The state of our inquiry –

Representing context for Negation

Richard Breheny

Division of Psychology and Language Sciences, UCL

Joint Work with…

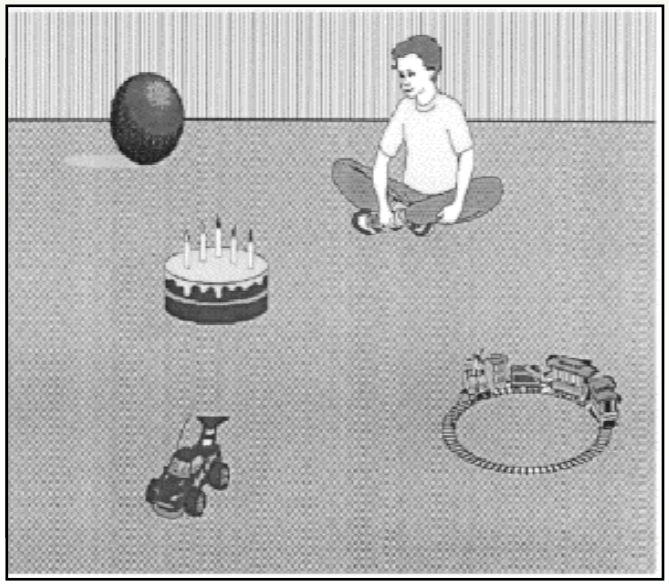
Ye Tian,
Université Paris Diderot

Outline

- Context in incremental processing
  - A role for QUDs?
- Projecting context when processing negation
  - Positive and negative QUDs?
- Relation between QUD and data?

Anticipation in Incremental Interpretation
Altmann & Kamide (1999)

- ‘Look and listen’ paradigm



"The boy will move the cake"

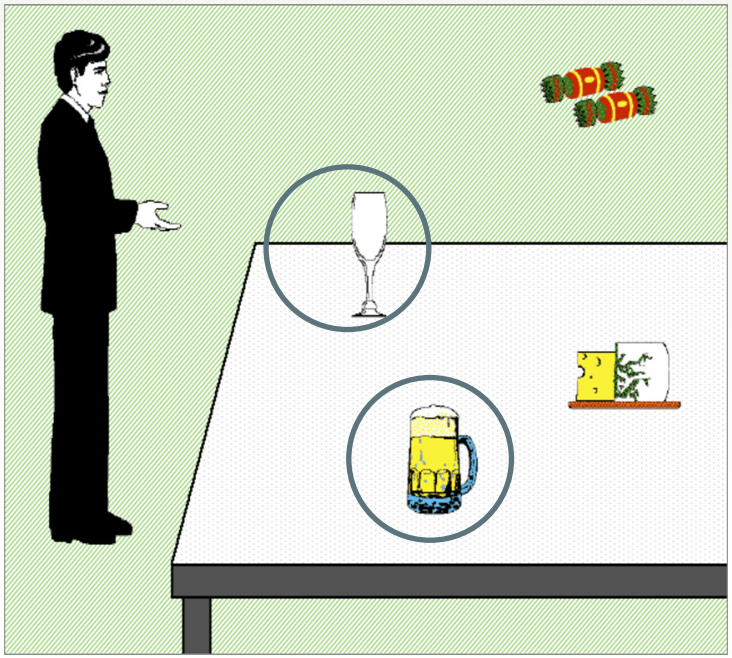
"The boy will eat the cake"

Ingredients of Incremental Interpretation: Compositional Semantics

Altman & Kamide (2007)

(1) The man **will drink**
all of the
beer.
(2) The man **has drunk**
all of the
wine.

- Results show semantic composition in incremental interpretation – over and above simple associations

