Sentence Processing

semantics and pragmatics

Psycholinguistics

LING/PSYC 27010

Autumn 2016

lecture #10
oct27/2016

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last time...

- competing models of sentence processing
  >> serial/parallel
  >> modular/interactive
  >> single- or multi-stage

- semantic and contextual influences on processing difficulty

- started on intro to auditory sentence processing

agenda for today (Thurs)

1. go over HW#3 (quickly)

2. look at some key experimental results in auditory sentence processing, focusing on **Visual World Paradigm** eye-tracking studies

3. begin the transition to **pragmatics** in sentence processing

referential processing

when we are processing sentences, we keep a mental note of the entities/people/things being referred to

just like lexical entries, our mental representations of conversational entities can be **activated** by **referring expressions**

(1) The astute lawyer who faced the female judge hated the long speech during the trial. (nonanaphor construction)
(2) The astute lawyer who faced the female judge hoped he would speak during the trial. (pronoun construction)

Probe: *astute*

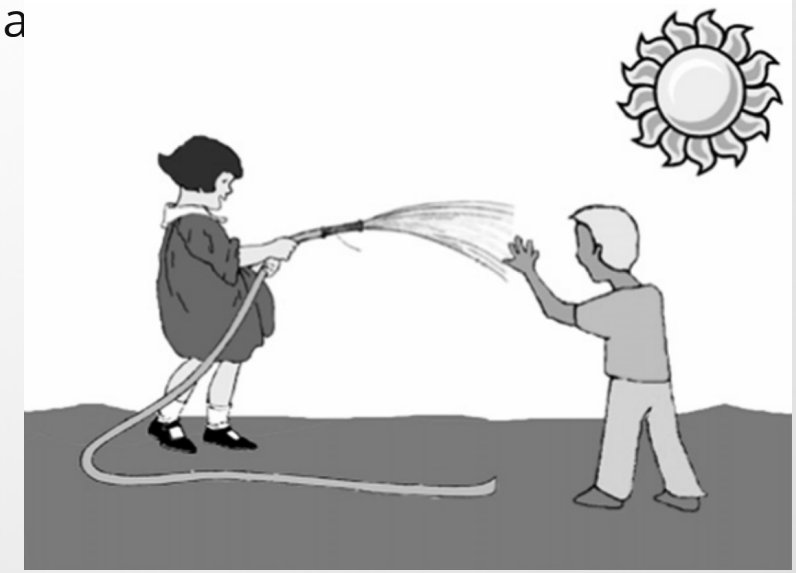
from reading to listening

so far we've been theorizing on the basis of reading studies -- reading studies carried out under non-typical circumstances

also: not all languages are written, so unclear degree to which these phenomena reflect linguistic processing independently of visual pattern recognition

also: real-life linguistic behavior involves *reference to language-external objects*, but in reading everything is a piece of langua

question: how can we measure *auditory* language comprehension in real time?



from reading to listening

one answer:

1. construct a mini-world containing collections of objects

2. selectively refer to those objects in auditory stimuli

3. manipulate properties of the stimuli *and* of the visual displays

4. measure eye-movements, looking times, or latencies to different visual objects across different experimental conditions

5. make inferences about how particular manipulations of linguistic stimulus and context affect processing time

from reading to listening

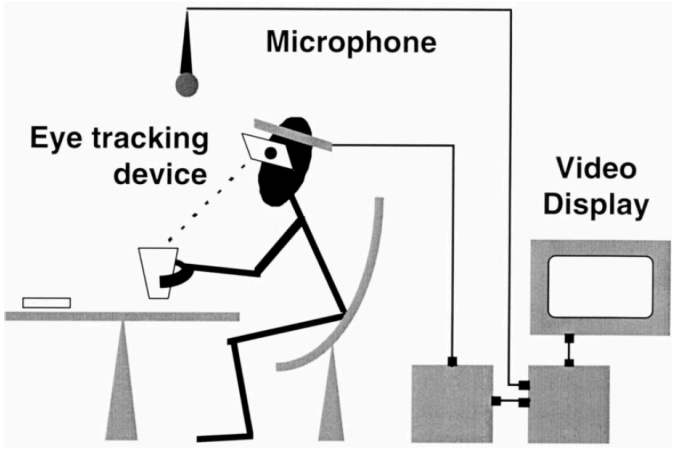
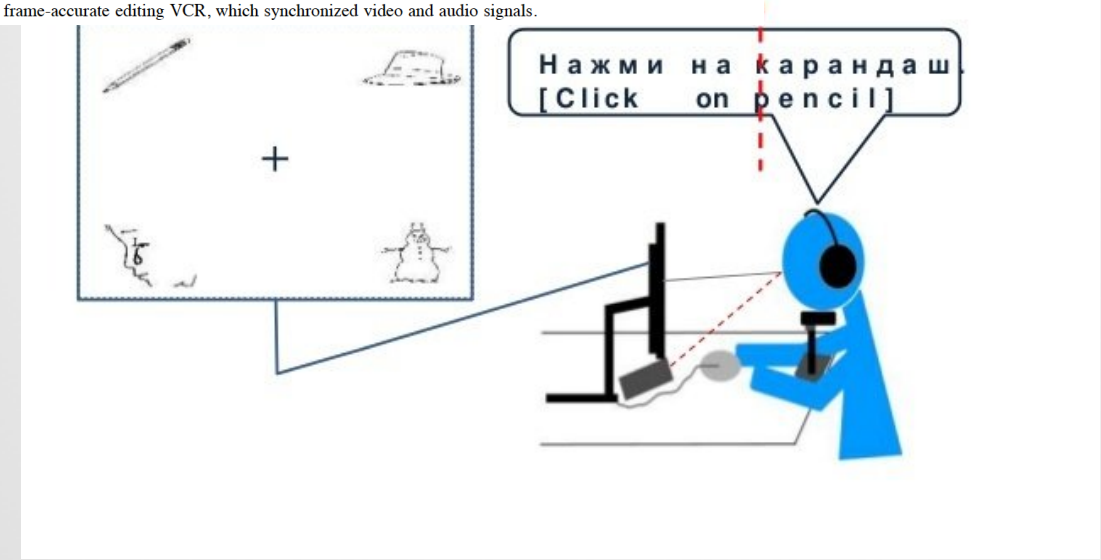


