The Text as a Context: Blurring the Boundaries between Sentence and Discourse

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ABSTRACT

A central and influential idea among researchers of language is that the sentence, by virtue of its direct relationship with syntactic parsing, represents the heart of language itself. Even in the field of pragmatics, models rooted in classical theories tend to put sentence prominence forward again. Here, we present results from recordings of event-related brain potentials that brings into question even the distinction between sentence and discourse. During natural communicative exchanges, the human brain continuously and immediately relates incoming words to the previous discourse, whether it is constituted of a word, a sentence or complex speech. Moreover, focusing on discourse instead of sentence represents a viable strategy to better understand the relationship between language and other cognitive systems.

Keywords: Discourse; text; context; experimental pragmatics; ERPs recordings.

Introduction

The theme of this paper is the pragmatics of discourse. The aim is to highlight the impact of discourse-level factors on language processing in order to demonstrate that the classic separation between sentence and discourse may be misleading if we want to investigate the processes that extract meaning from language. Moreover, moving the attention from sentence as an abstract and formal entity to discourse as a concrete and shaping context is a good way to release language from isolation and consider it on the basis of its relationship with other cognitive processes, in an interdisciplinary framework.

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Communicative activity, generally, does not rely on the exchange of isolated information but on the construction and transmission of meaningful and coherent sequences of sentences. In spite of the evidence, in cognitive science, for a long time, the study of discourse has received very little attention. Why? According to most of the interpretative models developed in the field of cognitive science, the proposition represents the essence of language. Since proposition belongs to the domain of syntactic analysis, assuming that proposition is the essence of language is equivalent to sustain that sintax represents the core of linguistic processing.

In pragmatics there is a widespread agreement on the idea that syntactic and semantic processing constitute just one side of the coin. The other side is represented by additional 'contextual' factors that help to fix the final interpretation of a sentence. In fact, in order to comprehend the speaker's meaning, listeners are required to perform two basic tasks: decoding what is said (semantic meaning) and understanding what is meant (pragmatic meaning). In other terms, "pragmatic theories agree in considering meaning as comprising a semantic component (the meaning of what is said) and a pragmatic component (the meaning derived by what is intended by the speaker). Both the processes involved in the unification of the two components and the time-course of these processes are, however, still under debate" (Balconi, 2010, p. 96). The debate, in particular, is between supporters of a "two step model" and supporters of a "one step model," borrowing Hagoort's expressions (Hagoort, 2007). The first group argues that these two processes are accomplished in a serial fashion – with semantic meaning processed first and pragmatic meaning processed in a delayed time – while the second group predicts an earlier interaction of linguistic and contextual information in order to obtain a complete representation of what is meant by the speaker.

The two step model originates from Grice's distinction between "what is said" (literal meaning) and "what is implicitly meant" (pragmatic meaning) (e.g. Grice, 1975, 1989). To grasp the speaker's communicative intentions, listeners are required to pass first through the comprehension of literal meaning. If their expectations are not attended (i.e. if the conversational maxims are not respected) at the explicit level, then inferential processes intervene to adjust literal meaning on the basis of linguistic and extra-linguistic context. Cognitive versions of the Gricean model predict that comprehension process occurs in multiple stages: (a) language module elaborates semantic meaning (b) the output of language module is related to contextual

information, (c1) if there is agreement between the two outputs, the process stops while (c2) if there is no agreement, a mechanism of contextual adjustment is activated. In the last case the processing time of language comprehension increases (Bambini, 2003, p. 137).

Agreeing with the two step model implies accepting the idea that sentence processing occurs always before discourse processing because, in this view, the contextual constraints conveyed by the text are considered only after that the literal meaning of the utterance is computed. Cutler and Clifton (1999), for example, state that, based on syntactic analysis and thematic processing, utterance interpretation takes place first and integration into a discourse model follows. In line with these considerations, Lattner and Friederici (2003) claim that mismatches between spoken message and speaker's intentions are detected relatively late, in slow pragmatic computations, that are different from rapid semantic computations in which word meanings are combined. According to Hagoort (2007), a model such this still embraces a "syntactocentric perspective" which perceives sintax as the central aspect of language (e.g. Chomsky, 1980). It is possible to sum up this perspective in two assumptions: (1) The truly relevant aspects of language are coded in syntax, (2) The semantic interpretation of an expression is derived from its syntactic structure (Hagoort, 2007, p. 801). The heaviest consequence of this inheritance is that language analysis continues to focus on the sentence first, leaving the discourse behind.

