What cues do 4-year olds use for pronoun resolution? Tracking eye movements to visually presented anaphoric referents

SAVERIA COLONNA (U. PARIS 8 – SFL)

In collaboration with

- Sarah Schimke (U. Münster)

- Barbara Hemforth (CNRS – LLF)

- Juhani Järvikivi (U. Alberta)

- Pirita Pyykkönen-Klauck (NTNU)

The use of cues in adult pronoun resolution

*"The rabbit tickles the fox when **he** is ..."*

-> who is he?

- During pronoun interpretation, adults rapidly take into account different linguistic cues such as (not exhaustive):

  - Order of mention
  - Grammatical role
  - Semantic role
  - Information structure

# The use of cues in child pronoun resolution

- Different hypotheses concerning the development of the use of cues during pronoun interpretation:
  - Children take into account a smaller number of cues than adults (restricted working memory)

    -> simple strategy such as first- or last-mentioned preference
  - They attend to all cues present from the start, but need to learn to weight cues in an adult-like manner

    -> the relevant cues are not the same for children and adults
  - They use the cues in the same way as adults but differ in the time course of resolution

The use of cues in child pronoun resolution

- First-mention/subject preference for ambiguous pronouns in English 3-year-olds (Song & Fisher, 2005; Pyykkönen et al., 2010)

  -> Late effects compared to adults (>1 sec. after the onset of the pronoun)

- Interaction between structural (grammatical role) and semantic prominence (verb transitivity): High verb transitivity reduced the agent-preference (Pyykkönen et al., 2010)

- Interaction between grammatical role and focus in 4-year-olds German children: Clefting enlarged the subject-preference (Järvikivi et al., 2013)

Järvikivi et al. (2013)
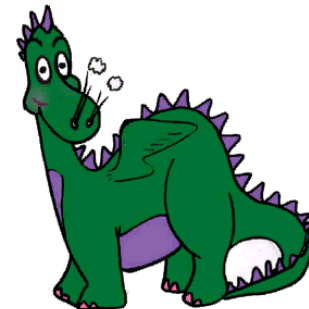
Järvikivi et al. (2013)

- N1 subject, non-clefted

  Der Löwe kratzt den Drachen, in der Nähe von dem Blatt, als **er**...

  *The lion-subj scratches the dragon-obj, near the leaf, when **he**...*

- N1 subject, clefted

  Es ist der Löwe, der den Drachen kratzt, in der Nähe von dem Blatt, als **er**...

  *It is the lion-subj who scratches the dragon-obj, near the leaf, when **he**...*

- N1 object, non-clefted

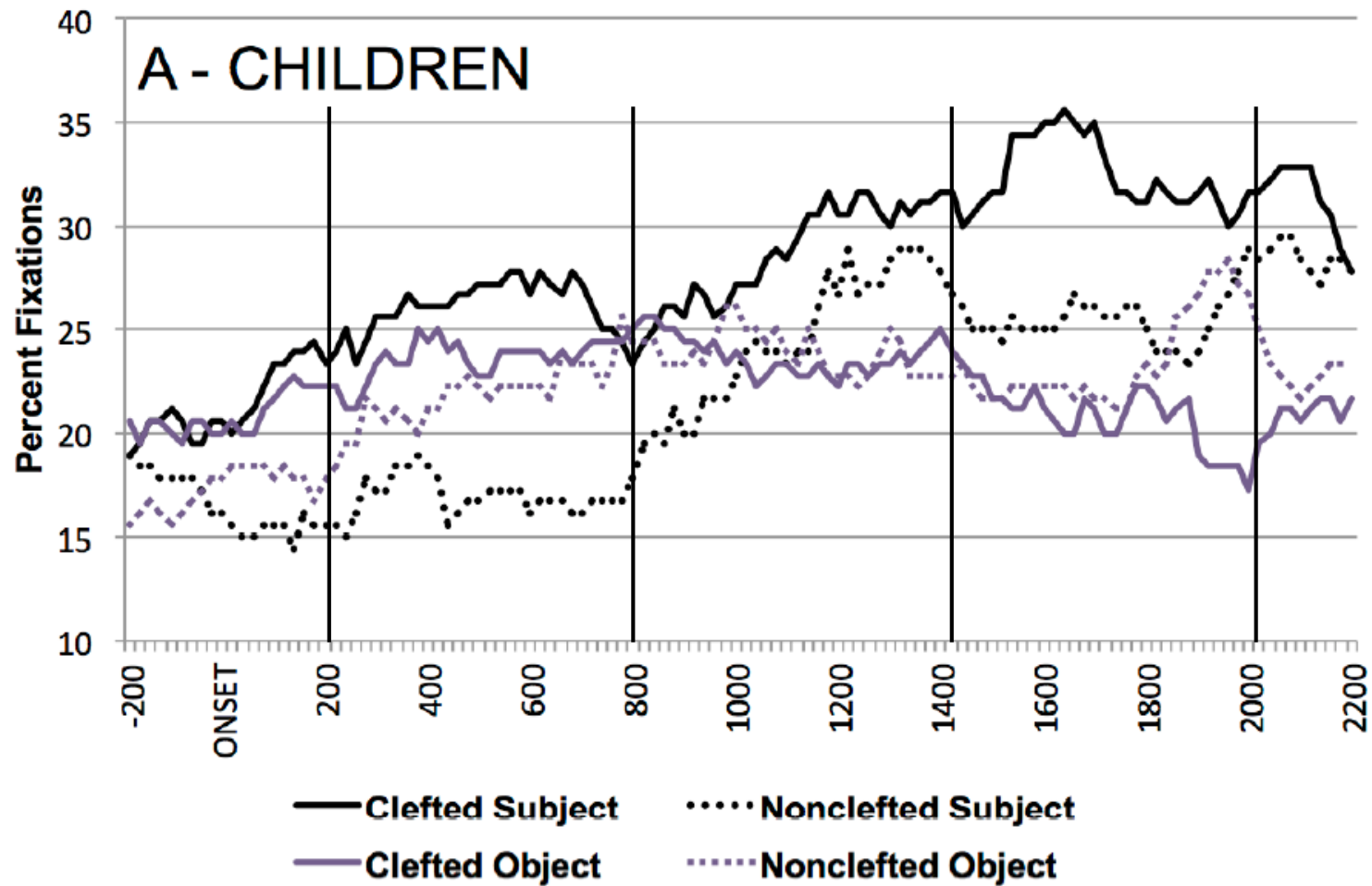 Den Drachen kratzt der Löwe, in der Nähe von dem Blatt, als **er**...

