Parallel worlds: The processing of negation and error disfluencies in the visual world paradigm.

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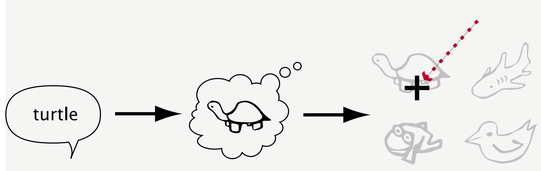
BACKGROUND

The visual world paradigm is based on a simple linking assumption (e.g. Cooper, 1974; Tanenhaus, et al., 1995; Boland, 2004), namely:



When an object is mentioned, mental representations lead to a rapid and automatic increase in the probability of looking at semantically related objects.

However, it is also possible to mention objects in the course of excluding them from the ongoing discourse model. Such a situation tests whether or not eye movements are being driven by mere reference or by the ongoing construction of a discourse model.

CURRENT STUDY

We tested two utterance types that overtly exclude an object from the discourse model:

- negation markers (e.g. *not this, but that one; only this, not that*)

  the negation markers precede the mention of the goal objects to be excluded

  » thus, it is possible that fixation on to-be-excluded objects could be avoided

  » or immediate fixations on to-be-excluded objects (as they are processed during negation) followed by saccades away as a result of mental simulation (e.g. Kaup, 2006)

- error disfluencies (e.g. *this- uh, that one*)

  corrections occur after the misstatement introduces objects that must then be excluded

  » thus, it is likely that to-be-excluded objects will already have been fixated

METHODOLOGY

- 14 participants
- 24 disfluent stimuli (24 disfluent fillers)
- 24 negation stimuli (36 fluent fillers)
- Arrington Viewpoint eyetracker recorded images at 60 Hz.

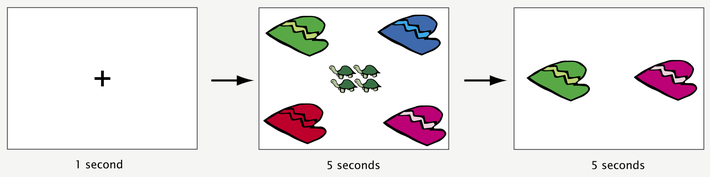
Put the turtles on the…
[1] (error disfluency; early adjective)
… lower, uh, the upper mittens.
[2] (error disfluency; late adjective)
… mittens on the bottom, uh, the top.
[3] (repeat disfluency; early adjective)
… upper, uh, the upper mittens.
[4] (repeat disfluency; late adjective)
… mittens on the top, uh, the top.

Don't put the turtles on the…
[5] (negation first; early adjective)
… lower mittens, *but* on the upper mittens.
[6] (negation first; late adjective)
… mittens on the bottom, *but* on the mittens on the top.

Only put the turtles on the…
[7] (negation second; early adjective)
… upper mittens, not on the lower mittens.
[8] (negation second; late adjective)
… mittens on the top, not on the mittens on the bottom.

…

Where are the turtles?