The theoretical background of the one step model, instead, lies in the *immediacy assumption,* formulated by Just and Carpenter in 1980, that states that linguistic information relative to the single words together with the linguistic and extralinguistic contextual information, concur, from the beginning, to determine the meaning of the incoming words. At a cognitive level, having immediately access to all information at one's disposal means, in concrete terms, to bypass the stage of the literal processing. The focus of attention is, in fact, on the effects of the context and the way it interacts with the rest of the linguistic information. In line with this idea, a first extension of the role of pragmatic processes has been made by relevance theorists (Sperber & Wilson, 1986): pragmatic processes concern the determination of both what is said and what is meant. According to the relevance theory, the main aim of inferential pragmatics is to detect speakers' communicative intentions since the processing of the literal meaning of an utterance is not sufficient to

determine what the speakers desire to communicate (*under-determinacy thesis*).

In the next paragraph we will see how experimental techniques can contribute positively to the debate, showing that the one step model is more appropriate than the two step model to suit the evidence provided by the study of the working brain.

1. Evidence from N400

A good deal of experimental data in favor of the one step model is offered by Gibbs' various work on reading times (Gibbs, 1989, 2002, 2004). Gibbs' reading times data showed that linguistic and contextual information interact early on to ensure the construction of contextually appropriate meanings and the inhibition of contextually inappropriate ones. In other words, when given enough contextual information, as in the ecological setting, listeners are able to directly access the correct interpretation of what is said, without elaborating conventional (but not appropriate) sentence meaning.

If reading-time experiments tend to concentrate on the processing of figurative language, electrophysiological studies face the question of discourse processing in a more direct way. Electrophysiological studies, for more than twenty years, have focused only on the processing of sentences rather than on discourse. According to Van Berkum, the reasons for this radical choice lie in historical, social and concrete motives:

> One reason is that psycholinguistic ERP research is for historical reasons strongly rooted in the sentence processing community. This means that most of the people with EEG expertise and easy access to EEG labs have sentence processing issues in mind, whereas those most interested in discourse and conversation are short of expertise and labs. Furthermore combining EEG with single sentences is already difficult enough as it is. Because at least 30–40 trials are needed per condition to obtain a relatively clean ERP, factorial sentence-level EEG experiments require the presentation on many lengthy trials, as well as sometimes months of work to create the materials. Another problem is that within each of these lengthy trials, people are not supposed to move their eyes, head or body. With a longer fragment of text or conversation in each trial, all this is only going to get worse (Van Berkum, in press)

In recent years, the fall of most of the ideological and practical obstacles has finally allowed electrophysiology to approach the discourse with fruitful results. For instance, the study of N400 component of the event-related

potentials (ERP)[1] that, at first, was very useful to throw light on sentence processing, in a second moment found a large application even in the field of discourse. Kutas and Hillyard (1980) were the first to observe this negative-going potential, comparing ERPs recordings to the last word of sentences that either ended congruously (1) or incongruously (2):

1. I take my coffee with cream and sugar
2. I take my coffee with cream and dog

The authors found negativity in the brainwaves that was much larger for incongruous sentence completions than for the congruous ones. Because it peaked about 400 milliseconds after the onset of the presentation of the word, this negativity was called the N400. Since its original discovery, much has been learned about the processing nature of the N400. In particular, as Hagoort and Brown (1994) observed, the N400 effect does not rely on semantic violation. For example, subtle differences in semantic expectancy, as between *mouth* and *pocket* in the sentence context "Jenny put the sweet in her *mouth/pocket* after the lesson", can also modulate the N400 amplitude (Hagoort & Brown, 1994). Specifically, as the degree of semantic fit between a word and its context increases, the amplitude of the N400 goes down. Owing to such subtle modulations, the word-elicited N400 is generally viewed as reflecting the process that integrate the meaning of a word into the overall meaning representation constructed by the preceding language input (Hagoort, 2007).