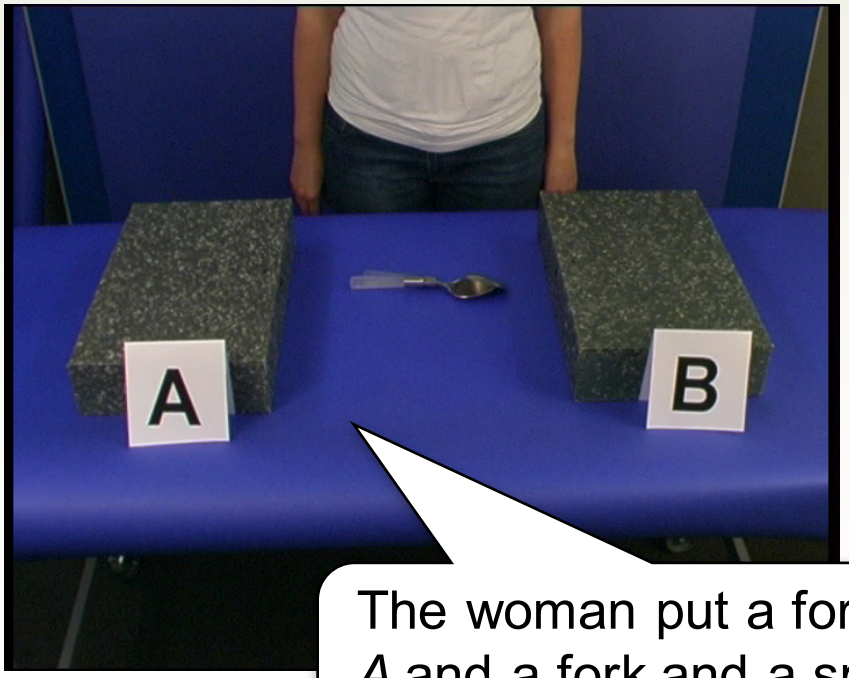


Background –
A Role for QUDs in Language Processing?

- Quantity Implicatures
  - Breheny et al. (2013) show incremental access to Particularised Implicatures.

Still of last frame of the video for the 'hearer'

Breheny, Ferguson & Katsos (2013)



Interim Summary

- We find immediate access to Particularised Implicatures on-line
- Access not only constrained by linguistic cues.
  - Ignorance condition had same prosody.
- PCI access integrated into cue-based probabilistic comprehension systems.

Discussion

- Cue-based/Probabilistic automatic comprehension systems cannot simply associate forms with all contextual inferences (e.g. PCIs)
  - Models of automatic processing set up to *select* decision from pre-determined options
  - Implicatures are *generated* in context.

- Pragmatic theory can provide a guide to what is monitored
  - For QIs, this is
    - likely source of relevance,
    - alternatives,
    - speaker's epistemic state regarding these etc.

Incremental Dynamics

Dynamics meets incremental interpretation

- Interpretation is an information update process.
- Rich shared information structures
- Includes not only information to satisfy presuppositions but also information about likely *source of relevance* of utterance.
  - Describe using 'Question Under Discussion' (QUD).
  - No commitment to specific rhetorical structure in dialogue (cf Ginzburg 2012).

Dynamics meets incremental interpretation

- Incrementalism says that automatic processes take linguistic input together with information in utterance situation to yield (anticipatory) hypotheses about interpretation.

- Interpretation involves updating shared information.

Dynamics meets incremental interpretation

- Incrementalism says that automatic processes take linguistic input together with information in utterance situation to yield (anticipatory) hypotheses about *shared information update*.

A History of Negation Research

- Negation is difficult but easier in context
  - For decades, psycholinguistic research has shown that processing negation is hard (takes longer, more errors) but it gets easier with context
  - Wason (1967), Clark & Chase (1972),…
- Processing widely assumed to proceed via the argument of negation:
  - John didn't cook the spaghetti

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    - [John cooked the spaghetti]

A History of Negation Research

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- Processing seems to proceed via the argument of negation:
  - John didn't cook the spaghetti
  - ➢ Not [John cooked the spaghetti]

A History of Negation Research

- Truth-functional approaches to negation (Clark & Chase 1972; Kaup et al 2006,2007) seek to account for cost/delay in terms of extra step of embedding under negation.
  - First represent the argument of negation, then 'negate' it.

- 'Contextualist' approaches seek to account for cost/delay in terms of the need for a context for negation (Wason 1965, etc.)

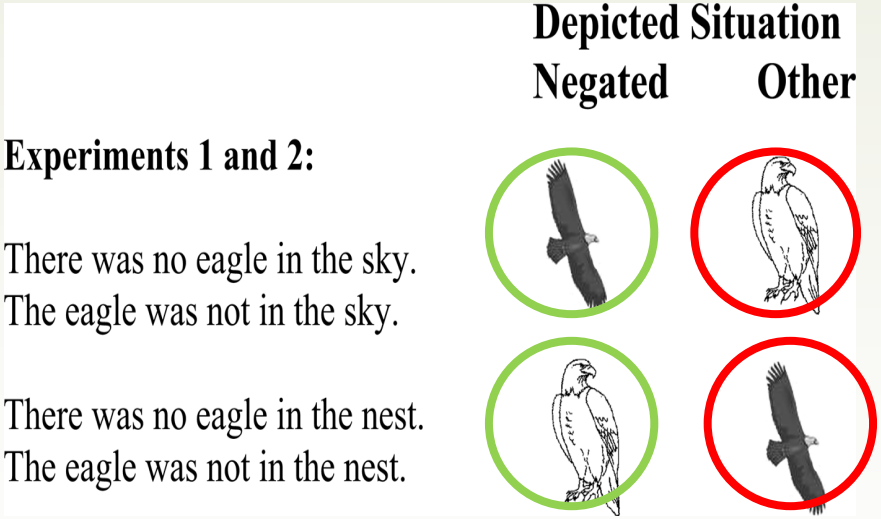
Kaup et al 2006, 2007

Based on visual probe recognition task.
Say ‘yes’ if type of object in image is mentioned.

