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Seminar:

„Gaze as function of instructions – and vice versa“

Presentation by Jörn Giesen

18. November 1013

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Overview

- Eberhard et al. 1995
  - review on 5 experiments
  - connections /backgrounds

- Hanna et al. 2003
  - common Ground/Privileged Ground
  - common ground and domain restriction

- Discussion

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Eye Movement as a Window into Real-Time Spoken Language Comprehension in Natural Contexts

Eberhard,Spivey-Knowlton, Sedivy & Tanenhaus 1995

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The basic Idea

During listening to instructions, eye movements are closely time locked to the refering words

These eye movements provide detailed information on real-time comprehension of spoken language

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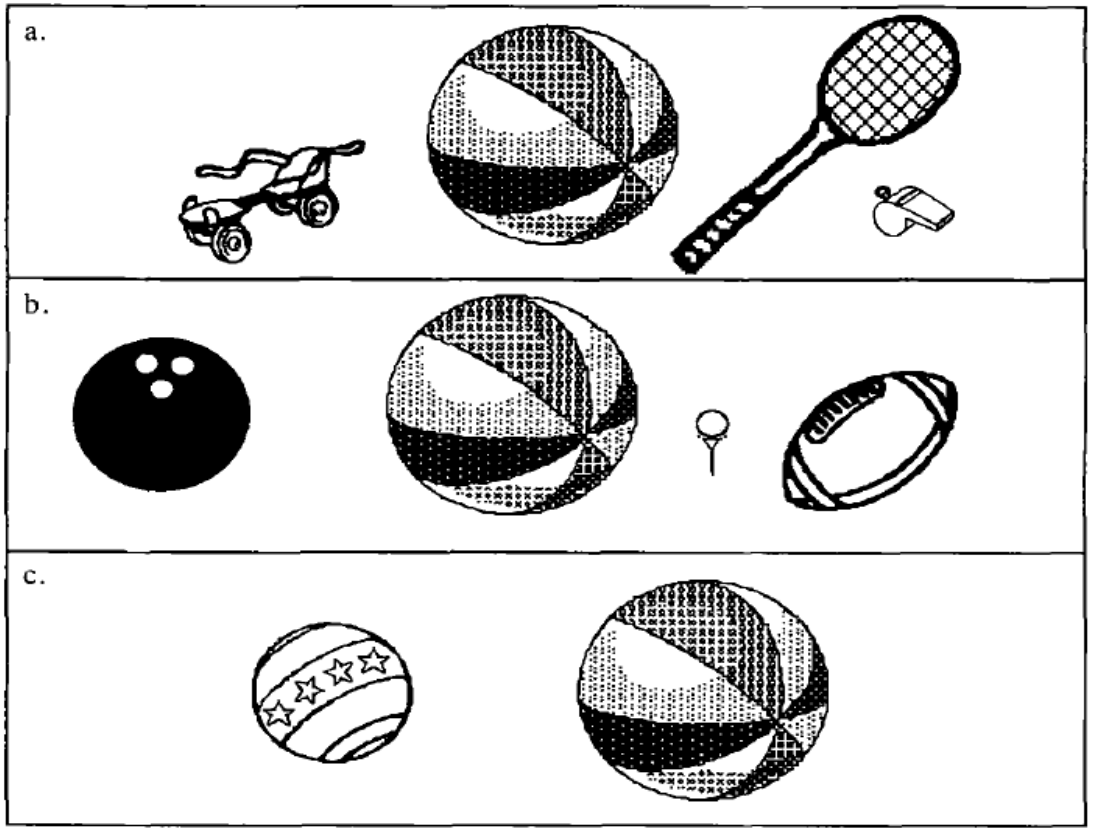
Comprehension and Discours context

„The large beach ball“ (Olson 1970)

No context: referent of the phrase cannot be understood before the word „ball“

Different expressions to refer to the same objekt depending on the context



Also: Grice 1975

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Comprehension and Discours context

Context of an utterance is highly important to language comprehension

2 different views on when context exerts comprehension

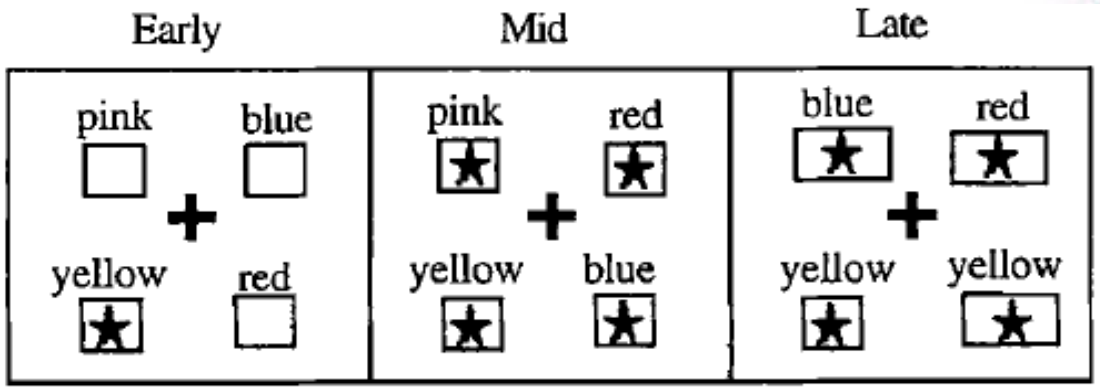
With or without immediate mapping onto discourse representation

So far (1995) mostly research on written language comprehension

Experiment 1

(Tanenhaus et al.)