Among the pioneer works that applied the study of N400 component to discourse processing figures the one of St George, Mannes and Hoffman (1994), aimed to investigate whether the N400 is sensitive to global, as well as local, semantic expectancy. Global coherence refers to the ease with which subjects can relate the current proposition they are reading with theme-related ideas. In this study, the effect of global coherence on event-related brain potentials was tested using four titled and untitled paragraphs, presented one word at a time. These paragraphs are non-coherent and are made coherent only through the presentation of a title. The EEG was recorded in response to every word in all four paragraphs. An example:

The procedure is actually quite simple. First you arrange things into different

[1] The N400 components is a negative-going wave that peaks approximately 400 ms after the onset of the stimulus and has a centro-parietal distribution (evident over the back of the head) which is slighty larger over the right hemisphere (Kutas, Van Petten & Besson, 1988).

> groups depending on their makeup. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step, otherwise you are pretty well set. It is important not to overdo any particular endeavor. That is, it is better to do too few things at once than too many. In the shorter run this may not seem important, but complications from doing too many can easily arise. A mistake can be expensive as well. The manipulation of the appropriate mechanisms should be self-explanatory, and we need not dwell on it here. At first the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity of this task in the immediate future, but then one can never tell (St, George, Mannes & Hoffman, 1994 cited in Van Berkum, in press).

Whereas the story appears locally coherent in that its individual sentences are interconnected and related to a single topic, it is rather difficult to understand what it is about. When the story is provided with a title, however, the subject becomes immediately clear (in this case, the title was "Procedure for washing clothes"). The ERP recordings, in fact, showed an increase in N400 amplitude in response to the words in the Untitled paragraphs relative to the Titled paragraphs, indicating that global coherence does affect the N400.

Building on this initial exploration, Van Berkum and colleagues (1999, 2003, 2008, 2009) performed Kutas and Hillyard' experiment (1980) on a large scale (micro-discourses compounded by two or more sentences). In particular, they examined the brain's response to words that were equally acceptable in their local carrier sentence (i.e., 1a and 1b) but differed radically in how well they fit the wider discourse (i.e., 2a and 2b) as in:

1. Jane told her brother that he was exceptionally...

   a) Quick

   b) Slow

2. By five in the morning, Jane's brother had already showered and had even gotted dressed. Jane told her brother that he was exceptionally...

   a) Quick

   b) Slow

Van Berkum and colleagues found that words which elicit N400s of approximately equal amplitude in an isolated sentence (i.e., 1) do not elicit equivalent N400s when they occur in a context that makes one version more plausible that the other (i.e., 2). Specifically, relative to the discourse-coherent counterpart (i.e. *quick*), the discourse-anomalous words (i.e. *slow*) elicited a larger N400 effect. Furthermore it is worthy to note that the discourse-dependent N400 effect emerged for clause-final words as well as for clause-medial words. This means that every incoming word is immediately related to the wider discourse. Furthermore, with spoken words (Van Berkum et al., 2003), the effect of discourse-level fit emerged as early as 150 ms after acoustic word onset, (i.e., only some 2-3 phonemes into the word). This suggests that spoken words are actually related to the wider discourse extremely rapidly, well before they have been fully pronounced, and possibly even before they have become acoustically unique. Finally, the timing, shape and scalp distribution of the N400 effect elicited by discourse-dependent anomalies did not differ from that of the 'classic' sentence-dependent N400 effect. This indicates that discourse and sentence-dependent semantic constraints are brought to bear on comprehension as part of the same unified interpretation process (Van Berkum, in press).