	Picture match	Picture mismatch	Picture unrelated
Sentence	(1) “The eagle was flying” 	(2) “The eagle was flying” 	(3) “The eagle was flying” 
	Yes!	Yes!	No!

Advantage for ‘matching’ image with positive sentences

Kaup et al 2006, 2007



- At short SOA, advantage for 'mismatch' image for negative sentences
- At longer SOAs, advantage for match image.

An Incremental-Dynamic Perspective
Tian, Breheny & Ferguson (2010)

- Incremental processes probabilistically establish QUDs for utterance
- Assume: Without any further contextual information, the most likely QUD for a negative sentence is the positive polar question.

An Incremental-Dynamic Perspective
Tian, Breheny & Ferguson (2010)

- I.e. for ‘The bird is not in the air’, the QUD is *whether the bird is in the air.*

  Exceptions like, ‘John is not happy’ (*vs. not sad*) based on things like frequency.

A Dynamic Perspective
Tian, Breheny & Ferguson (2010)

- Assume: Situational representations (e.g. ‘simulations’) for context include source of relevance/QUDs.
  - I.e. some representation that means an answer to the QUD would be desirable.

Rejection or Context Accommodation?

	Match	Mismatch
Clefted: *It was Jane who didn't cook the spaghetti*		
Non-cleft: *Jane didn't cook the spaghetti*		

Rejection or Context Accommodation?

	Match	Mismatch
Clefted: *It was Jane who didn't cook the spaghetti* Non-cleft: *Jane didn't cook the spaghetti*		

- Manipulate QUD using clefting. Keep assertive content the same.
  - For clefted items, presupposition is 'Someone didn't cook the spaghetti', assume QUD is 'Which person didn't cook the spaghetti'
- Assume cleft items lead to accommodation of a negative presupposition/QUD.
- Predictions at short SOA (250ms):
  - Kaup et al: $RT_{mismatch} < RT_{match}$ for both conditions
  - Tian et al: Interaction. $RT_{mismatch} > RT_{match}$ for cleft condition

John didn’t iron his shirt.