  *The dragon-obj scratches the lion-subj, near the leaf, when **he**...*

- N1 object, clefted

  Es ist der Drache, den der Löwe kratzt, in der Nähe von dem Blatt, als **er**...

  *It is the dragon-obj whom scratches the lion-subj, near the leaf, when **he**...*

Järvikivi et al. (2013)

The use of cues in child pronoun resolution

- Children from 3-years can take into account more than one cue at a time when resolving ambiguous pronouns (Järvikivi et al., 2013; Pyykkönen et al., 2010)

- While adults showed rapid reactions to all cues, children vary in when they reacted to different cues:
  - as fast as adults with gender information (Arnold et al., 2007)
  - slower for grammatical role information (Järvikivi et al., 2013; Pyykkönen et al., 2010; Song & Fisher, 2005)
  - as fast as adults with non-structural information?

The current study – German part

- We looked at the effects of grammatical role and of topicalization by dislocation
  - Subject-preference for (Bouma & Hopp, 2006) and topic-preference (Colonna et al., 2012) observed in German adult pronoun resolution
  - Children are sensitive to information structure cues such as clefting and show a late subject preference (Järvikivi et al., 2013)
- Are German children aged 4 sensitive to grammatical role but later than adults? Are they sensitive to dislocation?

Conditions

- **N1 subject, non-dislocated**

  Der Löwe kratzt den Drachen, in der Nähe von dem Blatt, als **er**...

  *The lion-subj scratches the dragon-obj, near the leaf, when **he**...*

- **N1 subject, dislocated**

  Der Löwe, der kratzt den Drachen, in der Nähe von dem Blatt, als **er**...

  *The lion-subj, he scratches the dragon-obj, near the leaf, when **he**...*

- **N1 object, non-dislocated**

  Den Drachen kratzt der Löwe, in der Nähe von dem Blatt, als **er**...