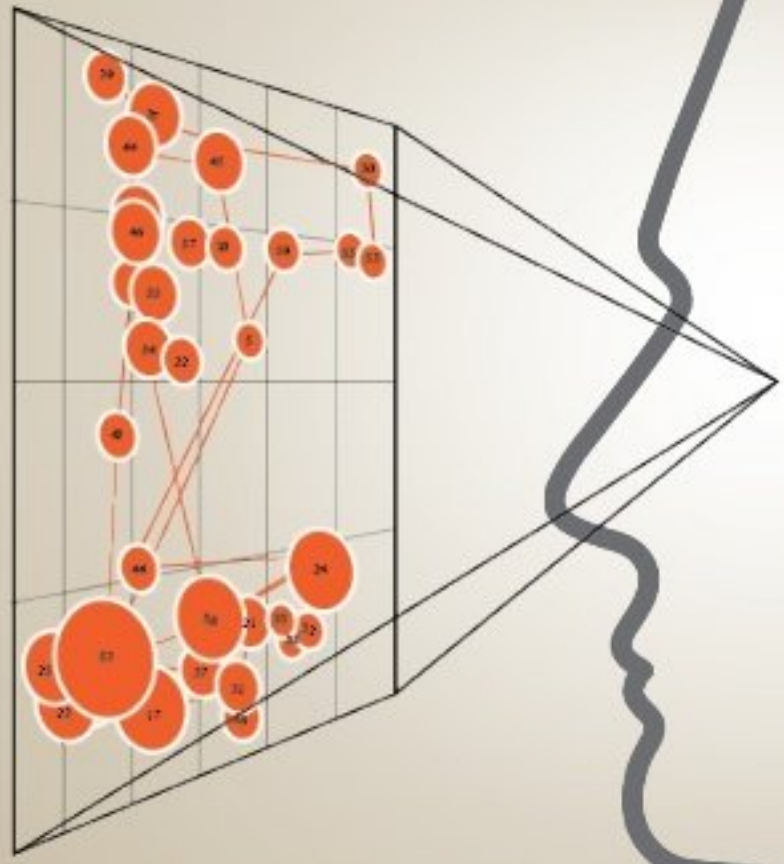
Fig. 2. An illustration of the configuration of the eyetracking equipment. Both eye image and scene image were taken in by camera mounted onto the headband. The CPU computed and superimposed the eye fixation over the scene image, with the resulting video data recorded by the VCR and displayed on the monitor. Experimental instructions were recorded via microphone directly onto the videotape by means of a frame-accurate editing VCR, which synchronized video and audio signals.

this is the basic approach of **the visual world paradigm**



- method for studying incremental syntactic and semantic processing
- made possible by the fact that people automatically, incrementally, and unconsciously try to relate visible objects in their surroundings to chunks of linguistic material

Eye-Tracking Metrics



ENGAGEMENT
Number of fixations
Total dwell time
Percentage of time on an area

PROCESSING
Fixation durations

FINDABILITY
Time to first fixation
Number of fixations prior to first fixation

PROCESSING ORDER
Gaze path

COMPREHENSION
Repeat fixations

WORKLOAD/EXCITEMENT
Pupil dilation

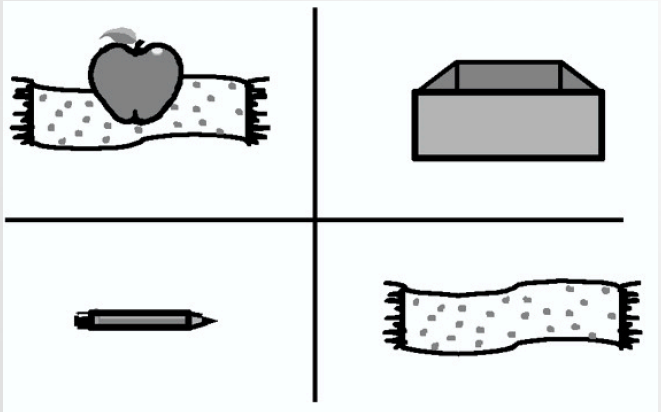
25

the visual world paradigm

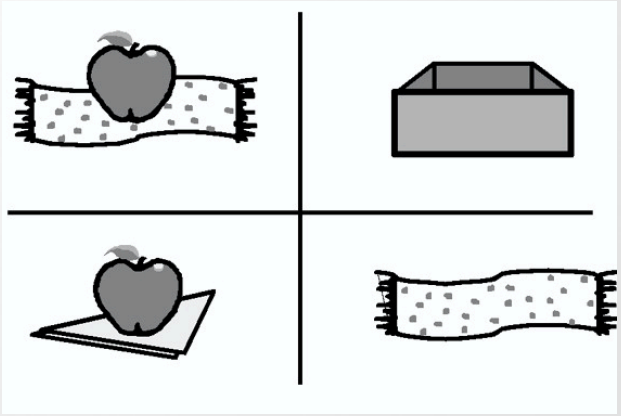
question: how do we know if someone has mis-analyzed this sentence?

Put the apple on the towel in the box.

