activity reflected in each IC (Congedo et al., 2010). Although the power spectrum of the ICs can be assessed to determine what frequencies are most powerful in a signal, providing some insight into the type(s) of brain activity that generated it, the spectrum of a single IC may exhibit power peaks in multiple frequency ranges of interest, as demonstrated by Congedo et al. (2010). Moreover, some of these peaks may be small, making it difficult to determine which type(s) of activity are reflected in the IC. This type of imperfect separation of brain activity signals is a result of multiple activity types demonstrating similar spatial activity across the scalp and, therefore, being grouped together into a single IC.

In connectivity analyses, decisions about the type(s) of activity represented in an IC are typically made simply by eyeballing power spectrum plots (Chen et al., 2013; Congedo et al., 2010), a strategy that could easily lead to misplaced inference, because it fails to account for the uncertainties associated with the IC estimates.

Here we demonstrate how our bootstrap approach allows for statistically sound identification of ICs containing alpha activity in an EEG connectivity analysis. The following analyses are performed using R (R Core Team, 2016), MATLAB (The MathWorks Inc., 2015), and EEGLAB (Delorme and Makeig, 2004) softwares. Resting state, eyes open EEG data were recorded from a single subject using an EEG cap with 32 electrodes, including vertical and horizontal electro-oculograms. Channels were referenced to the right mastoid (M2). Samples were collected at a rate of 500Hz with a 0.1570Hz bandpass recording filter. A 1Hz high pass filter was applied to the data to remove low frequency activity, such as slow drift, and the data were thinned to include only 10,000 time points.

We apply the CICA bootstrap to these data, including a pre-whitening step in the CICA algorithm. Pre-whitening is a common ICA pre-processing technique (Hyvarinen and Oja, 2000), which we apply to ensure that our assumption that the mixing matrix is orthogonal is met. Figures 1 and 2 contain the resulting lower 95% bootstrap confidence limits for the difference in the spectrum and the AR error variance for ICs 1-16 and ICs 17-32, respectively. Figure 3 provides the topographical maps ($A\hat{}$) corresponding to each of the ICs. While many of the IC spectra exhibit a "bump" in the alpha range, the lower 95% confidence limit for the difference in the spectrum and the AR error variance, which can be used for hypothesis testing, suggest that these bumps are not indicative of significant alpha activity in most of the ICs. Only nine of the ICs– 3, 4, 6, 8, 9, 10, 11, 12, and 14 – have a 95% confidence limit exceeding zero in the alpha range. Thus, we conclude that only these ICs contain significant alpha activity. The topographical maps for the ICs identified by our method as containing alpha activity largely agree with previous research, with alpha activity most prominent in the posterior regions during rest (Barry et al., 2007).

This analysis suggests that conclusions drawn from our method about which ICs contain brain activity may differ dramatically from the conclusions one might make by simply "eyeballing" IC spectra plots. Consider, for instance, IC 15. While the spectrum

for this IC exhibits a spike in alpha range and the spatial map exhibits high values in the posterior region of the head, which would likely lead us to assume this IC contains alpha activity without a formal testing mechanism, our test shows that, after appropriately accounting for the variability in the IC, this peak is not statistically significant. Erroneous conclusions about the type(s) of activity contained in an IC could result in misleading connectivity inference; thus, our formal hypothesis test for brain activity in the ICs is needed in order to increase the reliability of EEG connectivity studies.

5 Discussion

In this paper, we proposed a semi-parametric bootstrapping algorithm for constructing bootstrap samples of resting state EEG data and creating confidence intervals for CICA parameters, which can be used in resting state EEG connectivity analyses to detect brain activity in ICs. It is observed that the bootstrap samples created with this algorithm preserve correlation structures in the data that are critical to assessing connectivity, while simpler bootstrapping methods do not preserve these features. Simulations have been conducted to demonstrate the reliable performance of the confidence intervals for the IC time series parameters and to confirm that our hypothesis testing approach has high power, even when SNRs in the ICs are low. Finally, we applied the hypothesis testing method to an EEG resting state dataset to identify ICs containing significant alpha activity. This analysis revealed that a formal hypothesis testing mechanism like ours is needed in order to take into account the variability in the IC-related estimates when using them to make a decision about the presence of brain activity, otherwise erroneous conclusions could easily be made. Such erroneous decisions threaten the validity of results and inference made in downstream connectivity analyses.

The use of uncertainties in ICA has previously been limited because asymptotics for these methods are difficult and unappealing. This often leads to ad hoc and subjective decision making based on ICA results. To our knowledge, ours is the first attempt to develop a bootstrapping approach that can be used to measure uncertainty, create CIs, and perform hypothesis tests on either single subject or group ICA parameters. Because group ICA is typically performed by simply concatenating the data across subjects into a single matrix and applying ICA to all the data simultaneously, our bootstrap approach could easily be applied in this setting. While we have focused on an application to EEG resting state connectivity, the potential demonstrated by our method to accurately capture uncertainty in ICA parameters could have much more far-reaching effects. Variations of this approach could be used to construct CIs and hypothesis tests for task-based EEG and fMRI analyses.

One limitation to our approach that is crucial to address in order to extend the applicability of this method is that it cannot yet accommodate pre-ICA dimension reduction procedures. Pre-ICA dimesion reduction can be achieved using principal component analysis or singular value decomposition. Such procedures are extremely common in fMRI applications (McKeown et al., 1998), where the high spatial resolution can make direct application of ICA computationally untenable, and are increasingly appearing in EEG analyses as well, as the number of recording channels increases (De Vos et al., 2011; Dyrholm et al., 2007; Kachenoura et al., 2008; McMenamin et al., 2010; Xu et al., 2004). Future work will investigate an extension of this approach to account for pre-ICA dimension reduction.

6 Tables and Figures

Table 1: Steps to create a bootstrap sample of EEG data.

1. Run CICA on the observed EEG scalp channel data, **X**.
2. For each IC, resample from its estimated AR model residuals.
3. Plug resampled residuals back into the fitted AR model to get a bootstrap sample of the IC, $S_j^*(t)$
4. Concatenate the $S_j^*(t)$ into a matrix $\mathbf{S}^*$
5. Create a bootstrap sample, $\mathbf{X}^*$, of the data by plugging in $\mathbf{X}^* = \mathbf{A}\hat{\mathbf{S}}^*$

Table 2: Steps to form bootstrap uncertainties for CICA parameters.

1. Form a large number, *B*, of bootstrap samples of the data using the method described in Table 1
2. Run CICA on each bootstrap sample to get *B* bootstrap estimates of all parameters
3. Permute each set of bootstrap estimates to order the ICs and corresponding parameters in the same way they are ordered in the original estimates (based on the correlation in the IC spectra in the original and bootstrap estimates)
4. Using the permuted bootstrap estimates, compute bootstrap SEs and apply the percentile method to create CIs for the IC AR parameters and power spectra (pointwise)

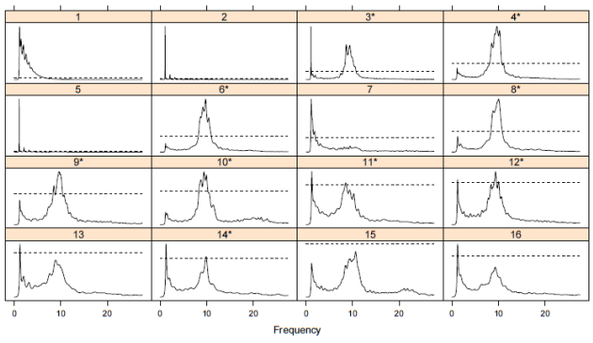


Figure 1: Lower 95% confidence limits for the di erence in the spectrum and the AR error variance (solid line) for ICs 1-16 with zero indicated by a dotted line. ICs containing signi cant alpha activity are labeled with a

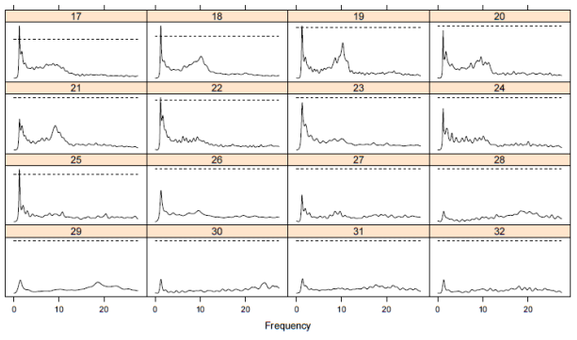
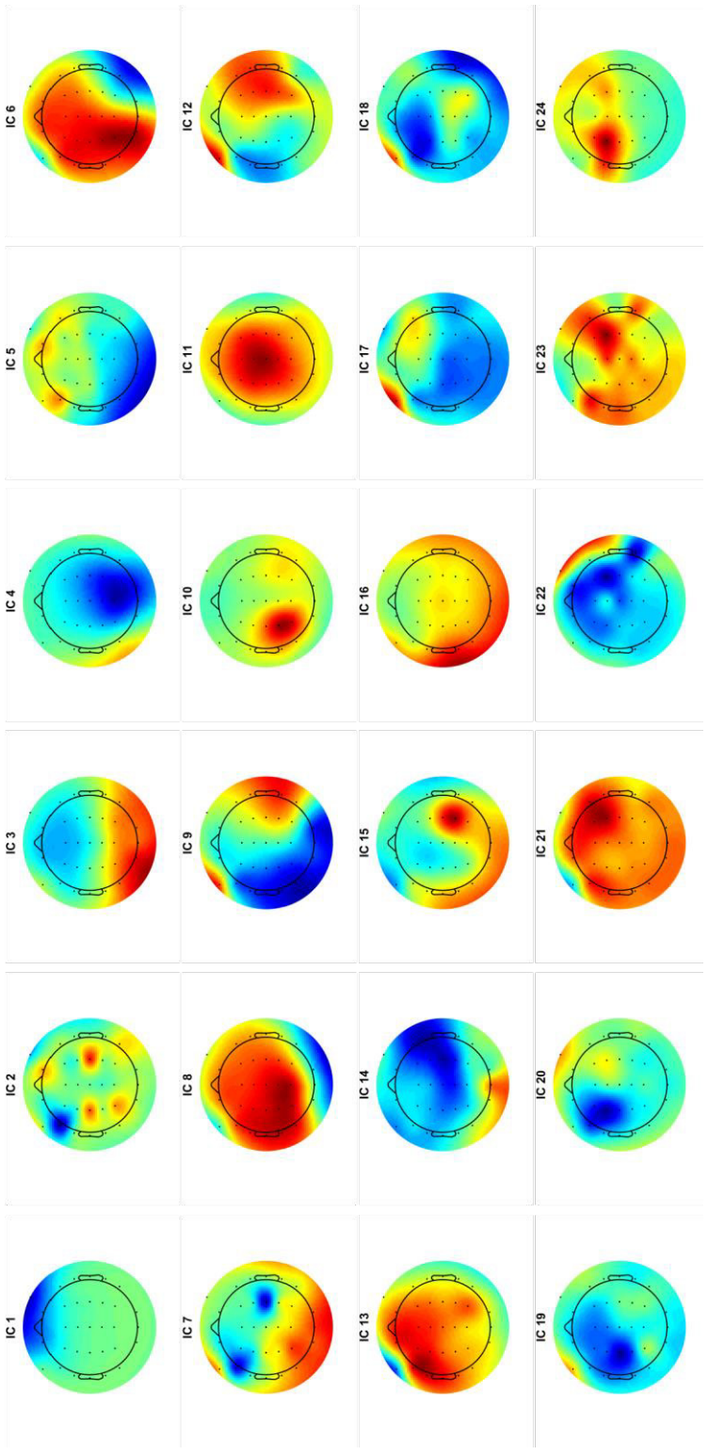


Figure 2: Lower 95% confidence limits for the difference in the spectrum and the AR error variance (solid line) for ICs 17-32 with zero indicated by a dotted line. ICs containing significant alpha activity are labeled with a *.



References

S. Amari, A. Cichocki, H.H. Yang, et al. A New Learning Algorithm for Blind Signal Separation. *Advances in Neural Information Processing Systems*, 8:757–763, 1996.

Assaf, M., K. Jagannathan, V. D. Calhoun, L. Miller, M. C. Stevens, R. Sahl, J. G. O'boyle, R. T. Schultz, and G. D. Pearlson (2010). Abnormal functional connectivity of default mode sub-networks in autism spectrum disorder patients. *Neuroimage 53*(1), 247–256.

Barry, R. J., A. R. Clarke, S. J. Johnstone, C. A. Magee, and J. A. Rushby (2007). EEG differences between eyes-closed and eyes-open resting conditions. *Clinical Neurophysiology 118*(12), 2765–2773.

Bell, A. J. and T. J. Sejnowski (1995). An information-maximization approach to blind separation and blind deconvolution. *Neural Computation 7*(6), 1129–1159.

Bluhm, R. L., J. Miller, R. A. Lanius, E. A. Osuch, K. Boksman, R. Neufeld, J. Th´eberge, B. Schaefer, and P. Williamson (2007). Spontaneous low-frequency fluctuations in the BOLD signal in schizophrenic patients: Anomalies in the default network. *Schizophrenia Bulletin 33*(4), 1004–1012.

D.R. Brillinger. *Time Series: Data Analysis and Theory*. Society for Industrial and Applied Mathematics, 2001.

Britz, J., D. Van De Ville, and C. M. Michel (2010). BOLD correlates of EEG topography reveal rapid resting-state network dynamics. *Neuroimage 52*(4), 1162–1170.

P.J. Brockwell and R.A. Davis. *Time Series: Theory and Methods*. Springer, second edition, 1991.

Broyd, S. J., C. Demanuele, S. Debener, S. K. Helps, C. J. James, and E. J. SonugaBarke (2009). Default-mode brain dysfunction in mental disorders: A systematic review. *Neuroscience & Biobehavioral Reviews 33*(3), 279–296.

Buckner, R. L., J. R. Andrews-Hanna, and D. L. Schacter (2008). The brain's default network. *Annals of the New York Academy of Sciences 1124*(1), 1–38.

Chen, A. C., W. Feng, H. Zhao, Y. Yin, and P. Wang (2008). EEG default mode network in the human brain: Spectral regional field powers. *Neuroimage 41*(2), 561–574.

Chen, J.-L., T. Ros, and J. H. Gruzelier (2013). Dynamic changes of ICA-derived EEG functional connectivity in the resting state. *Human Brain Mapping 34*(4), 852–868.

A. Cichocki, R. Zdunek, A. H. Phan, and S. Amari. *Nonnegative Matrix and Tensor Factorizations: Applications to Exploratory Multi-Way Data Analysis and Blind Source Separation*. John Wiley & Sons, 2009.

P. Comon and C. Jutten. *Handbook of Blind Source Separation: Independent Component Analysis and Applications*. Academic Press, 2010.

Congedo, M., R. E. John, D. De Ridder, and L. Prichep (2010). Group independent component analysis of resting state EEG in large normative samples. *International Journal of Psychophysiology 78*(2), 89–99.

Delorme, A. and S. Makeig (2004). EEGLAB: An open source toolbox for analysis of singletrial EEG dynamics including independent component analysis. *Journal of Neuroscience Methods 134*(1), 9–21.

De Vos, M., L. De Lathauwer, and S. Van Huffel (2011). Spatially constrained ICA algorithm with an application in EEG processing. *Signal Processing 91*(8), 1963–1972.

Dyrholm, M., S. Makeig, and L. K. Hansen (2007). Model selection for convolutive ICA with an application to spatiotemporal analysis of EEG. *Neural Computation 19*(4), 934–955.

Efron, B. and R. Tibshirani (1986). Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. *Statistical Science*, 54–75.

Garrity, A. G., G. D. Pearlson, K. McKiernan, D. Lloyd, K. A. Kiehl, and V. D. Calhoun (2007). Aberrant "default mode" functional connectivity in schizophrenia. *American Journal of Psychiatry 164*(3), 450–457.

Greicius, M. D., G. Srivastava, A. L. Reiss, and V. Menon (2004). Default-mode network activity distinguishes Alzheimer's disease from healthy aging: Evidence from functional MRI. *Proceedings of the National Academy of Sciences of the United States of America 101*(13), 4637–4642.

Gusnard, D. A., E. Akbudak, G. L. Shulman, and M. E. Raichle (2001). Medial prefrontal cortex and self-referential mental activity: Relation to a default mode of brain function. *Proceedings of the National Academy of Sciences 98*(7), 4259–4264.

Gusnard, D. A. and M. E. Raichle (2001). Searching for a baseline: Functional imaging and the resting human brain. *Nature Reviews Neuroscience 2*(10), 685–694.

Hyvarinen, A. and E. Oja (2000). Independent component analysis: Algorithms and applications. *Neural Networks 13*(4-5), 411–430.

A. Hyv¨arinen, J. Karhunen, and E. Oja. *Independent Component Analysis*. Wiley, New York, 2001.

Kachenoura, A., L. Albera, L. Senhadji, and P. Comon (2008). ICA: A potential tool for BCI systems. *IEEE Signal Processing Magazine 25*(1), 57–68.

A. Kawaguchi and Y. K. Truong. Logspline independent component analysis. *Bulletin of Informatics and Cybernetics*, 43:83–94, 2011.

Kennedy, D. P., E. Redcay, and E. Courchesne (2006). Failing to deactivate: Resting functional abnormalities in autism. *Proceedings of the National Academy of Sciences 103*(21), 8275–8280.

Laufs, H. (2010). Multimodal analysis of resting state cortical activity: What does EEG add to our knowledge of resting state BOLD networks? *Neuroimage 52*(4), 1171.

S. Lee, H. Shen, Y.K. Truong, M.M. Lewis, and X. Huang. Independent Component Analysis Involving Autocorrelated Sources with an Application to Functional Magnetic Resonance Imaging. *Journal of the American Statistical Association*, 106(495):1009–1024, 2011.

S. Lee, P. Zanini, H. Shen and Y. Truong. *coloredICA: Implementation of Colored Independent Component Analysis and Spatial Colored Independent Component Analysis*, 2015. R package version 1.0.0.

Lusted, H. S. and R. B. Knapp (1996). Controlling computers with neural signals. *Scientific American 275*(4), 82–87.

The MathWorks Inc. (2015). *MATLAB Release 2015b*. Natick, Massachusetts, United States: The MathWorks Inc.

McKeown, M. J., T. J. Sejnowski, et al. (1998). Independent component analysis of fMRI data: Examining the assumptions. *Human Brain Mapping 6*(5-6), 368–372.

McMenamin, B. W., A. J. Shackman, J. S. Maxwell, D. R. Bachhuber, A. M. Koppenhaver, L. L. Greischar, and R. J. Davidson (2010). Validation of ICA-based myogenic artifact correction for scalp and source-localized EEG. *Neuroimage 49*(3), 2416–2432.

Meinecke, F., A. Ziehe, M. Kawanabe, and K. Mu¨ller (2002). A resampling approach to estimate the stability of one-dimensional or multidimensional independent components. *IEEE Transactions on Biomedical Engineering 49*(12), 1514–1525.

Musso, F., J. Brinkmeyer, A. Mobascher, T. Warbrick, and G. Winterer (2010). Spontaneous brain activity and EEG microstates: A novel EEG/fMRI analysis approach to explore resting-state networks. *Neuroimage 52*(4), 1149–1161.

R Core Team. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria, 2016. URL http://www.R-project.org/. ISBN 3-900051-07-0.

Raichle, M. E., A. M. MacLeod, A. Z. Snyder, W. J. Powers, D. A. Gusnard, and G. L. Shulman (2001). A default mode of brain function. *Proceedings of the National Academy of Sciences 98*(2), 676–682.

Shumway, R. and D. Stoffer (2011). *Time Series Analysis and Its Applications, 3rd Edition*. Springer.

Stine, R. (1987). Estimating properties of autoregressive forecasts. *Journal of the American Statistical Association 82*(400), 1072–1078.

J. V. Stone. *Independent Component Analysis: A Tutorial Introduction*. MIT Press, Cambridge, MA, 2004.

Tian, L., T. Jiang, Y. Wang, Y. Zang, Y. He, M. Liang, M. Sui, Q. Cao, S. Hu, M. Peng, et al. (2006). Altered resting-state functional connectivity patterns of anterior cingulate cortex in adolescents with attention deficit hyperactivity disorder. *Neuroscience Letters 400*(1), 39–43.