  *The dragon-obj scratches the lion-subj, near the leaf, when **he**...*
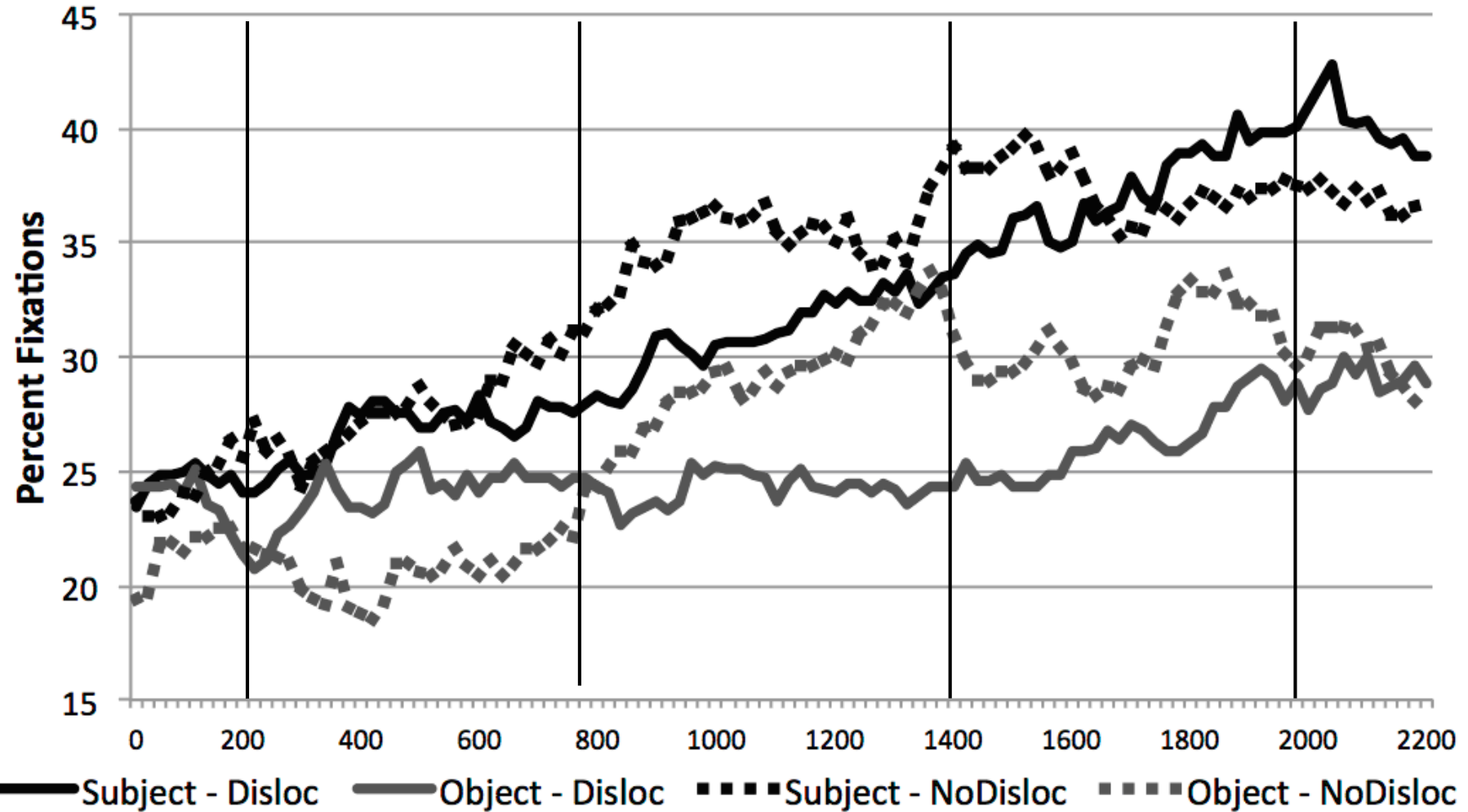
- **N1 object, dislocated**

  Den Drachen, den kratzt der Löwe, in der Nähe von dem Blatt, als **er**...

  *The dragon-obj, him scratches the lion-subj, near the leaf, when **he**...*

Method

- Participants
  - 39 mono-lingual German-speaking 4-year-olds
  - 24 native German adults
- Materials
  - 20 experimental mini-stories (5/condition), 10 fillers
  - Cross-spliced spoken stimuli
- Procedure
  - Passive task
- Apparatus
  - Tobii eye tracker

Results German adults

Summary German adults

- Clear subject-preference from 200 ms on till the end of investigated time span
- Topic-marking effect depends on the time window considered:
  - The dislocation reinforces the subject-preference after an early phase of increased attention to the object
- Strong influence of subjecthood compared to topichood