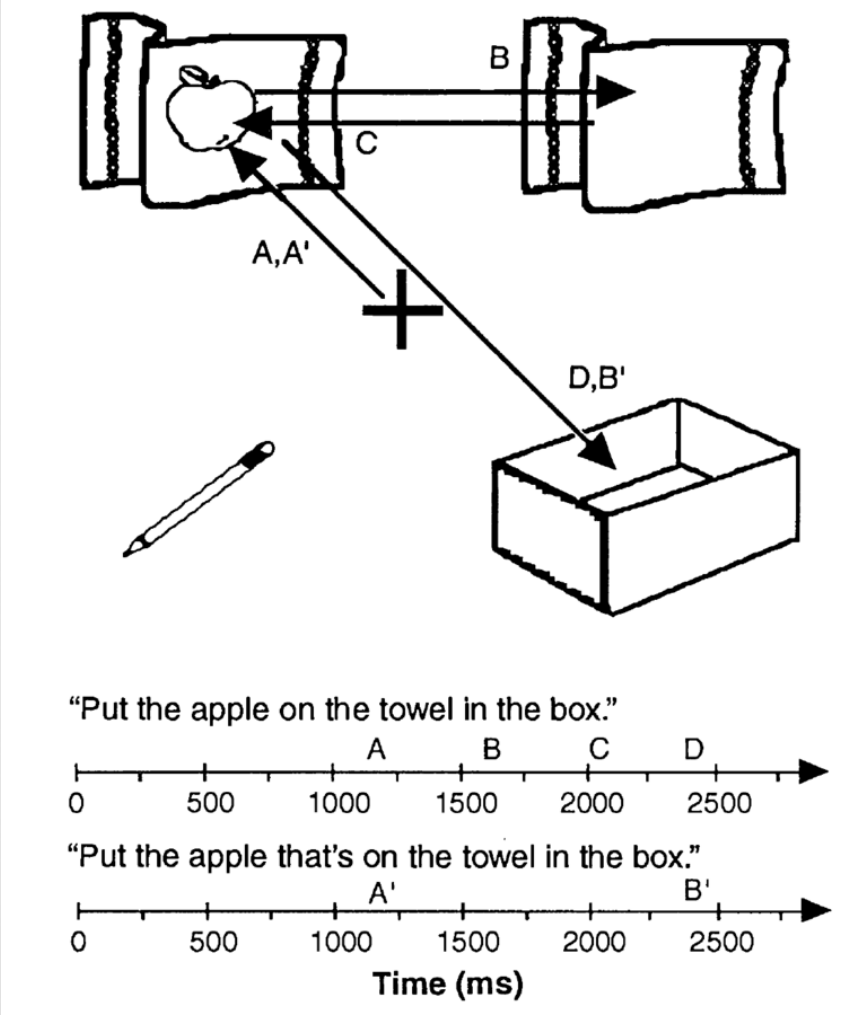
what about given this context?

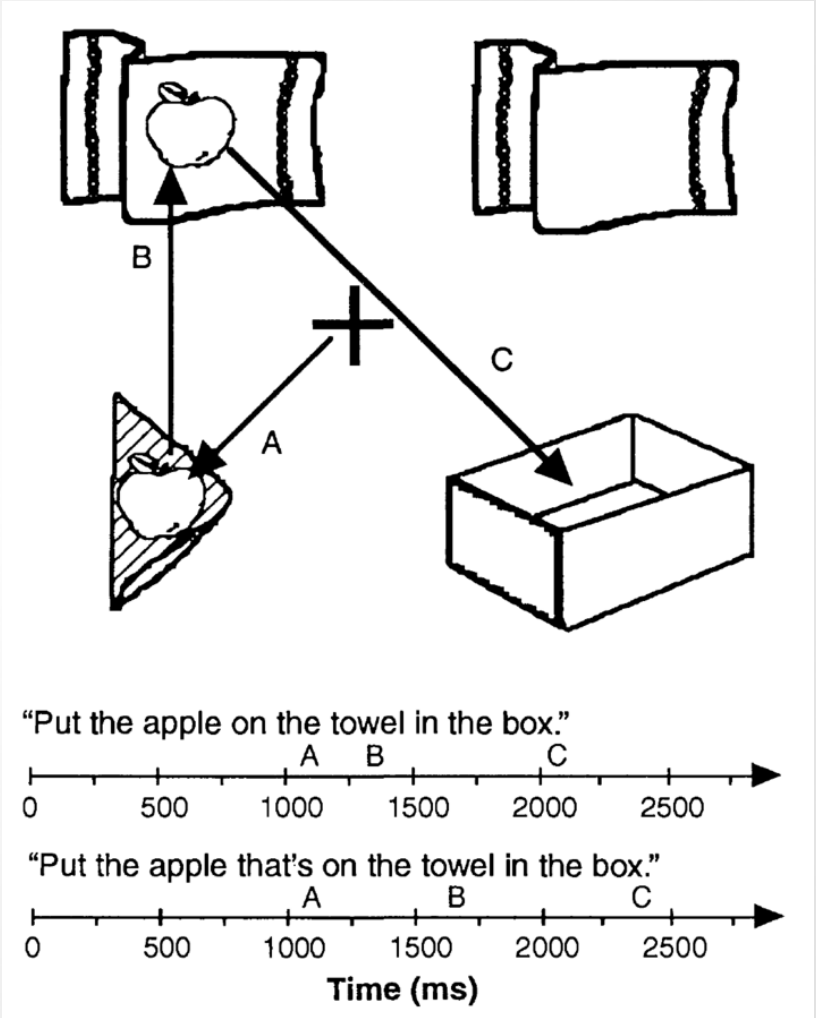


what about this one?



the visual world paradigm

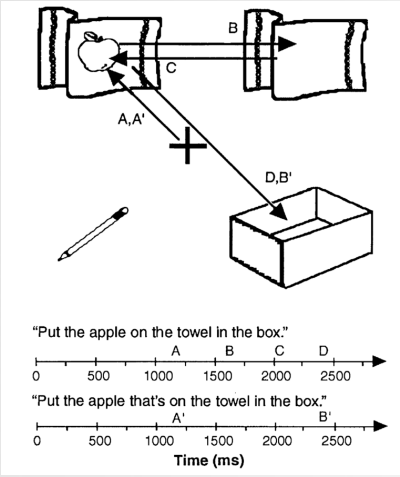




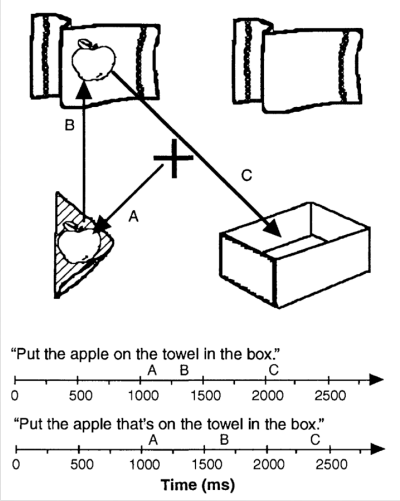
seminal study of Tanenhaus et al. (1995)