Y. Truong and M. Lewis. *Statistical Techniques for Neuroscientists*. Taylor & Francis, NY, USA, 2017.

P. Whittle. Some Results in Time Series Analysis. *Skand. Aktuarietidskr*, 35:48–60, 1952.

Xu, N., X. Gao, B. Hong, X. Miao, S. Gao, and F. Yang (2004). BCI competition 2003-data set IIb: Enhancing P300 wave detection using ICA-based subspace projections for BCI applications. *IEEE Transactions on Biomedical Engineering 51*(6), 1067–1072.

X. Yu, D. Hu, and J. Xu. *Blind Source Separation: Theory and Applications*. John Wiley & Sons, 2014.

Yuan, H., V. Zotev, R. Phillips, W. C. Drevets, and J. Bodurka (2012). Spatiotemporal dynamics of the brain at restexploring

EEG microstates as electrophysiological signatures of BOLD resting state networks. *Neuroimage 60*(4), 2062–2072.

Early Onset of Bilingualism and Frequent Language Switching Confers Executive Control Advantage

A Principal Component Analysis of Two Bilingual Populations

Katalin Tamasi, Liyang Zhang, and W. Quin Yow
Humanities, Arts and Social Sciences
Singapore University of Technology and Design
Singapore

Abstract—**Considerable evidence has been accumulated on the existence of a bilingual advantage in executive control. However, studies are inconclusive as to the source of such advantage: What aspects of bilingualism – onset, usage, proficiency, and language switching characteristics – give rise to cognitive benefits? We investigated this question with two bilingual populations, Singaporean and non-Singaporean individuals living in Singapore (71 Singaporeans and 60 non-Singaporeans) performing a series of executive control tasks. Even though these individuals study and work at the same institution, their language background and experience differ markedly. Language variables, along with demographic and personality variables, were submitted to respective Principal Component Analyses to explore the underlying structure of our data. After stepwise selections to identify the most parsimonious models, onset of bilingualism and language switching behavior emerged as significant language predictors of executive control in both bilingual groups. Fluid intelligence and video-gaming skills were also shared as significant predictors across the two groups, whereas no overlap was found in the 8 personality traits that also emerged as predictors between the two bilingual groups. Overall, despite significant differences in the language background of Singaporean and non-Singaporean bilinguals, the language predictors affecting their executive functioning proved remarkably comparable.**

Keywords-bilingualism; executive control; Principal Component Analysis

I. INTRODUCTION

Across the lifespan, bilinguals appear to perform better in executive control tasks than their monolingual counterparts [1], [2], [3], [4]. After all, bilinguals have to constantly monitor language use, actively select one language and suppress the other, and update the selection according to the needs of the communication partner and context [5], [6], [7]. Despite considerable research in the field, there is no clear consensus what mechanisms underlie the bilingual advantage in executive control. Some argue that because of the regular switching between their languages, bilinguals become experts in controlling their attention that leads to more efficient processing and thus superior metacognitive skills [7], [8]. Some findings indicate across-the-board superior performance for bilinguals in executive control [3], [9], while some suggest a more circumscribed advantage, mostly evident in cognitively demanding tasks [10]，[11], and before or after peak cognitive functioning has been reached [12]. Still others find scant evidence for bilingual advantage in executive control [13].

Such disparate findings come as no surprise to the bilingualism researcher. It is challenging to study bilingualism due to its multiple independent aspects: People can be exposed to two (or more) languages from birth simultaneously or acquire them successively, they can be more proficient in one than in the other, use one more than the other, and switch between the two regularly or not switch at all. There have been recent attempts to quantify these aspects of language background using detailed self-reports of bilingualism and distill them into four distinct variables [14], [15]: onset of bilingualism, balancedness of language proficiency, balancedness of language use, and frequency of language switching (definitions are provided in the Method section). When bilingualism is characterized by the above components, onset of bilingualism, balancedness of language usage, and balancedness of language proficiency emerged as significant predictors in executive control performance of young adults [14]. Using structural equation modeling, the underlying construct “balanced bilingualism” was created from the usage and proficiency variables due to their collinearity, while onset of bilingualism independently explained part of the variance in executive functioning. Using multiple hierarchical regression analyses to control for some potentially confounding variables (such as cognitive health, fluid intelligence, processing speed, and age), balancedness of language use predicted the executive functioning performance of the elderly as well [15].

Our research aims to build and expand on past findings in two respects. First, we introduce a comprehensive set of demographic and personality variables alongside language variables to determine their relative importance in predicting executive functioning. It is possible that such variables are responsible for effects that have been attributed to language variables. Second, due to our unique participant pool, we can assess what indicators of bilingualism predict executive functioning in two groups that differ in their experience with bilingualism: Singaporeans and non-Singaporeans living in

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.61

Singapore. The two groups arguably diverge in their experiences and attitudes to language as due to long-term, consistent bilingual policies in Singapore [16], Singaporeans may be more likely to be early bilinguals and use their languages in a more balanced manner than non-Singaporeans.

We deemed Principle Component Analysis (PCA) to be the most reasonable statistical approach to analyze our data. PCA is a multivariate statistical method, aiming to reduce the dimensionality in the data, and has been commonly applied to social science studies [17], [18]. Information is reshaped into a set of new variables, so-called principal components (PCs). Each PC is mutually orthogonal to the other PCs, is a linear combination of all input variables yet dominated by only a few. The PCs are presented in descending order of the amount of variance they contain. Usually the first few PCs accommodate most of the variance in the data and can be interpreted more sensibly than individual variables, drastically cutting the number of predictors. PCA is usually believed to work best on more normally-distributed data by nature [19], yet it is not a consensus among researchers and many have incorporated discrete or categorical columns, if not directly, with some simple variations [17], [20], [21].

PCA was our method of choice for three partially overlapping reasons. First, the study of the combined effects of language, demographic, and personality factors on cognitive performance is exploratory in nature. Therefore, some variables can be redundant, and those associate strongly with the last few principal components other than the first few can be deemed unimportant and eliminated from further analysis [22], [23]. Second, since variables within the language, demographic, and personality groups are expected to be collinear (to be shown by the correlation matrices presented in Table 1a and 1b), PCA helps to handle collinearity by clustering similarly structured variables into principal components. Third, the associations between the executive functioning variables and the PCs can be used as a guide to identify the most likely predictors [24] for each executive functioning variable to cut down the number of regressions needed and hence control for the inflation of false discovery rate [25].

II. Materials and Methods

A. Participants

One hundred and thirty-one young adults (34 women, M_{age} = 25.55, SD_{age} = 4.46, age range: 21– 37 years), all students, faculty, and staff at the authors' university, participated in the study. They either received course credits or monetary reimbursement for their time. Seventy-one of the participants were of Singaporean nationality (22 women, M_{age} = 24.66, SD_{age} = 4.52, age range: 21– 37 years), and the remainder 60 non-Singaporeans were Indian (11), Sri-Lankan (7), Chinese (7), Italian (6), Vietnamese (6), American (5), and other (18). Singaporean nationals have spent on average 23.14 years in Singapore, while non-Singaporeans (12 women, M_{age} = 26.57, SD_{age} = 4.20, age range: 21– 37 years) 3.56 years. Three participants' data were excluded due to absence of more than 50% recordings from executive control tasks.

B. General procedure

The tasks were administered individually in a quiet, artificially illuminated room at the authors' university. The study was conducted in accordance with the requirements of the Institutional Review Board. All participants provided informed consent before participating in the study. Participants first completed the Sixteen Personality Questionnaire (16PF) [26], followed by Raven's Progressive Matrices [27]. After that, they completed four computerized executive control tasks: go/no-go task, visual search task, task-switching, and 2-back task. The tasks were programmed in MATLAB 7.10 using PsychToolbox 3 [28] on a Windows desktop computer with a 20-inch monitor. Participants used a keyboard to record their responses. Instructions were presented in English at the beginning of each task. The four EF tasks were counterbalanced with the restrictions that either the visual search or the go/no-go task came first and that the two tasks were always separated by one other task. The trial order within tasks was identical across participants. Participants were instructed to respond as accurately and as quickly as possible. Finally, they filled out the Language and Demographic Background Questionnaire.

C. Materials

1) Personality Questionnaire [26]. Personality factors have been studied extensively for various purposes. Previous research has found that, in addition to cognitive variables affecting task performance, certain non-cognitive factors such as personality traits were good predictors of executive functioning performance as well [29], [30]. In particular, personality traits such as neuroticism, anxiety and emotional stability were able to explain differences in executive functioning performance [31], [32], [33], [34]. Hence, we administered the Sixteen Personality Questionnaire (16PF), which is a comprehensive measure of normal-range personality found to be valid in a variety of settings [26]. Participants completed a 164-item self-rated questionnaire in 15 minutes on average. For each statement, participants rated their agreement on a 5-point scale (1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree) on statements describing them (e.g., "I take time out for others."). A higher score therefore indicates that the particular trait is more representative of the participant. The 16 personality traits that were rated by the questionnaire are as follows: abstractedness, apprehension, dominance, emotional stability, liveliness, openness to change, perfectionism, privateness, reasoning, rule consciousness, self-reliance, sensitivity, social boldness, tension, vigilance, and warmth. After correcting for multiple comparisons [25], no significant group-level differences emerged among Singaporeans and non-Singaporeans on the above 16 dimensions (ts < 1.45).

2) Raven's Progressive Matrices [27]. We assessed nonverbal fluid intelligence using a computerized version of the Raven's Progressive Matrices. Individual intelligence was found in past research to be related to differences in executive functioning performance and working memory capacity [35]. Raven's progressive matrices [27] is a standard measure of abstract reasoning and as such, non-verbal fluid intelligence. In each trial, participants were presented with a series that shared certain patterns and were required to select one of six figures that best matched the series. Only one of the figures matched the series unambiguously. Although the experiment was not timed, participants were instructed to proceed with the trials as quickly and accurately as possible. The score was calculated as the number of correctly answered trials of 36 total. There was no difference between the average scores achieved by Singaporean and non-Singaporean participants ($t(100) = -0.09$, $p < 0.9$, $M_{Sing} = 29.09$, $M_{Nonsing} = 29.02$). Trials were completed in 19.6 seconds on average ($SD = 7.2$ seconds). The task lasted 10-13 minutes.

D. Executive Control Tasks

1) Task-switching (number–letter) task. This task, adapted from [36], was used as a measure of set-shifting skills. Participants were shown a letter-number pair (e.g., "f8") printed in 36-point Century Gothic font and were required to perform a speeded number (odd or even) or letter judgement (consonant or vowel) depending on a cue shown ("LETTER" or "NUMBER"). Participants pressed the "T" and "Y" keys respectively to indicate that the letter is a consonant or a vowel. These two keys were also used to indicate an odd or even number respectively. The letters used consisted of five lower-case consonants (f, k, s, n, p), and five lower-case vowels (a, e, i, o, u), and the numbers used included five odd (1, 3, 5, 7, 9) and five even numbers (2, 4, 6, 8, 0). Letter-number and number-letter pairs were created combinatorically except for the following pairs i1, 1i, o0, and 0o. Each trial began with a centered fixation cross for 1000ms, which was offset by a cue for 200ms. Following that, a letter-number or number-letter pair was presented for a maximum of 5000ms or until a response was made. Participants first completed two single task blocks (a letter judgement followed by a number judgement) of 72 trials each. A 144-trial mixed task block (comprising of 72 task-repeat trials, e.g., a number cue followed by another number cue and 72 task-switch trials, e.g., a number cue followed by a letter cue) then followed. Participants began the task by performing eight practice trials with feedback. Switching cost and mixing cost were used as the outcome measure. Mixing costs reflect sustained components of cognitive control in actively maintaining representations of multiple task demands and is expressed as the difference in response time (RT) between task-repeat trials in the mixed and single-task blocks. Conversely, switch costs reflect more transient control processes to update goals or task demands [37] and is expressed as the difference in RT between task-switch and task-repeat trials in the mixed block.

2) 2-back task. This task has been developed with the aim to test short-term visual working memory, monitoring, and updating [38]. In each trial, participants were presented with a blank 3-by-3 grid for 500ms. A black circle then appeared in one of the cells (except the middle one) for 500ms. The inter-stimulus interval was 2000ms. Participants were instructed to press the spacebar on the keyboard when the position of the black circle in the current trial matched those two trials ago. However, if the two configurations did not match, participants were instructed to do nothing. Nine practice trials were followed by 80 test trials over four blocks (20 trials in each block). A block of trials was initiated by a 500ms fixation cross. In each block, there were 4 target trials that needed action and 16 were lures that did not. Feedback on performance was provided only for the practice trials. The dependent variable (DV) of interest is the number of false alarms (= FA rate, the rate at which a response was inappropriately made).

3) Inhibition of pre-potent response: Go/No-go task. In this task (adapted from [39]), participants were presented with letters. They were to make a speeded spacebar response for every letter ("go" trials) except "X" (no-go trials). There were two blocks of 68 trials each. Block 1 contained 50% of "go" and "no-go" trials respectively. Block 2 contained 75% of "go" and 25% of "No go" trials. Each letter was displayed on screen for a maximum of 500ms or until a speeded response was made. The inter-stimulus interval was 1000ms. For each block, participants began with 20 "go" trials to build prepotency. The DV from this task is the FA rate in the "no-go" trials in the two sets of experiments (50% and 75% "go" trials).

4) Perceptual attention: Visual search task. The visual search task [40] is a measure of perceptual attention involving the active scan of a visual environment for a specific target object, in this case, a search for T among a number of Ls. The 48 trials (16 trials each of set size 4, 8 and 12) were preceded by 24 practice trials (8 trials for each set size). The size of each T and L were 0.45 by 0.45 degrees of visual angle. The stimulus was presented on screen for 4000 ms or until a response was detected. The inter-stimulus interval was 500ms. The outcome variable in this task is the RT for correct detections in the three sets of experiments.

E. Language and Demographic Background

Singapore is a multilingual and multicultural country in Southeast Asia. Its bilingual policy encourages proficiency both in English (the medium of instruction and of general communication) and a so-called mother tongue, which can be Mandarin, Malay, or Tamil. Participants completed a detailed language background questionnaire to assess various language factors such as age of acquisition (i.e., the age at which they were first exposed to a given language), proficiency (the mean of self-rated comprehension, reading, speaking and writing skills), frequency of use of each of their known languages (the weighted mean frequency of past and current language use), and frequency of language switching (i.e., using two or more languages within an utterance). From these values, the following variables were created, which are used as indicators of bilingualism [14], [15]:

(1) Onset of bilingualism, i.e., the age at which the person is exposed to their second language. A value close to zero is indicative of simultaneous, while a larger value of sequential bilingualism.

(2) Balancedness in proficiency, i.e., the difference between the proficiency levels of languages. Higher values suggest an imbalance in proficiency.

(3) Balancedness in use, i.e., the difference between the weighted mean frequency of first and second language use with family, friends, colleagues, and other people. Higher values suggest an imbalance in language use.

(4) Language-switching behavior; i.e., the tendency to use two or more languages in a single unit of discourse [41].

Missing data totaled ≅ 8.3%. As the combined usage of the first and second languages amounted to 93%, and 44% of the participants reported knowing exactly two languages, additional languages were not analyzed further. First language was defined as the first language the participant was exposed to. In case of multiple exposures at birth, we relied on the participants' order of listing the languages. The order of languages has also been cross-validated by significantly higher proficiency ratings for the first language relative to the second in all aspects including comprehension, reading, speaking and writing skills (Singaporeans: $t(69) > 7.89$, ps < 0.001, non-Singaporeans: $t(60) > 5.05$, ps < 0.001). The average reported proficiency score for the first language was 9.23 (on a 10-point scale where 1 was *not proficient* and 10 was *very proficient*, range = 5.5–10) and for the second language 6.99 (range = 1.5–10).

Eighty-seven percent of Singaporean participants listed English, 9% a Chinese language (i.e., Mandarin, Hokkien, or Teochew) and 4% Malay and Tamil as their first language. 75% Singaporeans listed Chinese as their second language, 11% English, and 14% Malay, Tamil and Punjabi. On the other hand, 23% non-Singaporean participants listed English as their first language, 13% Chinese, 11% Sinhala, 10% Vietnamese, 8% Indonesian and the remaining participants 17 other languages. Sixty-seven percent of non-Singaporean participants gave English as their second language, 5% Chinese, 5% Hindi, and the remaining participants 9 other languages. The questionnaire also included questions from [42] on language-switching using a 5-point scale, with higher scores indicating higher tendency to switch between languages. Singaporeans averaged 2.82 ($SD = 0.51$) and non-Singaporeans 2.66 ($SD = 0.66$) on this scale. The questionnaire also asked participants on a 10-point scale about the frequency of their computer use ($M_{Sing} = 8.0$, $SD_{Sing} = 1.95$, $M_{Nonsing} = 8.66$, $SD_{Nonsing} = 1.87$), the frequency of playing speeded videogames ($M_{Sing} = 4.06$, $SD_{Sing} = 2.845$, $M_{Nonsing} = 3.56$, $SD_{Nonsing} = 2.49$) and their skill thereof ($M_{Sing} = 4.87$, $SD_{Sing} = 1.96$, $M_{Nonsing} = 5.32$, $SD_{Nonsing} = 2.19$). These group-level demographic differences were not significant after controlling for multiple comparisons with the Benjamini-Hochberg method [25].

III. Results

A. Language background

Singaporean and non-Singaporean populations were analyzed separately due to their fundamentally different language background and experience (to be shown by PCA in section III.B). Singaporeans reported speaking fewer languages ($t(125) = -3.56$, $p < 0.001$, $M_{Sing} = 2.72$, $M_{Nonsing} = 3.03$), started acquiring their second languages earlier ($t(79) = -6.40$, $p < 0.001$, $M_{Sing} = 1$, $M_{Nonsing} = 5.21$), used their languages in a more balanced manner in childhood ($t(99) = -5.27$, $p < 0.001$, $M_{Sing} = 2.64$, $M_{Nonsing} = 5.23$), and switched slightly more between their languages ($t(107) = -1.7$, $p = 0.09$, $M_{Sing} = 2.83$, $M_{Nonsing} = 2.65$) than their non-Singaporean counterparts. The rate of balanced usage in adulthood was comparable across the two groups ($t(124) = 1.57$, $p = 0.12$, $M_{Sing} = 3.56$, $M_{Nonsing} = 2.8$). Although there was no significant difference between the groups in first language proficiency ($t(70) = -1.66$, $p = 0.1$, $M_{Sing} = 9.09$, $M_{Nonsing} = 9.40$), Singaporeans reported significantly lower proficiency in their second language than non-Singaporeans ($t(59) = -3.56$, $p < 0.001$, $M_{Sing} = 6.37$, $M_{Nonsing} = 7.71$).

TABLE 1A. Correlation matrix for the language background measures, Singaporean participants[a].

	1	2	3	4
(1) AoA_L2[b]	–			
(2) Balanced proficiency	0.04	–		
(3) Balanced usage	0.16	0.64***[c]	–	
(4) Language-switching	-0.19	-0.12	-0.22*	–

a. Sample size = 71. b. AOA_L2 = onset of bilingualism. c. p < 0.05, *p < 0.01, ***p < 0.001.

TABLE 1B. Correlation matrix for the language background measures, non-Singaporean participants[a].

	1	2	3	4
(1) AoA_L2[b]	–			
(2) Balanced proficiency	0. 01	–		
(3) Balanced usage	0.10	0.46***[c]	–	
(4) Language-switching	-0.22	-0.11	-0.33**	–

a. Sample size = 60. b. AOA_L2 = onset of bilingualism. c. p < 0.05, *p < 0.01, ***p < 0.001.

