

AL-FARABI KAZAKH NATIONAL UNIVERSITY
International Relations Department
Chair of Diplomatic Translation
Translation business in the field of international and legal relations
“Simultaneous Translation of Monologue and Dialogical Speech”
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Lecture 7

Module 2: Communicative situation in monologue and dialogical speech

Lecture 7: Anticipation of the content of speech

Plan of the lecture

1. Introduction
2. Anticipation affects speech recognition
3. Conclusion
4. References

Aspects of the lecture

1. Anticipation processes
2. Event-related brain potentials
3. Active lexical prediction
4. Adjective preceding the noun

Goals of the lecture

1. Explain the notion of Anticipation
2. Differentiate Anticipation types
3. Learn about triggers for lexical prediction
4. Explain the role of Communicative Situation in SI

Basic concepts

Anticipation processes; speech processing; spoken word recognition, ERPs, top-down information and etc.

A substantial body of research has shown that language comprehension involves anticipatory processes (DeLong, Urbach, & Kutas, 2005; Foucart, Martin, Moreno, & Costa, 2014; Martin et al., 2013; Otten, Nieuwland, & Van Berkum, 2007; Van Berkum, Brown, Zwitserlood, Kooijman, & Hagoort, 2005; Wicha, Bates, Moreno, & Kutas, 2003; Wicha, Moreno, & Kutas, 2004). That

is, comprehenders take an active role when processing a sentence by predicting upcoming words as the sentence unfolds. These anticipatory processes have been argued to ease communicative interactions (Pickering & Garrod, 2007). However, these studies suffer from an important limitation when used to inform speech comprehension processes. Namely, most studies have made use of sentences presented visually, at a relatively slow pace (but see, Otten et al., 2007; Van Berkum et al., 2005; Wicha, et al., 2003). This slow pace is certainly a feature that departs very much from regular communicative interactions in which the flow of speech is fast. For instance, the average speaker produces between 150 and 190 words per minute in English (Marslen-Wilson, 1973; Riding & Vincent, 1980) and up to 205 in Spanish (Navarro, 1950). The question arises of whether comprehenders can also take an active role anticipating upcoming words when faced with speech that runs at such high speed. This is precisely the question addressed in the current article. We assess the issue of the comprehender's active role by exploring the event-related brain potentials (ERPs) elicited during speech language comprehension. Many ERP studies have demonstrated the influence of sentence context on semantic processing. The common finding is a reduction of the N400 component (usually associated to semantic processing) for nouns that are highly expected from the context compared to nouns that are less expected but still fit semantically (Federmeier & Kutas, 1999; Federmeier, Wlotko, De Ochoa-Dewald, & Kutas, 2007). For example, in the sentence "I'm on my way to the library to return a...", the word "book" would elicit a reduced N400 component compared to the word "film" that perfectly fits within the context but is less expected. These studies, however, do not allow dissociating whether this reduction reflects integration processes, anticipation processes, or both. Indeed, as proposed by the "passive resonance" hypothesis, the integration of the word "book" is facilitated upon its presentation because it matches the semantic network activated by the sentence context (Kuperberg, Paczynski, & Ditman, 2011; Myers & O'Brien, 1998; Paczynski & Kuperberg, 2012). Alternatively, the "active lexical prediction" proposal assumes that such a reduction in the N400 component stems from the ability to anticipate words as the sentence unfolds and hence before they are presented (DeLong, Urbach, & Kutas, 2005; Neely, 1977, see Lau, Holcomb, & Kuperberg, 2013, for an extensive discussion on the debate). It is important to note that these two proposals are not mutually exclusive and that anticipation and integration processes might be at play during sentence processing. Indeed, it is likely that, depending on the comprehension conditions (e.g., if the sentence context is distorted by noise), comprehenders may rely more on one or the other. To dissociate whether the reduction of the N400 amplitude observed on the expected noun reflects passive integration only or active prediction recent studies have looked at the word directly preceding the noun. Using the phonological (DeLong et al., 2005; Martin et al., 2013) or syntactic features (Foucart et al., 2014; Otten et al., 2007; Van Berkum et al., 2005; Wicha et al., 2004;

Wicha, Moreno, & Kutas, 2003) of the preceding determiner or adjective, it has been observed that a noun is anticipated before it is actually presented. For example, Wicha et al. (2004) used high constrained sentences in which the gender of the expected and unexpected nouns differed, like in “Caperucita Roja llevaba la comida para su abuela en una[fem]canasta [fem] / un[masc] cesto[masc]” (Little Red Riding Hood carried the food for her grand-mother in a basket/hamper). They found that context effects were already present on the article preceding the noun, with reduced amplitude for the article that matched the gender of the expected noun compared to the article that matched that of the unexpected noun. The main conclusion of these studies is that both the noun and its features are actively anticipated, and that the features are used in real time to compute agreement and build up sentence meaning.