the visual world paradigm

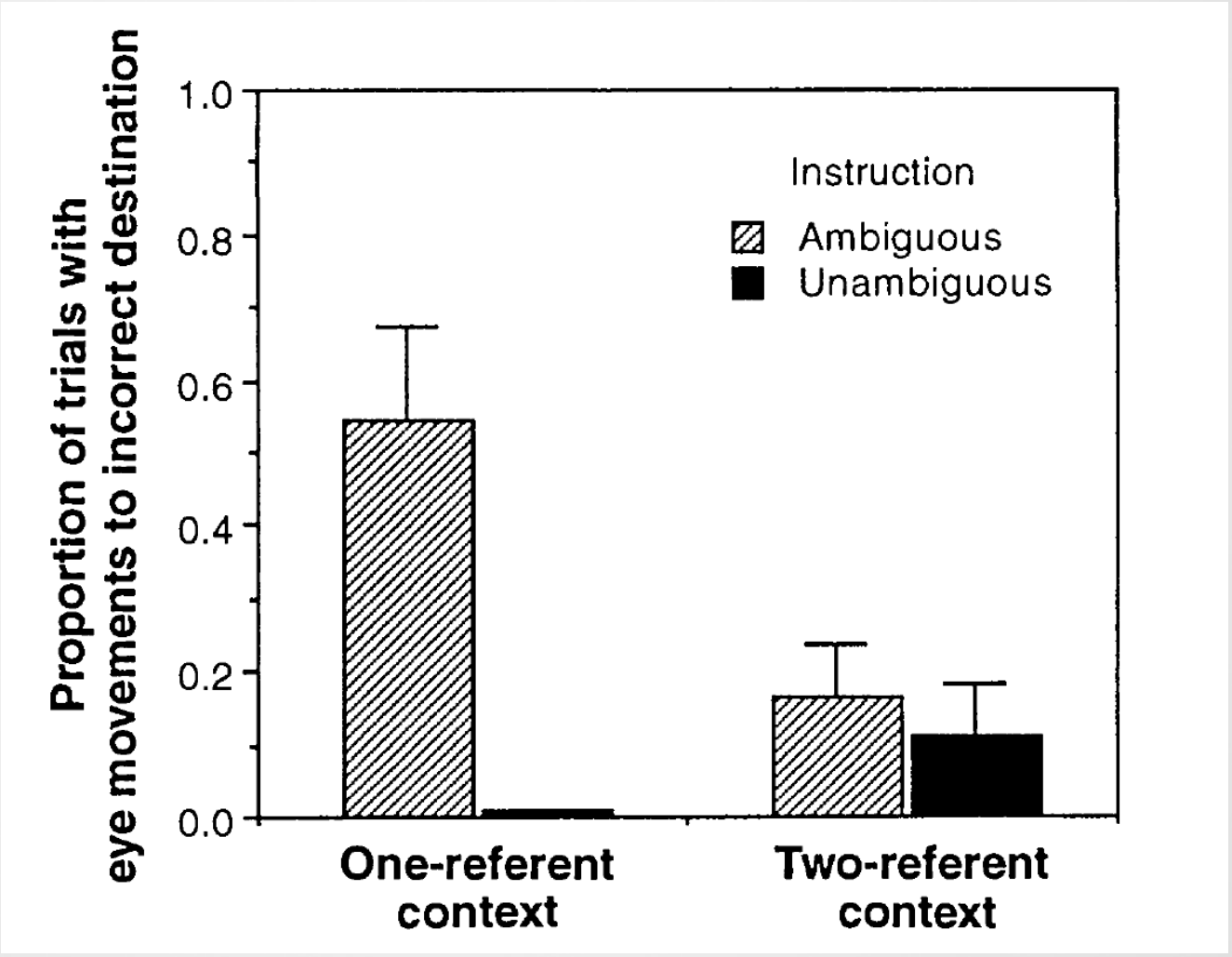
one-referent



two-referent



Tanenhaus et al. (1995)



the visual world paradigm

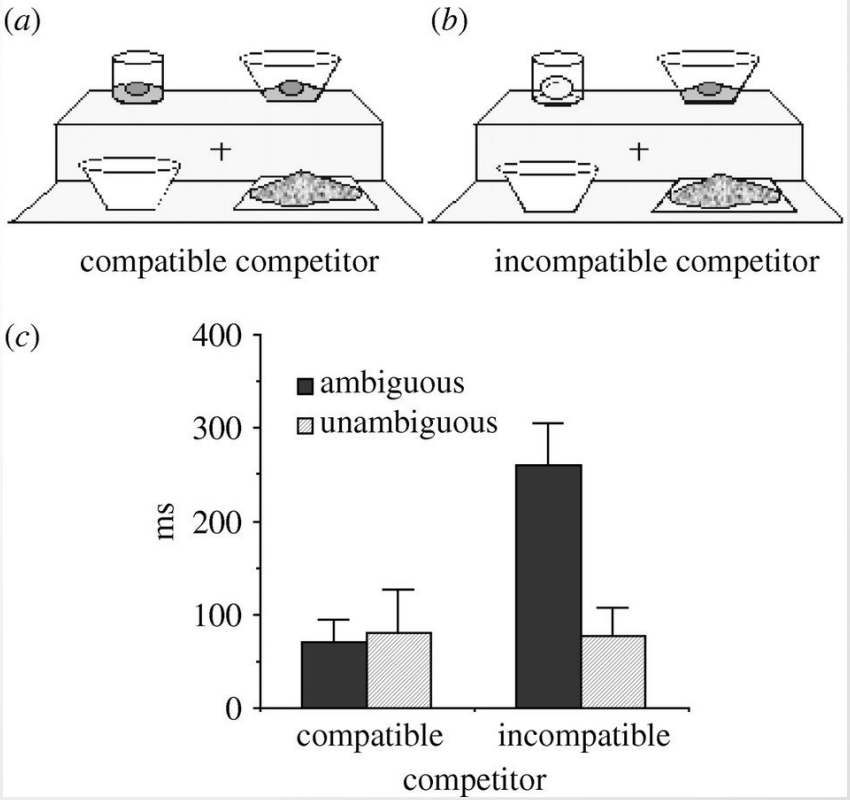
Tanenhaus et al. (1995):

- contextual information is taken into account *incrementally* during on-line sentence processing
- semantic information appears to be rapidly integrated (e.g. that *on the towel* signals multiple apples)

Chambers et al. (2004)

- rapid integration of verb-specific world knowledge during on-line processing of temporarily ambiguous sentences

"pour the egg (that's) in the bowl over the flour"