TABLE 1a and 1b show the Pearson's correlation matrix of the four indicators of bilingualism for the Singaporean and the non-Singaporean group, respectively. The matrix was generated by the *corr.test* function in R [43]. All values were centralized and scaled. The significance values were corrected for multiple comparisons by the Benjamini-Hochberg method [25]. A significant association was found between balanced usage and balanced proficiency, suggesting that participants who regularly use their two languages tend to be similarly proficient in them. Language-switching was also significantly correlated with balanced usage in both groups. This indicates that participants switch languages more frequently if they are

more balanced in the usage of their two languages, which in turn related with balanced proficiency of their two languages. This supported the notion that bilinguals switch between languages because they have the prerequisite competency in both languages [44]. However, the age of acquisition of the second language was not correlated with other language measures, indicating that early onset of bilingualism is not predictive of balanced usage, balanced proficiency, and language switching behavior. These results are consistent with those of [14].

B. Analyses of Executive Control Tasks

The DVs were aggregated for each trial for each participant in each task. In the response time measures, only accurate trials were considered. Response time values that were less than 200 ms or fell more than 2.5 standard deviations away from the participant's mean score were discarded. This allows an optimal measure of central tendency to emerge [45]. The percentage of the eliminated trials was less than 6% for all tasks. Average accuracy across the executive control tasks in the final sample was greater than 92%, which is in the expected range for young adults [14]. No significant group-level differences by nationality emerged after correcting for multiple comparisons [25] (ts < 1.03).

1) Principal Component Analysis (PCA). In order to satisfy the requirements to perform a PCA, missing data was populated by Multivariate Imputation by Chained Equations (MICE package in R [46]) using a tailored predictor matrix and 20 times of multiple imputation. The imputation method actively leverages interrelations among columns of different types (nominal, numerical, etc.) and has a number of advantages over simple imputation schemes. Variables were then normalized, centered, and scaled [19]. During the first round of PCA (using relevant functions from the FactoMineR package in R [47]) that included all 131 participants and 31 variables (age, fluid intelligence, 3 videogame skill variables, 10 language background variables, and 16 personality variables), 10 major PCs were identified that altogether explained over 70% of total data variance [17] and each of whose eigenvalues exceeded 1 (c.f., Fig.1), which satisfied Kaiser's rule for PC screening [48]. All input variables except age were strongly associated with at least one of the 10 PCs (rs > 0.4, ps < 0.001), so age was excluded from further analysis.

PC1, PC4 and PC6 were dominated by different combinations of personality factors. This is to be expected as [49] factor-analyzed the 16 personality variables into 5 higher order global factors (the "Big Five", termed B1- B5), and further into 2 third-order factors, which are interpreted as human behavioural pattern of activities directing outward and internal processes, respectively [49]. PC1 covered the Extroversion / Introversion (B1), High / Low Anxiety (B2), and Independence / Accommodation (B3) constructs, PC4 mainly covered the Tough-mindedness / Receptivity (B4) and Self-control/Lack of Restraint (B5) constructs, and PC6 mostly covered B1 and B2. Therefore, the most variance in our PCA was explained by personality traits that describe outward-directed behaviour (B1, B2 and B3) [49] that were clustered in PC1. PC2 and PC3 were occupied by the 4 language variables, while PC5 is a mixture of videogame usage variables and bilingualism variables. The other PCs were a mixture of factors across categories.

Nationality was found to be significantly associated with the first two PCs (R_{PC1}^2 = 0.09, p_1 < 0.001, R_{PC2}^2 = 0.20, p_2 < 0.001). A scatter plot visualizing the scores of each participant on the first two PCs (c.f., Fig.2) shows that Singaporeans had a lower mean in both dimensions. This confirms the ground truth of the gap in bilingual background between Singaporean and Non-Singaporean participants, and suggests a difference of personality traits across the two groups. Although no single personality factor of the 16PF exhibits a significant cross-group difference (Section II.C), a significant group difference in B1 emerged when testing on the three global traits (B1-B3) in PC1 (t(125.6) = –2.19, p < 0.05), with Singaporean participants scoring less than non-Singaporeans. Furthermore, the chi-square test for correlation matrices [50] of language background showed significant difference across the groups ($\chi 2$ (36) = 71.8, p < 0.001), which statistically motivated an analysis separated by nationality. Similar to the overall PCA, separate PCAs were performed on the Singaporean and non-Singaporean groups. The PC structures were identical for the 2 PCAs, indicating that the relative variance of the variables in the two populations were similar. The PCs were then correlated with the executive control performance variables for each nationality group. Correlations above 0.12 (post-hoc threshold based on the data) were further explored with stepwise selections.

2) Effects of Bilingualism on Executive Control: Stepwise selections. Multiple stepwise selections on linear regression analyses (using the lm function from the stats package in R [43]) were conducted separately for each of the outcome measures associated with the respective executive control task. First, the null model was defined that contained no predictors. Second, the full model was created that contained all predictors in the given principal component that were significantly associated with the outcome measure. Using stepwise selection in both directions (step function from the stats package in R [43]), the most parsimonious model was automatically selected based on the Akaike Information Criterion, AIC [51].

This process was repeated for each of the PCs found to be significantly associated with the outcome measure. In order to avoid the over-detection of significant predictors, the predictors identified this way were submitted to another stepwise selection process, similar to the previous one (selection in both directions, based on AIC). Consequently, the most parsimonious model was identified for each of the preselected dependent measure. The predictors that significantly contributed to model fit in the Singaporean data included frequency of language switching, onset of bilingualism, videogaming skills, fluid intelligence, and 5 personality traits: abstractedness, dominance, privateness, social boldness, and warmth. Significant predictors in the non-

Singaporean data were identical – language switching, onset of bilingualism, videogaming skills, fluid intelligence – except for personality traits, whereas emotional stability, openness to change, and reasoning emerged.

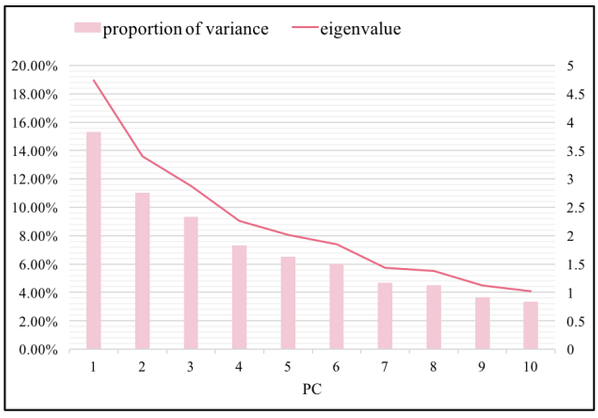


Figure 1. Percentages of variance and eigenvalues of PCs, all participants

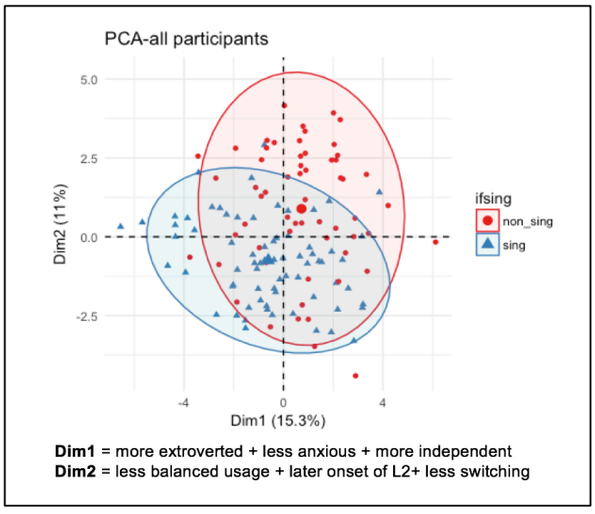


Figure 2. Individual scores on PC1 and PC2, colored by nationality group

Specifically, in the Singaporean group mixing cost was found to be inversely proportional to frequency of language switching, i.e., the more frequently participants switched between languages within an utterance, the lower mixing cost was observed in the task switching task (c.f., Table 2a, row 1). The false alarm rate in the go/no-go task was also inversely proportional to the frequency of language switching, that is, frequency of language switching predicted a low false alarm rate (row 2). Early onset of bilingualism was associated with superior performance in the visual search task (row 3). Furthermore, experience with videogames and high fluid intelligence predicted low false alarm rates in the 2-back task (rows 4–5). High fluid intelligence also predicted low false alarm rate in the go/no-go task (c.f., row 6). Personality traits abstractedness, dominance, privateness, social boldness, and warmth predicted a whole range of executive function performance (rows 7–13).

In the non-Singaporean group, both language factors language switching and onset of bilingualism predicted response time in the visual search task (Table 2b rows 1–3). Experience with videogames and fluid intelligence also predicted visual search performance (rows 4–5). In addition, three personality traits emotional stability, openness to change, and reasoning predicted mixing cost, switching cost, and false alarm rate in the go/go-no task, respectively (rows 6–8).

IV. Discussion

This research studied the effect of language variables on the executive control performance of two bilingual groups, Singaporean and non-Singaporean individuals living in Singapore. We introduced demographic and personality variables alongside language variables in order to assess their relative importance as predictors. With PCA and stepwise selections, we addressed the issue of collinearity (between the language variables balanced usage vs. proficiency and language-switching vs. proficiency and also between other variables known to be potentially collinear) by reducing the number of predictors.

The results indicate that for the two bilingual groups, the same language variables predicted executive functioning performance, namely onset of bilingualism and language-switching behavior, although the same language variables of the two bilingual groups predicted slightly different EF outcomes. Note that differences in the results may have arisen as the Singaporean group is by definition more homogeneous than the non-Singaporean group. More commonalities in the data structure of the Singaporean vs. the non-Singaporean group were reflected in two domains of our results. Firstly, more predictors have been identified within the Singaporean group than in the non-Singaporean group. Secondly, more aspects of executive control performance have been predicted in the Singaporean vs. the non-Singaporean group.

Regarding onset of bilingualism, [52] and [14] both found that it predicted executive function performance, in particular that early bilinguals performed better in the flanker task than late bilinguals, possibly because they reaped more benefits by having more experience with bilingualism. In our study, both Singaporeans who characteristically acquired their second languages relatively early at 1 year of age and non-Singaporeans who acquired it relatively late at the average age of 5 years, showed the positive effect of early onset of bilingualism on visual search performance. Namely, the earlier one acquired their second language, the faster they performed the more challenging visual search task of set size 12 (vs. set size 4 and 8) regardless of nationalism and other differences in language experience.

In a similar vein, although the two bilingual groups differed across language switching preferences (Singaporeans switching slightly more between the languages than non-

Singaporeans), frequent language switching was found to be a indicator of superior executive functioning. This is concordant with the findings of [9] and [42]. Frequent language switching is a complex and dynamic language behavior. Those who engage in it usually do so with the acute knowledge of communicative context, i.e., language-switching is licenced when the communicative partner is able to decode the utterance, and disfavored otherwise and in formal interactions [53]. Language-switching may confer cognitive advantages as it might have honed the ability to seamlessly switch between tasks and continually adjust to task requirements.

The other indicators of bilingualism, balancedness of language use (part of PC2 and PC3) and that of proficiency (part of PC3) did not reliably predict performance in our analyses (contra [14] and [15]). It is possible that the variance these indicators explained was subsumed under the variance that was captured by onset of bilingualism and language-switching behavior and as such, they did not emerge as significant predictors. Alternatively, differences in data treatment adhering to the statistical method (data transformation, imputation) compared to previous studies may be responsible for the divergence.

In terms of the non-language variables, fluid intelligence and videogaming skills appear among the predictors of executive functioning in both bilingual groups. This shows that besides language experience, fluid intelligence and videogaming skills are important in shaping executive control performance. This is in accordance with past results showing that fluid intelligence is an important factor of executive function [35] and that experience with videogames improves hand-eye coordination, which in turn improves response time and performance [54].

There was no overlap in the 8 personality traits that emerged as predictors of executive control performance between the two nationality groups. Recall that all identified traits except abstractedness belong to PC1, which as aforementioned in Section III.B, can be interpreted as outward-directed behavior. Specifically, the predicting traits in the Singaporean group fall in the "big five" personality categories B1, B3, and B4, whereas the predictors in the non-Singaporean group fall in B2, B3 and B4 [49]. Due to the significant group-level difference in B1 in the PCA, we conjecture that this difference, along with the interchangeability among factors, might account for the lack of overlap among the personality predictors across the two bilingual groups. IHowever, traits were mostly associated with executive control performance in the expected direction: More reported emotional stability, oppenness to change, and reasoning predicted better performance [34].

Short-term working memory as measured by the 2-back task has not been associated with language factors, a null finding that is consistent with previous studies that studied the effect of balanced bilingualism on executive functioning [14], [15]. Conversely, working memory performance has been found to be related to fluid intelligence, videogaming experience, and the personality trait privateness in the Singaporean group, which is again consistent with previous research [35].

TABLE 2A. OUTPUT OF THE MOST PARSIMONIOUS STEPWISE REGRESSION MODELS, SINGAPOREAN PARTICIPANTS[a].

Predictor	Outcome variable	*β*	*SE*	*t*	*P*[c]	$R^2_{Adjusted}$	*F*	*df*	*p*
language switching	mixing cost	-0.28	0.13	-2.03	*	0.10	4.9	2,67	*
language switching	FA rate (50% go/no-go)	-0.44	0.14	-3.15	**	0.16	7.6	2,68	**
AOA_L2[b]	RT (12-set)	0.29	0.13	2.2	*	0.17	8.32	2,68	***
videogaming skills	FA rate (2-back)	-0.28	0.11	-2.62	*	0.18	6.05	3,67	**
fluid intelligence	FA rate (2-back)	-0.33	0.11	-2.92	**	0.18	6.05	3,67	**
fluid intelligence	FA rate (75% go/no-go)	-0.3	0.13	-2.22	*	0.05	4.92	1,69	*
abstractedness	mixing cost	0.33	0.12	2.76	**	0.10	4.9	2,67	*
dominance	FA rate (50% go/no-go)	0.32	0.12	2.73	**	0.16	7.6	2,68	**
privateness	FA rate (2-back)	0.23	0.11	2.13	*	0.18	6.05	3,67	**
social boldness	RT (4-set)	0.59	0.12	4.79	***	0.24	11.7	2,67	***
social boldness	RT (8-set)	0.385	0.11	3.63	***	0.15	13.2	1,68	***
social boldness	RT (12-set)	0.439	0.11	4.19	***	0.21	9.87	2,67	***
warmth	RT (4-set)	-0.27	0.13	-2.11	*	0.24	11.7	2,67	***

a. Sample size = 71. b. AOA_L2 = onset of bilingualism. c. $p < 0.05$, *$p < 0.01$, ***$p < 0.001$.

TABLE 2B. OUTPUT OF THE MOST PARSIMONIOUS STEPWISE REGRESSION MODELS, NON-SINGAPOREAN PARTICIPANTS[a]

Predictor	Outcome variable	*β*	*SE*	*t*	*P*[c]	$R^2_{Adjusted}$	*F*	*df*	*p*
language switching	RT (4-set)	-0.25	0.09	-2.85	**	0.39	10.8	4,56	***
AOA_L2[b]	RT (8-set)	0.34	0.13	2.72	**	0.15	6.37	2,57	**
AOA_L2	RT (12-set)	0.31	0.13	2.32	*	0.11	4.66	2,57	*
videogaming skills	RT (4-set)	-0.5	0.12	-4.13	***	0.39	10.8	4,56	***
fluid intelligence	RT (4-set)	-0.34	0.09	-3.54	***	0.39	10.8	4,56	***
emotional stability	mixing cost	-0.47	0.13	-3.5	***	0.16	12.2	1,59	***
openness to change	switching cost	-0.36	0.13	-2.78	**	0.1	7.71	5,59	**
reasoning	FA rate (50% go/no-go)	-0.27	0.11	-2.37	*	0.19	5.55	3,56	*

a. Sample size = 60. b. AOA_L2 = onset of bilingualism. c. $p < 0.05$, *$p < 0.01$, ***$p < 0.001$.

Taken together, our results speak to a limited scope of bilingual advantage in executive control. Specifically, our study suggest that early bilingualism only confers advantage with more challenging tasks, e.g., 8 and 12-set visual search, but not 4-set visual search [10], [11]. This is concordant with past research that found bilingual advantage in more complex visual search tasks (conjunction-type search), but not in simple tasks (feature-search), showing that bilinguals have better control over their perceptual attention processes [55]. In addition, the bilingual experience was found to aid performance with complex working memory tasks that require greater attention, but not with simpler ones [56].

The implication of these findings are that despite differences in attitude and experience with language, the effects of bilingualism across the Singaporean and non-Singapoeran groups are remarkably similar. Although it is crucial to appreciate the diversity among bilinguals (e.g., how early they became bilinguals, how frequently they switch between their languages), onset of bilingualism and frequency of language switching emerged as predictors of executive functioning in both groups. Such similarity across the language predictors of the two bilingual groups suggest that our results may generalize to other bilingual language communities as well, a question that can be addressed in future research.

REFERENCES

[1] Green, D. W. (1986). Control, activation, and resource: A framework and a model for the control of speech in bilinguals. *Brain and language, 27*(2), 210-223.

[2] Rodriguez-Fornells, A., Rotte, M., Heinze, H. J., Nösselt, T., & Münte, T. F. (2002). Brain potential and functional MRI evidence for how to handle two languages with one brain. *Nature, 415*(6875), 1026-1029.

[3] Bialystok, E., & Martin, M. M. (2004). Attention and inhibition in bilingual children: Evidence from the dimensional change card sort task. *Developmental science*, *7*(3), 325-339.

[4] Bialystok, E., Craik, F. I., & Luk, G. (2012). Bilingualism: consequences for mind and brain. *Trends in cognitive sciences*, *16*(4), 240-250.

[5] Hernandez, A. E., Martinez, A., & Kohnert, K. (2000). In search of the language switch: An fMRI study of picture naming in Spanish–English bilinguals. *Brain and language, 73*(3), 421-431.

[6] Marian, V., Spivey, M., & Hirsch, J. (2003). Shared and separate systems in bilingual language processing: Converging evidence from eyetracking and brain imaging. *Brain and language*, *86*(1), 70-82.

[7] Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Review of Educational Research, 80*(2), 207-245.

[8] Bialystok, E. (2001). Metalinguistic aspects of bilingual processing. *Annual Review of Applied Linguistics*, *21*, 169-181.

[9] Bialystok, E., & Viswanathan, M. (2009). Components of executive control with advantages for bilingual children in two cultures. *Cognition*, *112*(3), 494-500.

[10] Costa, A., Hernández, M., Costa-Faidella, J., & Sebastián-Gallés, N. (2009). On the bilingual advantage in conflict processing: Now you see it, now you don't. *Cognition*, *113*(2), 135-149.

[11] Hernández, M., Martin, C. D., Barceló, F., & Costa, A. (2013). Where is the bilingual advantage in task-switching?. *Journal of Memory and Language*, *69*(3), 257-276.

[12] Craik, F. I., & Bialystok, E. (2006). Cognition through the lifespan: mechanisms of change. *Trends in cognitive sciences*, *10*(3), 131-138.

[13] Paap, K. R., & Greenberg, Z. I. (2013). There is no coherent evidence for a bilingual advantage in executive processing. *Cognitive psychology*, *66*(2), 232-258.

[14] Yow, W. Q., & Li, X. (2015). Balanced bilingualism and early age of second language acquisition as the underlying mechanisms of a bilingual executive control advantage: why variations in bilingual experiences matter. *Frontiers in psychology*, *6*.

[15] Quin Yow, W & Oei, Adam. (2017). Cognitive Mixing Costs Advantage in Balanced Bilingual Elderly. 137-144. 10.5176/2251-1865_CBP17.46.

[16] Dixon, L. Q. (2005). Bilingual education policy in Singapore: An analysis of its sociohistorical roots and current academic outcomes. *International Journal of Bilingual Education and Bilingualism*, *8*(1), 25-47.

[17] Jolliffe, I. T. (2002). *Principal Component Analysis* (2nd ed.). Aberdeen: Springer.

[18] Mackiewicz, A., & Ratajczak, W. (1993). Principal components analysis (PCA). *Computers and Geosciences*, *19*, 303-342.

[19] Kolenikov, S., & Angeles, G. (2004). The use of discrete data in PCA: theory, simulations, and applications to socioeconomic indices. Chapel Hill: Carolina Population Center, University of North Carolina, 1-59.