As mentioned earlier, these studies were conducted mainly in sentence reading with a word by word presentation of a minimum of 500 ms (300 ms word duration and 200 ms inter-stimulus interval), which is slower than the normal reading rate. Moreover, in ERP visual experiments words are read in their entirety, which contrasts with listening which involves words being processed from their onset onwards (see Rayner & Clifton, 2009). Thus, it is possible that in high-speed conditions as in fluent speech, the role of anticipatory processes may be limited. This would concord with models of word recognition that reject the idea of prediction and support a bottom-up view (Marslen-Wilson, 1987, 1989; Norris, 1994).

There are, however, a few ERP studies that have shown some indication that anticipation processes take place also during speech processing. A technical problem when trying to investigate this question using ERP is discriminating between the ERP components elicited by the word preceding the noun and those generated by the noun itself as they may overlap. Recall that ideally one would like to explore anticipation effects without any contribution of the noun itself, since otherwise the effects could reflect integration processes. Wicha and colleagues intended to overcome this problem by replacing the (un-)expected noun by a picture (Wicha, Bates, et al., 2003). Indeed these authors reported an N400 for the unexpected article as compared to the expected one. However, this effect might have been altered by that triggered by the picture, since it was presented immediately after article offset. Van Berkum and colleagues also examined anticipation processes in auditory modality by looking at the effect triggered by the inflection of the adjective preceding the noun (e.g., een groot schilderij/een groote boekenkast, a big painting/a big bookcase) (Otten et al., 2007; Van Berkum et al., 2005). Adjectives that did not match with the expected noun elicited an early differential ERP effect but again, this effect might have also been affected by the effect elicited by the noun or by coarticulatory changes in the stem of the adjective due to the presence or absence of the suffix (see Van Berkum et al., 2005 for a discussion). Hence, although these two

studies suggest the presence of anticipatory processes in speech comprehension they also have some limitations since the observed effects may also reflect the integration of the target noun.

In the present experiment we aim at overcoming this limitation by removing the target noun from the speech string. Specifically, we recorded participants' brain activity as they were listening to high-constraint sentences in Spanish. We used the same sentences as in Foucart et al. (Foucart et al., 2014), in which anticipation effects were observed on the article in visual modality. To avoid overlapping effects between the article and the noun we "muted" the noun (see Methods for more details); this manipulation affected both conditions (i.e., expected and unexpected) similarly. To make it sound more natural, we pretended the sentences were extracted from mobile phone conversations, as nowadays people are used to talking over devices and to interferences distorting speech fluency. Note that these "unnatural disfluencies" contrast with disfluencies produced by the speaker such as hesitations (e.g., "er...") or silences, which have been shown to decrease anticipation of the expected noun when occurring in the sentence context because they imply uncertainty from the speaker (Corley, MacGregor, & Donaldson, 2007; MacGregor, Corley, & Donaldson, 2010). Removing the (un-)expected noun from the sentence allows observing the effect elicited by the article; if anticipation processes take place during speech processing, we should observe different ERP amplitudes for the article matching the (muted) expected noun than for that matching the (muted) unexpected noun.

In addition, in the second part of the experiment, we asked participants to complete a lexical recognition task in which they had to indicate whether they had heard the word during the listening phase. They were presented with "new" words, "old" words (from filler sentences) and the "expected/unexpected" words (muted in the listening phase). This recognition task was designed to examine whether anticipation processes allow for a memory trace of a word that is not presented to be created. It tests Van Berkum's proposal that the word recognition system may benefit from word pre-activation (Van Berkum et al., 2005). In other words, if comprehenders rely more on integration processes during speech comprehension because the sentence context unfolds too fast, a word should be encoded only if presented; conversely, if comprehenders use linguistic cues incrementally to predict upcoming words as the sentence is spoken out, a word may be encoded even if it is not presented. If the latter case is correct, no difference should be observed between "expected" nouns that were muted during the listening phase and "old" nouns that were heard; on the other hand, a difference should be observed between "old" nouns and "unexpected" nouns since the latter are not expected from the sentence context.

Follow-up questions

1. Describe general phenomenon of anticipation in SI

2. Explain cognitive mechanisms in SI
3. Describe types of triggers in linguistic anticipation
4. Describe the role of Communicative Situation in SI

References

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