„Touch the starred yellow square“



3 Dimensions:
marking/color/shape

Disambiguation by:
marking adj / color adj. / noun

Expectation:
-timing of eye movement relative to disambiguating words

This reveals speed of integration from nonlinguistic information

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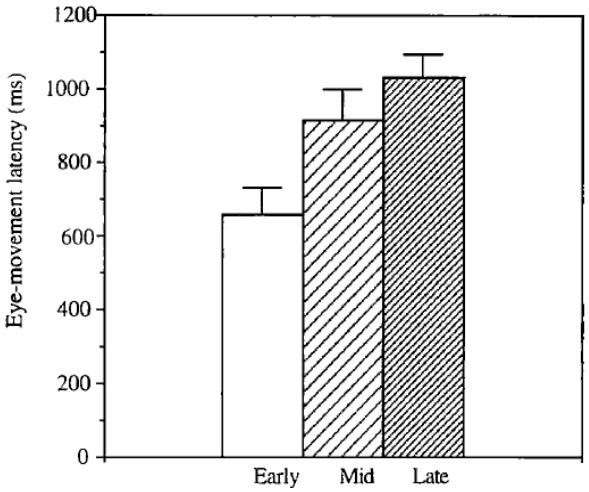
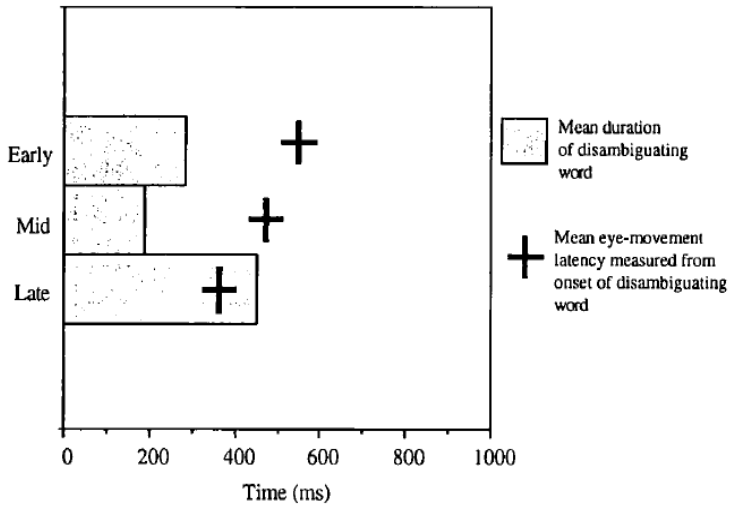
Experiment 1

(Tanenhaus et al.)

- recorded audio and video (eye tracking) data

- analyzed frame by frame, 30 Frames/sec





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Experiment 1

(Tanenhaus et al.)

Results:

1) incremental processing of spoken language
2) nonlinguistic context rapidly integrated
3) eye movement methods very useful

Criticism:

- only very simple Dispays tested

→ Maybee subjects developed strategy rather than parse sentences

Therefor do 2nd Experiment more complicated

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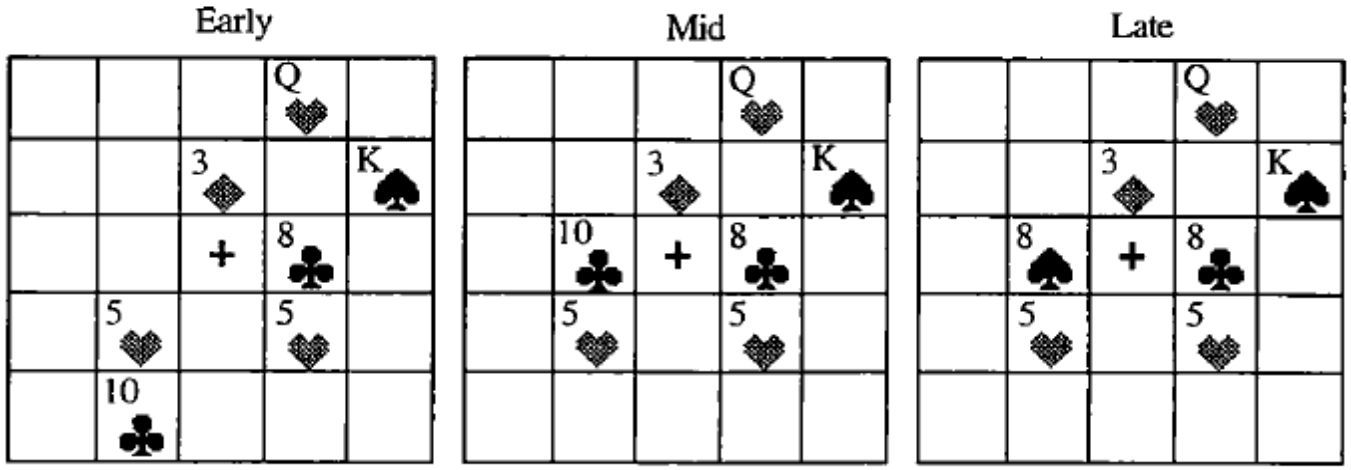
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)



„Put the five of hearts that is below the eight of clubs above the three of diamonds“

– 3 conditions, this time with 2 potential target cards
– disambiguated on different places

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Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)

– 17 Displays presented to each subject (4+4+4+5)

– Subjects were allowed to watch the experiments preparation

– „Look at the cross“

– Variable „Filler“ instructions

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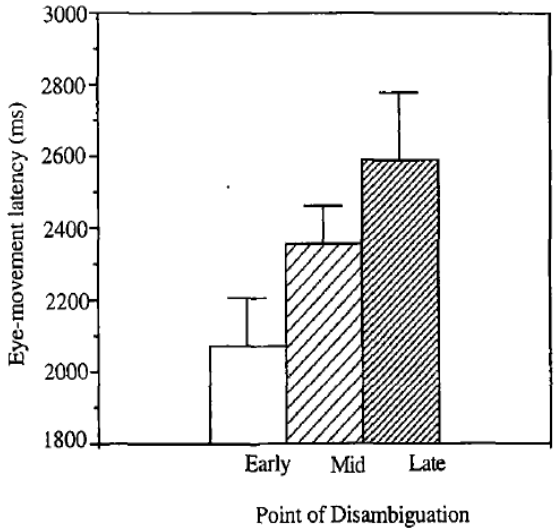
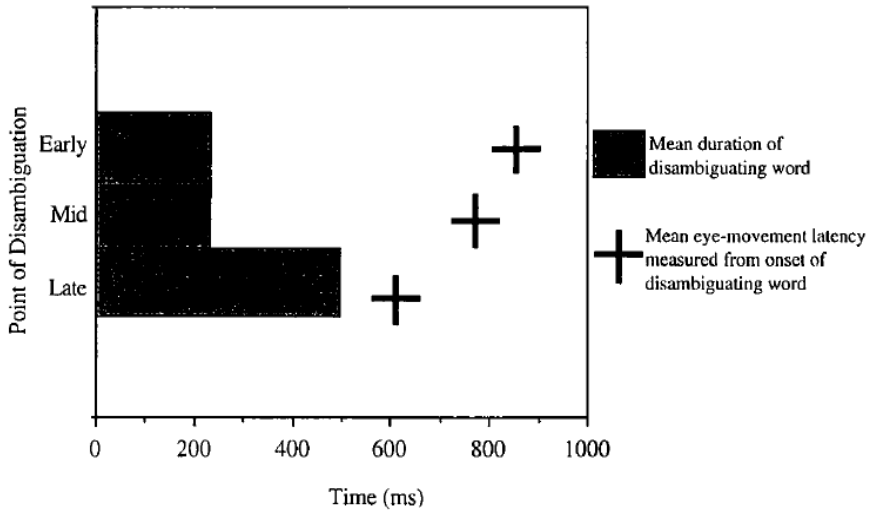
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)

