



Research paper

Semantic and pragmatic processes in the comprehension of negation: An event related potential study of negative polarity sensitivity



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ABSTRACT

Most previous studies on negation have generally only focused on sentential negation (*not*), but the time course of processing negative meaning from different sources remains poorly understood. In an ERP study (Experiment 1), we make use of the negation-sensitivity of negative polarity items (NPIs) and examine the time course of processing different kinds of negation. Four kinds of NPI-licensing environments were examined: the negative determiner *no*, the negative determiner *few*, the focus marker *only*, and emotive predicates (e.g., *surprised*). While the first three contribute a negative meaning via semantic assertion (explicit negation), the last gives rise to a pragmatic negative inference via non-asserted content (implicit negation). Under all these environments, an NPI elicited a smaller N400 compared to an unlicensed NPI, suggesting that negation, regardless of its source, is rapidly computed online. However, we also observed that explicit negative meaning (i.e., semantic, as contributed in the assertion) and implicit negative meaning (contributed by pragmatic inferences) were integrated into the grammatical representation in different ways, leading to a difference in the P600, and calling for a separation of semantic and pragmatic integration during sentence processing (and NPI licensing). The qualitative differences between these conditions were also replicated in a self-paced reading study (Experiment 2).

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1. Introduction

Polar opposition—negation vs. affirmation—is one of the distinctive properties of human language (Horn, 2001): every natural language includes at least one device that expresses the negation of an affirmative constituent. In English, an affirmative sentence such as *John came to school* can be denied by sentential negation *didn't*, as in *John didn't come to school*; a predicate such as *mortal*, can be negated by attaching *not* or a negative affix to it, i.e., *immortal* or *not mortal*. All else being equal, the semantic computation of negative sentences seems to be more complex than that of their affirmative counterparts, since negative statements involve an extra step of semantic processing, along with extra morphological or syntactic structure. Negation presents challenges for semantic and syntactic computation not only because it is an additional layer of meaning and structure to process, but also because there are many different ways to express negation. *Not many students came to school*

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is approximately synonymous with *Few students came to school*. Likewise, *John didn't believe Mary would win* expresses a similar negative meaning to *John doubted Mary would win*. The necessity of identifying different types of negative expressions, based on morphosyntactic, semantic, or pragmatic cues, enhances the processing complexity of negation.

Even though negation is extremely common in everyday communication, the comprehension process of negation remains poorly understood. Most previous investigations have focused almost exclusively on the negative form *not* (Clark & Chase, 1972; Fischler, Bloom, Childers, Roucos, & Perry, 1983; Kounios & Holcomb, 1992; Nieuwland & Kuperberg, 2008; Tian, Breheny, & Ferguson, 2010; Wason, 1959, 1961), and we know relatively little about how other types of negation are processed. In the current study, we make use of the negation-sensitive property of a closed-class of items known as “negative polarity items” (such as *ever*) to investigate how negative meaning is extracted from a number of different negative environments. These environments fall under two general classes that we call explicit (asserted) and implicit (non-asserted) negation.

1.1. Explicit and implicit negation

Natural language has a rich landscape of negative expressions. There are a number of dimensions we can use to classify negative expressions into groups. In the current paper, following Clark (1976),¹ we make a distinction between negation in the *asserted* meaning of an expression and negation in the *non-asserted* content (also see Horn (1996)); also following Clark (1976), we call the first group *explicit* negation, and the second *implicit* negation. Under Clark's classification, explicit negation in English includes expressions like *scarcely*, *hardly*, *few*, *seldom*, *little*, and *only*, as well as more obviously negative expressions like *no*, *not*, and *never*. Implicit negation, on the other hand, includes expressions like *forget*, *fail*, *doubt*, and *deny* (see also Fodor, Fodor, and Garrett (1975)).² It is already clear from these examples that *explicit* negation is not a label for morphologically explicit (or overt) negation, though overt negation is indeed a core member of this category. The contrast between explicit versus implicit negation relies on which level of semantic representation, i.e., assertion or non-assertion, negation appears at, a distinction we elaborate on below.