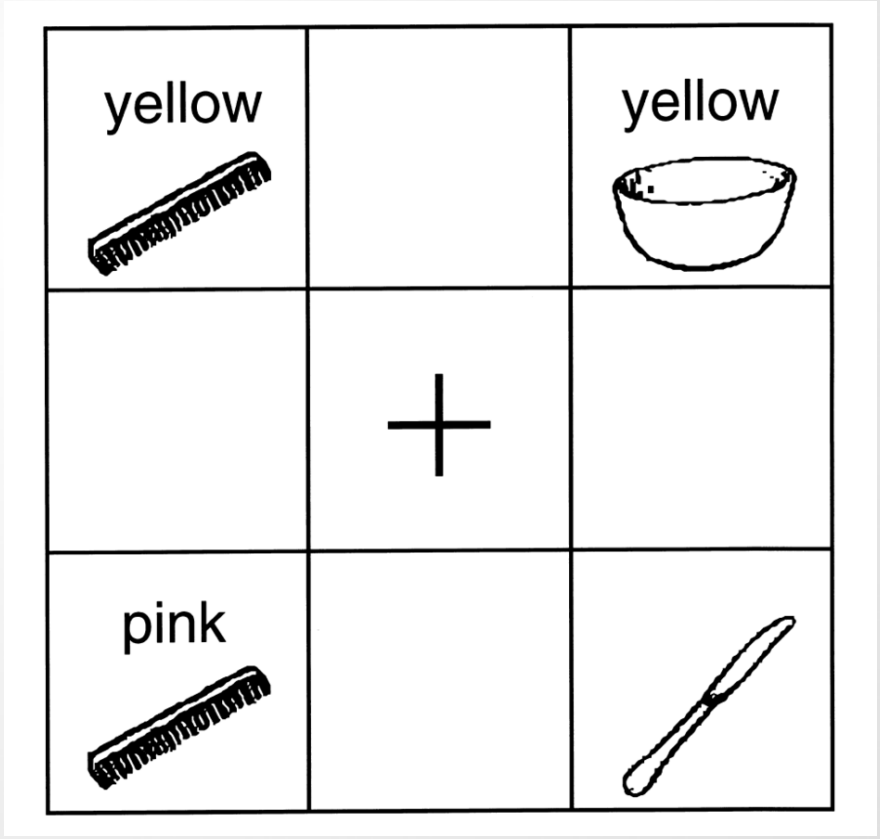


incremental semantic processing

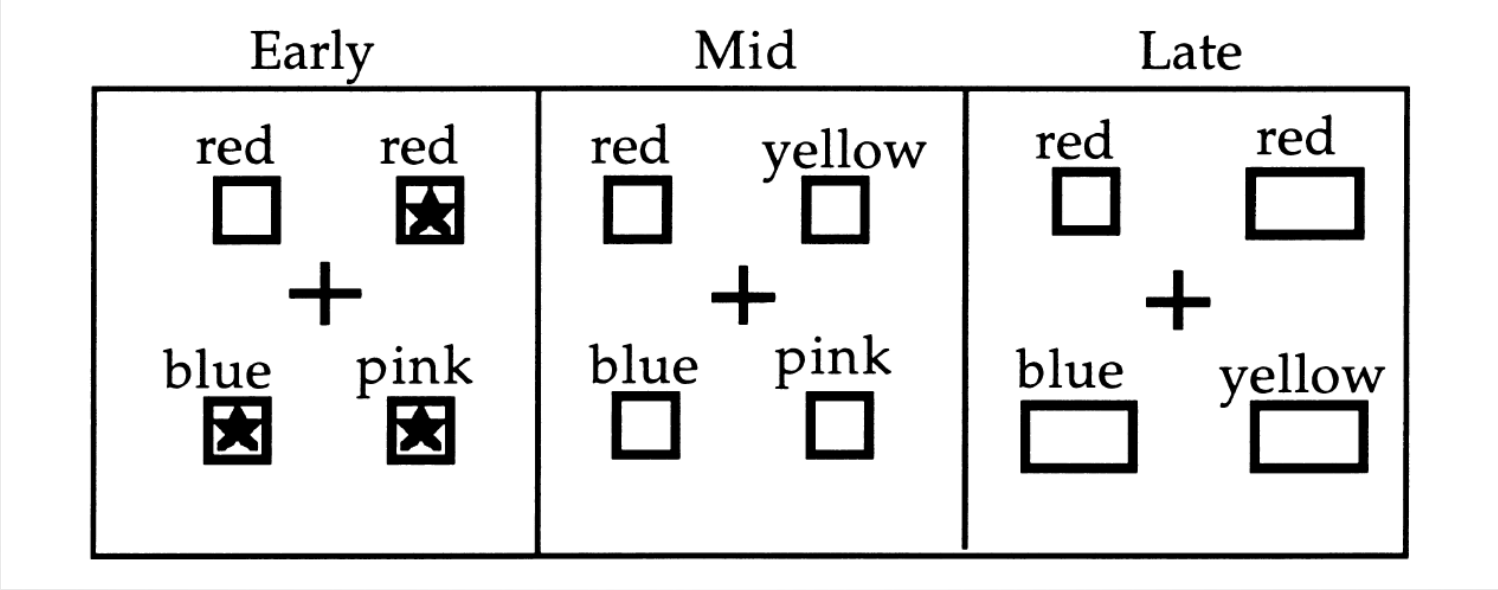
question: can these results be attributed entirely to syntactic misanalysis?

what about the **contrastive function of modification**?

seems like pre- versus post-noun position of modifier should affect referential processing (**why?**)