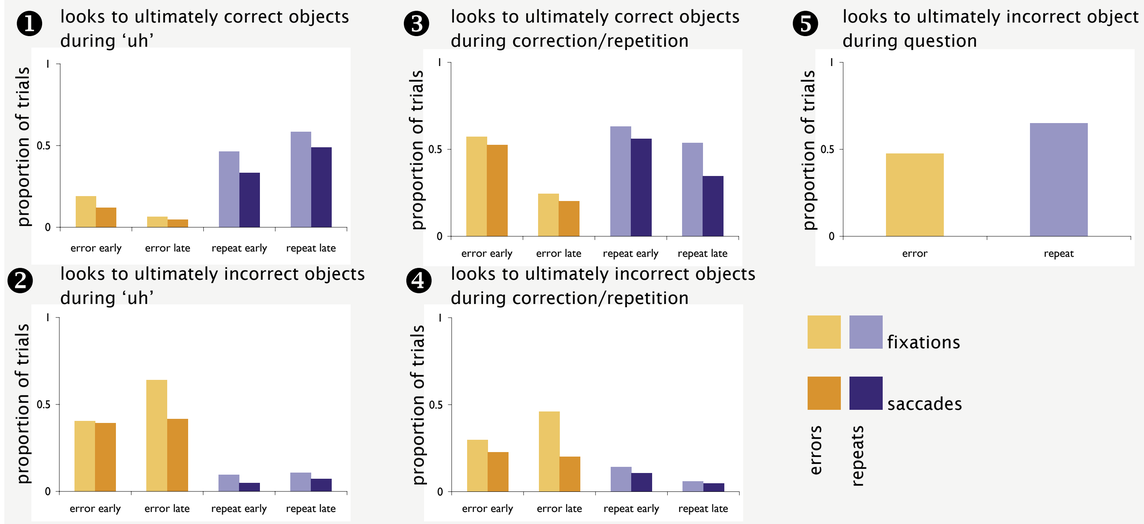


VARIETIES OF EYE MOVEMENTS

- H1: If eye movements in the visual world paradigm are controlled by mental simulation (e.g. Kaup, 2006), and if eye movements are directly related to activation of a concept in the mental model, participants should immediately look to negated goal objects, and then look away as they exclude the objects from their mental model.
- H2: If, on the other hand, eye movements are controlled by reference within a revelant behavioral context, participants should not look at excluded goal objects after a negative marker, and should immediately look away from excluded objects upon encountering a disfluency correction.
- H3: If negation is resource demanding, participants may reduce their overall frequency of eye movements to conserve processing resources (e.g. Cooper, 1974).

RESULTS

DISFLUENT UTTERANCES

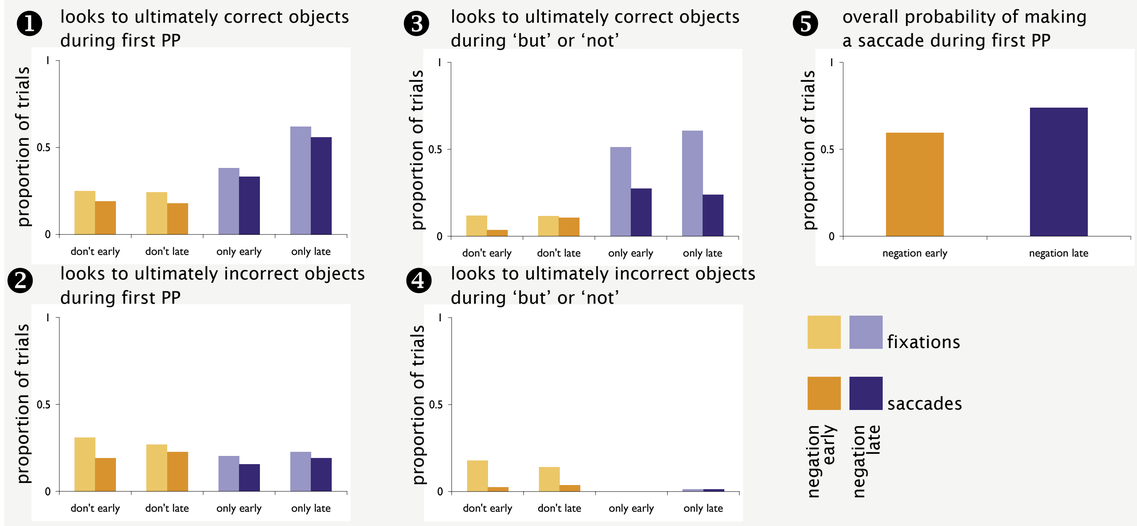


❶❷ Looks during the filled pause 'uh' are driven by the goals already mentioned: the correct goal (❶) for repeat disfluencies and the incorrect goal (❷) for error disfluencies.

❸❹ Particpants perseverate in looking at incorrect objects during the correction or repetition (after the 'uh'); the later the correct goal occurs, the greater the perseveration (❹), which also decreases the likelihood of looking to the correct object (❸).

❺However, when questioned about where the objects were placed, participants are less likely to look to the incorrect goal, suggesting that such looks are being inhibited.

NEGATION UTTERANCES



❶❷ Particpants looked less often to the correct goals (❶) during the first PP in the negation early (*don't*) utterances than the negation late (*only*) utterances, but equally to the incorrect goals (❷).

❸❹ The same pattern held for looks to correct goals in the segment immediately following the first PP (either *but* or *not*; ❸), while some perseveration occurred for looks to incorrect goals (❹).

❺ It appears that these effects are driven by a decreased overall likelihood of making eye movements during these segments of negation early utterances.

IMPLICATIONS

- Processing of error disfluencies leads to initial perseveration of looks to mistakenly introduced objects, followed by inhibition of looks to those objects.
- Processing of negation leads to 'point fixation' (Cooper, 1974), a reduced tendency to intiate eye movements.
- The simple linking assumption cannot sufficiently account for these patterns.
- As in studies of reading, there are multiple factors underlying the eye movement patterns generated by participants in visual world paradigm studies.

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