When Stored Knowledge Competes with Scene Information in Sentence Comprehension

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The present research aims to determine the relative importance of depicted event information versus stored linguistic and world knowledge during on-line spoken sentence comprehension. Experimental evidence from sentence comprehension testifies to the rapid influence of both types of information. People's prior linguistic and world knowledge has immediate effects on the comprehension of unambiguous sentences (Kamide et al., 2003). On the other hand, non-stereotypical agent-action-patient event structures that have to be extracted from depicted scenes also influence rapid construction of mental role-representations in disambiguation of initially ambiguous German and English sentences (Knoeferle et al., 2003). Even within relatively interactive frameworks, such as Jackendoff (2002), there are reasons to expect a priority of stored (selectional, stereotypical & world) knowledge in online thematic role-assignment. In contrast to a Jackendoffian framework, the importance of the visual environment in shaping our cognitive architecture is emphasized by research in the tradition of Clark (1992) (e.g., Tanenhaus et al., 1995).

To investigate priority of stored versus scene knowledge, the present study monitored eye-movements in scenes while people were listening to related OVS (PATIENT-VERB-AGENT) sentences. An image showed two agent-action-patient events, e.g., wizard-spying-on-pilot, and detective-giving-food-to-pilot. Crucially, one agent on each image was a plausible competitor for the depicted event action performed by the other agent (e.g., the detective was a plausible competitor for the depicted wizard-spying event). By manipulating the verb people heard, we created four conditions, crossing the factors "competitor/no-competitor" with "depicted"/"plausible". For the competitor conditions (1) the verb "bespitzeln" ('spy-on') allowed two entities as likely agents: the wizard, being depicted as performing a spying-action (1a), and the detective, a plausible competitor for a spying-action (1b). For the no-competitor conditions (2), the verb permitted either a depicted or a plausible agent only: "verköstigen" ('give-food-to') determined the detective (2a) as depicted agent; "verzaubern" ('jinx') identified the wizard as plausible agent. (2b) Materials were constructed so as to avoid potential biases of specific plausible or depicted relations. Participants were instructed to listen to the sentences, inspect the images, and to try and understand sentences and scenes. There was no other task. We expected effects in the eye-movements shortly after people had heard the verb. Following Jackendoff (2002), we would expect more anticipatory looks to the plausible agent (detective) over the depicted agent (wizard) for the competitor conditions (1). Conversely, an approach suggesting greater reliance on information extracted from the immediate scene, would predict the opposite pattern of looks.

For the competitor conditions (1), we found more looks to the depicted agent (the wizard) (ps < 0.001). For sentences (2) (no competitor), we observed clear disambiguation using either depicted information or plausibility (ps < 0.01): For (2-a), significantly more fixations went to the likely depicted agent (detective-giving-food) than to the wizard, and vice versa for (2-b). A three-way interaction (Part/Items x Competitor(yes/no) x Target Agent (depicted/plausible) confirmed that the difference between the competitor conditions (1), and conditions (2) was significant (ps < 0.05). Our results show within a single study that people use both stored knowledge and information that has to be extracted from depicted scenes effectively. In the face of competition, however, they suggest greater priority of depicted information.

Examples

(1a)   Den Piloten   bespitzelt   gleich   der Zauberer.
         'The pilot (PAT.) spies-on   soon   the wizard.'   (depicted AGENT)
(1b)   Den Piloten   bespitzelt   gleich   der Detektiv.
         'The pilot (PAT.) spies-on   soon   the detective.'   (plausible AGENT)
(2a)   Den Piloten   verköstigt   gleich   der Detektiv.
         'The pilot (PAT.) gives-food-to   soon   the detective'   (depicted AGENT)
(2b)   Den Piloten   verzaubert   gleich   der Zauberer.
         'The pilot (PAT.) jinxes   soon   the wizard.'   (plausible AGENT)