Results:





Similar to Experiment 1 but not the same

– eye movements to various objects in the display

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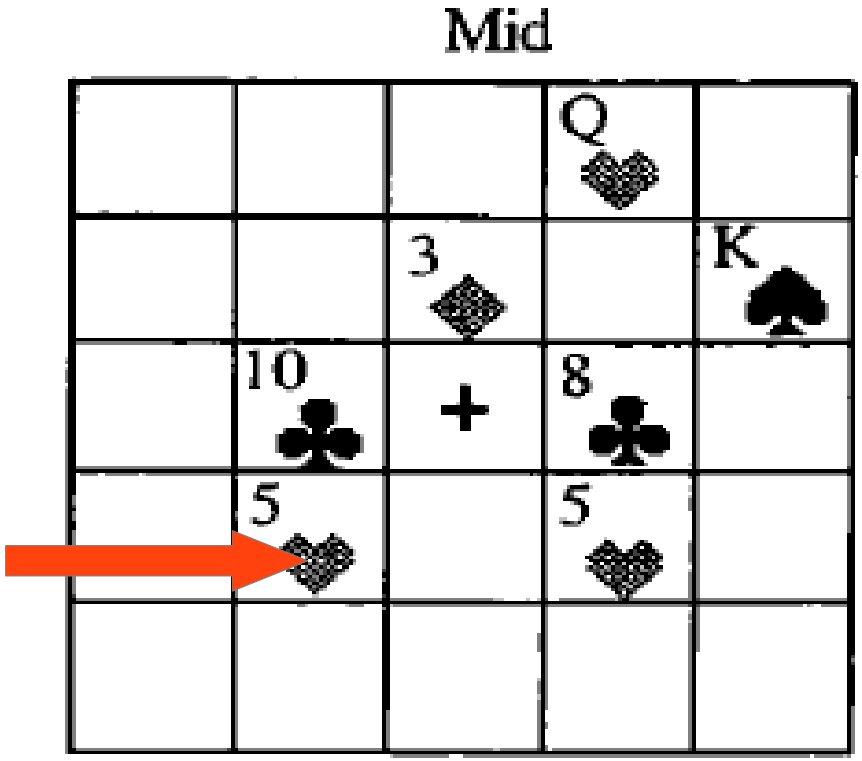
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)

Eye movements Example:



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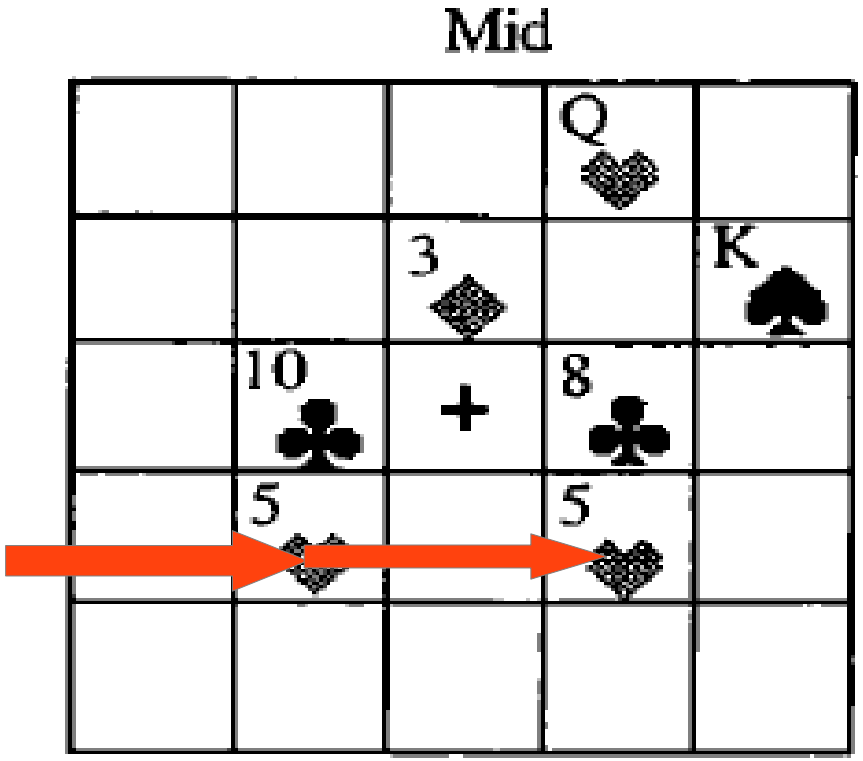
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)