SOA = 250ms

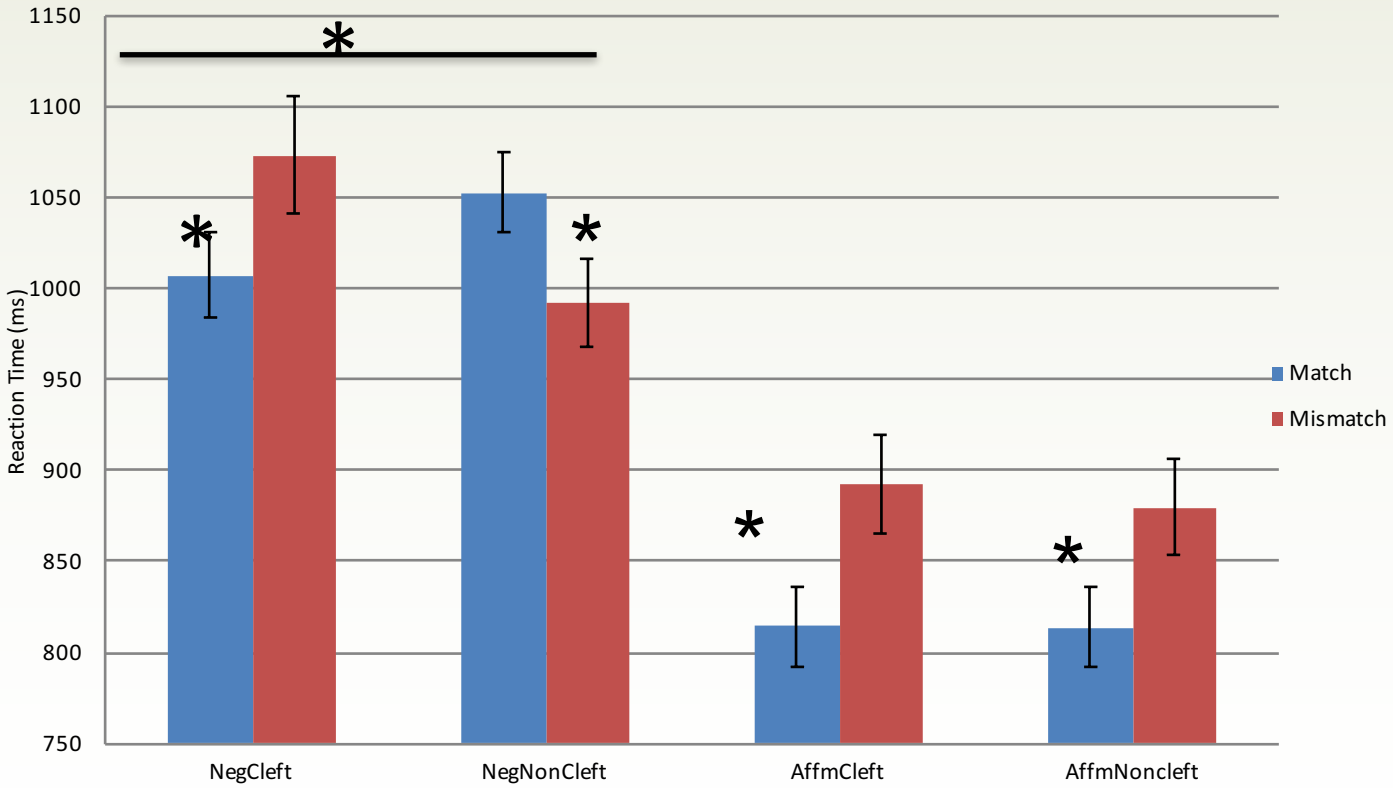
or

It was John who didn’t iron his shirt.

SOA = 250ms

or

Tian et al (2010)



Interim Summary

- We have some evidence that participants spontaneously accommodate source of relevance even for decontextualised experimental items.
- But positive context seems to be represented before negative state of affairs?
- Can negative content find representation in the same timecourse as positive?

Move to Visual World

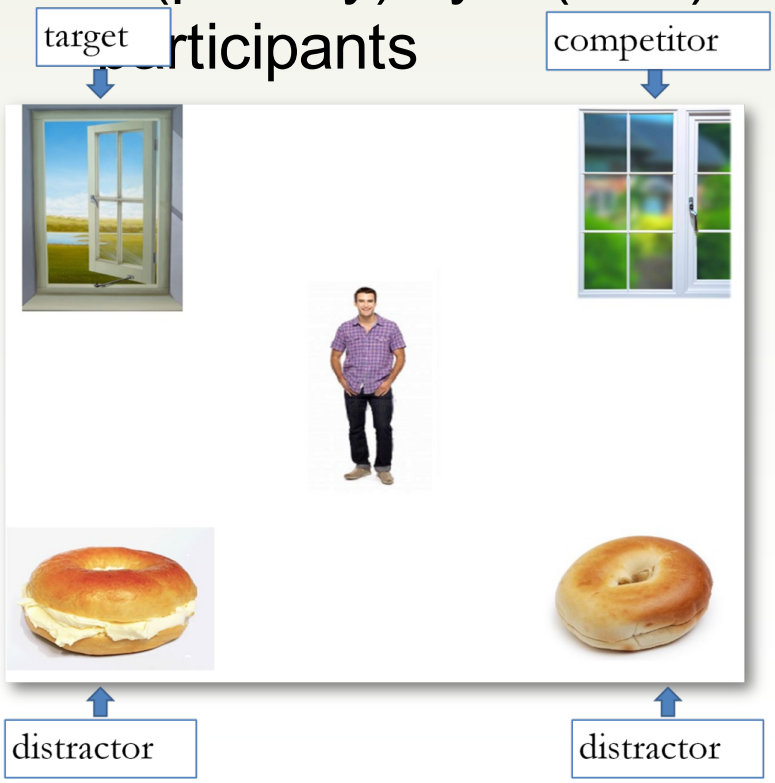
- Minimise secondary cost of negative viz a viz affirmative.

- Infer what state of affairs supports a sentence:
  - For affirmative, access relevant properties of soa from an interpretation of sentence structure.
    - 'John ironed the shirt'

  - For negative, an extra step of inference:
    - 'John didn't iron the shirt'

Context accommodation on-line (Tian et al. 2016)

2 (polarity) by 2 (cleft) within design. 36 participants



	Simple	Cleft
Affm	Matt **has** shut his dad's window.	It is **Matt** who has shut his dad's window.
Neg	Matt **hasn't** shut his dad's window.	It is **Matt** who hasn't shut his dad's window.