[20] Filmer, D., & Pritchett, L. (2001). Estimating Wealth Effects without Expenditure Data-or Tears: An Application to Educational Enrollments in States of India. *Demography, 38*, 115-132.

[21] Niitsuma, H., & Okada, T. (2005). Covariance and PCA for categorical variables. *Pacific-Asia Conference on* Knowledge Discovery and Data Mining (pp. 523-528). Berlin: Springer.

[22] Jolliffe, I. T. (1972). Discarding variables in a principal component analysis. I: Artificial data. *Applied statistics*, 160-173.

[23] Jolliffe, I. T. (1973). Discarding variables in a principal component analysis. II: Real data. *Applied statistics*, 21-31.

[24] Jolliffe, I. T. (1982). A note on the use of principal components in regression. *Applied Statistics*, 300-303.

[25] Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the royal statistical society. Series B (Methodological)*, 289-300.

[26] Cattell, R. B., & P. Cattell, H. E. (1995). Personality structure and the new fifth edition of the 16PF. *Educational and Psychological Measurement*, *55*(6), 926-937.

[27] Raven, J. (2003). Raven progressive matrices. In *Handbook of nonverbal assessment* (pp. 223-237). Springer US.

[28] Kleiner, M., Brainard, D., Pelli, D., Ingling, A., Murray, R., & Broussard, C. (2007). What's new in Psychtoolbox-3. *Perception*, *36*(14), 1.

[29] Murphy, K. R. (1996). Individual differences in organizations: Much more than g. In K. R. Murphy (Ed.), *Individual differences and behavior in organizations* (pp. 3–30). San Francisco: Jossey-Bass.

[30] Lieberman, M. D., & Rosenthal, R. (2001). Why introverts can't always tell who likes them: multitasking and nonverbal decoding. *Journal of personality and social psychology*, *80*(2), 294.

[31] Szymura, B., & Nęcka, E. (1998). Visual selective attention and personality: An experimental verification of three models of extra version. *Personality and Individual Differences*, *24*(5), 713-729.

[32] Szymura, B., & Wodniecka, Z. (2003). What really bothers neurotics? In search for factors impairing attentional performance. *Personality and individual differences*, *34*(1), 109-126.

[33] Campbell, J. S., Castaneda, M., & Pulos, S. (2009). Meta-analysis of personality assessments as predictors of military aviation training success. *The International Journal of Aviation Psychology*, *20*(1), 92-109.

[34] Guastello, A. D., Guastello, S. J., & Guastello, D. D. (2014). Personality trait theory and multitasking performance: Implications for ergonomic design. *Theoretical Issues in Ergonomics Science*, *15*(5), 432-450.

[35] Colom, R., Martínez-Molina, A., Shih, P. C., & Santacreu, J. (2010). Intelligence, working memory, and multitasking performance. *Intelligence*, *38*(6), 543-551.

[36] Rogers, R. D., & Monsell, S. (1995). Costs of a predictible switch between simple cognitive tasks. *Journal of experimental psychology: General*, *124*(2), 207.

[37] Braver, T. S., Reynolds, J. R., & Donaldson, D. I. (2003). Neural mechanisms of transient and sustained cognitive control during task switching. *Neuron*, *39*(4), 713-726.

[38] Carlson, S., Martinkauppi, S., Rämä, P., Salli, E., Korvenoja, A., & Aronen, H. J. (1998). Distribution of cortical activation during visuospatial n-back tasks as revealed by functional magnetic resonance imaging. *Cerebral cortex (New York, NY: 1991)*, *8*(8), 743-752.

[39] Garavan, H., Ross, T. J., & Stein, E. A. (1999). Right hemispheric dominance of inhibitory control: an event-related functional MRI study. *Proceedings of the National Academy of Sciences*, *96*(14), 8301-8306.

[40] Treisman, A. M., & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive psychology*, *12*(1), 97-136.

[41] Genesee, F., Paradis, J., & Crago, M. B. (2004). *Dual language development & disorders: A handbook on bilingualism & second language learning, Vol. 11*. Paul H Brookes Publishing.

[42] Rodriguez-Fornells, A., Kramer, U., Lorenzo-Seva, U., Festman, J., & Münte, T. F. (2012). Self-assessment of individual differences in language switching. *Frontiers in Psychology*, *2*, 388.

[43] R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: http://www.R-project.org/.

[44] Yow, W. Q., Patrycia, F., & Flynn, S. (2016). Code-switching in Childhood. *Lifespan Perspectives on Bilingualism*.

[45] Friedman, N. P., Miyake, A., Robinson, J. L., & Hewitt, J. K. (2011). Developmental trajectories in toddlers' self-restraint predict individual differences in executive functions 14 years later: a behavioral genetic analysis. *Developmental psychology*, *47*(5), 1410.

[46] Stef van Buuren, Karin Groothuis-Oudshoorn (2011). mice: Multivariate Imputation by Chained Equations in R. Journal of Statistical Software, 45(3), 1-67. URL http://www.jstatsoft.org/v45/i03/

[47] Lê, S., Josse, J., & Husson, F. (2008). FactoMineR: an R package for multivariate analysis. *Journal of statistical software*, *25*(1), 1-18.

[48] Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and psychological measurement*, *20*(1), 141-151.

[49] Cattell, H. E., & Mead, A. D. (2008). The sixteen personality factor questionnaire (16PF). *The SAGE handbook of personality theory and assessment*, *2*, 135-178.

[50] Steiger, J. H. (1980). Tests for comparing elements of a correlation matrix. *Psychological bulletin*, *87*(2), 245.

[51] Akaike, H. (1998). Information theory and an extension of the maximum likelihood principle. In *Selected papers of hirotugu akaike* (pp. 199-213). Springer, New York, NY.

[52] Luk, G., De Sa, E. R. I. C., & Bialystok, E. (2011). Is there a relation between onset age of bilingualism and enhancement of cognitive control?. *Bilingualism: Language and Cognition*, *14*(4), 588-595.

[53] Muysken, P. (2000). *Bilingual speech: A typology of code-mixing*. Cambridge University Press.

[54] Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, *423*(6939), 534-537.

[55] Friesen, D. C., Latman, V., Calvo, A., & Bialystok, E. (2015). Attention during visual search: The benefit of bilingualism. *International Journal of Bilingualism*, *19*(6), 693-702.

[56] Bialystok, E., Craik, F., & Luk, G. (2008). Cognitive control and lexical access in younger and older bilinguals. *Journal of Experimental Psychology: Learning, memory, and cognition*, *34*(4), 859.

Workload, Job Stress, and Work Engagement among Field Workers

Cahyo Adi Prabowo
Department of Psychology
Islamic University of Indonesia (UII)
Yogyakarta, Indonesia

Annisaa Miranty Nurendra
Department of Psychology
Islamic University of Indonesia (UII)
Yogyakarta, Indonesia

***Abstract*—** This study aims to determine the relationship between workload, job stress and work engagement on field worker. Participants in this study were 141 civil servants in one ministry in Indonesia. The hypotheses were workload and job stress will correlate negatively with work engagement. Data were collected with the workload scale (based on Hart & Staveland, 1981), job stress scale (based on Robbins, 2006), and adaptation of Utrecht Work Engagement Scale (UWES-17) developed by Schaufeli and Bakker (2003). The results of data analysis showed that: 1) there is positive correlation between workload and work engagement (r = 0.363 dan p = 0.000), 2) there is positive correlation between job stress with work engagement (r = 0.321 dan p = 0.000). The results showed that hypotheses were rejected because the negative correlation was not happen. Another additional test showed there is significant positive correlation between workload with job stress (r = 0.739 dan p = 0.000). Further analysis are discussed.

Keywords: *work engagement, workload, job stress, field worker*

I. INTRODUCTION

Employee is the major asset or resource that serves as driving force for the organization to achieve the desired goal. Employees with high spirited attitude, who able to complete the task and responsibility, is the ideal employee for organization. In addition, organizations need employees who are psychologically connected or tied to their work. Thus, employees will be able to exert their full capacity in performing their role in an organization (Bakker, Albrecht, & Leiter, 2011).

Work engagement is a positive, satisfying, and connected mental state with work-related matters (Schaufeli, Salanova, Gonzalez-Roma & Bakker, 2002). Work engagement also refers to persistence and affective-cognitive that not only focus on an object, event, individual, or behavior (Schaufeli & Bakker, 2004). In addition, works engagement are characterized by three aspects, namely: vigor, dedication (dedication), and absorption (Schaufeli, et al., 2002). With high work engagement, the employee will involve himself in completing the work by expressing himself physically, cognitively and emotionally in performing his performance (Coetzee & de Villiers, 2010). Thus, the positive impact given is the emergence of the desire to take the initiative in work and self-direction, create a positive side of self and improve themselves, the similarity of values and norms between himself and the work in the organization, and work done though tiring can make sense satisfied or pleasant (Van den Berg, Manias & Burger in Coetzee & de Villiers, 2010). In addition, work engagement can increasing 21% of work productivity, 65% can reducing turnover rate, 48% reducing accident risk in work, and 27% reducing absenteeism (Harter, Schmidt, Agrawal, & Plowman, 2013).

Work engagement can also provide benefits for the organization. Based on the results of the Corporate Leadership Council (2004) survey, the organization will benefit from work engagement at every level, such as: manager level, senior executive team, compensation, benefits, onboarding, day-to-day work, learning and development (learning and development), and organizational culture. Some of the benefits are felt as follows: employees are able to manage critical information, have responsibility for success and failure, accurately help evaluate performance and performance potential, have the convenience to work with anyone and anywhere and can improve organizational integrity , 2004). Whereas if there is no work engagement in the organization then it is predicted to contribute 25% high turnover rate in the organization (Harter, 2013). In addition, employees will not perform tasks well so that employees will hide the identity of their work, thoughts and feelings during performance (Coetzee & de Villiers, 2010).

Based on survey results cited by PTPN X (January, 2015) the employee engagement rate reached 64%. This indicates that the average Indonesian employee has a high engagement within the organization. However, the fact is that not all feel the same, another result of Aton Hewitt's (2015) survey shows that there is a relationship between the total income of a country (GDP) and the level of work engagement, the result is that Indonesia has a slow development or about 3% with other Southeast Asian countries. Even in the previous year, in 2013, the result of economic movement in Indonesia only moved 1.2% with total demand of labor 3.6%. This indicates that the movement of Indonesia is not so much change, so it seems there is an imbalance that resulted in the level of employee engagement.

The researcher conduct preliminary interview to explore the phenomenon. The field conditions that occur is the number of projects that accumulate so that can not be completed in accordance with the targets, jobs that are not settled in one place and often exposed to sunlight and pressure and tutuntutan that exist in the culture of the institution. In

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.63

addition, other things that usually happen when given the task out of town is the number of cheating on employees such as abuse of time to work for things that are not concerned, for example, to go home early and not in accordance with the rules of organization determination, even found some employees go to other places when given job duty out of town. Based on the results of these interviews indicated the existence of employee work ties that tend to be less or low.

Work engagement can be affected by work sources and job demands (Schaufeli & Bakker, 2004). One of the most important parts that can affect work engagement is job demands (Bakker, 2011). Working demands are something to be resolved (Jones & Fletcher in Schaufeli & Bakker, 2004). Work demands refer to several aspects of the physical, mental, social, and organizational aspects of a job. The forms of demands of work are physical demands (Demerouti, Bakker, Nachreiner, & Schaufeli in Schaufeli & Bakker, 2004), mental and emotional demands (Bakker, 2011), as well as workload and work stress (Schaufeli & Bakker, 2004).

Workload is a set or a number of activities to be completed (Menpan in Dhania, 2010). Different according to Hart and Staveland (in press) which states workload as experience of natural consequences of daily activities. These consequences can serve as an evaluation between demand and potential. Prior empirical studies explain work demands such as excessive workload can drain the energy of employees resulting in fatigue (Maslach in Coetzee & de Villiers, 2010). Even other forms of behavior that may occur are increased absenteeism in work (Schaufeli, Bakker, & Rhenen, 2009). Behavior absenteeism in work is shown as a mechanism of coping with high work as a form of dissatisfaction in work (Kristensen in Schaufeli, et al., 2009). Not only that, the worst is the occurrence of burnout so as to increase the intensity of turnover in the company (Schaufeli & Bakker, 2006).

In addition, based on the results of other interviews, it is found that employees working in the field have job duties that tend to pay less attention to the working conditions. Field conditions provide demands to work on the night at 21.00 pm until 06.00 pm, which then continued to perform mandatory attendance at 07.00 at headquarters. Even if there is additional project, it takes extra time to do the workmanship and supervision at 09.00 am until finished. Other demands, every day employees need to recapitulate daily work reports on activities that have been done.

According to Schaufeli and Bakker (2004), high work demands are also related to psychological pressure, one of which can cause stressors in the work. Stressors are anything that can cause stress (Mansoor, Fida, Nasir, & Ahmda, 2011). Stress is a condition that occurs when the individual is aware of the ongoing stress on the self without any time, mental, and physical lag (Mansoor, et al., 2011). If the condition is not able to overcome it can cause work stress (Cooper & Palmer in Blaug, Kenyon, & Lekhi, 2007). Previous empirical research says stress can affect problems in work and career especially in terms of welfare and employee engagement during work activities (Coetzee & de Villiers, 2010). In addition, employees who are under stress will be prevented from achieving the desired performance goals and achievement goals (Hoeckey's in Schaufeli, et al., 2009). In addition, problems that may arise are fatigue and irritability (Schaufeli, et al., 2009) and the tendency to withdraw mentally (Maslach in Coetzee & de Villiers, 2010). If the employee gets a mental withdrawal then the level of employee engagement will decrease (Coetzee & de Villiers, 2010). As for the results of other additional interviews, found the behavioral results of work stress caused by the tendency melakukkan home at the beginning of time before work hours completed, late doing work attendance, and high absenteeism rate. So as to result in doing work that is not maximal and the incidence of fatigue in working high enough.

Based on the above description can be concluded that the workload, work stress and work engagement into one important phenomenon that must be studied more deeply so that employees can work optimally and achieve organizational goals together. Therefore, in this study the researchers raised the question of whether the workload and work stress can affect the work engagement to employees.

II. Research Methods

A. Participants

The participants are the civil servants in one ministry in Indonesia. Mainly, the participants works as the field workers. Characteristics of subjects in this study were in the age range of 23-60 years with both male and female gender.

B. Data Collection

Data collected by using Likert scale, namely: Workload Scale, Work Stress Scale, and Work Engagement Scale.

1. Workload Scale

The workload scale is prepared by the researchers themselves by referring to Hart and Staveland (in press) theory on the physical, mental and time aspects. Overall it consists of 24 favorable questions aitem and no unfavorable questions in this scale.

2. Job Stress scale

The job stress is a scale compiled by the researchers themselves by referring to the theory of Robbins (2006) on the physiological aspects, aspects of psychological and behavioral aspects. Altogether consists of 28 aitem of favorable questions and no unfavorable questions on this scale.

3. Work Engagement Scale

The scale used to reveal the variable of work engagement in this study is the adaptation of Utrecht Work Engagement Scale (UWES-17) developed by Schaufeli and Bakker (2003). The scale is based on the theory of work engagement proposed by Schaufeli, Salanova, Gonzalez-Roma, and Bakker (2002). The scale used in this study consisted of 17 items, with 6 items measuring the vigor aspect, 5 items measuring the dedication aspect, and 6 items measuring the absorption aspect.

C. *Data Analysis*

This research is correlation research category that looking for effect of work load and job stress to work engagement. The method used is statistical correlational product moment. The calculation of data analysis is done by using IBM SPSS 20.0 for windows program as statistical analysis tool.

III. Result and Discussion

Spearman Rho techniques was conducted to analyze the data.
First, there is a significant positive relationship between workload and work engagement. Based on these results obtained value r = 0.363 with p = 0.000 (p <0.01). That is, the higher the workload the higher the work engagement and vice versa. So the first hypothesis proposed in this study was rejected.
Secondly, there is a significant positive relationship between job stress and work engagement. Based on these results obtained value r = 0.321 with p = 0.000 (p <0.01). That is, the higher the work stress the higher the engagement of work and vice versa. So the second hypothesis proposed in this study was rejected.

The hypothesis stated a negative relationship. That is, the higher the workload the lower the engagement of work and vice versa. So the hypothesis is declared rejected. Likewise on the hypothesis of work stress with work engagement obtained r value = 0.321 and p = 0.000 (p <0.01) which revealed that there is a positive relationship between work stress with work engagement. The hypothesis should have a significant negative relationship. That is, the higher the work stress the lower the engagement of work and vice versa. So the hypothesis is rejected. In addition, when viewed in depth based on additional tests of sex. The findings of male and female results do not differ significantly when viewed from the level of workload, occupational stress, and work engagement. In addition, when viewed from the influence of age, found a positive correlation between age to workload, job stress, and work engagement. Although the contribution of the given effect is not sufficiently influential.

When viewed from the type of occupation and occupation, the majority of respondents are employees of the field of "road and bridge supervisor" as much as 65.2% (see table 4.7). Based on the demands of their job duties, in the field of road and bridge supervisors have jobs that are often involved with field work so that the intensity of workload tends to be more severe. When it can not be handled properly will cause symptoms of stress. As Robbins (2006) suggests, stress symptoms can arise from three indicators: mental, psychic, and behavioral. Plus, the facts of the field are found, namely: The number of hours of work fraud such as the number of projects that accumulate so that can not be completed in accordance with targets, jobs that are not settled in one place and often exposed to sunlight and pressure and tutuntutan that exist in the culture of the institution. Not only that, if the workload and work stress are not immediately addressed, it will affect the employee's work engagement. As previous research suggests, if employees have low work engagements it will lead to inconsistent behavior in work as will not perform their duties in accordance with established standards (Coetzee & de Villiers, 2010).

However, the findings in this study say differently. The findings of this study suggest that workload and high work stress are followed by high engagement conditions. It could happen, because employees like the job as a civil servant. Reinforced data results by conducting interviews, as for the explanation as follows: Although faced with a heavy workload resulting in the emergence of work stress, but employees still has a sense of engagement to work. This is because the existence of the name Civil Servant is still the biggest attraction to work in it. The form of attraction in question is prestige (prestige) as respected people around. Not only that, the allowance given became one of the attractions of most people to work as civil servants.

So it can be said, in this study high work engagement because it is influenced by job resources (source of work). In addition, Xanthopoulou, Bakker, Demerouti and Schaufeli (2007) tested the personal resources in work, so there are three things that affect the JD-R model, namely self-efficacy, organizational- based self-esteem, and optimism. If looking at the job resources regarding the process of motivation, both seen in terms of intrinsic and extrinsic alike can accelerate the individual in achieving the desired goals (Xanthopoulou, et al., 2007). So with the motivation to make employees have a sense of commitment to his work (Hackman & Oldham in Xanthopoulou, et al., 2007). In short, this study reveals personal resources in work to play an important role that is significantly related to job resources, where personal resources contribute to the variation in fatigue and work engagement. Thus, self-esteem, self-efficacy, locus of control and ability to generate positive emotional regulation can predict work engagement (Albrecht in Bakker 2011). Not only that, it should be understood that the work load and work stress received can be channeled positively, then the results given will not make the employee feel depressed but give new opportunity to learn and improve work productivity (Shah, et al., 2011) and increase self potential as a show of skill itself towards achieving better performance levels during times of crisis (Robbins & Coulter, 2012).
This research can not be separated from the weaknesses. First, in the process of data retrieval not all measuring instruments filled by the subject can be monitored and observed directly by the researchers. This causes some information is not filled completely. Secondly, the scale used in this study has been through a review process and other professional judgment from experts in the field, but did not rule out that the scale still contains many weaknesses. Third, the workload scale of 6 aspects is reduced to 3 aspects. Finally, this study initially used a mediation analysis design, but was not done because of the limitations of researchers in performing advanced statistical analysis. It is therefore expected to be an evaluation for subsequent research.