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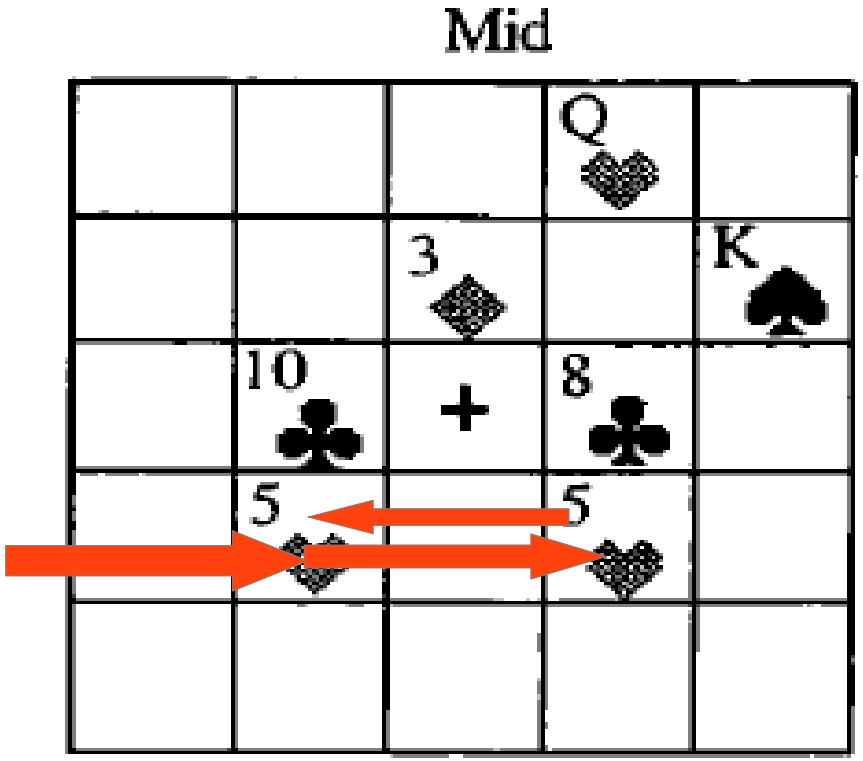
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)



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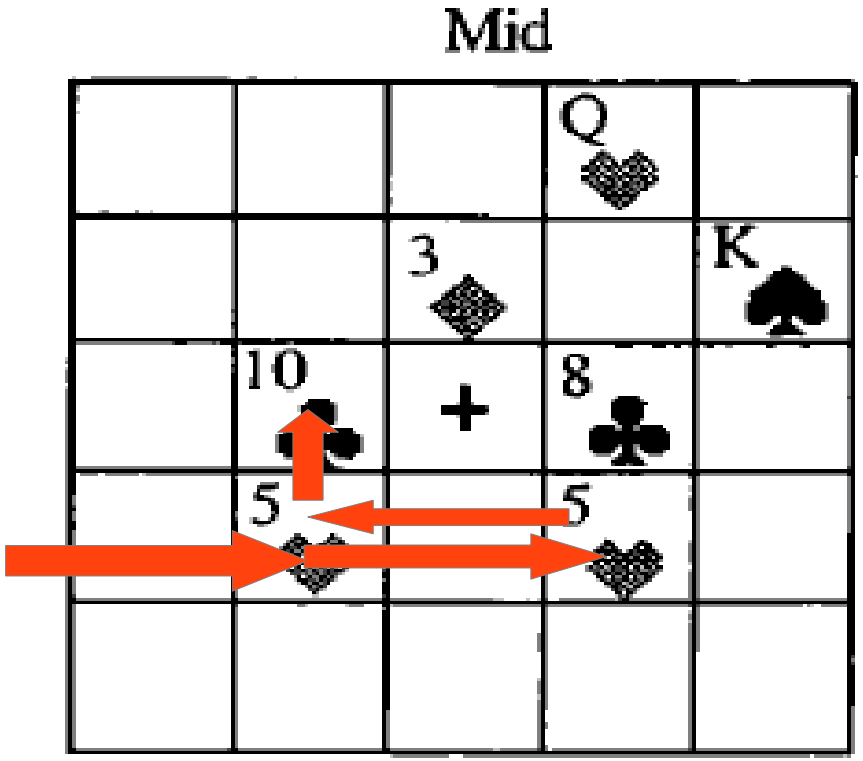
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)



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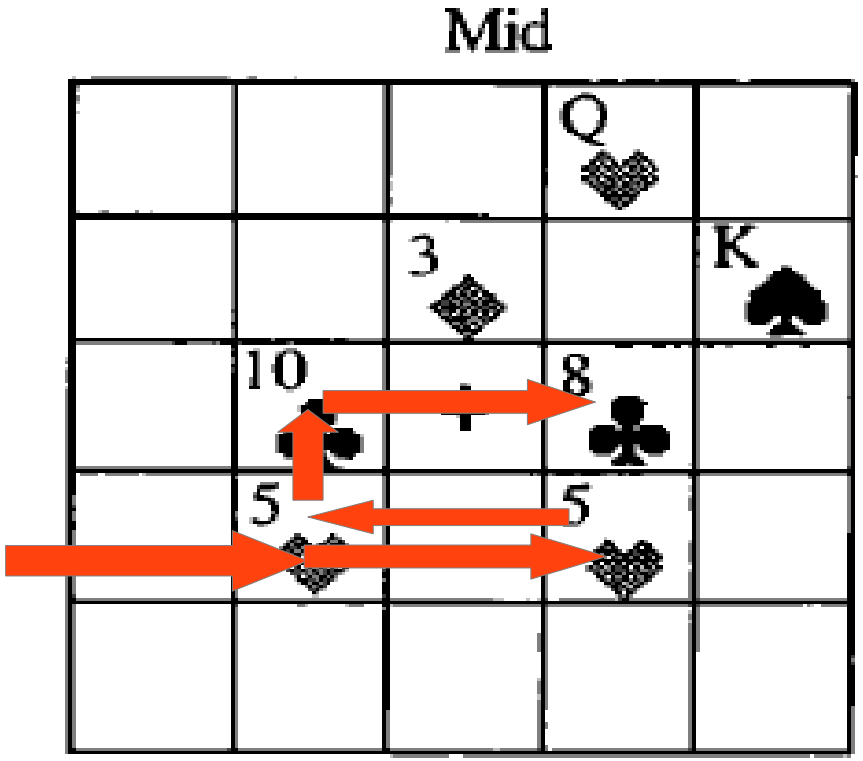
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)