The relevance of identical sentence- and discourse-dependent anomaly effects would of course be somewhat limited if the commonality simply reflected some common error detection process, activated by two otherwise very different comprehension processes. However, it has long been know that the word-elicited N400 effect is not a simple anomaly detector, but a reliable index of the ease with which lexical meaning is integrated into the wider sentential context (Kutas & Van Petten, 1994). In line with this, Otten and Van Berkum (2005) showed that in a sentence such as:

3. The brave knight saw that the dragon threatened the benevolent sorcerer. He quickly reached for a:

   a) Sword

   b) Lance

relative to highly expected words in discourse (e.g., "sword"), words that are merely somewhat less expected (e.g., "lance") also elicit a N400 effect.

Until now, none evidence has been found in support of the standard model according to which new words are related to the discourse model only after they have been evaluated in terms of their contribution to local sentence semantics. On the contrary, evidence from the N400 consistently indicates that words are related immediately to the wider discourse and in a way that is no different from how they are related to local sentence-level context. This accords well with the models of language comprehension that do not make a distinction between the computation of sentence- and discourse-level meaning. Considerations such as these bring into question the traditional and well accepted idea that discourse-related information is not instantly available and must be retrieved from memory when needed (Ericsson & Kintsch, 1995). The relevant discourse information can sometimes be brought to bear on local processing within a mere 150 ms after spoken word onset. This indication appears to be at odds with estimates of how long it would take to retrieve information about prior discourse from long-term memory, i.e., 300-400 ms at least (Hagoort, 2007).

Fancy stories constitute a clear evidence of the power of discourse to determine meaning because when knowledge of the real world is not useful to make sense of the incoming words, the alternative way is to call upon the rest of the story to find out what it is going on. Indeed, in cases such as these, the immediate integration of lexical-semantic information into a discourse model is particularly clear. Evidence regarding this has efficiently been provided by Nieuwland & Van Berkum (2006). They had subjects listening to short stories in which the inanimate protagonist was attributed with different animacy characteristics.[2] For instance, one of these stories was about a peanut in love:

> A woman saw a dancing peanut who had a big smile on his face. The peanut was singing about a girl he had just met. And judging from the song, the peanut was totally crazy about her. The woman thought it was really cute to see the peanut singing and dancing like that. The peanut was *salted/in love*, and by the sound of it, this was definitively mutual. He was seeing a little almond.

The canonical inanimate predicate (i.e., salted) for this inanimate object (i.e, peanut) elicited a larger N400 than the locally anomalous, but contextually appropriate predicate (i.e., in love). These results show that

[2] Animacy is the classification of nouns, and the things these words refer, based on the degree to which they are "alive" or animate.

discourse context can completely overrule constraints provided by animacy, a feature claimed to be part of the evolutionary hardwired aspects of conceptual knowledge (Caramazza & Shelton, 1998) and often mentioned as a prime example of the semantic primitives involved in the computation of context-free sentence meaning. Therefore we agree with Van Berkum when he says that what primarily seems to matter is how things fit what is being talked about right now, be in the real world or in a fancy world of happy peanuts (Van Berkum, 2008, p. 377).

Conclusion

The observed identity of discourse- and sentence-level N400 effects can be accounted for in terms of a processing model that abandons the distinction between sentence and discourse. One viable way to do this, according to Hagoort (2007), is by invoking the notion of 'common ground' (see Clark, 1992 for a discussion about the definition of common ground). Linguistic analyses have demonstrated that the meaning of utterances cannot be determined without taking into account the knowledge that speaker and listener share and mutually believe they share such as information that comes from the bases of community membership, physical co-presence, and linguistic co-presence. For example, conversational participants would be able to infer that they share various types of knowledge on the basis of both being in a particular city, or by looking at a particular object at the same time.

Now we know, from electrophysiological evidences, that in the notion of common ground we should also include a model of discourse which is continually updated as the discourse unfolds. With a single sentence, the relevant common ground only includes whatever discourse and world knowledge has just been activated by the sentence fragment presented so far. With a sentence embedded in a discourse context, the relevant common ground will be somewhat richer, now also including information elicited by the specific earlier discourse. But the unification process that integrates incoming words with the relevant common ground should not really care about where the interpretative constraints came from (Hagoort, 2007, p. 803).