IV. CONCLUSIONS

Based on the result of research, it can be concluded that:

1. There is a significant positive relationship between the workload with the engagement of work on the subject. This means that the higher the level of workload perceived subjects, the higher the level of work involvement in the subject. so this hypothesis is rejected. Because when the workload on the subject increases should be coupled with the engagement of the subject work is decreased.
2. There is a significant positive relationship between job stress with the engagement of work on the subject. This means that the higher the level of work stress perceived subject, the higher the engagement of work, so this hypothesis is not accepted.

Based on the results of research, there are several suggestions that can be raised by researchers for the relevant parties and further research.

1. For Institutions

The agency should understand the problem of the given workload. So the agency can measure the tendency of stress levels that occur after the given workload. If the workload and work stress can be understood with the agency it will facilitate the agency to foster a sense of engagement to the employee.

2. For Future Research

The next researcher is expected to run the research procedure better, face-to-face with the subject to minimize errors that occur in the filling questionnaire. Researchers are also expected to add professional judgment of at least two experts to make the measuring tool made more leverage and minimize the occurrence of a biased aitem. Finally, perform mediation analysis with advanced statistical analysis.

REFERENCES

[1] Anita, J., Aziz, N., & Yunus, M. (2013). Pengaruh Penempatan dan Beban Kerja terhadap Motivasi Kerja dan Dampaknya pada Prestasi kerja Pegawai Dinas Tenaga Kerja dan Mobilitas Penduduk Aceh. *Jurnal Manajemen Pascasarjana Universitas Syiah Kuala*, 2(1), 67-77

[2] Aon Hewitt. (2015). *2015 Trends in global employee engagement*. Performance, Reward & Talent, pp 1-48

[3] Apriani, R. (2013). Pengaruh Stresor Kerja Iindividu terhadap Kinerja Pegawai di Dinas Pekerjaan Umum Kota Pontianak. *Jurnal S1 Ilmu Administrasi Negara,* 2(2), 1-8

[4] Azwar, S. (2012). *Penyusunan Skala Psikologi*. Yogyakarta: Pustaka Pelajar

[5] Bachroni, M., & Asnawi, S. (1999). Stres Kerja. *Bulentin Psikologi*, (2), 1-12.

[6] Bakker, A.B. 2011. An Evidence-Based Model of Work Engagement. *Current Directions in Psychological Science*, 20(4), 265-269

[7] Bakker, A.B., Albrecht, S., & Leiter, M.P. (2011). Work Engagement: Further Reflections on The State of Play. *European Journal of Work and Organizational Psychology,*20 (1),74-88

[8] Blaug, R., Kenyon, A., & Lekhi, R. (2007). *Stres at Work*. The Work Foundation: London

[9] Coetzee, M., & de Villiers, M. (2010). Source of Job Stres, Work Engagement and Career Orientations of Employees in A South African Financial Institution. *Southern African Business Review*, 14(1), 27-58

[10] Ccorporate Leadership Council. (2004). Driving performance and retention through employee engagement: A quantitave analysis of effective engagament strategies. *Corporate Executive Board*, pp 1-45.

[11] de Klerk, S., & Stander, M.W. (2014). Leadership Empowerment Behavior Work Engagement and Turnover Intention: The Role of Psychological Empowerment. *Journal of Positive Management*, 5(3), 28-45

[12] Dewe, P.J., O'Driscoll, M.P., & Cooper, C.L. (2012). Theories of Psychological Stres at Work. *Handbook of Occupational Health and Wellness*, pp 23-38

[13] Dhania, D.R. (2010). Pengaruh Stres Kerja, Beban Kerja Terhadap Kepuasan Kerja. *Jurnal Psikologi Universitas Kudus*, 1,(1), 1-9

[14] Folkman, S., & Lazarus, R.S. (1986). The Dynamic of Stressful Ecounter: Cognitive Appraisal, Soping and Ecounter Outcomes. *Journal Personality and Social Psychology,* 46(4), 839-852.

[15] Hart, S.G., & Staveland, L.E. (*in press*). Development of NASA-TLX (Task Load Index): Result of empirical and theoretical Research. *NASA-Ames Research Center*

[16] Harter, J.K., Schmidt, F.L., Agrawal, S., & Plowman, S.K. (2013). The relationship between engagement at work and organizational outcomes. *Gallup*, pp 1-32.

[17] Kayastha, D.P., & Kayastha, R. (2012). A Study of Occupational Stress on Job Satisfaction Amog Teachers With Particular Reference to Corporate, Higher Secondary School of Nepal: Empirical Study. Asian Journal of Management Sciences and Educations, 1(2), 1-11.

[18] Leka, S., Griffiths, A., & Cox, T. (2003). *Work Organization and Stres*. Protecting Workers' Health Series No. 3. University of Nottingham, Nottingham.

[19] Mansoor, M., Fida, S., Nasir, S., & Ahmad, Z. (2011). The Impact of Job Stress on Employee Job Satisfaction A Study on Telecommunication Sector akistan. Journal of Business Studies Quarterly, 2(3), 1-7.

[20] Mark, G.M., & Smith, A.P. (2008). Stress Models: A Review and Suggested New Direction. *Occupational health psychology*, 3, 111-144.

[21] Munandar, A. S. 2001. *Psikologi Industri dan Organisasi*. Jakarta: UI Press

[22] Mutia, M. (2014). Pengukuran Beban Kerja Fisiologis dan Psikologis Pada Operator Pemetikan Teh dan Operator Produksi Teh Hijau di PT Mitra Kerinci. *Jurnal Optimasi Sistem Industry*, 13(1),503-517

[23] PTPN. (14 Januari 2015). Dari Kepuasan Karyawan Menuju Keterikatan Karyawan. Diunduh pada tanggal 14 Mei 2016 dari http://www.ptpn10.com/blog/dari-kepuasan-karyawan-menuju-keterikatan-karyawan.

[24] Robbins, S. P. (2006). *Perilaku Organisasi*. Jakarta: Gramedia

[25] Robbins, S. P. (2007). *Teori Organisasi, Struktur, Desain, dan Aplikasi.* Edisi Terjemahan. New Jersey: Prentice Hall.

[26] Robbins, S.P., & Coulter M. (2012). *Management: Eleventh Edition*. New Jersey: Prentice Hall

[27] Schaufeli, W.B., & Bakker, A.B. (2004). Job Demands, Job Resources, and Their Relationship with Burnout and Engagement: A Multi-Sample Study. *Journal of Organizational Behavior*, 25, 293-315

[28] Schaufeli, W.B., Salanova, M., Gozalez-Roma, V., & Bakker, A.B. (2002). The Measurement of Engagement and Burnout: A Two Sampe Confirmatory Factor Analytic Approach. *Journal of Happiness Studies*, 2, 71-92

[29] Schaufeli, W.B., Bakker, A.B. & Rhenen, W.V. (2009). How changes in job demands and resources predict burnout, work engagement, and sickness absenteeism. Journal of Organizational Behavior, 1-25.

[30] Shah, A.A.H., Jaffari, A.R., Aziz. J., Ejaz, W., Ul-Haq. A., & Raza, S.N. (2011). Workload and Performance of Employees. Interdisciplinary *Journal of Contemporary Research Business,* 3(5), 256-267

[31] Sugiyono. (2011). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: Alfabeta

[32] Suherman. 2011. Pengaruh Budaya Organisasi, Efektivitas Kepemimpinan Dan Stres Kerja Terhadap Kinerja: Studi Kausal Pada Kepala Sekolah Menengah Pertama (SMP) Di Kabupaten Murung Raya Kalimantan Tengah. *Jurnal Managemen Pendidikan Universitas Negeri Jakarta*, 345-353

[33] Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W.B. (2007). The Role of Personal Resources in the Job-Demands, Resources Model. *International Journal of Stres Management*, 14(2), 121-141

Ethnopsychological peculiarities of the structure of value scope of titular ethnicity of Kazakhstan

Prof. Gaukhar Aldambergenova
Kazakh State Women's Pedagogical University Almaty, Kazakhstan

Assoc.Prof. Bulat Serimbetov
Kazakh University of Economics, Finance and International Trade
Astana, Kazakhstan

Prof. Sveta Berdibayeva
Al-Farabi Kazakh National University
Almaty, Kazakhstan

Assoc.Prof. Kuandyk Kulmanov
L.N.Gumilyov Eurasian National University
Astana, Kazakhstan

Prof. Assiya Kukubayeva
A.Myrzakhmetov Kokshetau University
Kokshetau, Kazakhstan

Lecturer Satybaldy Berdibayev
L.N.Gumilyov Eurasian National University
Astana, Kazakhstan

***Abstract*—Fundamental change of the public system and other changes, over) over the past decade in the Republic of Kazakhstan after receiving State independence, demanded reassessment of values, including character and features of value orientations of the Kazakh people.**

Interest in the value orientations of the individual and society is increasing in crisis, critical stages of historical development, which raises the need for their full understanding. Studying value orientations of ethnology is one of the most actual problems of modern psychological theory and practice.

Undoubtedly, the new values of modern civilization affect the ethnic consciousness-oriented people who value traditional culture. This influence affects the system of values of the individual and, in particular, on a system of ethical values of ethnology.

The purpose of the research: Explore the structure of value scope of titular nation of Kazakhstan at the modern stage.

To examine the value orientations of the Kazakhs, we have developed a comprehensive package of psychological techniques, which allows to consider the structure of value scope of titular nation (method of Sh. Schwartz (value questionnaire Schwartz), methodology of studying value orientations of Milton Rokeach, system diagnostic methodology of value orientations E.B. Fantalova , L. S. Kolmogorova, D. V. Kashyrsky, modification methods of Kun "Who am I?".

According to the results of our research, value orientation activity, initiative, employment generally takes an important place in the structure of value scope of titular nation of Kazakhstan Along with this, informative factor as the national value belonging to the title ethnicity of Kazakhstan during factor analysis is equal to 1.8%, which corresponds to only 19 factors in the structure of value scope of sampling study.

The results of factor analysis allow us to conclude that the structure of value scope of titular nation of Kazakhstan is multi-faceted and includes both individual and group, social values.

Valuable orientation of Kazakh people in the system of cultural ties and relationships are based on valuable backbone component, which determines the conditions for their development, orientation, the nature of the activity of the individual and to ensure the integrity and the unity of ethnic group: the most important characteristics of the structure of value scope of titular nation of Kazakhstan are: competence, commitment, self-discipline, which testifies to the importance of achieving social success, success in work for the Kazakh ethnic group.

In summary, we would like to point out that the formation of a national identity based on values is a long process, which, of course, for the period of the beginning of the modern history of Kazakhstan is not completed yet.

The results of this research can be used for implementing national policy of the Republic of Kazakhstan and works towards the preservation of cultural traditions of Kazakh people.

The theoretical and practical analysis carried out in the research suggests that the problem of preserving and enriching the ethnic values of the titular nation Kazakhstan, is now extremely urgent, but it is not enough elaborated now

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.65

Keywords- ethnopsychology; values; structure of values' scope; titular ethnicity; ethno value; individual component of value orientations; national identity; ethnic self-consciousnes

I. INTRODUCTION

Modern civilization raises the problem of understanding the human values of individual social groups and society as a whole in a number of extremely relevant to scientific knowledge and practical solutions.

Fundamental change of the public system and other changes, over the past decade in the Republic of Kazakhstan after obtaining independence, demanded a reassessment of values, including character and features of value orientations of the Kazakh people.

Considering the value orientations of ethnology (individual media ethnic cultures and national psyches, representative of the ethnic group), it is not possible to circumvent the problem of ethnicity, it's ethno cultural characteristics, socialization, national mentality, ethnic identity and so on the actuality of the research problems in the Republic of Kazakhstan is growing rapidly.

Among the most prominent researchers of ethnic characteristics to the socialization, damn the national character, inter-ethnic contacts should be named to Berdibayeva S.K., A.H. Kukubayev, Z.M. Balginbayev, Shalharbekov N.A. and others.

In the world of psychology there are a huge number of works dedicated to the values and value orientations, examines their hierarchy (Cantril, Kluckhohn; Rokeach). Normative and evaluative approach exploring the mindset of society comes from E. Durkheim, T. Parsons, M. Weber, A. Marshall, and V. Pareto.

In most modern research values are under the socio-psychological perspective, appear as a social phenomenon, as a product of society and social groups [5, 6, 7, 8]. Three types of belief (existential, evaluation and forecasting), M. Rokeach relates values to the last, third type, which allows you to navigate the desirability is advisable way of conduct (operational, instrumental values) and existence (semantic, terminal values) [9].

Researchers of terminal values divide them into two large classes, depending on whether they are directed at society (interpersonal) or an individual (intrapersonal) (Allpor, Mas1ov, Morris, Rosenberg, Smith, and Woodruff). The adoption of these values each person individually variable. On the extent of the coverage values can be individual, group and society. Among the group values the special place occupied by ethnic values.

In western ethnic presents the main theories that have developed: R. Benedict (concept model), A. Kardiner, R. Linton (basic structure theory of personality), A. Inkelis, E. Levinson, H. D'juker and H. Fraid (the concept of modal personality), B. Hellpag and P. Hofstetter (theory of geographical factors), A. Farnham and S. Bochner (concept of culture shock), R. Brislin, E.T. Hall (work in the area of intercultural interaction), M. Argyle, R. L. Bjordvistell, A. Kendon, J. Rush, P. Ekman, B. Friesen (study of cross-cultural non-verbal communication), S.Huntington (theory of clash of civilizations), M. Rokeach (classification of American cultural values), and Richmond, J. Smith, C. Clyde Kluckhohn, F. Strodtbek, T. Knutson, G. Hofstede, G. Triandis (study of national character features).

As the analysis shows, the better known are the value orientations of the individual of different age groups, group cohesion, conflict, aggression, professionally significant qualities.

So far, there is almost no conceptual psychology research on fundamental shifts in development of value orientations of the individual in society crisis.

Realizing of ethnicity, ethnic affiliation, ethnic views, habits, norms of behavior as the constituent elements of everyday consciousness form national identity in the narrow sense of the word. The self-consciousness of the nation includes: consciousness of ethnic community and relationship to other ethnicities, commitment to national values.

Variables of ethnic consciousness (the native culture, value orientation, etc.) are included in the structure of each individual's consciousness. In the development process of the structural links of identity are filled with content, resulting from the historical development of social relations, value orientations, conditions of inter-ethnic relations.

In general our study challenges solved. Theoretical analysis of literature on studying value orientations of the individual as a dynamical system, namely, factors and conditions affecting the development of value orientations in the ethnic aspect, reviewed and analyzed research aimed at exploring the value scope of titular nation of Kazakhstan. Value scope of titular nation of Kazakhstan on contemporary stage was studied.

Republic of Kazakhstan is a young State, which, of course, exerts its influence on the values of the titular nation of Kazakhstan. The desires to prove him, a desire to realize them, the desire to do everything possible for his family are unconditional personal values priorities. Perhaps a sense of community, a sense of piety and harmony will also be among the priorities, values when economic, social and cultural situation in Kazakhstan is increasingly stabilizes and prospers.

II. METHODS

A. Subjects

In our research examined the structure of value scope of titular nation of Kazakhstan. The study was conducted in Kazakhstan in Almaty in May, 2013. The study involved 100 representatives of the titular nation of Kazakhstan; the average age of survey participants was 32 years and 5 months. Let us characterize sampled in more detail: men-12.0%, women-88.0%, 56% of respondents with a higher education, 44%-secondary vocational education, social status-100 employees (%).

The study used techniques such as: Sh. Schwartz (value questionnaire Schwartz), the test studying value orientations of M. Rokeach, the methods of diagnostics system of value orientations E.B. Fantalova, modified by L. S.

Kolmogorova, D. Kashyrsky, modification methods of Kun "Who am I?".

The validity and reliability of the obtained during the experiment provided data showing a variety of research procedures and techniques, a combination of qualitative and quantitative analysis of collected data: methods of mathematical-statistical data processing. During the mathematical processing of experimental data method was compared of Mann-Whitney criteria, Kruskalla-Wallis and factor analysis.

B. Task

The empirical part of the individual inspection was conducted in two phases.

In the first phase was carried out research and subjects was proposed test studying value orientations of M. Rokeach and S. Schwartz. In the second phase, adolescents were offered a diagnosis methodology of value orientations E.B. Fantalova, modified by L. C. Kolmogorova, D. Kashyrsky and modification methods of Kun "Who am I?".

The main hypothesis of the study: value orientations of the Kazakh people in the system of cultural ties and relationships are based on ethnic value backbone component, which determines the conditions for their development, orientation, the nature of the activity of the individual and ensures the integrity and unity of the Kazakh ethnic group.

III. Results

Initial results obtained rank analysis of value orientations, obtained by the method of M. Rokeach, allow us to conclude that the value orientations of titular nation of Kazakhstan research sample have a complex structure in which the large role played by active work, based on the high social queries. A minor role in the structure of value orientations on the importance of play, with fun and creativity does not stand out as a significant value-aim.

In order to achieve the objectives are not considered as preferred tools such as: courage and will, preference is given to such objectives as: manners (good manners), the high level of claims and the sense of humor. This may indicate that to achieve the objectives of the study sample respondents prefer to not act directive, using his sense of humor, the rules of ethics, while, thanks to the high level of claims without ceasing for a moment to chase a goal.

Other methods of our research findings were obtained to complement the diagnostics results of value orientations, obtained by the method of M. Rokeach. Due to the large number of quantitative data to identify the structure of value scope of factor analysis was applied, the meaning of which is obtained in the course of the study, the number of variables to submit fewer other variables called factors. Factors act as more fundamental variables that characterize the subject. When performing factor analysis of the original variables are combined into groups, each of which represents a factor.

For aggregation by factoring the analysis made of the package of statistical programs SPSS.

Processing was carried out using the method of principal components procedure was chosen with Varimax rotation normalization on Kaiser, considered factors with large units. Rotation in case of 124 variables (74-variables methods S. Schwartz, 36-variables technique M. Rokeach , 13-variables methods Fantalova, variable is the method of "who am I?") required 96 iterations.

As a result of factor analysis was founded thirty-six new factors that explain together more 82.31% of the total variance that is a good result. We analyzed the first 20 factors, information which exceed or equal to 1.8% of the total variance.

Proceed to the interpretation of the results. During analyzing data was provided on the module load factor greater than 0.4. During interpretation especially stands out for each variable, the largest in absolute value of factor loading.

The positive pole of the factor is interpreted on the basis of the positive poles of the variables that have the greatest positive loads, and the negative poles of the variables that have the greatest negative load module. Accordingly, the negative pole of the factor variables are represented by negative pole with maximum positive loads and the positive pole of the variables with the greatest negative module loads [13].

To summarize the work done and will list the latent factors, discovered through joint analysis methodologies: methodologies S. Schwartz (value questionnaire Schwartz), methods of studying value orientations of M. Rokeach, methods of diagnosis system of value orientations E.B. Fantalova, modified by L. C. Kolmogorova, D. Kashyrsky, modification methods of Kun "Who am I?" in descending order of their significance for the structure of value scope of titular nation Kazakhstan:

1. Competence;
2. Sense of purpose;
3. Orderliness;
4. Focus on ecological expediency, absence of pitting man and nature;
5. Diligence and commitment;
6. Conscious preservation of traditions;
7. Harmony (balance between internal and external conditions);
8. Equality;
9. Activity directions of the implementation of their own and others ' interests;
10. The right to freedom;
11. Continuous physical and spiritual perfection;
12. Wisdom;
13. Employment;
14. Ability to act for ourselves and others;
15. Spirituality from a sense of community, and usefulness to other;
16. Self-confidence;
17. Perseverance;
18. Ability to assert their opinion;
19. National value belonging to the title ethnicity of Kazakhstan;
20. Initiative.

Thus, the results of factor analysis allow us to conclude that the structure of value scope of titular nation of Kazakhstan is multi-faceted and includes both individual and group, social values. The first three values that represent the most important characteristics of the structure of the sphere of values, namely competence, commitment, organization indicate that prevailing are individual values that allow, above all, achieve social success, success in employment.

Noteworthy in the structure of value scope of titular nation of Kazakhstan, examined by us in the course of the study, the importance of value orientations associated with adherence to the principles of traditionalism. Perhaps this is due to the ethnic values characteristic of the Kazakh people.