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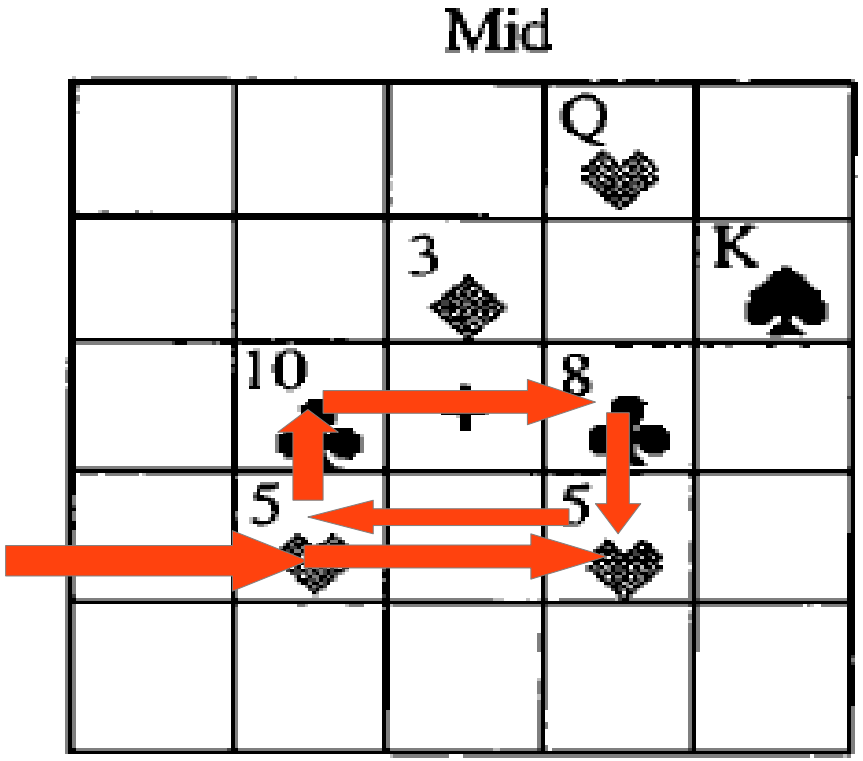
Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)



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Experiment 2

(Eberhard,Tanenhaus, Spivey & Sedivy)

General Discussion:

Unlike in Experiment 1, subjects typically made several eye movements to various objects

But probabilities of looks to target or „wrong-target“ are much higher than to irrelevant cards

The peak probabilitie (in all 3 conditions) occurres about 400ms after disambiguating word

These patterns of eye movements show, subjects are following and interpreting the instructions
(rather than just searching for keywords)

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Experiment 3

(Eberhard,Tanenhaus, Carlson, Spivey & Sedivy)

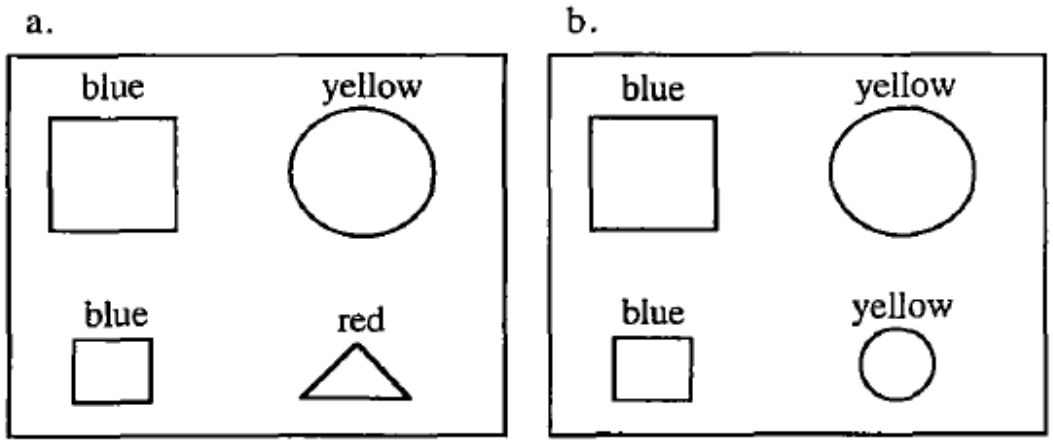
Question:

How can prosody be used to direct listeners attention to relevant entities?

„Touch the LARGE blue Square“

Problem:

Stressing words increases duration



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Experiment 4

(Eberhard,Tanenhaus, Spivey & Sedivy)

Effects of a cohort competitor on the processing of sublexical information

background:
recognition occours shortly after the input uniquely specifies a lexical item

example:

elephant	eloquent
	elevator
	elegant

cohort: (Marslen-Wilson 1987)
set of words that are similar to the target word

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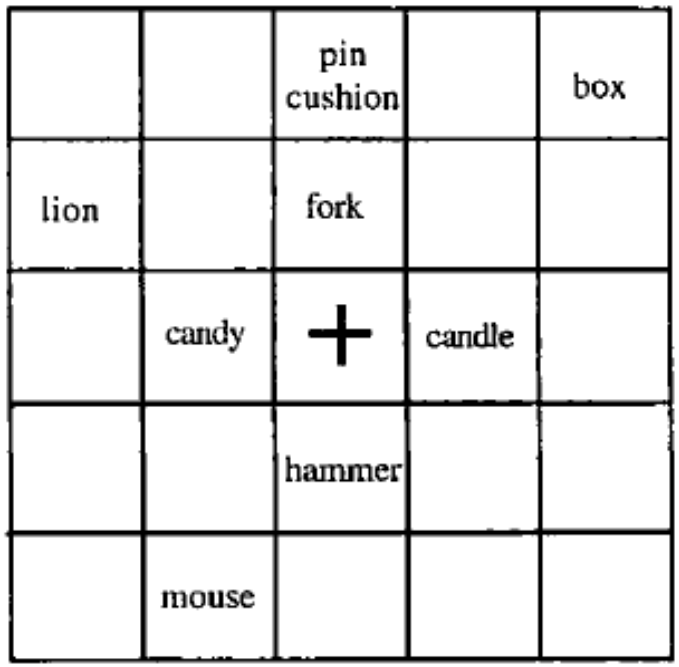
Experiment 4

(Eberhard,Tanenhaus, Spivey & Sedivy)

Hypothesis:

Eye-movements to target object slower when competitor in visual context

„Pick up the candle.“



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Experiment 4

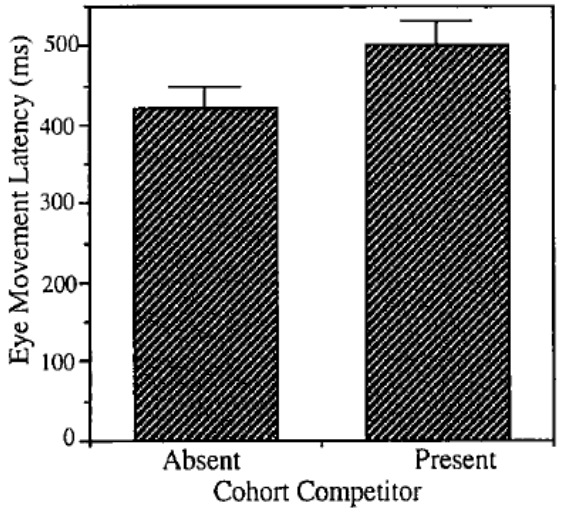
(Eberhard,Tanenhaus, Spivey & Sedivy)

Result:

Reliable „competitor effect“
(isn't that just a later point of disambiguation?)