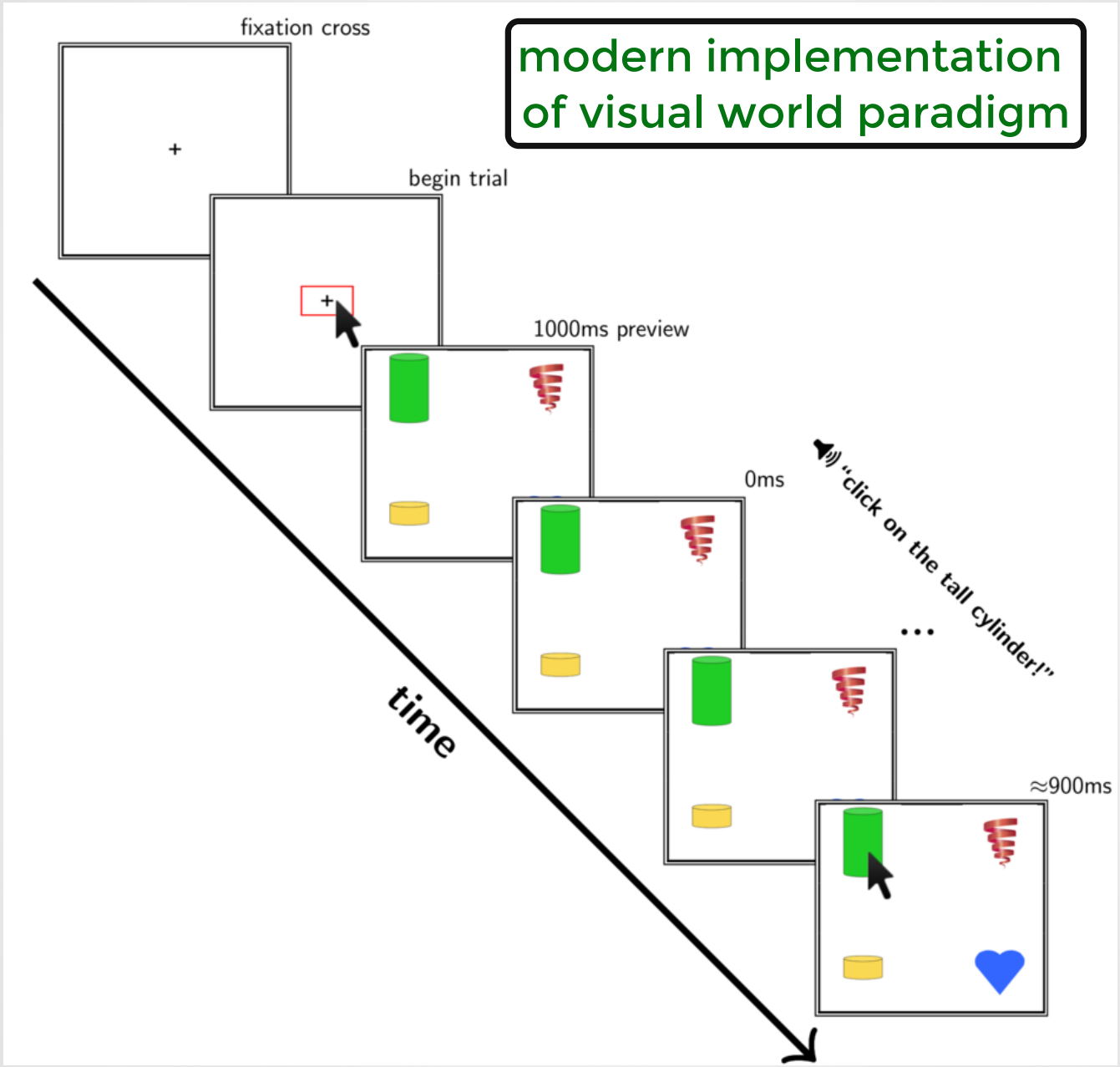


incremental semantic processing



click on the plain red square!

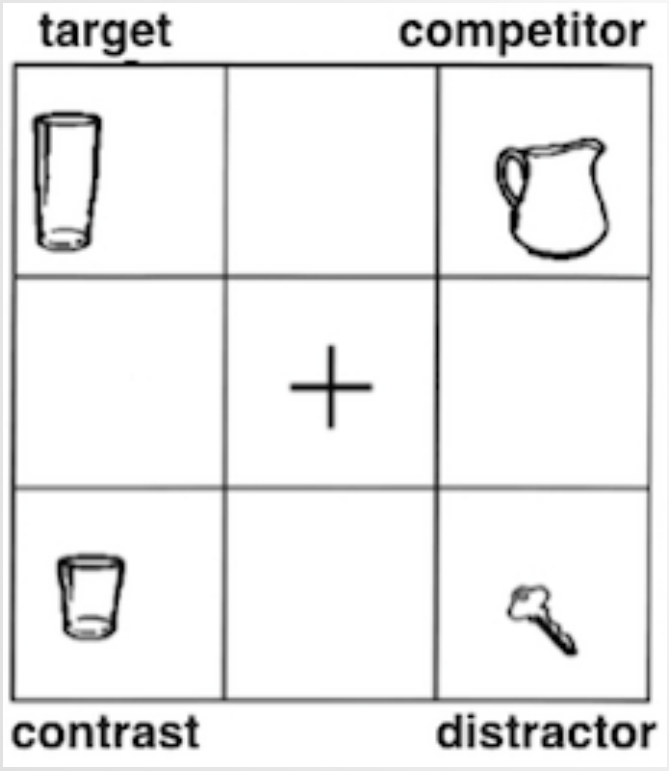
note: *click on* is used in place of *touch for older studies*


modern implementation
of visual world paradigm
fixation cross
begin trial
1000ms preview
0ms
"click on the tall cylinder!"
...
≈900ms
time

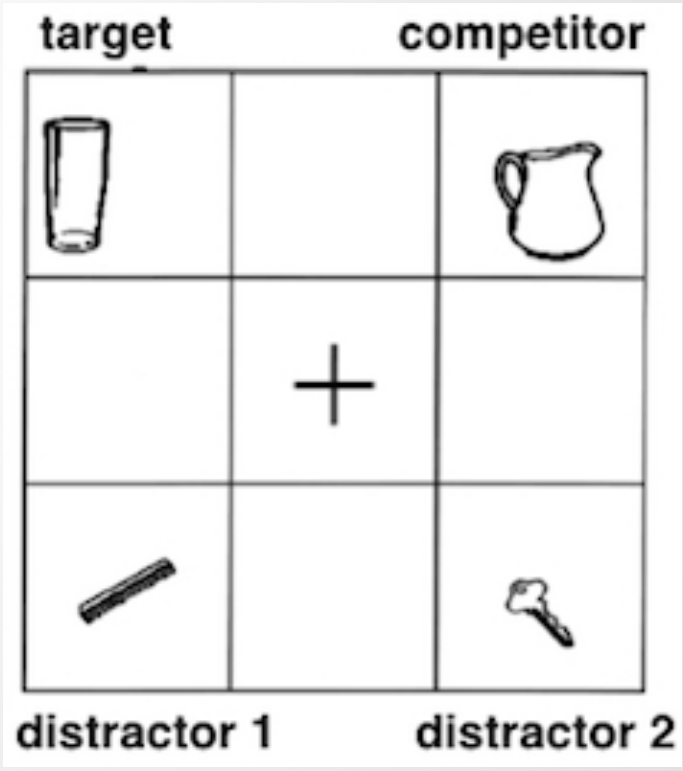
incremental semantic processing

Sedivy et al. (1999)

click on the tall glass!