You should also, in our view, to draw attention in the value structure for the value orientations, showing the importance of equality and freedom. These value orientations reveal themselves also in the ability to defend their opinion, persistence and initiative.

An interesting result is also represented in the structure of value scope of titular nation of Kazakhstan value orientations, revealing the relationship to others, namely, the focus on the desire to be useful to others to act for others. Perhaps it is also associated with ethnic features of value scope of the Kazakh people.

Value orientation activity, initiative, employment generally occupies an important place in the structure of value scope of titular nation of Kazakhstan according to the results of our study. Along with this, informative factor as the national value belonging to the title ethnicity of Kazakhstan during factor analysis is equal to 1.8%, which corresponds to only 19 factors in the structure of value scope of sampling study.

Perhaps this is due to the fact that the technique of Kun less informative in our study compared with the methods of S. Schwartz, M. Rokeach and E. B. Fantalova. Perhaps this is due to the recent history of Kazakhstan from the Soviet period, when following the national values of the individual peoples of the USSR, not rewarded, but rather tightly restricted and punished. In this connection the low importance values-ability to assert their opinions and creativity-complement the above indicated the problem of forming national values.

In the second phase, adolescents were offered a diagnosis methodology of value orientations E.B. Fantalova, modified by L. C. Kolmogorova, D. Kashyrsky and modification methods of Kun "Who am I?".

In the second part of our study compared indicators of value scope of different age groups of the titular nation of Kazakhstan developed a standardized set of methods that enable you to holistically address the various indicators of the value of the scope, which includes study of the guiding principles and their value of life importance values, goals and values-funds, internal conflict or internal vacuum between the availability and importance of values, values of belonging to a national group.

In this part of the study was attended by 100 representatives of the titular nation of Kazakhstan, Kazakhs, 50 of them between the ages of 20-to 30 years (Group 1) and 50 of the Kazakhs in aged 31 years to 55 years of age (Group 2).

Move on to the results of the study. First look at the results of diagnosis value of the scope for each methodology in groups 1 and 2 and compare the results of such statistical criteria like U of Mann-Whitney test and T- criterion for independent samples.

Analysis of ranks table on the Mann-Whitney criterion allows statistical differences obtained as (Ucr = 1010 for $p \leq 0,05$, Ucr = 912 for $p \leq 0,01$). For a group of Kazakh people aged 20 to 30 years statistically more important guiding principles in life are true friendship, peace, social justice and beauty compared to the group of Kazakhs from age 31 to 55 years.

While Kazakhs aged 31 up to 55 years more important values-integrity and reliability are qualities compared to youth group. This may indicate that the new economic and socio-cultural developments in Kazakhstan during recent history, associated with the proclamation of the independence of the Republic of Kazakhstan are reflected in changing values of the younger generation have priorities.

For Kazakhs adolescence more than for generations of Kazakhs coming of age are important values of this beauty, friendship, peace and social justice. There are still a large number of values that are important and meaningful for both the Kazakhs adolescence and for Kazakhs coming of age (from 74 submitted values methodology S. Schwartz revealed statistically significant differences only for the 5 values).

Move on to consideration of the results and statistical analysis of results of diagnosis 1 and 2 groups of examinees obtained by the method of M. Rokeach.

A comparative analysis of the diagnostic results 1 and 2 groups of examinees on the methodology of M. Rokeach on t-test, terminal values (t-test).

On t-test significant differences were detected in 10 of 18-minute terminal values (tcr = 2,00 for $p \leq 0,05$, tcr = 2,66 for $p \leq 0,01$, tcr = 3,46 for $p \leq 0,001$) –objectives, namely: active life, health, interesting work, the beauty of nature and art, public recognition, productive life, happy family life, happiness, creativity and confidence between groups of Kazakhs adolescence and adulthood sampling study Kazakh.

The result may indicate that for Kazakhs in adolescence values objectives to a greater extent with the social success and recognition than for Kazakhs adulthood for which define the values, the objectives are the goals relating to health and family. Of course, the result can be explained and also the age of psychology, as for adolescence determines age development task is socialization, that is finding its place in this case in the society.

For a group of examinees coming of age, this task becomes secondary, because it has already been solved in youth or early adulthood.

By T- identified significant differences in 9 of 18-minute instrumental values (tcr = 2,00 for $p \leq 0,05$, tcr = 2,66 for $p \leq 0,01$, tcr = 3,46 for $p \leq 0,001$) –objectives, namely: accuracy,

sense of duty, the intransigence of the weaknesses in ourselves and others, education, rationalism, self-control, tolerance, honesty, efficiency in matters between groups of Kazakhs adolescence and adulthood sampling study Kazakh.

The result may indicate that for Kazakhs in adolescence values means more associated with efficiency and youthful perfectionism than for Kazakhs adulthood for which defines the values of the means are tools associated with tolerance for the shortcomings and personal integrity.

Turning to the results of the methods of E.B. Fantalova modified by L. C. Kolmogorova, D. Kashyrsky.

Identified significant differences in the values of active life and cognition are tested 1- and 2- nd group. This suggests that the internal conflict between the importance and availability values active life increasingly characterized the Kazakhs in adolescence than in mature as well as value of "cognition", more valuable and simultaneously available in adulthood than in youth.

Move on to the descriptive statistics, diagnostic results to modify methods of Kun. We reviewed the response of the test subjects, indicating nationality to cover ethnic group in Kazakhstan. In 1 group of 88% (44 people) respondents from 20 possible answers to the question "Who am I?" is not answered, pointing to a nationality to the front to ethnic culture of Kazakhstan. 6% (3 people) answered this question with the indication of the nationality in the first 10-minute response options, 6% (3 people) responded accordingly in the second response options. This may indicate that the Kazakhs adolescence sampling studies are still not formed a national identity itself as the representative of the titular nation of Kazakhstan.

In Group 2, 68% (34 people) respondents from 20 possible answers to the question "Who am I?" is not answered, pointing to a nationality to the front to ethnic culture of Kazakhstan. 32% (16 people) answered this question with the indication of the nationality in the first 10-minute response options. This may indicate that the Kazakhs coming of a sample age research increasingly shaped national identity itself as the representative of the titular nation of Kazakhstan compared with Kazakhs adolescence sample research.

IV. Conclusion

The structure of value scope of titular nation of Kazakhstan is multi-faceted and includes both individual and group, social values. The first three values that represent the most important characteristics of the structure of the sphere of values, namely competence, commitment, organization indicate that the value field of titular nation of Kazakhstan are the dominant individual and universal values, which allow, above all, achieve social success, success in employment.

In the structure of value scope of titular nation of Kazakhstan important value orientations associated with adherence to the principles of traditionalism, equality and freedom. These value orientations reveal themselves also in the ability to persevere with a simultaneous focus on the desire to be useful to others to act for others. Value orientations of activity, initiative and employment also hold an important place in the structure of value scope of titular nation of Kazakhstan. Perhaps, these value orientations are primarily ethnic values characteristic of the Kazakh people.

Key factors of value structure latent scope of titular nation of Kazakhstan are: 1. Self-realization, implying a greater role a sense of community and well-being of individualism; 2. self-determination, which plays a success; 3. Happy family life and materially secure life more meaningful, than actively engaged life and vital maturity.

Value orientation of "belonging to an ethnic group of Kazakhstan" title, role of national identity in the structure of the axiological orientation of the titular nation of Kazakhstan is insignificant. Perhaps this is due to the recent history of Kazakhstan from the Soviet period, when following the national values of the individual peoples of the USSR, not rewarded, but rather tightly restricted and punished.

Value scope of the representatives of the titular nation of Kazakhstan adolescence and adulthood is characterized by the following features:

- For Kazakhs titular nation of Kazakhstan irrespective of age preferred guidelines in life are family security, close people and authority. The least important is the value-quality is gentleness. Most of the values that are important and are the guiding principle for Kazakhs adolescence, are also the Kazakhs coming of age.
- Significant differences in terms of value were diagnosed areas as: true friendship, beauty world, social justice, quality - is complete and reliable. For a group of Kazakh people aged 20 to 30 years statistically more important guiding principles in life are true friendship, a world of beauty and social justice. Kazakhs aged 31 to 55 years more important values-integrity and reliability is qualities compared to youth group.
- The most preferred values objectives Kazakhs adolescence are: interesting work, active life, financially secure life. The least preferred values-objectives are: happy family life, creativity, development and self-confidence. The most preferred values-objectives of Kazakhs adulthood are: health, happy family life and as well as Kazakhs adolescence is financially secured life. The least preferred values objectives are: confidence, fun and creativity.
- The most preferred values of Kazakhs means teenagers are good breeding, high sense of duty and queries. For Kazakhs coming of age the most preferred values means are orderly, politeness and cheerfulness. Politeness is the preferred value-tool for both samples study.

For Kazakhs adolescence above the significance of values such as active life, interesting work, the beauty of nature and art, public recognition, productive life, happiness, creativity, compared with Kazakhs, ranging in age from 31 to 55 years. For Kazakhs coming of age above the significance of such values are as health, happy family life and self confidence.

Strong differences in values-goals and values means also identified among the Kazakhs of adolescence and adulthood. For Kazakhs adolescence internal conflict in values between the values and significance of the availability is

expressed by such values as an active, engaged life. Subjects not older uncovered internal conflicts on any of value orientations in isolation, but diagnosed an inner conflict between availability and overall value on all the indicators considered together.

In general, the similarity value scope applies, first and foremost, the security value of the family, loved ones and credibility, the basic guidelines for the titular nation of Kazakhstan, regardless of age. National identity sufficiently formed as Kazakhs adolescence and Kazakhs coming of age (88% and 68% of Kazakhs respectively).

Thus, our study confirmed the hypothesis, i.e. the value orientations of the Kazakh people in the system of cultural ties and relationships are based on ethnic value backbone component, which determines the conditions for their development, orientation, the nature of the activity, of the individual and to ensure the integrity and the unity of ethnic group.

REFERENCES

[1] Berdibayeva S.K. "Etnopsychological features of the creative activity of the man (on an example of creative competition)," pp. 40, Almaty, 2005.

[2] Kukubayeva A.H. **"**Phenomenology, structure, features of the development of national identity (for example, the Kazakh ethnic group)," synopsis, Almaty, 2009.

[3] Balgimbayeva Z.M., "The role of the family in the event of sexual ethnic prejudice in children" synopsis, Candidate for Doctor of Psychology, Almaty, 2002

[4] Shalkharbekova N.A., "Formation and development of ethnic prejudices in process of social adaptation in a new ethno-cultural environment: synopsis", Candidate for Doctor of Psychology, Almaty, 2013.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press. Dontsov A.I., "About the value relationship of the person", pp. 67-76, Soviet pedagogy, 1974.

[6] Leontiev D.A., "Psychology of meaning", p. 487, Meaning, 1999.

[7] Ajzen I., Fishbein M., "Understanding attitudes and predicting social behavior", Englewood Cliffs, NJ: Prentice-Hall, 1980.

[8] Schwartz, S. H. & Bilsky, W., "Towards a psychological structure of human values", pp.550-562, Journal of Personality & Social Psychology, 1987.

[9] Burlachuk L. F., "Psychodiagnostics. Textbook for Universities", p. 50, St. Petersburg, 2003.

[10] Karandyshev V.N., "Schwarz's methods for the study of the individual values. Concept and guidance", p.72, St. Petersburg, 2004.

[11] L.S. Kolmogorova, "Methods for diagnostics of value orientations of the personality by E. B. Fantalova modificated by L.S. Kolmogorov, D.V. Kashirsky", "Diagnosis of psychological culture of pupils: a practical guide for school psychologists", p.259–263, Vlados-Press, 2002.

[12] N.N. Palagina, "Ethnopsychology: Theory and Methods", p. 91, Bishkek: Kyrgyz-Russian Slavic University, 2001.

[13] Ermolaev O.U., "Mathematical statistics for psychologists(textbook)", p. 336, MPSI, Flint, 2003.

Close Friendship Networks in Medical School:
The Uncertainty Problem

Mary J. Gallant
Department Sociology and Anthropology
Rowan University
Glassboro, New Jersey, United States

***Abstract*--Following Emile Durkheim's (1897; 1951[1922]) position regarding anomie and expressions of it like uncertainty as not referring to a state of mind but themselves representing a property of social structure, the research referred to in this paper used indicators of close friendship networks, knittedness and relative centrality, to explore medical school training in a panel study design of the first two years of the program. (Abstract)**

Keywords- uncertainty; friendship networks; knittedness; relative centrality

I. INTRODUCTION

A. Uncertainty and the Structure of Medical School Socialization

What influences the selection of candidates for medical school is their prior academic success. Given their capacity for high performance, it is something of a surprise to find a degree of uncertainty expressed in their own performance and fittedness for the program as they continue through their first and second year (Light 1979: 310-315; Bucher and Stelling 1977:12). Effects of their uncertainty are represented in terms of a higher tendency to suicidal ideation and higher suicide rates than similar age populations. In part this may be understood in terms of previous academic success accounting for less than 6 percent of the variance in academic performance (Ferguson, James and Madeley 2002:954; Mosley 1994) in the program. In the first year of medical school for young adults accustomed to rapid mastery of material and academic distinction (Dyrbye, Thomas and Shanafelt 2005:1613-1614), doubt is cast by their now mixed performance on high stakes examinations in the new learning environment of medical school. Gough and Hall (975:301-314) refer to heavy stress from long hours, a grueling pace, fatique and test anxiety contributing to their de-sensitization and, for a time, growing cynicism. Other researcher like Broadhead (1983:35-38), Hochschild (2012 [1985]) as well as Haas and Shaffir (1977; 1982) point to an emotional dimensionality in what is occurring.

Recent studies of nationally representative samples show no abatement of the problem (Schwenk, Davis and Wimsatt 2010:1181; Dahlin, Joneborg and Runeson 2005). Goebert et al. (2009) and Gerrity (1992) note that for nearly a half century, stress in medical training has been a growing issue with recent research showing that burnout rates are also among medical students, residents and physicians in the United States and Canada (Dyrbye, Thomas and Shanafelt 2006; 2005; Gold, Ananda and Schwenk 2013), as well as Europe and the U.K. (Tyssen et al. 2001).

B. Friendship as a Network Analytic Indicator

Friendship is a silent partner to life in complex organizations and formal workplace structures; it is "the weak tie" that influences getting a job (Granovetter's 1973) as well as articulating the most profound relationships we have across our different roles. The research literature on social cohesion and structural integration conceptualize friendship as having both personal and positional dimensionality (Levin, Cross and Abrams 2002) in the workplace and the professions. Kuipers (2009) sees it in the workplace as being a person-to-person relationship that in organizational analysis allows for overlap between the informal and personal and the formal and positional relationships. Friendship is an important part of intimacy and trust in various organizational settings (Gibbons 2004:238-240) and can facilitate the development of new learning without negatively affecting the friendship network. In the literature it is associated with organizational commitment, resource sharing during crisis, handling sensitive issues, enhancing cooperation and forwarding open communication. Within formal work settings, Kadushin (1995) looking at friendship within a financial elite notes that friendship does not compete with positional relations but contributes in its own way to social cohesion, bringing off smooth flow within the elite across changes in regimes or political parties. Elements of homogeneity of background in education, club membership, overlapping board memberships and shared social status brings members of an elite together, but overlaps in friendship in organizational bonds build "an enforceable trust" as an emergent

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.67

from interaction (Portes and Sachsenbrenner 1985; 1993).

Studying close friendship in terms of social networks helps clarify how moral cohesion in Durkheim's terms (1947 [1893]; 1938[1895]; Marske 1987:2-4) is facilitated across various levels of organizational structure (Fine and Kleinman 1979; Galaskiewicz 1985:640; 1979; Wellman 1983). Claude Fischer (1982) as well as others like Bochner, Ellis and Tillmann-Healey (2000) show how friendship networks influence the construction of meaning generally as well as the management of emotions and feeling rules.

Friendship networks are associated with a multi-dimensioned set of effects not directly intended by any one of the participants in them. As a pervasive force friendship has a capacity to influence a variety of outcomes (Pahl 2001: 421-422), from advancing individual interests to becoming part of the moral basis of society (Durkheim [1893] 1964:226-29) of society. Its effects can be seen to ramify across a series of dyadic encounters affecting attachment and identity in professional and organizational contexts (Levin, Cross and Abrams 2002; Kuipers 2009; Stets and Carter 2011).

C. Connecting Medical Students Close Friendship Networks with the Uncertainty Problem

Knittedness and relative centrality are indicators of social cohesion, integration and communal solidarity (Freeman 1977; 1979), the network literature shows that in Western societies there is a tendency for interpersonal and professional relations to ramify as size and complexity of society increase. Network ramification is associated with change in values and orientations favoring inclusiveness, breadth of perspective, and positive commitment to ethics and self-confidence. What it loses in terms of warmth of constant association it gains in terms of flexibility and independence. The other indicator of network structure, knittedness (Bott 1957), is more often associated with measurement of smaller units and anticipates solidarity and unanimity more than flexibility and broadening of perspective. It does not disappear as relative centrality emerges. Where there is a direct set of ties between members of a social unit, a condition of high structural "knittedness" holds, and a tightly circumscribed communal effect is sustained, especially where the social unit is small and many of the actors are visibly co-present. Members of such a unit interact in light of the fact that they share proximity, that is, the same locale or area rather than individual idiosyncrasies, interests and preferences. Positions within organizations may provide examples of both kinds of network structure, at times sponsoring conditions of local knittedness (direct tie density) within a wider more ramified patterning of ties.

Overall, the more knitted or directly tied the members of a social network are, the more locked into strait-jacketed traditions, limiting self definitions and narrowness. Networks with high relative centrality are more likely to be associated with the capacity for less judgementalism, more flexibility and inclusiveness in perspective than is knittedness. While proximity is clearly important in the network literature for the formation of communal bonds to occur, close friendship is selective. Forming and keeping friendships that prove themselves situationally is part of a process of constant reckoning. Similarly, friendship networks emerge and take shape in response to the flow of situated interaction. In terms of friendship in organizational contexts Galaskiewicz (1985) notes, "Especially under conditions of uncertainty, professionals will seek out those with whom they can communicate easily, even if that means that they systematically segregate themselves from a subset of other actors" (1985:640). In studying situations generating uncertainty, the ability to find a specific fit that then promotes continuity and higher knittedness does not preclude at the same time holding on to relations that thrive in the openness of highly ramified ties as conditions change.

D. Testing the Variable Relationships

Data for the path analytic models to be tested (Gallant 2013 [1985]) used cosmopolitanism and (moral) consistency as dependent variables. The independent variables were structural indicators of knittedness[1] and relative centrality[2]. Linking measures of knittedness

[1] Knittedness:the degree to which a network is connected by a wide variety and intensity of ties in each type of relation that it manifests. Following Burt (1980), knittedness may be further clarified: where the network contains n actors, its density in regard to the kth type is the mean such relation between separate actors in the network $(\sum\sum z_{jik}) / n(n-1)$ for all actors $i \neq j$ in the network.

Knittedness is the degree to which a network is connected by a wide variety and intensity of ties in each type of relation that it manifests. Following Burt (1980), knittedness may be further clarified: where the network contains n actors, its density in regard to the kth type is the mean such relation between separate actors in the network $(\sum\sum z_{jik}) / n(n-1)$ for all actors $i \neq j$ in the network.

and relative centrality to measures of normative consistency[3] and cosmopolitanism (perspective)[4] there are four hypotheses:

H1 As knittedness in the network increases, moral consistency increases.

H2 As knittedness increases, cosmopolitanism decreases (i.e. orientations become more particularized and local).

H3 As relative centrality of a network increases, moral consistency decreases.

H4 As relative centrality of a network increases, cosmopolitanism increases (i.e. orientations become more generalized and inclusive).

II. RESULTS

A. The Sample

Data for the present paper came from research using a panel study design. A two-point in time panel study representing a cohort of 170 medical students of whom 65 participated at the first point in time and 45 participated at both points in time was conducted. Students were contacted near the start of the first two years of the program and again nearer the end. Questionnaires were used to gather the data on networks of close friendship, normative consistency, and cosmopolitanism. Network data was gathered on respondents' close friendships that included their past and present ties to (off-campus) families and friends. Called "General Networks," they were bonds that held across long periods of time and were rich in terms of shared experience. "Campus Networks" were comparatively new and were specifically focused on the kinds of concerns and activities normal to a medical school program.