Results German children
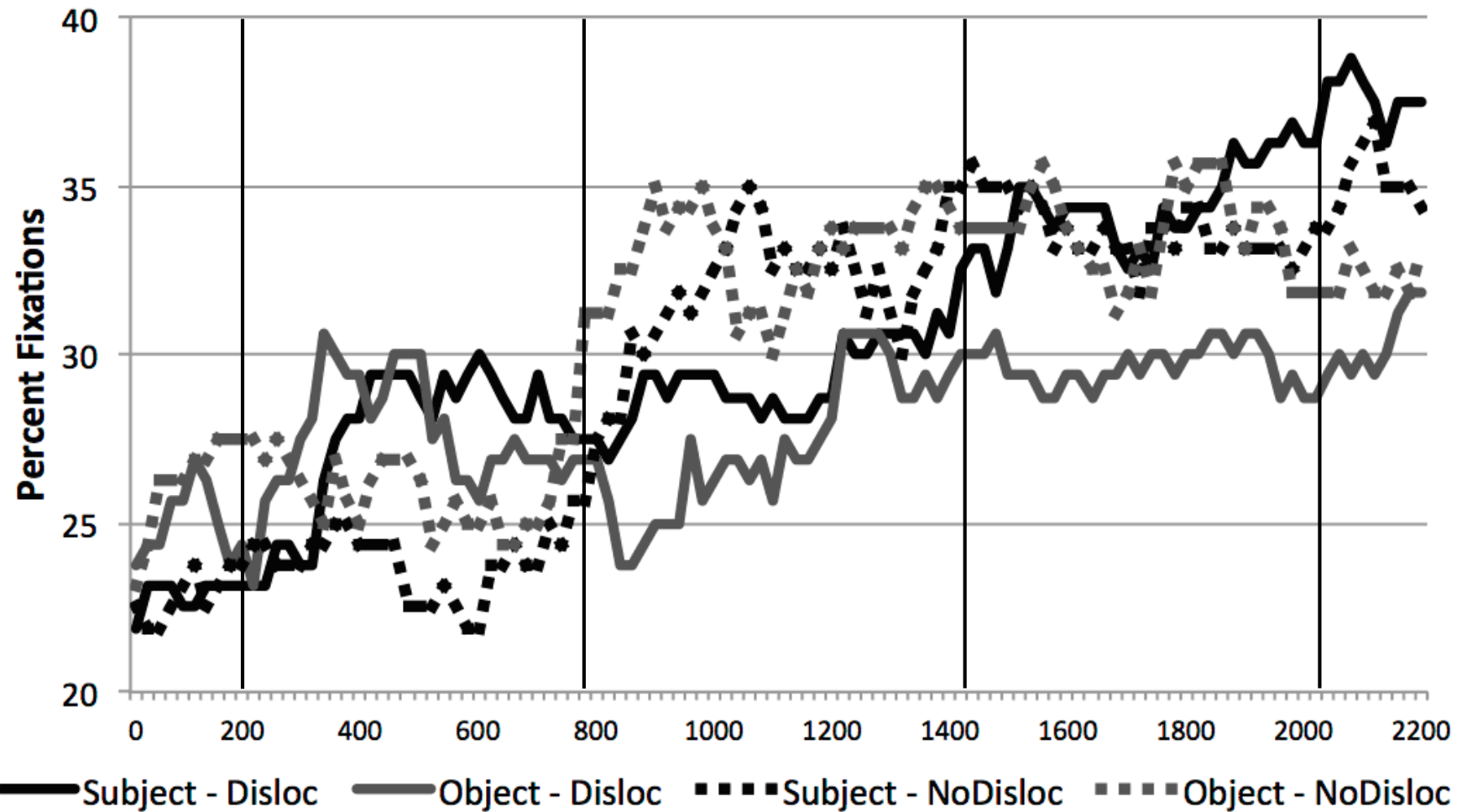
Summary German children

- They are sensitive to both subjecthood and topichood
- On the second time window (800-1400), preference for the non-dislocated referents over the dislocated ones
- Late subject-preference (from 1400 ms after the onset pronoun)
- This subject preference is stronger for dislocated than non-dislocated N1

Discussion: Comparison children/adults

- Similarities between adults and children:
  - React equally fast and in a qualitatively similar manner to dislocation of N1
  - Dislocation seems to highlights both referents but at different time in processing
  - Subject-preference for both adults and children
- Differences:
  - Subject-preference comes later in children

The current study – French part

- We looked at the influence of two informational foregrounding devices: passivization and dislocation
  - Experimental evidence from the influence of passivization (Kaiser et al., 2011) and dislocation (Colonna et al., 2012) on adult pronoun resolution
  - Children are sensitive to information structure cues such as clefting (Järvikivi et al., 2013)
- Are French children aged 4 sensitive to passivization and dislocation? Do they differ from adults in how and when they take into account these information-structural markings?

Visual-World Eye-Tracking

Stimuli

- Presentation of both characters

  Voici le lapin et le renard/ le renard et le lapin. *Here are the rabbit and the fox/ the fox and the rabbit.*

- Performance of the action

- Mention of location

- Clause containing critical pronoun

  Le lapin chatouille le renard, pas loin de la rivière, alors qu'il est en train de penser à quelque chose de particulièrement rigolo. *The rabbit tickles the fox, near the river, when he is just thinking about something particularly funny.*
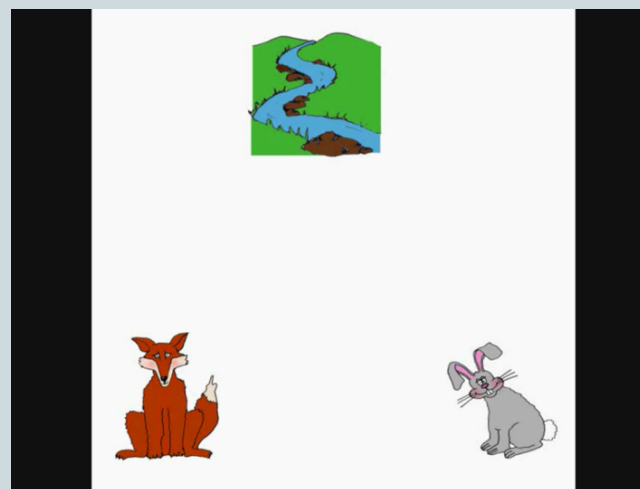
- Unrelated ending of the story