According to an impressive analogy coined by McCarthy (1994), processing the discourse is like watching an impressionist painting. When you stop looking for strokes and brushworks, you can grasp the global meaning of what is represented. What are the advantages from taking the landscape of the

text as our starting point rather than focusing on its constituent forms? First of all, we are compelled to recognize that such a landscape is not just an assemblage of linguistic strokes but a coherent entity purposefully constructed. Moreover, "the moment one starts to think of language as discourse the entire landscape changes, usually forever"(McCarthy, 1994, p. 201). Admiring the beauty of the composition, instead of focusing on the single strokes of the brush, obviously, is not a strategy to reduce the importance of the components but merely a way of seeing how each of them contributes to the entire project of the painting.

In the same vein, focusing on the deeper rather than on the shallow level of comprehension is not a way of diminishing the relevance of lexical processing or syntactic parsing at a surface plane. Blurring the boundaries between sentence and discourse is not intended to deny the relevance of the sentential structure for semantic interpretation. On the contrary, sentence-level syntactic devices (such as word order, case marking, local phrase structure or agreement) and thematic roles constrain the structure of discourse. However, this is fully compatible with the claim that contextual information conveyed by discourse are processed in parallel with local sentence meaning.

The scientific study of language has been shaped by the assumption that the human language faculty evolved for thinking rather than for communicating (e.g., Chomsky, 1980). This "language-as-product" tradition takes language itself as the object of study, focusing on grammatical knowledge and the core processes for recovering linguistic structure from sentences. As Brennan states:

> "This common focus has given generations of psycholinguists and other cognitive scientists license to concentrate on the study of the linguistic representation and processing in the mind and brain of a lone (and largely generic) native speaker, independent of context. As a result, a great deal is known about how individuals store, organize, and access knowledge in the mental lexicon; how individuals parse sentences and resolve syntactic ambiguity; and how individuals plan and articulate utterances. But there is more to language processing than these (seemingly) autonomous processes" (Brennan, 2010, p. 302).

What remains to investigate is what happens in the brain during communicative processes. This implies, first of all, overcoming the Chomskyan distinction between competence and performance, "one of the heaviest burdens for a truly comprehensive approach to language" (Baggio, in press). In

my view, studying performance using experimental tools seems to be the best way to enlighten the nature of language processing and "if experimental research provides evidence which does not align with the introspective judgments of the linguist or other native speakers, then, following common practice in science, there is no other choice than to accept the results of the former and reject the latter" (*ibidem*).

We have claimed that the brain does not seem to honor the classical division between sentence and discourse. Indeed, electrophysiological data indicate that there is no qualitative difference between processing a word in a sentence or processing it in a discursive frame. In both cases, the brain adopts the biggest frame at its disposal to interpret the word's meaning:

> To the language user, discourse-level processing is simply language-driven conceptual processing, regardless of whether it occurs in a single sentence or a longer discourse. And intuitively, this makes sense. Does it really matter, for example, whether the targeted entity of a free referential pronoun like "he" has been introduced in the previous sentence or in the current one? (Van Berkum, in press, p. 16).

Two-step models, following Gricean tradition, assume that comprehension processes take place in a two-step fashion. First, the context-free meaning of a sentence is computed by combining fixed word meanings in ways specified by the syntax. Second, the sentence meaning is integrated with information from prior discourses, world knowledge, information about the speaker and semantic information from extra-linguistic domains such as co-speech gestures or the visual world. Such ideas are not supported by electrophysiological evidence and consequently are not adequate in light of our understanding of the principles of brain function. One-step models, instead, represent the "neuro-friendly" alternative to two-step models. At the heart of these models there is the idea that comprehension processes are based on the parallel use of multiple clues of both a linguistic (phonology, syntax, semantics) and pragmatic nature (knowledge about the context, the speaker, states of affairs in the world and the rest of discourse) that operate under unification principles in order to address the interpretation processes.