B. Path Analysis; Testing the Models

A path analysis of the four models representing the hypotheses (Figure 1) examines the direct and indirect effects of the structural variables, network knittedness and relative centrality on the dependent variables, (a) consistency, and, (b) cosmopolitanism. Four equations which describe the general path model reflect each of the four hypotheses. The analysis examines the adequacy of the general model as well as the relative strength of each of the variables when the effects of all other influences are controlled. Table 1 presents Inter-Correlations among the Indicators. Table 2 shows the path Coefficients for Knittedness and Relative Centrality as Determinants of Consistency and Cosmopolitanism. Tables 3 and 4 display the strongest path models representing coefficients for knittedness and relative centrality as determinants of Consistency and Cosmopolitanism.

The General Path Model: The general model (see Figure 1) consists of each of the structural variables: (1) knittedness of campus nets (KNITCAMP1), (2) knittedness of general nets (KNITGEN1), (3) relative centrality of campus nets (CENTCAMP1), and, (4) relative centrality of general nets (CENTGEN1) as they affect either consistency (CONSIS2) or cosmopolitanism (COSMOPL2), the dependent variables. The structural variables (taken at time one) are temporally prior to the dependent variables (taken at time two). Description of the model is complete with the mention of the effect of CONSIS1 on CONSIS2 and COSMOPL1 on COSMOPL2 (see Figure 1). In all there are four tables shown here which in the general path model represent the dependence of either consistency (see Figures 1a and 1b) or cosmopolitanism (see Figures 1c and 1d) on the logically prior structural variables at two points in time. The general model represents the effect of social structure on indicators of consistency in normative orientations and cosmopolitanism in perspective. The equations in the model follow the general theorem of path analysis (Mueller, Schuessler and Costner 1977:312-329).

In Table 2, path coefficients for knittedness and relative centrality as determinants of consistency and cosmopolitanism, show significant results in general networks only, and only with cosmopolitanism (KNITGEN1 -.48, $p \leq .01$ with COSMOPL2; CENTGEN1 with COSMOPL1 .38, $p \leq .01$ and

[2] Relative Centrality:the degree to which an actor may be said to be involved in all the relationships in his or her network. Following Freeman (1979), it is measured in some cases in terms of the total interactions in the network that any one actor shares with others. Alternately it is a multi-dimensional property of a group. Centrality is used as an indicator of the integration of positions of actors in a network. The more each actor is tied to others, the more the relational system is likely to be integrated as a whole. An actor's position is central to the extent that the proportion of the sum of all relations in a network that involve him approaches unity. At that point, the set of actions that involve him and all relations in the network approach maximum overlap.

[3]See Moral consistency was indicated in the questionnaire by asking would there be any problems in your friendships if you consistently were at odds with your friend(s).

[4]In the present research, Thielbar's (1970 [1966]) Local-Cosmopolitan scale was used to indicate the linkage between values and world view.

CENTGEN1 with COSMOPL2 .46, p ≤ .01). General networks show the strongest effects; ties in General networks have endured longer than campus networks and across different contexts, some of which may be highly knitted at times. The directionality of the effect of knittedness on cosmopolitanism (-.48, p ≤ .01) sustains the hypothesis that as knittedness increases in friendship networks cosmopolitanism decreases (H2). In contrast, the effects of knittedness on consistency (as a ordinal level indicator in this research) shows weaker effects that are not significant. Looking at the comparative effect of relative centrality in general networks on cosmopolitanism, significant effects (.38, p ≤ .01; .46, p ≤ .01) occur at both points in time and in the direction anticipated in the hypotheses (H4). The hypothesis that as relative centrality increases moral consistency decreases (H3)is sustained in campus and general networks at the second point in time though it is not significant (-14, p is ns; -10, p is ns). For this sample of medical students, relative centrality as a structural variable in general networks has a strong effect on cosmopolitanism at both points in time, contributing to an increased cosmopolitanism over time.

Table 3, the actual correlations and decomposed paths for the effect of knittedness on cosmopolitanism focus on cosmopolitanism, detailing how knittedness in the general model affects cosmopolitanism at time one (.255, p ≤ .05) and time two (.472, p ≤ .01). At time one the association between knittedness and cosmopolitanism is due almost completely to the direct effect of this path (-.293). At time two this is due to a strong direct effect (.309) but with a stronger indirect effect (.160). The effect of cosmopolitanism itself at time one on cosmopolitanism at time two (.398, p ≤ .01) is strong and most of that due to direct effects. Overall, the model itself is strong accounting for 49.7 percent of the variance in the dependent variables and most of that due to the direct effects of the structural variables.

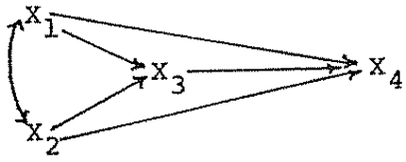
Table 4, the actual correlation and decomposed paths for the effect of relative centrality on cosmopolitanism, details how relative centrality in the general model affects cosmopolitanism. The effect of relative centrality at time two on cosmopolitanism at time two (.463, p ≤ .05) is significant and due to the direct effect of this path (.365). However the effect of cosmopolitanism itself at time one on cosmopolitanism at time two (.611, p ≤ .01) is considerable. Most of this is due to the effect of relative centrality on cosmopolitanism (.384, p ≤ .05). The model is strong and accounts for 46.3 percent of the variance in the dependent variable.

Significant results were evident only for path models 1c and 1d (see Figure 1). In both models, significant results support the hypotheses contending a specific directionality for the structural influence of knittedness and relative centrality only on cosmopolitanism. Looking at Figure 1c, it was found that: (a) KNITGEN1 significantly influences cosmopolitanism, that is, as knittedness increases, cosmopolitanism decreases (and vice versa); (b) CENTGEN1 significantly influences cosmopolitanism, that is, as relative centrality increases, cosmopolitanism increases (and vice versa).

Cosmopolitanism as the Dependent Variable: Relative centrality in general networks at time one (see Table 3) contributes the most (p_{43} = 0.61; p_{42} = 0.46 at time two; at time one, p_{32} = 0.38) to explaining variance in cosmopolitanism. Relative centrality in campus networks at time one, though important, contributes less than general network relative centrality to the overall explanatory power of the model. Having examined a path model with the smaller paths deleted, neither the separate remaining paths nor the overall R^2 was enhanced by the omission. Regardless of their separate explanatory weight, no paths in the model were deleted. The hypothesis that as relative centrality increases, cosmopolitanism increases was confirmed in general (p_{42} = 0.46) and campus networks (p_{41} = 0.16) by time two. In general networks (but not campus) the hypothesis was confirmed at both points in time (p_{32} = 0.38, p ≤ .01; p_{42} = 0.46, p ≤ .05). Thus where networks are highly centralized, cosmopolitanism is higher both in campus and in general networks at both points in time, but especially by time two.

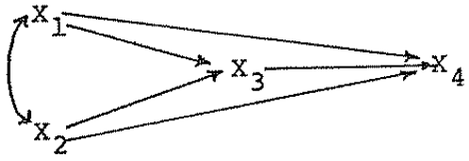
Consistency as Dependent Variable: Looking at the effects of knittedness on consistency in campus (r_{13}), and general contexts (r_{23}), we see that none of the paths are significant (see Table 13; Fig. 2a and 2b). Looking at the total effects of general knittedness at time one (KNITGEN1) on consistency at time two (CONSIS2), most of the weight is due to the unanalyzed component (r_{12}), rather than the separate direct effects of knittedness on consistency. Of the direct effects, however, knittedness of campus networks at time one (KNITCAMP1 = -.12) is the stronger of the two structural variables (KNITCAMP1, KNITGEN1) that were used to predict

Figure 1. The Path Models for the Variables Knittedness, Relative Centrality, Cosmopolitanism, and Consistency in each of the four Hypotheses.*



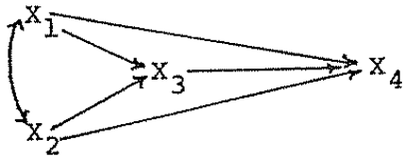
x_1 = KNITCAMP1 x_2 = KNITGEN1
x_3 = CONSIS1 x_4 = CONSIS2

1a



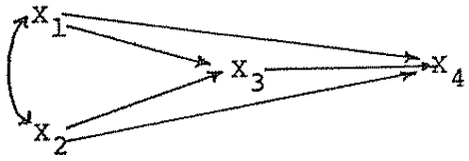
x_1 = CENTCAMP1 x_2 = CENTGEN1
x_3 = CONSIS1 x_4 = CONSIS2

21



x_1 = KNITCAMP1 x_2 = KNITGEN1
x_3 = COSMOPL1 x_4 = COSMOPL2

21



x_1 = CENTCAMP1 x_2 = CENTGEN1
x_3 = COSMOPL1 x_4 = COSMPL2

1d

*The figures correspond with the hypotheses as follows:
H1 = a; H2 = c; H3 = b; H4 = d.

Table 1. Inter-Correlations Among Indicators of Network Knittedness (Campus and General), Relative Centrality (Campus and General), Cosmopolitanism and Consistency at Two Points in Time.

	a.	b.	c.	d.	e.	f.	g.	h.
a. KNITCAMP1	1.000	0.225	-0.625	-0.191	-0.115	0.116	0.102	-0.137
b. KNITGEN1		1.000	-0.267	-0.728	-0.022	-0.159	-0.255	-0.476
c. CENTCAMP1			1.000	0.008	0.187	-0.135	-0.209	0.158
d. CENTGEN1				1.000	0.115	0.279	0.384	0.463
e. CONSIS1					1.000	0.042	-0.195	0.088
f. CONSIS2						1.000	-0.134	-0.044
g. COSMOPL1							1.000	0.611
h. COSMOPL2								1.000

Table 2. Path Coefficients for Knittedness and Relative Centrality as Determinants of Consistency and Cosmopolitanism

Independent Variables	Dependent Variables CONSIS1	CONSIS2	COSMOPL1	COSMOPL2
KNITCAMP1	-0.12	-0.16	0.10	-0.14
KNITGEN1	-0.02	-0.15	-0.26	-0.48**
CENTCAMP1	0.19	-0.14	-0.02	0.16
CENTGEN1	0.12	-0.10	0.38**	0.46**
CONSIS1		0.02		
COSMOPL1				0.61**

* significant; $p \leq 0.05$
** significant; $p \leq 0.01$

Table 3. Actual Correlations and the Decomposed Paths for the Effect of Knittedness on Cosmopolitanism

Actual r	Total Effect	=	Direct	+	Indirect	+	Spurious or unanalyzed				
r_{12}= 0.225	0.225	=				+	0.225				
r_{13}= 0.102	0.102	=	0.168			-	0.066				
r_{23}= -0.255	-0.255*	=	-0.293			+	0.038				
r_{14}= -0.137	-0.137	=	-0.123	+	0.092	-	0.036	-	0.070		
r_{24}= -0.476	-0.472**	=	-0.309	-	0.160	+	0.021	-	0.028		
r_{34}= 0.611	0.398**	=	0.54	-	0.021	+	0.09	-	0.225	+	0.008

R^2 4.321 = 0.497

* significant; p = .05
** significant; $p \leq .01$

Table 4. Actual Correlations and the Decomposed Paths for the Effect of Relative Centrality on Cosmopolitanism

Actual r	Total Effect	=	Direct	+	Indirect	+	Spurious or unanalyzed
r_{12}= 0.009	0.009	=				+	0.009
r_{13}= -0.210	-0.021	=	-0.024			+	0.003
r_{23}= 0.384	0.384*	=	0.384			+	0.0002
r_{14}= 0.158	0.158	=	0.166	-	0.012	+	0.002 + 0.003
r_{24}= -0.463	0.463*	=	0.365	+	0.197	-	0.0001 + 0.0014
r_{34}= 0.611	0.611**	=	0.513	-	0.004	+	0.102 - 0.0001 + 0.0005

R^2 4.321 = 0.463

* $p \leq .05$
** $p \leq .01$

consistency at time two. In a path model with weaker paths (p_{41}, p_{43}) deleted there was little change in the strength of the individual components or the overall R^2. The most robust model is the one presented in Figure 1a. with none of the paths removed. For this set of respondents, the direct effects of knittedness of campus (KNITCAMP1) and general networks at (KNITGEN1) at time two form the largest paths and contribute the most to explaining variance in consistency at time two (CONSIS2) with an R^2 = .04. The amount of variance explained by knittedness and consistency at time two (CONSIS2) is not large (R^2 = .038). Looking at the total effects of centrality on consistency (CENTCAMP1 and CENTGEN1), the largest components are the direct effects of campus relative centrality at time one (p_{31} = .19; p_{41} = -.13) on consistency at time two (CONSIS2). However, the amount of variance explained by the effect of relative centrality on consistency at time two (CONSIS2) is not large (R^2 = .034).

The hypothesis that as relative centrality increases consistency decreases (H3) was confirmed in campus networks (p_{41} = -.13) but not confirmed in general networks (p_{42} = .10). None of the path coefficients (betas) in the model (see Fig.1b) were significant. This suggests that on campus at time two, the more centralized the network the less the normative consistency which is as expected. Compared to relative centrality, knittedness is less prominent in these networks overall but especially by time two.

Overall it was intended that this research cast some light on the role of interpersonal structure in the professional socialization process. Firstly, it appears that the general network has a powerful effect on perspectives that campus friendships do not as clearly show. The effects of general interpersonal networks are in a position to affect the student right from the start of training while campus structures are just beginning to come together. Secondly, structural effects of networks are strong on cosmopolitanism, but by contrast are quite shallow or weak for consistency in normative orientations of close friends.

This set of results which show weak effects between structures of close friendship and consistency should not be interpreted as indicating a weak "mediating" role for close friendship within institutional contexts (see also Alexander and Campbell, 1964:568-575). The normative consistency variable was expected to respond to increased social solidarity in new friendships over time, particularly in campus networks. Instead, while knittedness in campus networks is the stronger of the two structural variables used to predict normative consistency at time two, if we use the sociological literature on advice networks to understand what is happening the interpretation has greater salience. Campus networks in the present research take on the characteristics of advice networks. The study by Cross, Borgatti and Parker (2001) in their study of the social aspects of knowledge sharing and development (2001:229; 231), found that certain kinds of information flow benefit more readily than others across newly merged

organizational boundaries. While admitting that the effects of different network structures on the individuals is insufficiently studied (Burt and Schott, 1985), in their research, advice networks are moved by frequent interaction involving procedural, solutions-based concerns. Similarly in the medical student data, campus networks become more highly knitted as students are seeking answers from campus friends on criterion based questions at the start of the program.

To sum up, in exploring the influence of close friendship during the first three years of medical training, network structures were assumed to have a prior effect on orientations (CONSIS1, CONSIS2) and perspective (COSMOPL1, COSMOPL2). The choice of dependent variables in the path models was governed by four hypotheses, two of which, H2 and H4, were strongly supported. The supported hypotheses are:

H2 As network knittedness increases cosmopolitanism decreases.

H4 As relative centrality of a network increases, cosmopolitanism increases.

Hypotheses dealing with the second dependent variable, (i.e. consistency) had some support at time one in campus networks, that is:

H3 As relative centrality of a network increases, consistency decreases.

In summary, in the present research on social networks, four hypotheses assert the temporal priority of structural variables in accounting for perspective and orientations of network members. Specifically, changes in network structure were expected to affect significant change in the variables cosmopolitanism and consistency. Findings of a path analysis show that the general model connecting the variables is strong, thereby lending support to the hypotheses. There was sufficient evidence to confirm that friendship network structure does influence the complex learning that takes place in early medical training.

IV. DISCUSSION AND CONCLUSION

Empirical studies, --both quantitative and qualitative, clearly indicate that uncertainty during the first two years of medical school (and beyond) is a continuing problem in medical training. Studies of organizations and professions are increasingly focused on repairing problems that hinder social integration affecting competency and proficiency. Gibbons (2004), comparisons of friendship and advice networks in the context of changing professional values and how they overlap, notes that friendship networks are stable, enduring and more difficult to replace than advice relations. Her findings show that while friendship can act as a catalyst for change, advice networks are more likely to be threatened by divergence (2004:243). In a similar way campus and general networks in the path analysis for the present research finds indicators of knitttedness and relative centrality produce different, but important, effects on normative consistency and cosmopolitanism.

Considering the hypotheses as initially stated, the reader may suppose that there is some kind of inverse relationship between the independent variables. However, the general model for the path analysis affords a more multi-dimensioned interpretation. The effect of knittedness on consistency is strongest in campus networks at time one (KNITCAMP1); the effect of relative centrality increases across both points in time as consistency decreases at both points in time in general networks. The path analysis models suggest that in the first years of medical training when there is more programmatic emphasis placed on the acquisition of new information and knowledge to meet curricular goals, knittedness and relative centrality fluctuate in friendship networks. So, while effects are weaker for the relationship between the dependent variable consistency and the independent variable knittedness, an adaptive functionality –as in advice networks, may nevertheless be at work. Once the situational requirements for specific information needed in studying for an exam or gathering new knowledge has passed, the ramified network pattern continues while the effects of knittedness disperses. Network knittedness is strongest at the first point in time because it is then that students and their friends scramble to find new problem solving information to master different bases for knowledge.

The social network analysis of friendship in the social science literature comparing “advice” (Gibbons 2004) and “trust” networks (Kuipers 2009) in organizations, indicate that friendship networks have strong capacity for integrative/cohesive as well as instrumental functions. Without too great a leap, the overlaps and interlacings of general friendship and “advice” networks, could be useful in rectifying different kinds of uncertainty in the first two years of medical school. More research on medical student close friendship networks needs to be done to ascertain how all of these vary with fluctuations in program goals. It may at least be warranted that the present data suggest friendship networks have a capacity for strong constructive insight at a time when competition and conflict, doubt and anxiety connected with medical school programs produce unintended consequences on students.

REFERENCES

Alexander, Norman C. and Ernest Q. Campbell, "Peer Influences on Adolescent Educational Aspirations and Attainment," American Sociological Review, vol. 19, pp. 267-272, 1964.

Bochner, Arthur P., Carolyn Ellis and Lisa Tillmann-Healy, "Relationships as Stories: Accounts, Storied Lives, Evocative Narratives," in Communication and Personal Relationships, edited by Kathryn Dindia and Steve Duck. New York: Wiley, 2000, pp.13-29.

Broadhead, Robert S., The Private Lives and Professional Identity of Medical Students. New Brunswick, NJ: Transaction Press, 1983.

Burt, Ronald S. "Structural Holes versus Network Closure as Social Capital," in Social Capital: Theory and Research edited by Nan Lin, Karen S. Cook and R.S .Burt. New York: Aldine de Gruyter, 1983.

Burt, Ronald S. and Thomas Schott, "Relation Contexts in Multiple Networks" *Social Science Research,* vol.14, pp: 287-308, 1985.

Bucher, Rue and Joan Stelling, Becoming Professional. Sage: Beverley Hills, 1977.

Dahlin, M., N. Joneborg, and B. Runeson, "Performance-based Self-esteem and Burnout in a Cross-sectional Study of Medical Students," Medical Teache*r,* vol, 29(1), pp 43-48, 2007.

Dahlin, M., N. Joneberg, and B. Runeson, "Stress and Depression among Medical Students: A Cross-sectional Study," Medical Education, vol. 39(6), pp. 594-601, 2005.

Durkheim, Emile. *The Division of Labor in Society*. Translated by George Simpson. New York: Free Press, 1964[1893].

Durkheim, Emile, The Rules of Sociological Method. Trans. Sarah A. Solovay and John H. Mueller. Glencoe IL: Free Press, 1938[1895].

Durkheim, Emile, Suicide; A Study in Sociology. New York: Free Press, 1951[1897].

.

Durkheim, Emile, Moral Education. Sociology and Philosophy. New York: Free Press, 1974[1922].

