Non-referential aspects of visual contexts inform language comprehension incrementally: evidence from eye-tracking

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A well-documented finding in psycholinguistics research is the rapid influence of non-linguistic visual information on language comprehension, at least when there is a referential relation between linguistic content and visual context\textsuperscript{1}. Yet, it is not clear whether non-referential aspects of visual contexts alone (e.g. movement or distance) can influence real-time language comprehension. Complementary, embodied theories of language have proposed that action and perception processes are involved in language comprehension\textsuperscript{2}. For instance, conceptual metaphor theory proposes that perceptual information (e.g., distance) is essential for understanding abstract concepts (e.g., similarity), and that these two concepts are linked through a metaphorical mapping mechanism. In line with this proposal, recent studies have shown that spatial distance between words/pictures can modulate participants’ similarity judgments about those words/pictures\textsuperscript{3}. Similarity-distance mapping implies ‘non-referential” concept-world relationships. While referential visual context can rapidly inform comprehension, it’s unclear whether this holds for non-referential concept-world relationships.

Three eye-tracking reading studies examined whether non-referential aspects of visual contexts can modulate real-time interpretation of abstract sentences. Experiment trials had three parts (see Figure 1): In a first step (i), participants (n=32) inspected a visual context (cards far versus close to one another). Subsequently, in (ii) they read a sentence and judged based on their world knowledge (“yes” vs. “no”) whether it described possible facts or events. Finally, in (iii) they verified whether a target card picture matched (vs. mismatched) the cards from part (i).

\textbf{Figure 1.} Schematic representation of an experimental trial in Experiment 1. For Experiments 2 and 3, cards were empty rather than showing words.
Experimental sentences implied either similarity or dissimilarity between two nouns, as exemplified in (1) and (2) respectively,

(1) \textit{Begabung}_{NP1} \textit{und}_{coord.} \textit{Weisheit}_{NP2} \textit{sind}_{VP1} \textit{freilich}_{ADV} \textit{entsprechend}_{ADJ}, \textit{das erklärte}_{VP2} \textit{der Professor}_{NP3}.

‘Talent and wisdom are indeed similar, this explained the professor’

(2) \textit{Dummheit}_{NP1} \textit{und}_{coord.} \textit{Weisheit}_{NP2} \textit{sind}_{VP1} \textit{bestimmt}_{ADV} \textit{verschieden}_{ADJ}, \textit{das erklärte}_{VP2} \textit{der Professor}_{NP3}.

‘Stupidity and wisdom are certainly different, this explained the professor’

In Experiment 1, the two playing cards displayed the first two sentential nouns whereas Experiment 2 used empty cards on the critical trials. In Experiment 3, the cards were empty, however, the experiment was divided in six blocks and participants studied and learnt the first two sentential nouns of the experimental trials (and other nouns for filler trials) before each of these blocks. Accommodating any immediate effects of card distance on sentence comprehension across these three studies would require more than just a referential mechanism.

We observed words distance effects in first-pass reading times. Cards distance effects, however, were only observed for regression path duration and total times. Furthermore, the effect patterns were different when participants previously read sentential nouns (Experiments 1 and 3) and when the sentential nouns were not presented before the sentence (Experiment 2). In Experiment 1, we observed a reliable \textit{facilitation effect} in first-pass (ADJ; NP3) and total (NP3) times, both shorter for sentences implying similarity after seeing cards close together (vs. far apart), and vice versa for sentences implying dissimilarity. Experiment 2 in contrast, revealed an \textit{interference effect} in total times (ADJ) with longer reading for sentences implying similarity after seeing cards close together (vs. far apart), and vice versa for sentences implying dissimilarity. In Experiment 3, we observed a \textit{facilitation effect} in regression path duration (ADJ) and total times (ADJ). No other interaction effects were observed.

The rapid and extended time course with which word (Experiment 1) and card (Experiments 2 and Experiment 3) distance differentially affected semantic interpretation, implicates more than just a referential mechanism, and suggests that relating spatial distance to abstract content can be instantaneous and part and parcel of ongoing semantic interpretation.

References