In every communicative situation, the brain selects from among the information at its disposal that which is more suitable to the context and less expensive from a cognitive point of view. The contextual information has a double function: on the one hand it is necessary to interpret what has been said in an appropriate way, on the other hand it allows to anticipate what is going to

be said. Looking forward positively affects the speed and efficiency of the comprehension processes. As Van Berkum states "what we see is an opportunistic proactive brain at work" (Van Berkum, 2008, p. 379), a brain that seeks, from the first moment, to pick up the communicative intentions of the speaker without necessarily passing through a literal phase that is often little informative from a pragmatic point of view.

Establishing the weight to be assigned to the discourse is not a question of little importance. It determines, for example, which is the place of pragmatics in relation to other levels of language analysis. The discussion has two major opponents; complementary theory and perspective theory. While the first considers pragmatics as an additional linguistic component, the second concerns pragmatic competence as a fundamental aspect of a more general communicative competence (Balconi, 2010). According to complementary theory, it is possible to represent linguistic components in a hierarchical fashion. Along imaginary stairs, discourse, as the "biggest chunk" (Van Berkum, in press), has to be positioned on the top. Underneath we can find all the others units, from sentences to phonemes, going through words and morphemes. This kind of approach tends to crumble the research object in separate units to better understand it. The result is a puzzle of pieces waiting to be connected to each other. If this strategy is fruitful from an analytic point of view, it is not really useful to understand how communicative processes really works. On the other side, perspective theory states that pragmatics is not just a level of analysis among others, but it is a way to interpret language as a communicative phenomenon immersed into the contexts at all levels. As we have seen, electrophysiological data go exactly in this direction, attesting perspective view as the best way to describe linguistic processes as they really happen in the brain.

In line with the perspective theory, discourse, intended as the widest linguistic context at disposal, becomes the unit of reference of every linguistic exchange. Given the binding action that discourse exercises on interpretative processes, it is endowed with cognitive priority, metaphorically representing the dam of the spoken flux that constantly guides production and comprehension processes. Interestingly, the distinguishing mark of discourse is coherence intended as the thematic and conceptual unit of a text. It is possible to conceive of coherence as the glue thanks to which words and sentences are stuck together and connected to each other. It is not a coincidence that the word "text" (from latin, "textus") alludes to the fact that

the sentences that form the "biggest chunk" are interwoven with each other in a specific, i.e. in a coherent, way (Simone, 2002, p. 406). In spite of its importance, coherence has always been considered by linguists out of the Pillars of Hercules (*ivi*, p. 449) because it is not just a linguistic phenomenon but it is situated in a border zone where language interfaces other cognitive processes such as memory and executive functions (e.g. Ferretti & Adornetti, 2012).

In general terms, studying language as a context-dependent phenomenon means cutting the distances between language and other cognitive processes:

> In its infinite variation, context permeates information processing: regularities in the way the brain integrates and exploits context might bypass the distinctions among cognitive modules, while maintaining the distinctiveness of each faculty. Indeed, we might be facing a point here where language and other systems share mechanisms that developed evolutionarily in response to environmental demands. So, in order to get a full account of processing pragmatic fact in the brain, one cannot exclude that neuropragmatics should dialogue with other context-sensitive 'neuro'disciplines and become even more interdisciplinary (Bambini, 2010, p. 15).

In the future, the pragmatics of discourse could surely gain important successes if it will choose to follow the interdisciplinary route. Now that we are moving away from the "modular era" and we are approaching a new "network era", the idea that language shares some mechanisms with other cognitive processes is becoming so evident that it is not acceptable anymore to consider language as an isolated system. Indeed, more and more studies, using fMRI or PET, have proved the existence of a common network shared by discourse processing and other cognitive processes such as social cognition or spatial and temporal navigation (e.g, Ferstl, 2008, Spreng, 2008, Ferstl, 2010). "Now that we can look under the hood of the car" , as Van Berkum states, (Van Berkum, 2008, p. 379), what remains to do is to go into the conceptual implications of the experimental data to see what the interaction between language, cognition and perception can tell us about the nature of language itself.

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