Incremental interpretation within words

→ rapid integration of spoken information



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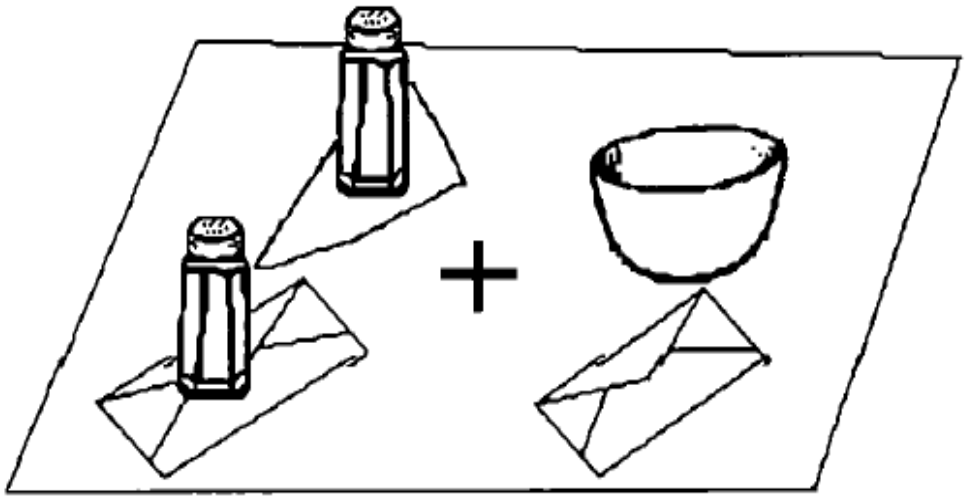
Experiment 5

(Eberhard,Tanenhaus, Spivey & Sedivy)

Can real-world visual context influence initial syntactic decisions?

Double PP construction:

„Put the saltshaker on the envelope in the bowl.“



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Experiment 5

(Eberhard,Tanenhaus, Spivey & Sedivy)

„Put the saltshaker on the envelope in the bowl.“

Encapsulating model: first PP initially interpreted as goal, not as modifier

(Minimal attachment, Frazier 1987)

(PP as argument rather than adjunkt, Abney 1989)

So far(1995): only studies on encapsulating model by investigating written comprehension

Problem: Context must be memorised

Maybee better: visual Context for immediate access

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Experiment 5

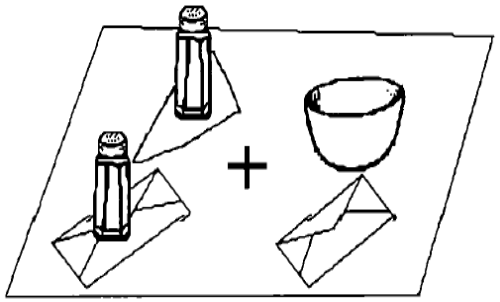
(Eberhard,Tanenhaus, Spivey & Sedivy)

Experimental Design:

2 different spoken instructions

„Put the saltshaker on the envelope in the bowl.“

„Put the saltshaker that's on the envelope in the bowl.“



Hypothesis:

If syntactic processing is initially structured independantly from context

⇒ listeners show evidence of misinterpreting

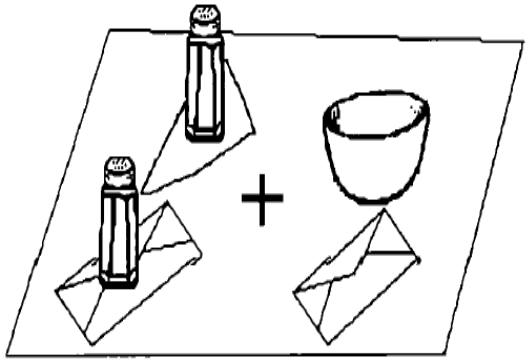
If there is no misinterpretation evidence against encapsulated syntactic processing?

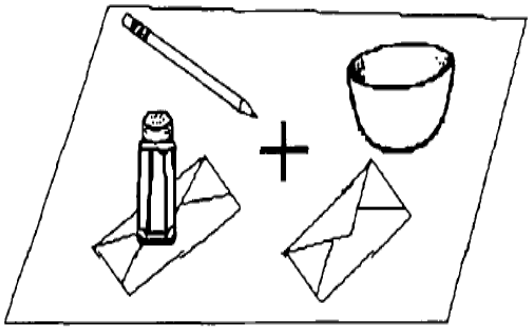
Experiment 5

(Eberhard,Tanenhaus, Spivey & Sedivy)

Experimantal Design2:

2 different display settings





2nd setting:

„Encapsulated account“ and „Incremental account“ predict misinterpretation of PP (on the envelope)

Why?