  Mais ensuite, le lapin se met à pleurer. *But then, the rabbit suddenly cries.*

Conditions

- N1 agent, not dislocated
  Le lapin chatouille le renard, …
  The rabbit tickles the fox, …
- N1 agent, dislocated
  Le lapin, il chatouille le renard, …
  The rabbit, he tickles the fox, …
- N1 patient, not dislocated
  Le renard est chatouillé par le lapin, …
  The fox is tickled by the rabbit , …
- N1 patient, dislocated
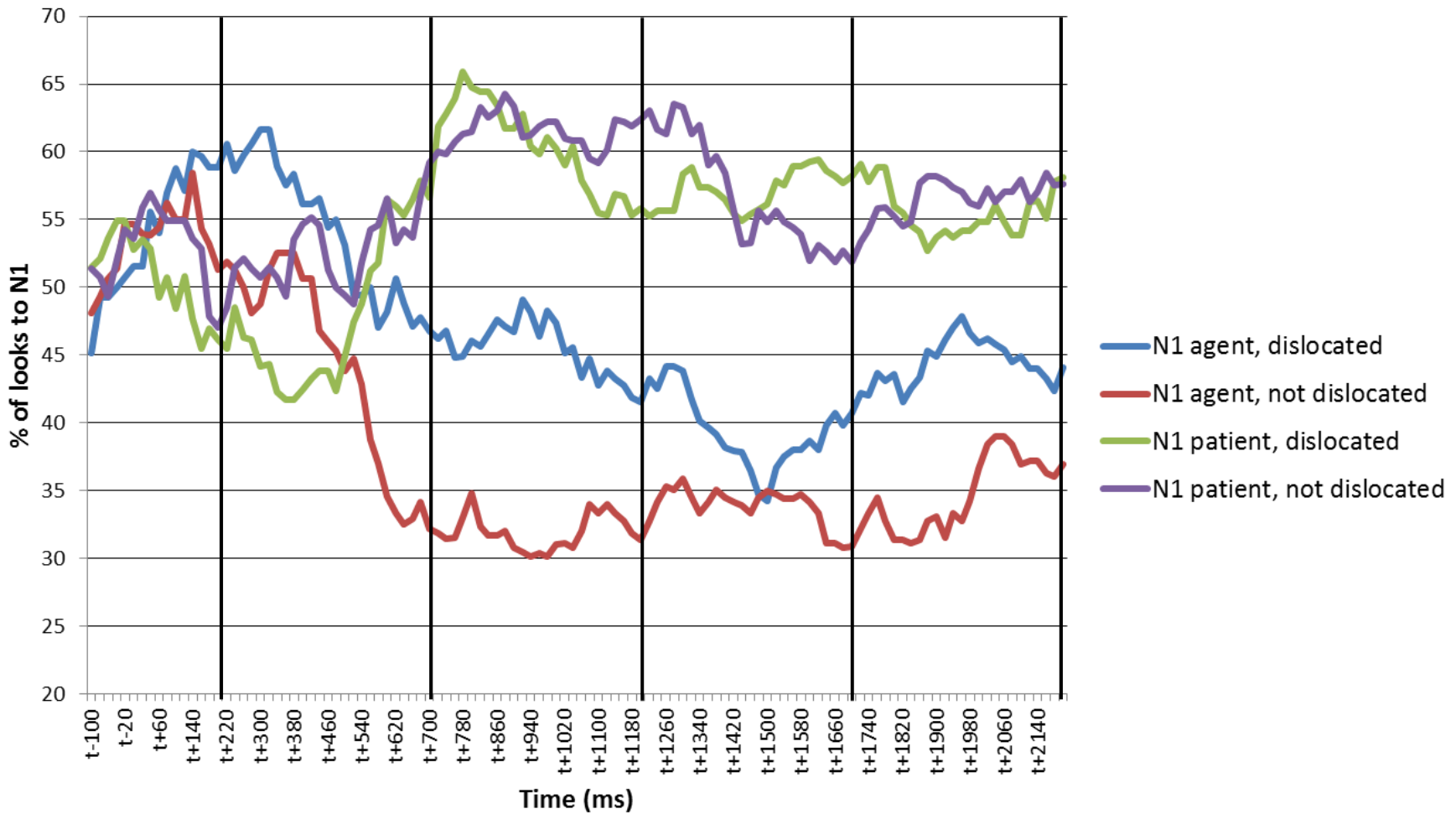 Le renard, le lapin le chatouille, …
 *The fox, the rabbit tickles him, …*