QUDs, Negation and Clefting

	Simple	Cleft
Affm	Matt **has** shut his dad's window.	It is **Matt** who has shut his dad's window.
QUD	***Has Matt shut his dad's window?***	***Who has shut their dad's window?***
Neg	Matt **hasn't** shut his dad's window.	It is **Matt** who hasn't shut his dad's window.
QUD	***Has Matt shut his dad's window?***	***Who hasn't shut their dad's window?***

QUDs, Negation and Clefting

	Simple	Cleft
Affm	Positive sentence	Positive sentence
QUD	**Positive QUD**	**Positive QUD**
Neg	Negative sentence	Negative sentence
QUD	**Positive QUD**	**Negative QUD**

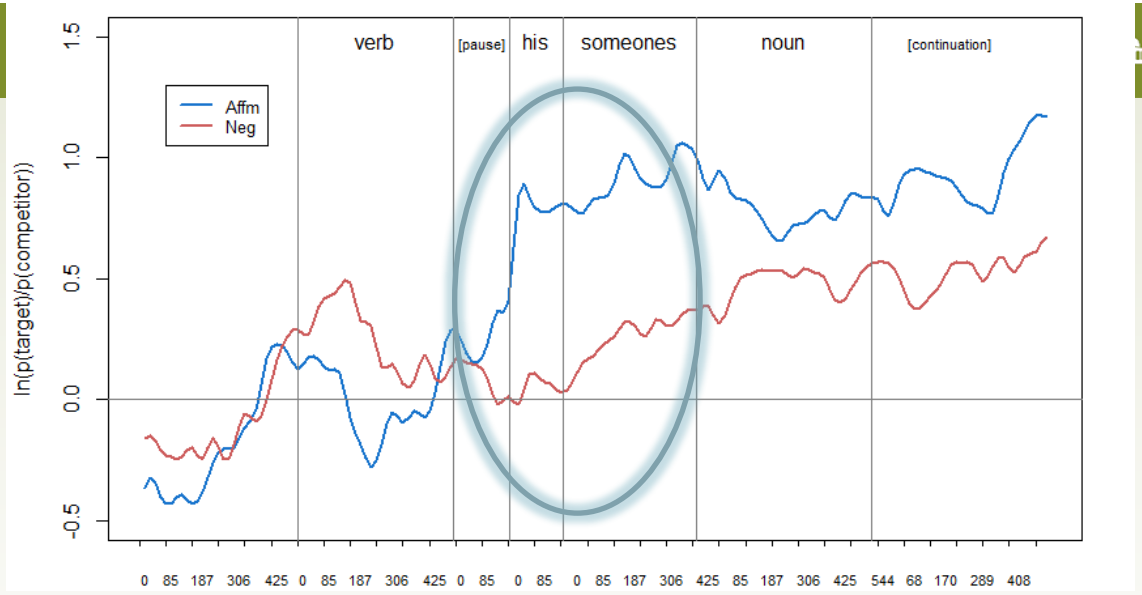
Predictions

- For simple sentences, more interference from the competitor for negative compared to positive sentences.
  - Due to positive QUD accommodation
- For cleft sentences, no more interference for negatives than positive sentences.
- Negation is incorporated incrementally: more looks to target before onset of noun, at least in the cleft case.

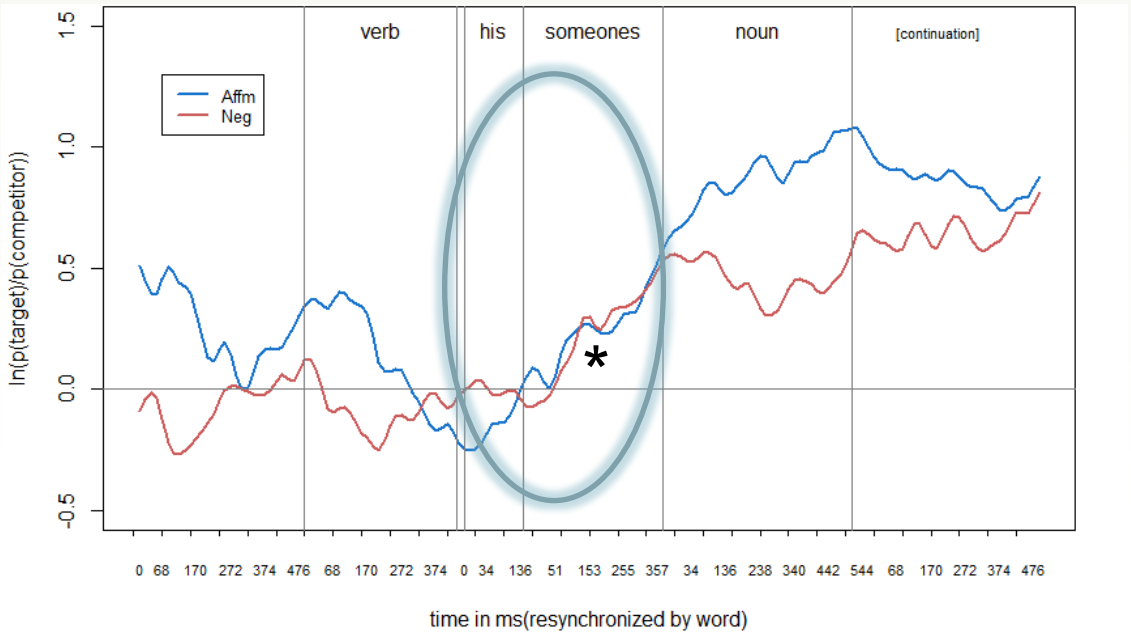
Target advantage: Ln(p(target)/p(competitor)