Dyrbye, Liselotte, Matthew R. Thomas, and Tait D. Shanafelt,"Systematic Review of Depression, Anxiety and Other Indicators of Psychological Distress among US and Canadian Medical Students." Academic Medicine*,* vol. 81(4), 354-373, 2006.

Dyrbye, Liselotte, Matthew R. Thomas and Tait D. Shanafelt, 2005. "Medical Student Distress: Causes, Consequences, and Proposed Solutions," Mayo Clinic Proceedings, vol, 80(12), 1613-1622, 2005.

Ferguson, Eamonn, David James, and Laura Madely, "Factors associated with Success in Medical School: Systematic Review of the Literature, British Medical Journal, vol, 324:952-957 2005.

Fischer, Claude S.,To Dwell Among Friends; Personal Networks in Town and City. Chicago, IL: University of Chicago Press, 1982.

Freeman, Linton C. 1979. Centrality in Social Networks: Conceptual Clarification. Social Networks vol, 1: 215-239, 1979.

Galaskiewicz, Joseph, Professional Networks and the Institutionalization of a Single Mind Set. American Sociological Review, vol, 50(5), 639-658, 1985.

Gallant, Mary J., Friendship Networks in Medical School; a Network Analytic Approach to the Study of Social Solidarity. Saarbrucken, Deutschland, Lamberts Academic Publishing, 2013[1985].

Gerrity, Martha S., Jo Anne Earp, Robert F. DeVellis and Donald W. Light, "Uncertainty and Professional Work," American Journal of Sociology, vol. 97(4), 1992, pp. 1022-1051.

Gibbons, Deborah E., "Friendship and Advice Networks in the Context of Changing Professional Values," Administrative Science Quarterly, vol, 49(2), 2004, pp. 238-262.

Goebert, Deborah, Diane Thompson, Junji Takeshita, Cheryl Beach, Philip Bryson, Kimberly Ephgrave, Alan Kent, Monique Kunkel, Joel Schecter, and Jodi Tate, "Depressive Symptoms in Medical Students and Residents: A Multi-school Study," Academic Medicine 84(2), 2009, pp:236-241.

Gold, Katherine J. Gold, Ananda Sen, Thomas Swenck, "Details on Suicide among US Physicians: Data from the National Violent Death Reporting

System," General Hospital Psychiatry vol. 35: 2013, pp. 45-49.

Harrison G. and Wallace B. Hall, The Prediction of Academic and Clinical Performance in Medical School," Research in Higher Education, vol. 3(4), 1975, pp. 301-314).

Granovetter, Mark S., "The Strength of Weak Ties." American Journal of Sociology, vol.78 (6), 1978, pp.1360-1380.

Haas, Jack and William Shaffir, "Taking on the Role of Doctor: A Dramaturgical Analysis of Professionalization," Symbolic Interaction, vol. 5(2) 1982, pp.187-203.

Haas, Jack and William Shaffir, "The Professionalization of Medical Students: Developing Competence and a Cloak of Competence." Symbolic Interaction, vol.1, 1977, pp. 71-88.

Hochschild, Arlie Russell, The Managed Heart; Commercialization of Human Feeling, Berkeley: University of California Press, 2012 [1983].

Kadushin, Charles, "Friendship among the French Financial Elite." American Sociological Review, vol. 60(2), 1995, pp. 202-221.

Kuipers, Kathy J.,"Formal and Informal Network Coupling and its Relationship to Workplace Attachment." Sociological Perspectives, vol. 52(4), 2009, pp. 455-479.

Levin, Daniel Z., Bob Cross and Lisa C. Abrams. 2002. "The Strength of Weak Ties You can Trust: The Mediating role of Trust in Effective Knowledge Transfer," Best Papers Proceedings of the Academy of Management, *2002*.

Light, Donald W., "Uncertainty and Control in Professional Training," Journal of Health and Social Behavior 20(4), 1979, pp. 310-322.

Marske, Charles E., "Durkheim's "Cult of the Individual" and the Moral Reconstitution of Society." Sociological Theory vol. 5(1), 1987, pp.1-14.

Mosley, Thomas H. Jr., Sean G. Perrin, Susan M. Neral, Patricia M. Dubbert, Carol A. Grothues, and Bernadine M. Pinto, "Stress, Coping, and Well-being among Third-Year Medical Students," Academic Medicine, 69(9), 1994, pp.765-767.

Mueller, John H., Karl F. Schussler and Herbert Costner. Statistical Reasoning in Sociology. New York: Houghton Mifflin Company, 1977.

Pahl, Ray, "Towards a More Significant Sociology of friendship," European Journal of Sociology 43(3), 2002, pp. 410-423.

Pahl, Ray and Liz Spencer, Rethinking Friendship: Hidden Solidarities Today. Princeton: University of Princeton Press, 2001.

Portes, Alejandro and Julia Sachsenbrenner. 1993. "Embeddedness and Immigration: Notes on the Social Determinants of Economic Action." American Journal of Sociology vol. 98(6), 1993, pp. 1320-1350.

Portes, Alejandro and Robert Bach, Latin Journey, Berkeley, University of California Press, 1985.

Sobal, Jeffrey and Bruce R. DeForge. 1991. Medical Uncertainty in Students entering Medical School. Sociological Focus, vol. 24(4), 1991, pp, 291-301.

Stets, Jan E. and Michael J. Carter, "The Moral Self: Applying Identity Theory," Social Psychology Quarterly, vol. 74(2), 2011, pp. 192-215.

Swenck, Thomas L., Lindsay Davis, and Leslie A. Wimsatt, "Depression, Stigma, and Suicidal Ideation in Medical Students," Journal of the American Medical Association, vol, 304(11), 2010, pp. 1181-1190.

Thielbar, Gerald W., Localism-Cosmopolitanism: Social Differentiation in Mass Society, Ph.D. Dissertation, Minneapolis: University of Minnesota Press, 1966.

Tyssen, R., P. Vaglum, N.T. Gronveld, and O. Ekberg, "Suicidal Ideation among Medical Students and Young Physicians: a Nationwide and Prospective Study of Prevalence and Predictors," Journal of Affective Disorders vol.64, 2001, pp. 69-79.

Wellman, Barry, "Network Analysis: Some Basic Principles," Sociological Theory vol. 1983, pp, 155-200.

Paraventricular Thalamic Mechanism of Opioid Addiction

Yingjie Zhu
The Brain Cognition and Brain Disease Institute, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences
Shenzhen, China

Keywords: opioid addiction, opiate withdrawal, paraventricular nucleus of thalamus, neural circuit

Introduction

Opioids are commonly prescribed to treat pain. However, chronic opioid use also cause physical dependency and addiction[1]. Opioid addiction is characterized by severe withdrawal symptoms when drug use is terminated. Avoiding withdrawal symptoms is an important motivational drive to continued drug use and relapse[2]. Recently, a glutermatergic projection from paraventricular nucleus of thalamus (PVT) to nucleus accumbens (NAc) was identified to mediate opiate withdrawal[3]. However, the involvement of PVT in aversive behavior and opiate withdrawal remains unknown. By using in vivo electrophysiology and optogenetics, we found that PVT was activated by a variety of aversive stimuli including tail pinch and opiate withdrawal. Furthermore, optogenetic inhibition of PVT robustly suppressed opiate withdrawal symptoms. Those results highlight the importance of PVT in processing aversive stimuli and particularly in opiate withdrawal.

PVT mediates aversive behavior

To study the role of PVT on motivated behavior, we employed optogenetic approach. We injected channelrodopin2-expressing adeno-associated virus (AAV-ChR2) and implanted optic fiber into the PVT. In a real time place preference test[4], optogenetic activation of PVT reduced the time mouse spent in the chamber paired with light stimulation. In GFP control mice, light stimulation had no effect on the time spent in each chamber. This indicates that activation of PVT is aversive.

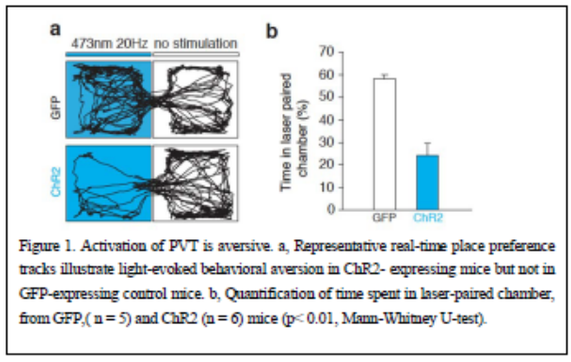


Figure 1. Activation of PVT is aversive. a, Representative real-time place preference tracks illustrate light-evoked behavioral aversion in ChR2- expressing mice but not in GFP-expressing control mice. b, Quantification of time spent in laser-paired chamber, from GFP,(n = 5) and ChR2 (n = 6) mice ($p < 0.01$, Mann-Whitney U-test).

PVT was activated by aversive stimuli

To study whether PVT neurons can be activated by aversive noxious stimuli, we delivered two different types of stimuli. First, we performed in vivo extracellular recording from PVT neurons and delivered tail pinch. Tail pinch evoked robust firing rate increase in PVT neurons, suggesting PVT was activated by mechanical pain. Second, we used naloxone-precipitated opiate withdrawal model[5]. Mice were injected with morphine for 6 days (escalating from 10 to 50mg per kg body weight, i.p.). Two hours after the final morphine treatment, we injected naloxone, a μ-opioid receptor antagonist (5mg per kg body weight, i.p.). Naloxone evoked negative withdrawal behavior signs including jumping, rearing and tremors. Moreover, injection of naloxone induced robust expression of c-Fos, a marker for recent neuronal activity[6], in the PVT neurons. Together, our result indicates PVT can be activated by both mechanical pain and opiate withdrawal.

Silencing of PVT suppressed opiate withdrawal

To directly test whether PVT activity is required for aversive behavior such opiate withdrawal, we used optogenetic silencing. We injected an archaerhodopsin-3 (ArchT)-expressing AAV and implanted optic fiber into the PVT. Remarkably, constant optogenetic silencing of PVT

7th Annual International Conference on Cognitive and Behavioral Psychology (CBP 2018)

ISSN 2251-1865
doi: 10.5176/2251-1865_CBP18.68

suppressed somatic signs of opiate withdrawal. In GFP control mice, light stimulation had no effect on the somatic signs of opiate withdrawal. Those results indicates that suppressing PVT activity is effective in eliminating opiate withdrawal symptoms, providing a potential therapeutic strategy for people who are depend on opiate.

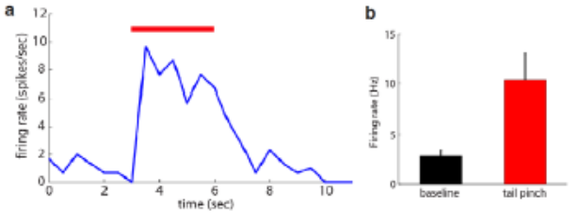


Figure 2. PVT was activated by mechanical pain. a, Tail pinch evoked firing rate increase from an example PVT neuron. Red bar indicates the delivery of tail pinch. b, Quantification of firing rate from a population of PVT neuron during baseline and tail pinch (n = 13, $p < 0.01$, Wilcoxon signed-rank test).

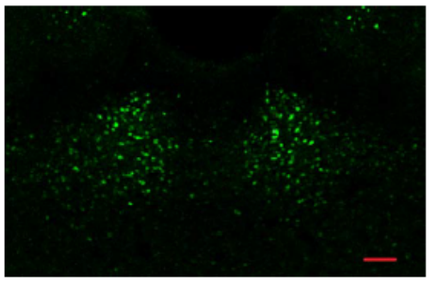


Figure 3. PVT was activated naloxone-precipitated opiate withdrawal. Green: immunostaining for neural activity marker cfos. Scale bar: 100 μm.

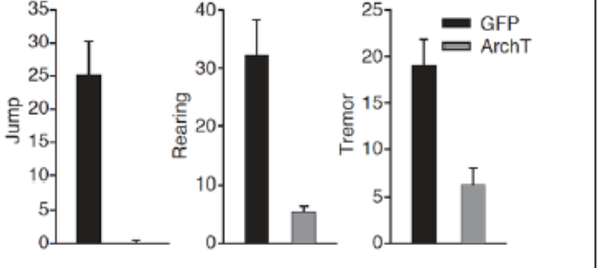


Figure 4. PVT is required for opiate withdrawal. Optical silencing the PVT suppressed the jumping (left, $p < 0.001$), rearing (middle, $p < 0.01$) and tremor (right, $p < 0.01$) induced by nalxone in morphine-treated GFP (n = 6) and ArchT (n = 8) mice (Mann-Whitney U-test).

Methods:

Surgery: Mice (6-8 weeks) were anaesthetized with ketamine and xylazine (100mg per kg body weight and 10mg per kg body weight, i.p.). Stereotaxic injections were performed using a stereotaxic instrument. A small volume of concentrated virus solution was injected into the PVT (200nl AAV, bregma −1.4mm; lateral 0.1mm; ventral 3.0mm, with a 4° angle towards the midline) with a pulled glass capillary at a slow rate (100 nl per min) using a pressure microinjector. The injection needle was withdrawn 10 min after the end of the injection. For mice involved in optogenetic experiments, an optic fiber was implanted 500 μm above the PVT and cemented onto the skull using dental cement (Lang Dental Manufacturing). Mice were allowed at least 2 weeks to recover and to express the virus before behavioural experiment. The injected AAV led to the expression of ChR2 or ArchT. AAVs used in this study were AAV1.hSyn.eGFP.WPRE.bGH, AAV1.hSynp.hChR2(H134R)-eYFP.WPRE.hGH and AAV9.CAG.ArchT.GFP.WPRE.SV40.

Real-time place preference assay. After connecting with optical fibre, mice infected with AAV-ChR2 or AAV-eGFP were placed in the CPP training apparatus for 15min to assess their baseline preference. During the test, we assigned one side of the chamber as the stimulation side. When the mouse crossed to the stimulated side of the chamber, it triggered 20Hz laser stimulation (473nm, 20ms pulses, 7mWmm−2 at the PVT) until the mouse crossed back to the nonstimulated side.

Electrophysiological recording. Mice were anesthetized with an intraperitoneal injection of urethane (2 mg/g). The animal was head fixed into a stereotaxic apparatus. A craniotomy was made above the PVT. Single tungsten microelectrode (FHC) was used to record the spontaneous activity of PVT neurons. The signals were recorded using a TDT RZ5Dsystem (Tucker-Davis Technologies), filtered (0.3–8 kHz) and digitized at 25 kHz for offline spike detection and sortingwith offline sorter (Plexon) based on principal component analysis.

Naloxone-precipitated morphine withdrawal. Mice received a single daily injection of morphine (i.p.) for 6 consecutive days with doses escalating at 10, 20, 30, 40, 50, 50mg per kg body weight in their home cage. Two hours after the last morphine injection, mice received an injection of naloxone (5 mg per kg body weight, i.p.) and were place in the behavior chamber. During the withdrawal, a constant green laser (532nm, 5 mW per mm^{-2} at the NAc) was delivered through

the fiber onto the PVT. Withdrawal symptoms were recorded for 20min before each mouse was returned to its home cage. Physical signs (jump, rearing and tremor) were manually scored offline.

c-Fos immunostaining. Ninety minutes after naloxone-precipitated withdrawal, animals were deeply anaesthetized and perfused with 10ml of saline (0.9%) followed by 10ml of 4% paraformaldehyde in PBS. Coronal brain sections (50μM) were cut using a cryostat (Leica). Brain sections (between

bregma −1.2 to –1.9mm) were first washed in PBS (3×10min), then blocked with 10% NDS/0.3% Triton X-100 (PBST) at room temperature for 2 hours and then incubated with primary anti-c-Fos antibody (Santa Cruz, SC-52G, rabbit polyclonal IgG, 1:2,000 dilution) for 3 days at 4 °C. Brain sections were washed in PBS (3×10min), followed by incubation for 2 h with fluorophore-conjugated secondary antibody (1:1,000 in 5% NDS PBST) and finally counterstained with Hoescht (1:10,000, ThermoFisher Scientific).

References:

1. Shurman, J., G.F. Koob, and H.B. Gutstein, *Opioids, pain, the brain, and hyperkatifeia: a framework for the rational use of opioids for pain.* Pain Med, 2010. **11**(7): p. 1092-8.
2. Koob, G.F. and M. Le Moal, *Addiction and the brain antireward system.* Annu Rev Psychol, 2008. **59**: p. 29-53.
3. Zhu, Y., et al., *A thalamic input to the nucleus accumbens mediates opiate dependence.* Nature, 2016. **530**(7589): p. 219-22.
4. Stuber, G.D., et al., *Excitatory transmission from the amygdala to nucleus accumbens facilitates reward seeking.* Nature, 2011. **475**(7356): p. 377-80.
5. Harris, G.C. and G. Aston-Jones, *Involvement of D2 dopamine receptors in the nucleus accumbens in the opiate withdrawal syndrome.* Nature, 1994. **371**(6493): p. 155-7.
6. Guenthner, C.J., et al., *Permanent genetic access to transiently active neurons via TRAP: targeted recombination in active populations.* Neuron, 2013. **78**(5): p. 773-84.

Saeideh Karimi-Haghighi	CBP - 1
Abbas Haghparast	CBP - 1
Eric Siu-Chung Lo	CBP - 2
Andus Wing-Kuen Wong	CBP - 2
Xin Jin and Shiqi Chen	CBP - 2
Edwin Yuen-Sun Law	CBP - 2
Jerry Kin Pang	CBP - 2
Monica Pellerone	CBP - 3
Riccardo Granà	CBP - 3
Simona Migliorisi	CBP - 3
Calogero Iacolino	CBP - 3
Yan Kong	CBP - 7
Fen Zhu	CBP - 7
Benny Y.C. Hon	CBP - 7
Lynn Van Camp	CBP - 8
Bernard G. C. Sabbe	CBP - 8
Gabriel Jarillo Enríquez	CBP - 14
John McDowall	CBP - 16
Lucy Lightfoot	CBP - 16
Aileen Pidgeon	CBP - 19
Ashleigh Upton	CBP - 19
Natalie Eckberg	CBP - 19
Aidan Carlan	CBP - 19
Adriana Mira	CBP - 20
Carla Soler	CBP - 20
Azucena García-Palacios	CBP - 20
Rosa María Baños	CBP - 20
Javier García-Campayo	CBP - 20
Fermín Mayoral	CBP - 20
Ammar Ahmed	CBP - 22
Jaffar Abbas	CBP - 22
Muhammad Aqeel Brig(R) Dr.Tanvir Akhtar	CBP - 22
Kinza Noor	CBP - 22
Kaltam Al-Kuwari	CBP - 24
Ouhao Chen	CBP - 26
Mangala Sadasivan	CBP - 27

Hsueh-Han Yeh	CBP - 27
Taomei Guo	CBP - 28
Chunyan Kang	CBP - 28
Fengyang Ma	CBP - 28
Jian Han	CBP - 31,35
Miaodan Fang	CBP - 31
Shenglu Ye	CBP - 31
Chuansheng Chen	CBP - 31
Xiuying Qian	CBP - 31
Qun Wan	CBP - 31
Liang Xu	CBP - 35
Rong Ma	CBP - 35
Xiuying Qian	CBP - 35
Qun Wan	CBP - 35
ZaoyiSun	CBP - 36
Pei Zhang	CBP - 36
XiuyingQian	CBP - 36
Reza Kormi-Nouri	CBP - 39
Shaghayegh Zahraei	CBP - 39
Sofia Bergbom	CBP - 39
Diego Flores	CBP - 40
Frank Robertson	CBP - 40
Mike Seeley	CBP - 40
Marcia Ventura	CBP - 40
Harold L Miller, Jr.	CBP - 40
Aderinwale Adedoyin	CBP - 46
PouyaGhasemlou	CBP - 46
Jaeseung Jeong	CBP - 46
Emma J Williams	CBP - 49
Jan M Noyes	CBP - 49
Bogdan Warinschi	CBP - 49
Keong Yuhan Melissa	CBP - 50
Grace S. Chng	CBP - 50
Clare Henn-Haase	CBP - 50
Evadne E Ngazimbi	CBP - 51
A. Antonesei	CBP - 56
K. Murayama	CBP - 56