Method
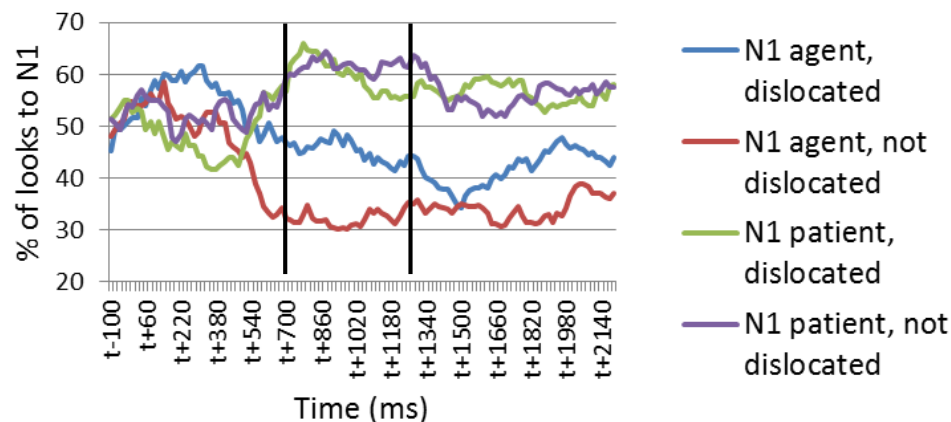
- Participants
  - 33 mono-lingual French-speaking 4-year-olds
  - 24 native French adults
- Materials
  - 20 experimental mini-stories (5/condition), 10 fillers
  - Cross-spliced spoken stimuli
- Procedure
  - Passive task
- Apparatus
  - Tobii eye tracker

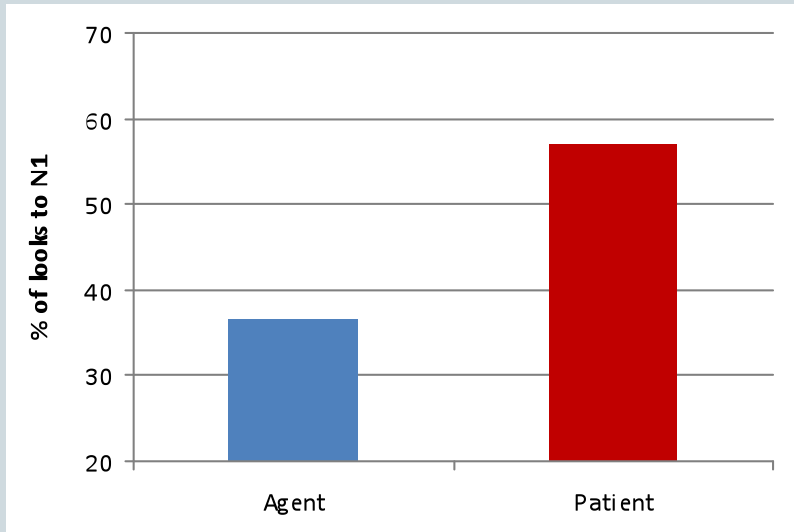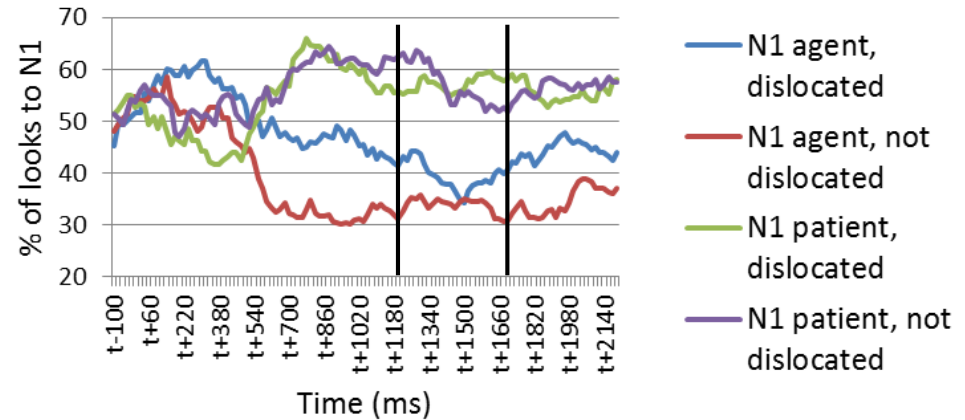# Results French children