Any given utterance conveys an array of meanings. In the widely used Gricean and neo-Gricean frameworks (Geurts, 2010; Grice, 1975; Horn, 2001; Stalnaker, 1978), assertion conveys the logical meaning of a sentence, i.e., the truth conditions and *entailments* of a sentence; and non-asserted meaning is thought of as *pragmatic* meaning, i.e., inferences beyond entailments, including presuppositions, conversational implicatures, and conventional implicatures (Potts, 2005; Tonhauser, Beaver, Roberts, and Simons, 2013). We can define two classes of negation based on the source of negative meaning. If negation is expressed as part of the asserted meaning of an utterance, i.e., if it is an entailment, it is *explicit* negation; if it belongs to the non-asserted meaning (i.e., presupposition or implicature), it is *implicit* negation. Overt negation, such as *no* and *not*, marks grammatical negation and obviously affects the assertion. *No* and *not* constitute explicit negation. But it is important to remember that explicit negation does not necessitate that negation is morphologically overt. As noted already, expressions such as *few*, *scarcely*, *hardly*, *seldom*, and *little*, although not morphologically negative, behave nevertheless syntactically and semantically as negative under a number of well known diagnostics (Klima, 1964; Horn, 2001 etc.). For instance, *few*, *scarcely*, *hardly*, *seldom*, and *little* can be followed by a conjunct modified by *neither*, but not by *so*. Moreover, they may also co-occur in a conjunct with *either*, but not with *too*. At the same time, it has also been noted that syntactic diagnostics alone are not sufficient for all kinds of explicit negation. Consider, e.g., the exclusive focus particle *only*. By saying *Only John read the article*, one asserts content equivalent to that asserted by the exceptive sentence *Nobody other than John read the article*. It is generally agreed that this negative exclusive component is part of the asserted meaning of *only* (and of negative exceptives in general; Horn, 1996, 2002; Atlas, 1993; Beaver & Clark, 2008),³ even though *only* does not have negative morphology, and is not syntactically negative based on the tests mentioned above.⁴

This brief discussion shows that semantically asserted negation does not map uniformly onto syntactic or morphological negation. Some instances of explicit negation contain overt negative morphology (e.g., *no*, *nobody other than*); some contain no overt morphology but pass syntactic diagnostics of negation (*few*); and yet others are neither morphologically nor syntactically negative, but nevertheless assert a negative meaning (*only*). We call all these cases in which negation is an entailment of the sentence “explicit” negation, regardless of their morphosyntactic realization.

Implicit negation, on the other hand, involves negative meaning whose source is pragmatic (presuppositional or implicature). For current purposes, we consider the class of “emotive” predicates, which trigger negative inferences, though their

¹ Clark (1976) was specifically making a distinction between asserted negation and negation in the presuppositions of an expression. It should be pointed out that presupposition is only one type of non-asserted meaning.

² We agree with Clark (1976) on the general distinction between asserted and non-asserted negation. We do not necessarily adopt his specific classification of verbs like *doubt*, *deny*, etc., but we leave the discussion on these verbs open since the current study does not address these verbs.

³ What is not agreed upon is whether the meaning that *John read the article* is also part of the assertion of the sentence *Only John read the article*. Opinions differ here, with those that believe it part of the assertion (Atlas, 1993) and those that believe it is a presupposition (Beaver & Clark, 2008; Horn, 1996, 2002).

⁴ There are good reasons why some of the syntactic tests do not apply to *only* (or negative exceptives in general, such as *nobody other than*). For example, one cannot say “*Only Bill read the newspaper, and John did either*. The particles *either* or *neither* are additive – they would require somebody other than Bill to read the newspaper – which clashes with the negative exceptive meaning of *only*. So, the fact that *only* fails the *either* test does not tell us anything about its negativity, it is merely a case where the test cannot be applied.

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