Positive
Negative

Simple



Cleft



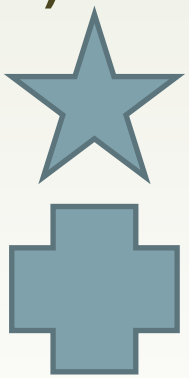
Discussion

- Cleft condition shows that when we control for QUD accommodation, the time course for processing negatives is the same as positives.
- Simple negatives take longer to process than their positive counterparts due to QUD interference.
- Our results show that QUDs are incorporated **incrementally**
  - Negation also! - Rather than after the argument is processed

A Role for Context in QUD accommodation

Verification Task
Clark & Chase (1972), Carpenter & Just (1975)

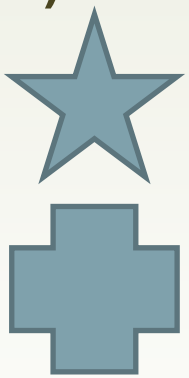
The star is above the cross



True Affirmative (TA)

Verification Task
Clark & Chase (1972), Carpenter & Just (1975)

The cross is above the star

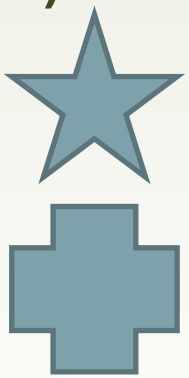


False Affirmative (FA)

Verification Task

Clark & Chase (1972), Carpenter & Just (1975)

The cross is not above the star

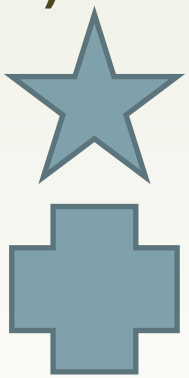


True Negative (TN)

Verification Task

Clark & Chase (1972), Carpenter & Just (1975)

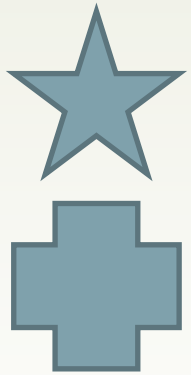
The star is not above the cross



False Negative (FN)

Verification Task

Clark & Chase (1972), Carpenter & Just (1975)



- All studies find ME of polarity
- Many studies find interaction effect:
  - TA < FA < FN ≤/≈ TN
- Insight: Pattern can be explained as joint effect of ‘negation time’ and ‘verification time’.

Verification Procedure - TN

Clark & Chase (1972), Carpenter & Just (1975)

- Translate sentence and picture into propositional format
- Set response at default, 'True'
- Compare most embedded representation. Switch to 'False' if mismatch.
- Compare next most embedded operator, switch response if mismatch.
- RT reflects number of switches

- Image = A(s,c); S = ¬A(c,s)
- A(s,c) vs. A(c,s)____FALSE!
- Aff. vs. Neg_____TRUE!

Verification Procedure - FN

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- Translate sentence and picture into propositional format
- Set response at default, 'True'
- Compare most embedded representation. Switch to 'False' if mismatch.
- Compare next most embedded operator, switch response if mismatch.
- RT reflects number of switches

- Image = A(s,c); S = ¬A(s,c)
- A(s,c) vs. A(s,c)___no switch
- Aff. vs. Neg_____FALSE!

Verification Procedure?

- No real reason why this should be the procedure.
- FA and FN have the same amount of switches but different latencies. (FA < FN)
- Need extra assumption that ‘negation time’ is longer than ‘falsification time’
  - No motivation for this.
  - In fact, it seems easier to compare polarities (1 bit) than embedded propositions (2-3 bits)

Doing Verification Task Straight

- Task QUD: ?True(utterance content)
- Assume extra costs to infer negative state.
- Assume there is a greater cost for falsification than verification.
  - Given data for positives.