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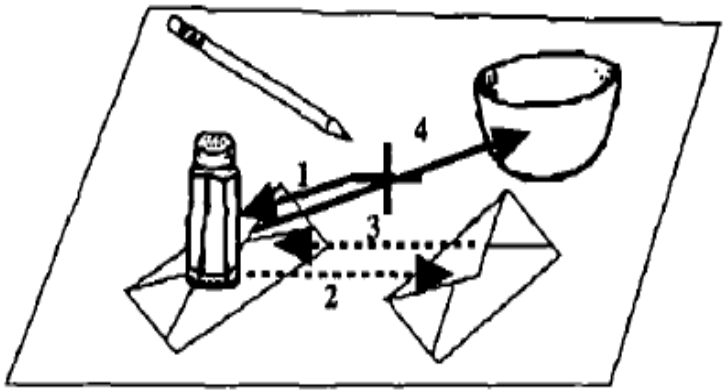
Experiment 5

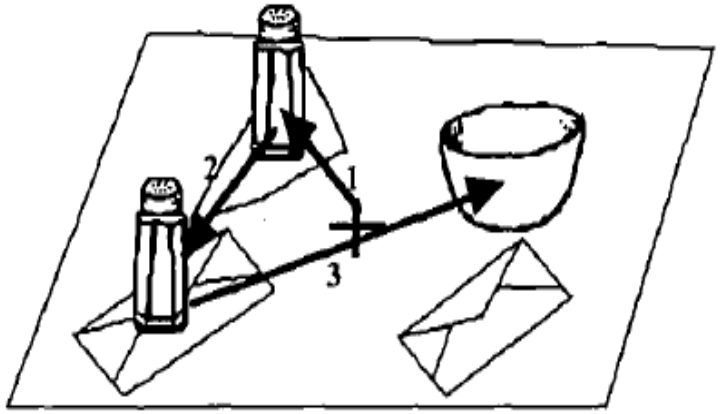
(Eberhard,Tanenhaus, Spivey & Sedivy)

Results:



Ambiguous: Put the saltshaker on the 1 envelope in 2 the bowl. 3 4

Unambiguous: Put the saltshaker that's 1 on the envelope in the bowl. 4



Ambiguous: Put the saltshaker on the 1 envelope 2 in the bowl. 3

Unambiguous: Put the saltshaker that's 1 on the envelope 2 in the bowl. 3

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Experiment 5

(Eberhard,Tanenhaus, Spivey & Sedivy)

2 referent displays:

Timing and pattern for ambiguous and unambiguous instructions similar

→ PP correctly interpreted as modifier

These results are inconsistent to some modular theories (i.e. Frazier 1987)
but are fully consistent to others. (Crain, Altman & Steedman)

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General Discussion

– so far only weak and delayed effects of referential context (using linguistic not visual context)

– this lead to conclude that context is used after an initial syntactic commitment

– Results of this studies show no evidence for a time window in which syntyctic processing is not sensitive to nonsyntactical constraints(i.e. Context)

– Thus encapsulating hypothesis in its reduced form can not explain these results

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Conclusion

Results have methodological and theoretical implications for further research

Although no measurements provide a window into cerebric operations, eye tracking has important advantages in investigating language comprehension

It provides an opportunity to investigate comprehension in well-defined interactive situations.
(especially with Discourse-Context)

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So far,

Questions?

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The effect of **common ground** and **perspective** on domains of referential interpretation

Joy E.Hanna, Michael K. Tanenhaus & John C. Trueswell

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References

Definite reference:

The car, *that* house,*he ,she, it*

Problem:

Without context there is an unlimited number of possible interpretations for all of them.

Solution:

„common ground“ or „domain of interpretation“

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Common Ground

Includes information from:

– community membership
– physical co-presence
– linguistical co-presence

Primary role of common ground:

– to act as domain of interpretation for references (Clark, 1992)

Timing of common ground effects still an open question

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Common Ground

How could Common Ground influence speech?
(production and perception)

Continuous update?

– could be ineffective
– extremely memory intensive
– information about anothers beliefs can be uncertain

Common Ground on a marcolevel?
(Keysar and colleagues)

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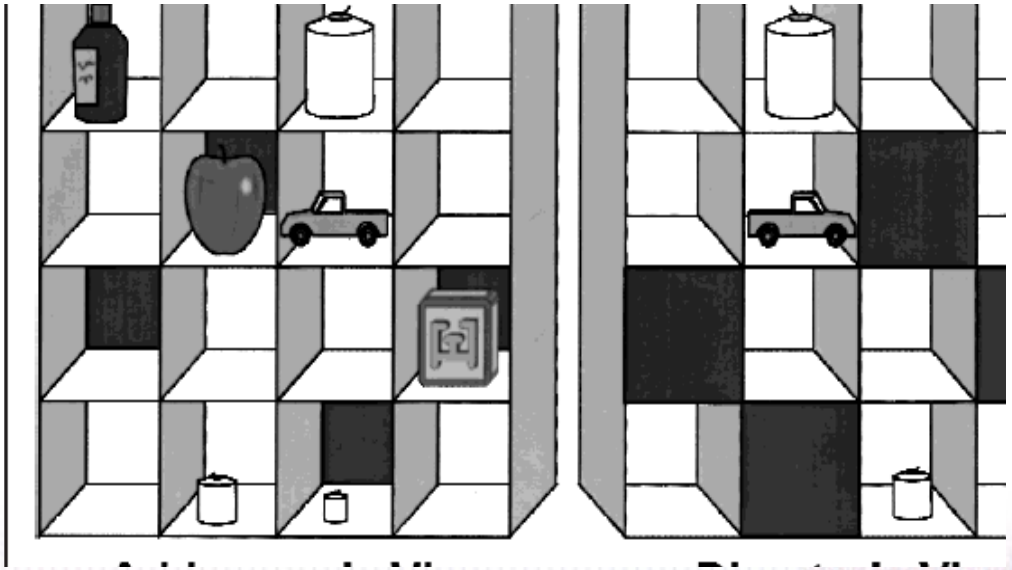
Common Ground

Perspective adjustment model(Keysar et al., 2000)

– Common Ground is a 2nd stage filter to rule out inapropriate interpretations.

– Dekompression(1st stage) is more egocentrical and without appeal to common ground



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Common Ground

Perspective adjustment model(Keysar et al., 2000)

Criticism on Keysars experiments:

Hidden object was always a better match to the referring expression („Put the bottom Block“, „Put the small candle“)

In control conditions, critical items were replaced by completely unrelated items

So, does information from common ground influence the early moments of reference resolution??

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Experiment 1

(Hanna et al. ,2003)

„physical co-presence is among the strongest kinds of evidence for common ground“ (Clark, 1992)

Why could this assumption be a problem for an experiment like Keysar did?

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Experiment 1

(Hanna et al. ,2003)

„physical co-presence is among the strongest kinds of evidence for common ground“ (Clark, 1992)

Why could this assumption be a problem for an experiment like Keysar did?