Results French children: 700-1200 ms

- Interaction Semantic role*Dislocation (p=.055)
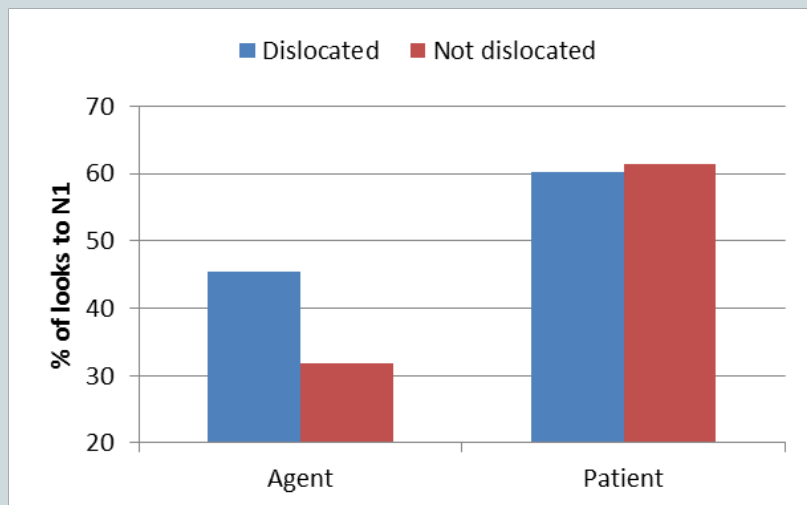
- More looks to **N1 agent** when it was dislocated than when it was not

- More looks to **N1 patient** (than agent) whether or not dislocated
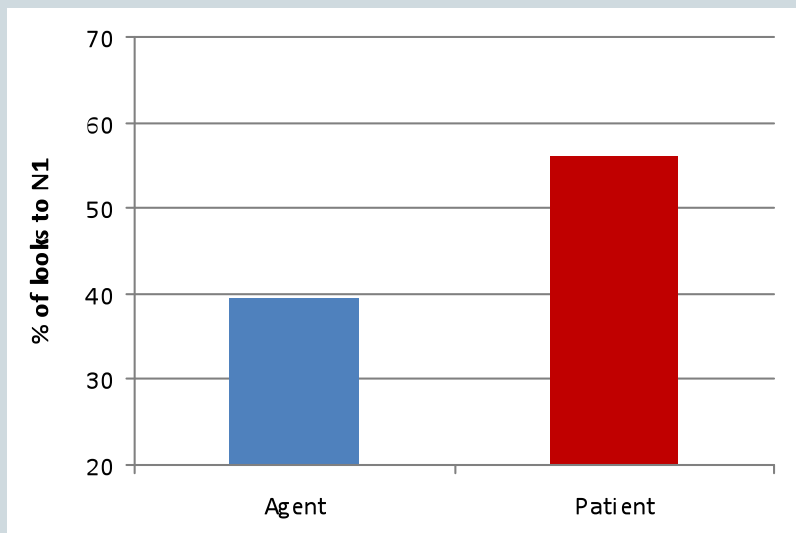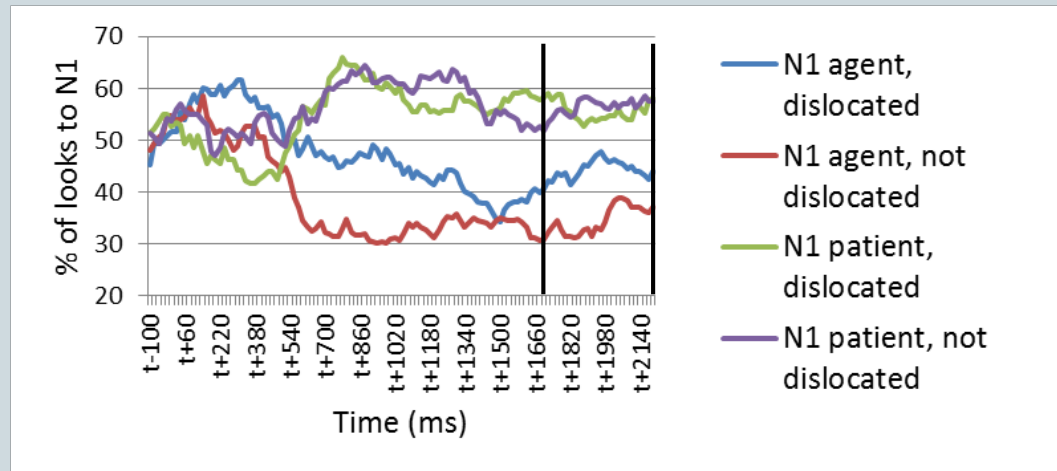
Results children: 1200-1700 ms

- ## Main effect of Semantic role (p<.01)

- ## Preference for N1 patient

Results children: 1700-2200 ms

- Main effect of Semantic role (p<.001)

- Preference for N1 patient

Summary French children

- Children are sensitive to both passivization and dislocation
  - Passivization highlights the first referent (patient)
  - Dislocation highlights the first one as well, but only when it was agent
  - The dislocation of the patient do not significantly enhance its preference already high due to the passivization

