Understanding speaker meaning:
neural correlates of pragmatic inferencing in discourse comprehension

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Introduction

Although the explicitness of words and phrases often suggests otherwise, natural communication is to a large extent inferential (Grice, 1975; Sperber & Wilson, 1995). Depending on the context, an utterance like "It is hard to give a good presentation for this audience" can convey very different messages, for example "You'd better submit a poster!" or, alternatively, "Your talk was a mess!". The recovery of such context-dependent speaker meanings is absolutely central to communication. However, most neuroimaging studies of language comprehension to date have focused on the comprehension of rather simple coded meaning, or on relatively context-free pragmatic enrichment (e.g. metaphor). As a result, we know almost nothing about how the brain supports the computation of fully contextualized speaker meaning.

What are the neural systems involved, and how are they different from the neural systems involved in relatively context-free semantic analysis?

We used fMRI to examine the pragmatic inferencing required to comprehend indirect replies (Holtgraves, 1999).

Materials and Methods

→ 28 native Dutch speakers listened to natural spoken dialogues (~ 30 sec), ending in a question-answer (QA) pair

→ 30 trials/condition, no task demands apart from comprehension questions on filler items

→ final and critical utterance had different meanings depending on the lead-in story and the immediately preceding question:

(1) Direct reply:
…
Q: "How is it to give a good presentation?"
A: "It is hard to give a good presentation."

(2) Indirect reply, informative:
…
Q: "Will you give a presentation at the conference?" (rather than a poster)
A: "It is hard to give a good presentation."

(3) Indirect reply, face-saving:
…
Q: "Did you like my presentation?"
A: "It is hard to give a good presentation."

→ differences between indirect replies:
- with informative replies (2), the speaker's aim was to provide more information than just a simple "no";
- face-saving replies (3) involved a socio-emotional aspect; the reason for indirectness was to 'save face' (as in excuses, or polite refusals and other attempts not to offend somebody).

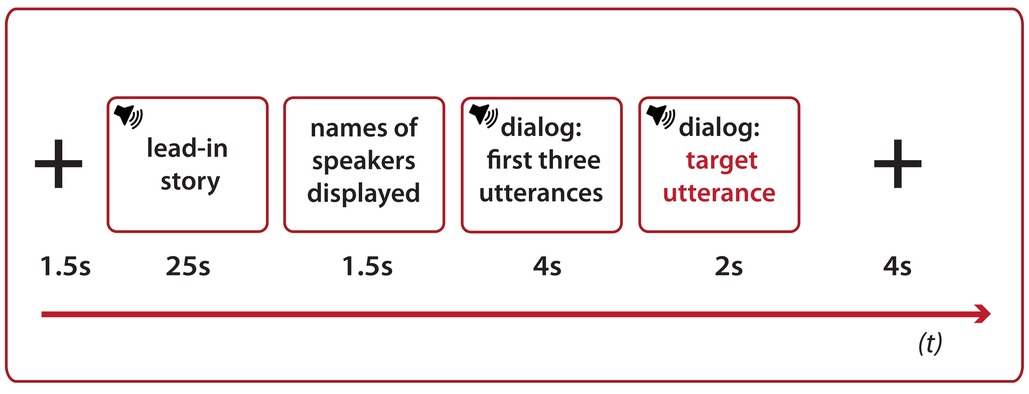

Figure 1: A typical trial composition. Context was provided by lead-in stories, in which a narrator introduced the main characters and topic. The characters speaking in the subsequent dialogs were identified by names displayed on screen before the dialog. The first 3 utterances of the dialog served as immediate context for the closing sentence of the dialog, the target sentence.

Results

Interpreting indirect replies

Indirect replies (pooled)
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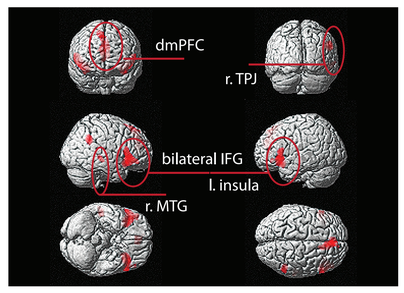
Direct replies

Figure 2: Clusters activated more strongly for pooled indirect replies (informative + face-saving) in comparison to direct replies.

All reported activation is at a 0.001 threshold, cluster corrected.



The effect of indirectness:

→ ToM areas (including the right temporo-parietal junction (TPJ) and dorsomedial prefrontal/ frontal cortex (dmPFC))
- play a role as "protagonist perspective network" (Mason and Just, 2009)

→ empathy/affective processing (left anterior insula)

→ semantic processing areas (bilateral inferior frontal cortex, right middle temporal cortex)
- left IFG: semantic unification of lexical information, semantic selection of concepts when linking causally related sentences in texts (Kuperberg et al., 2006)
- bilateral IFG: semantic selection of inferential information (Mason and Just, 2011)
- MTG: semantic integration of inferential information (Mason and Just, 2006)

Interpreting face-saving replies

Indirect face-saving replies
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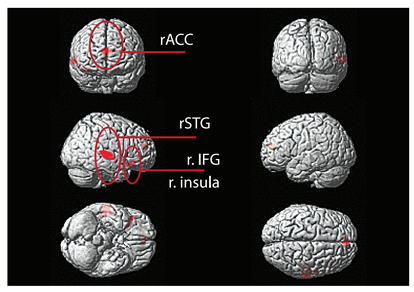
Indirect informative replies

Figure 3: Clusters activated more strongly for indirect replies with a face-saving aspect in comparison with more emotionally neutral, informative indirect replies

All reported activation is at a 0.001 threshold, cluster corrected.



Interpreting face-saving replies:

→ empathy/affective processing (right anterior cingulate cortex (ACC), right anterior insula)

→ inferencing (right superior temporal gyrus, STG)
- supplying implicit information, connecting different sources of information during inference generation, e.g. knowledge of social norms

→ contextual integration (right inferior frontal cortex) (e.g. Tylén, Wallentin, & Roepstorff, 2008)
- interpretation of indirect replies - which are instances of particularized conversational implicatures - crucially depends on contexts (at discourse and social meaning level)

Conclusions

√ Inferring intended meaning of implicit messages engages areas partly different from the classic language network

√ Speaker meaning comprehension requires taking the speaker's perspective, at both affective and cognitive level

√ Interpreting face-work adds not only a social-emotional aspect but also leads to more complex situation/discourse model building

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