- Predict only MEs of polarity and TV!
  - E.g. TA < FA ☒TN < FN

‘Classic’ Strategy?

- The classic interaction effect is not always obtained.
- In C&C and C&J and elsewhere, studies are very long and repetitive with very long training phases (training data not analysed).
- We conjecture that the interaction is the result of participant strategies

‘Classic’ Strategy Results from Dynamic Pragmatic Processes

- Task QUD: ?True (utterance content)
  - So, participants need to interpret the utterance prior to task.

- As per above studies, assume that participants project positive polar question as most likely QUD.
  - I.e. ?S(s,c) for both ‘The star is above the cross’ and ‘The star is not above the cross’.

‘Classic’ Strategy Results from Dynamic Pragmatic Processes

- We conjecture that there is an interference from the utterance QUD in this task.
- As a result, participants form a strategy to respond to utterance QUD and, in the case of negation, more or less consciously switch responses.

Verification Strategy for ‘Classic’ Interaction Pattern: TN

- ‘The cross is not above the star’
- Project QUD: ?A(c,s)
- Answer ‘no’ by inferring situation of image supports negative proposition. (Falsification time)
- Switch answer because sentence is negative (Negation Time).

Verification Strategy for ‘Classic’ Interaction Pattern: FN

- ‘The star is not above the cross’
- Project QUD: ?A(s,c)
- Answer ‘yes’ by inferring situation of image supports positive proposition. (Verification time)
- Switch answer because sentence is negative (Negation Time).

‘Classic’ Strategy?

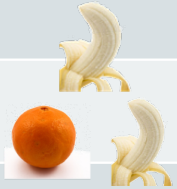
- On our account, both TN and FN involve extra ‘negation time’ due to strategy.
- Assuming falsification time is longer than verification time, FA > TA and TN > FN.
- We explain both the ME of negation and the interaction in classic studies in terms of indirect strategy.

(Tian & Breheny, 2015, *in prep*)

- We predict that participants change their behaviour in the course of an experiment from simple ME pattern to interaction pattern.
- We predict that altering the utterance QUD will eliminate this strategy.

Design

Between Groups

Context	Sentence	Image	Type
1 Item	The banana is peeled		TA
			FA
	The banana isn't peeled		TN
			FN
2 Item	The banana is peeled		TA
			FA
	The banana isn't peeled		TN
			FN

2*2*2 Mixed design – Context a between groups factor

QUDs

Context	Sentence	Task QUD	Utterance QUD
1 Image	The banana isn't peeled	Is it true that the banana isn't peeled?	Is the banana peeled
2 Image	--------//----------	--------//----------	Which one isn't peeled

Methods and Results

- Sentence-picture verification (80 participants, 146 trials in total).
- Sentence presented first.
- Half the participants saw one-item pictures and had simple sentences as fillers, while the other half saw two-item pictures and had cleft sentences as fillers.
- Both groups had the same experimental sentences.

Methods and Results

- Overall we found a main effect of polarity and truth value in both 1-item and 2-item groups (Fs>16.85, ps<0.01).
- Combining 1 and 2-item groups, there was a significant 4 way (2(picture context) x 2(half) x2(polarity) x 2(truth value)) interaction (F(1,78)= 10.41, p=0.002).
- We found a training effect in the one-item group: interaction only emerged in the second half of the experiment (F (1,39) =6.70, p=0.01).
  - No differences in 2-item group between stages.

- The predicted change of behaviour occurred in 1-picture context.
  - Participants got relatively better at FN items.

- No change in 2-picture context.

Discussion

- In a verification task, there are two stages:
  i. interpret the sentence,
  ii. judge if it is true.

- QUD accommodation for stage (i) explains a lot of the difficulty in verification tasks.
  - Difficult to ignore or 'turn off' QUD accommodation in spite of the actual task demand.
- Suggests QUD accommodation 'automatic'

Interim Summary from Negation Research

- QUD accommodation occurs in the same timecourse as inferring sentence content.
- QUD accommodation is automatic

Summary from Negation Research

- Different factors affect QUD accommodation
  - Sentence form/semantic properties
    - clefting, focus (watch this space)
  - Situational context
  - Frequency
    - Mary is not sad vs. Mary is not happy

QUDs in Language Processing

- QI and Negation studies show evidence for incremental access to inferences about likely source of Relevance.