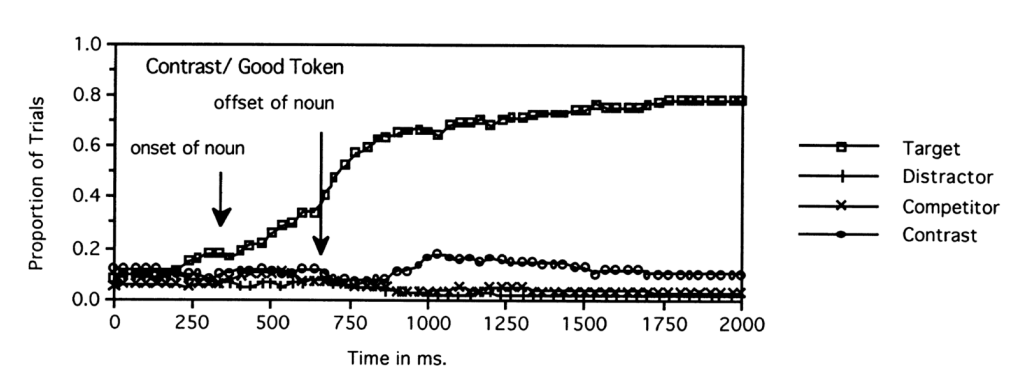
contrast

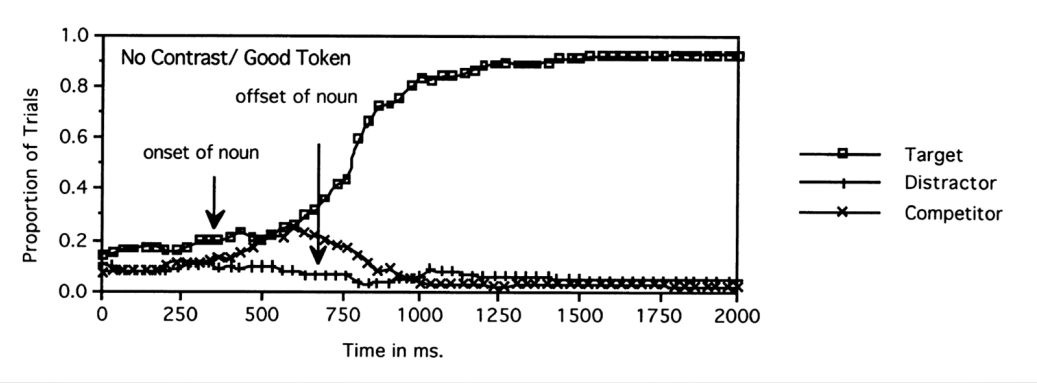


no-contrast

incremental semantic processing

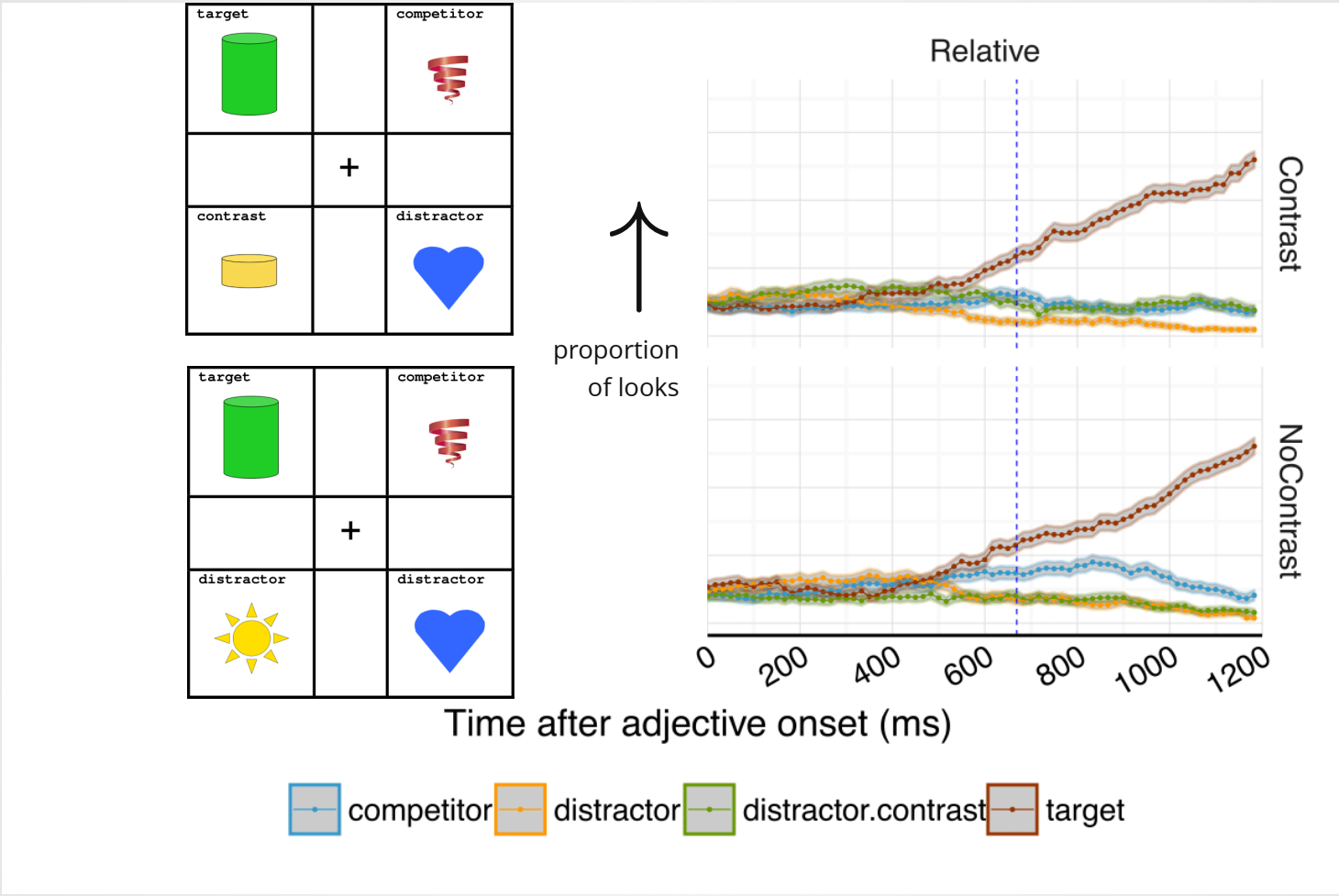
0.001). A main effect of contrast was also observed, with displays that included a contrasting object resulting in shorter latencies than displays that did not include a contrasting object ($F_1(1,21) = 11.62$, $P < 0.01$; $F_2(1,19) = 4.19$, $P < 0.06$).