Results adults
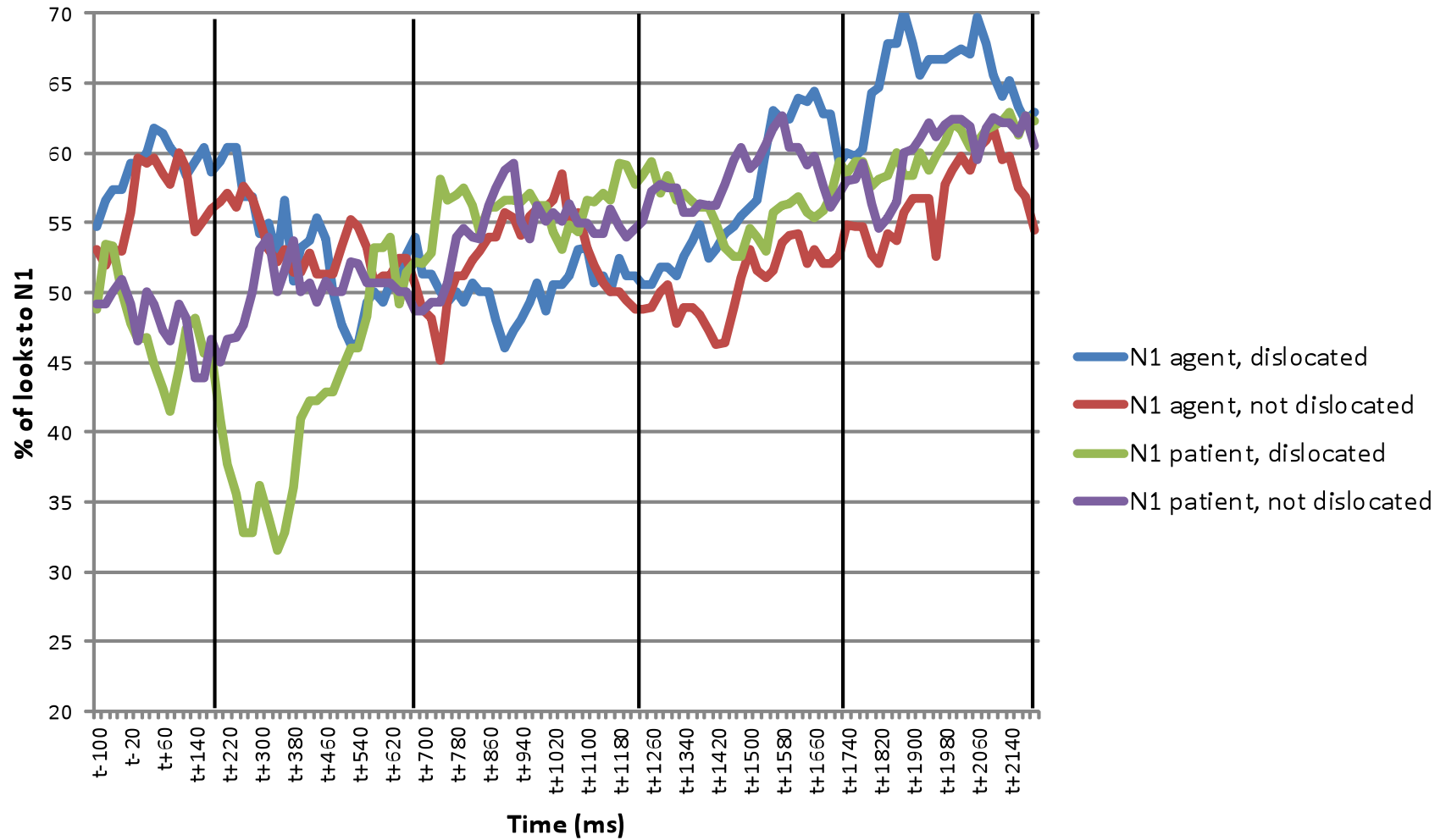
Summary adults

- No influence of dislocation, no influence of semantic role

- Do not replicate previous on-line findings
    - Preference for topicalized referents (Colonna & al., 2014; Kaiser, 2011)
    - Preference for the object (and patient) in French (Colonna & al., 2014)

- Why do we not observe any effect in the current study?
    - Too child-friendly linguistic and visual materials and too few fillers -> adults were rapidly aware of the ambiguity and did not try to interpret the ambiguous pronoun

Summary French results

- Are French children aged 4 sensitive to passivization and dislocation?

  -> YES

  - They do not interpret the pronoun on a simple cognitive strategy such as first- or last-mention
  - Nor on a structural strategy based on the grammatical role of the antecedents

- Do they differ from adults in how they take into account these information-structural markings?

  -> Maybe even more sensitive than adults

  - Dislocation more frequent in child language (e.g., De cat, 2007)

Discussion: Comparison German /French

- ## Similarities between German and French:
  - ○ German and French children aged 4 are sensitive to information-structural cues such as dislocation and clefting
  - ○ In both languages, children react to these cues **early** and **strongly**

- ## Differences:
  - ○ **Subject-preference in German** (adults and children), **but not in French**

Thanks to

- Coralie Vincent

- Naomi Yamaguchi for lending her voice