# Disentangling the Processing Cost of Negation and Implicatures

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Much experimental work on the processing cost of negation has relied on the comparison between explicitly negated sentences and their affirmative counterparts. However, the former are subject to different pragmatic constraints compared to the latter (Wason, 1965) and the complexity of explicitly negated utterances may stem from their contextual unexpectedness or intrinsic underinformativity (Xian et al., 2020). In this study, we propose to compare explicit negation with another linguistic phenomenon: Scalar Implicatures (SIs). SIs are inferences whereby lexical items like *some* are taken to imply the negation of their stronger alternatives. For instance, interpreted with an SI, a sentence like (1) is taken to convey a negated proposition, as in (2). In this sense, SIs can be considered a form of implicit negation:

(1) *Some cards have sharks*
(2) *Not all cards have sharks*

To our knowledge, no study has directly compared the processing of explicit negation with that of negation derived via SIs. However, such a comparison allows for holding the propositional content constant (compare (1) and (2) above), while assessing whether the cognitive cost of the two phenomena is due to the common negative content, rather than the distinct mechanisms by which such content is derived.
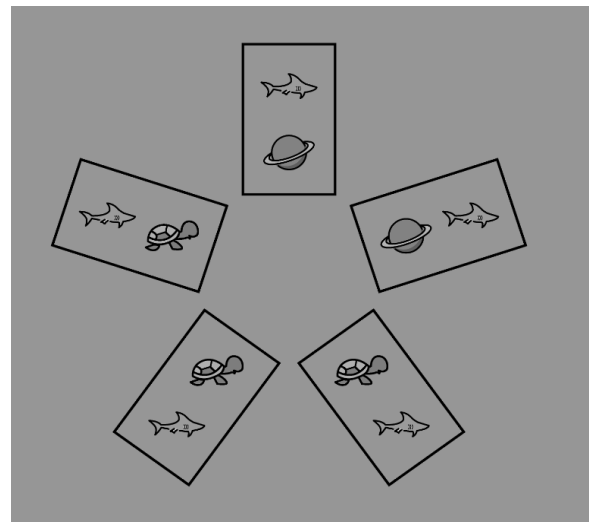
This study (data are currently being collected) addressed the following research questions:

1. Is explicit negation associated with processing delays compared to SIs (i.e., implicit negation), due to the intrinsic underinformativeness of explicit negation? Or is verifying negative content equally effortful, regardless of whether it is expressed explicitly or implicitly (via an SI)?
2. Does individual response inhibition affect the processing of negative content, regardless of whether such negative content is expressed explicitly or implicitly (via an SI)?

The experiment includes two tasks: a linguistic task and a response inhibition task. The linguistic task consists of a sentence-picture verification task with reaction time measurements. The two critical conditions involve sentences that mismatch the visual display (e.g., Figure 1) and share the same propositional content: *Some*-Underinformative (e.g., *Some cards have sharks*, which, via an SI, implies "Not all cards have sharks") and Explicit-Negation (e.g., *Not all cards have sharks*, which includes an explicitly negative operator). Table 1 shows example sentences for critical and control conditions (highlighted in orange and yellow, respectively). Following the linguistic task, participants' response inhibition is assessed using a go/no-go task (Wessel, 2018).

**Table 1**

| Condition | Determiner | Picture match? | Example sentence (paired with Fig. 1) |
|---|---|---|---|
| *Some*-Underinformative = SI/Implicit negation | Some | Mismatch[1] | *Some cards have sharks* |
| **Explicit-Negation** | Not all | Mismatch | *Not all cards have sharks* |
| **Some-True** | Some | Match | *Some cards have turtles* |
| **Not-All-True** | Not all | Match | *Not all cards have turtles* |
| **Some-False** | some | Mismatch | *Some cards have penguins* |
| **All-True** | All | Match | *All cards have sharks* |
| **All-False** | All | Mismatch | *All cards have turtles* |

**Figure 1**

**References**

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[1] In experimental settings, the majority of adult participants tend to derive SIs, interpreting *some* as "not all" (Bott & Noveck, 2001) and rejecting *some*-Underinformative sentences. However, some adults prefer to interpret *some* with its logical/literal meaning (i.e., "at least one"), and therefore tend to accept *some*-Underinformative sentences. Trials in which participants accept such sentences will be excluded from our analyses, because the literal interpretation of *some* does not involve implicit negation.