Sedivy et al. (1999), expt 2 (adapted)

incremental semantic processing



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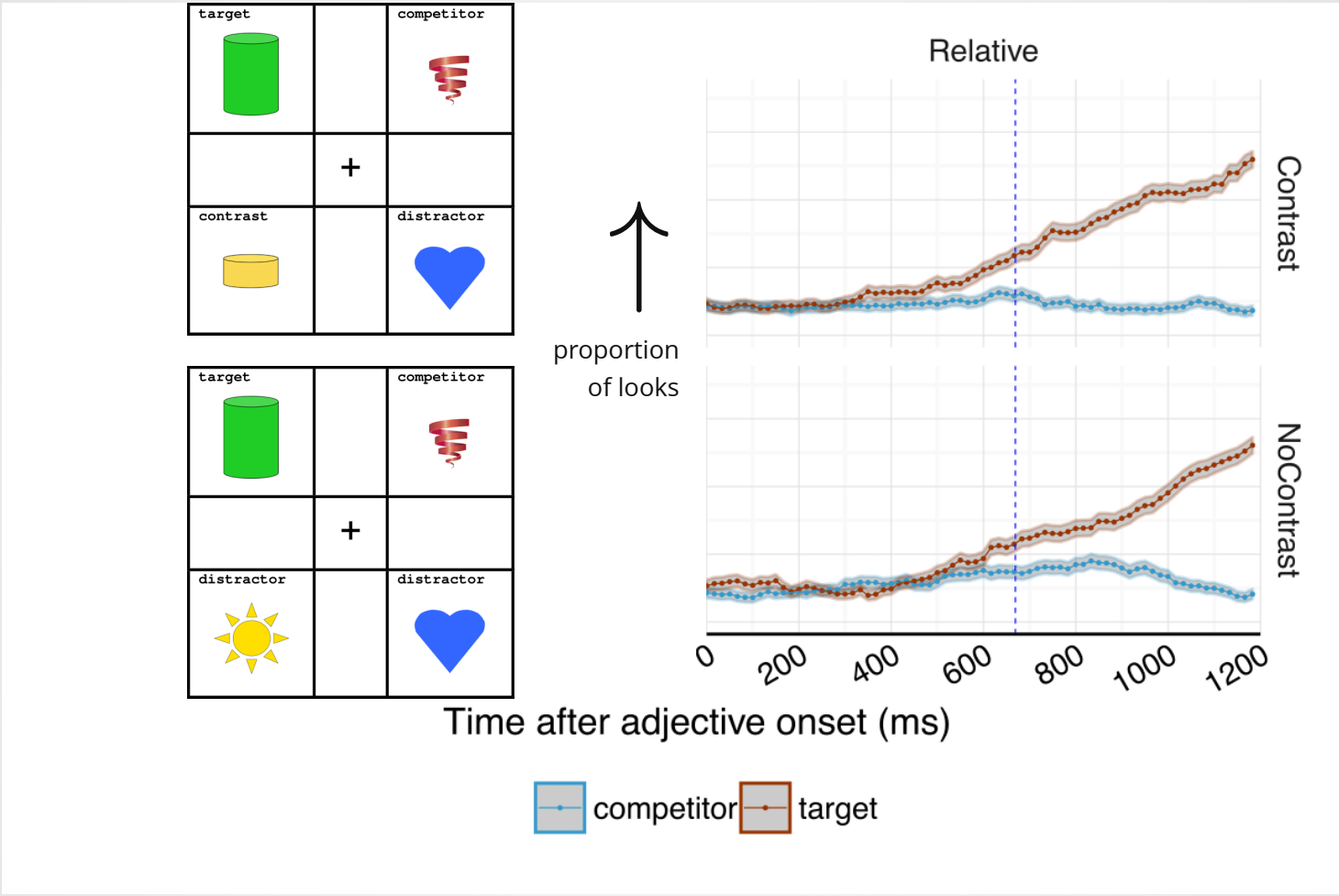
Sedivy et al. (1999), expt 2
(adapted -- plots from different study but show corresponding effect)

incremental semantic processing



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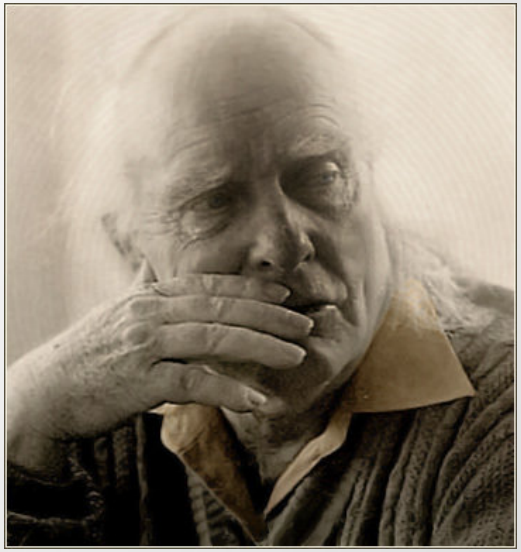
Sedivy et al. (1999), expt 2
(adapted -- plots from different study but show corresponding effect)

incremental semantic processing

question: what is the nature of the **referential contrast effect** observed in the Sedivy study (and many others)?!

- probably not part of the literal meaning of the words
- not necessarily the syntactic structure either (cf. non-restrictive modifiers)
- seems like something else entirely -- maybe the result of...

pragmatic reasoning!



Sedivy et al. (1999), expt 2 (adapted)

which is where we're going next!

in case you made it to the end of this deck while studying for the midterm, take a quick break to watch/read this cool piece on itch contagion:

https://www.scientificamerican.com/article/itch-when-an-itch-goes-viral-video/