Solution: „Grounding“ procedure at the beginning of experiment

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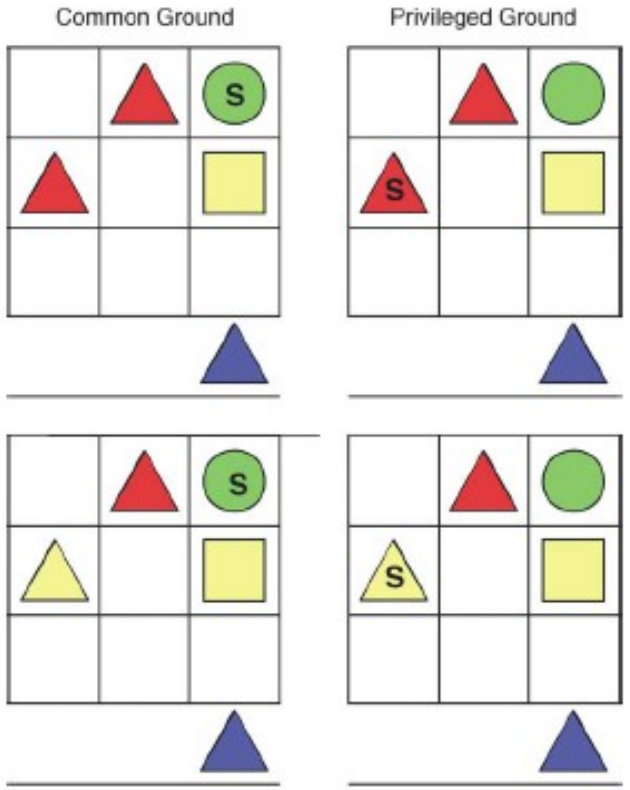
Experiment 1

(Hanna et al. ,2003)

„Now put the blue triangle on the red one“

Hypothesis:

– no competition from different color competitor
– same color competitor in common ground ⟹ subject asks
– in privileged ground:
subject quickly choses target shape in common ground



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Experiment 1

(Hanna et al. ,2003)

Participants and procedure:

– 12 paid, undergraduated participants

– native english speakers, naive to the experiment

– 1 trained, undergraduated research assistant

– participants were encouraged to talk to assistant and ask for clarification if needed

– eye movements monitored via E4000 eyetracker

– resolution: 30 frames/second

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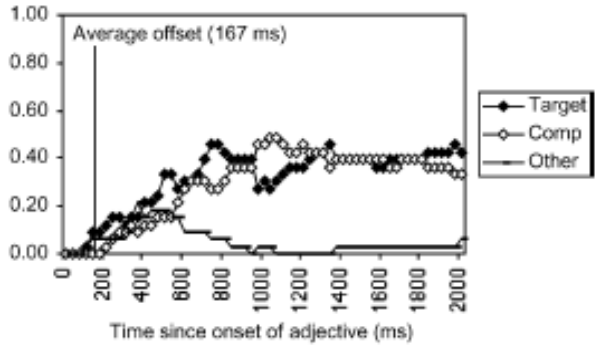
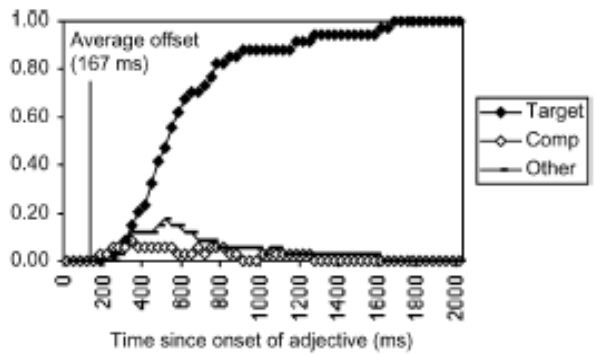
Experiment 1

(Hanna et al. ,2003)

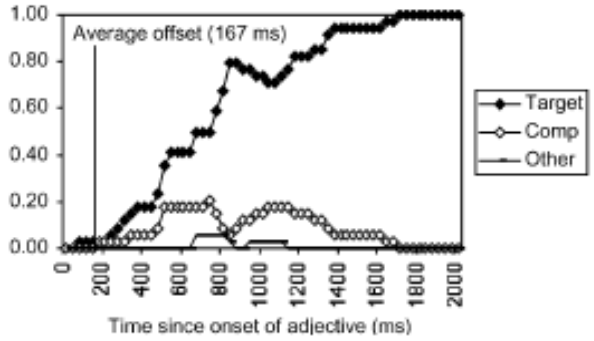
Results:

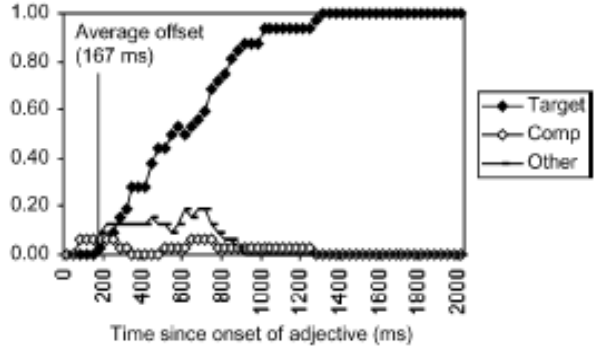
Competitor in common ground





Competitor in privileged Ground





Same color competitor

different color competitor

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Experiment 1

(Hanna et al. ,2003)

Discussion:

- clear competition between target and competitor when in common ground and matching referential description

- when same color competitor in priv. ground, participants looked at the competitor less often then looked at target

⇨ Common Ground not completely ignored in initial processing state

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Experiment 1

(Hanna et al. ,2003)

Discussion:

- similar findings with simplified display in experiment for children (Arnold et al. 1999)

- results can be integrated into constraint-based accounts of language processing

- from a constraint based perspective, common ground can be thought of as another kind of contextual constraint

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Constraint-Based accounts

Constraint-based accounts of laguage processing:

– C-B accounts propose that alternative interpretations are evaluated in parallel

– based on simultanious and continuous integration of probabilistic evidence provided by multiple constraints

– constraints can be:
    discourse Context
    structural and lexical biases
    freqencies of words/categories/structures

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Again!

Questions?

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Thank You very much for your attention!