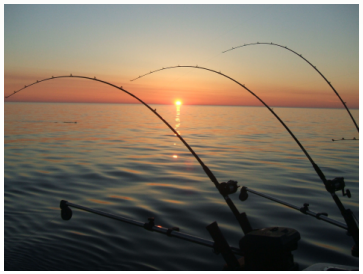
- Do we really represent source of Relevance in terms of QUDs?

- What does it mean to represent a QUD?
- What do QUDs have to do with question interpretation?
  - What is the difference between:
    - Did Matt shut his dad's window?
    - Did Matt not shut his dad's window?

Aims

- Explore the time course of processing for positive and negative questions using visual world paradigm.

- Explore time course of response particles, ‘yes’ and, ‘no’.



Our experiment – visual world eyetracking

	Question	Answer
Positive	Has John ironed his father's shirt?	Yes, he has. No, he hasn't
High-neg	Hasn't John ironed his father's shirt?	
Low-Neg	Has John not ironed his father's shirt	

"Has John ironed his father's shirt?"

"Yes, he has."

"No, he hasn't."

Our experiment – visual world eyetracking

	Question	Answer
Positive	Has John ironed his father's shirt?	Yes, he has. No, he hasn't
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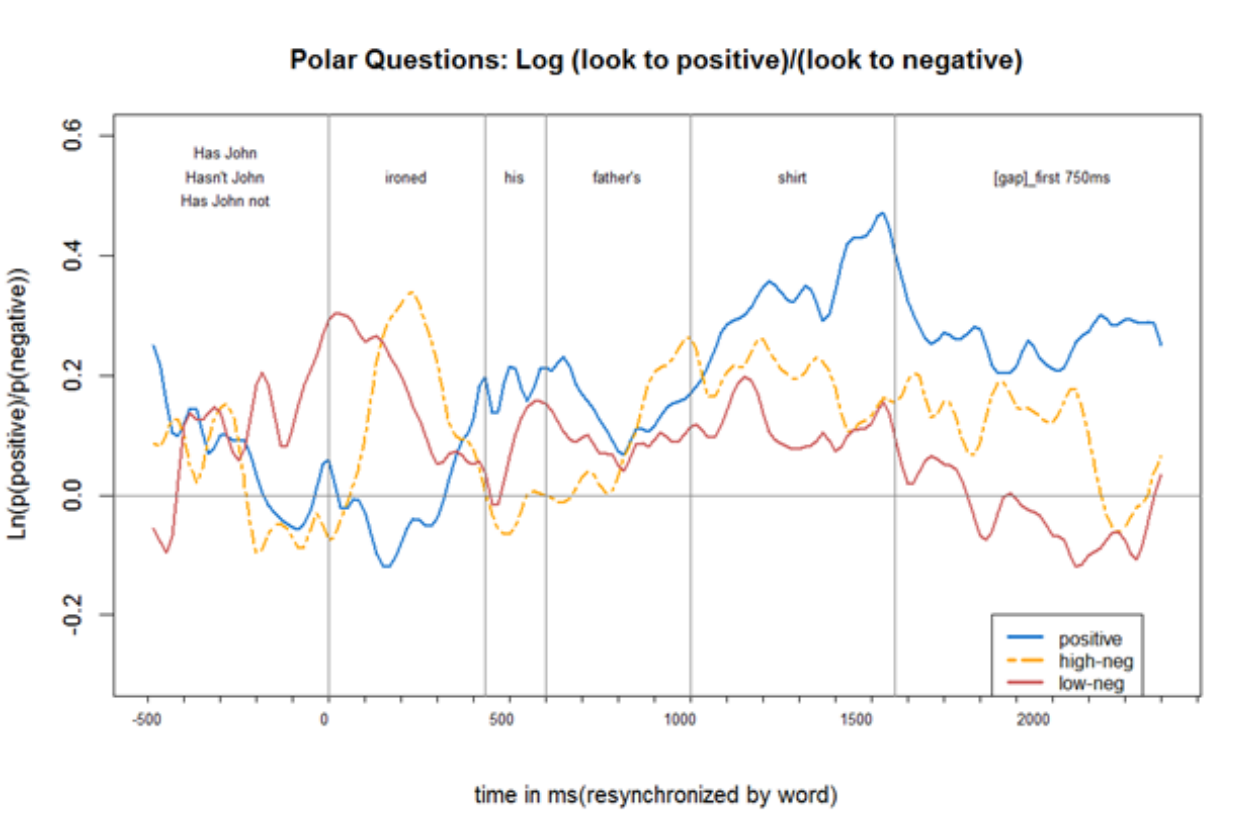
Low-Neg	Has John not ironed his father's shirt	

Our experiment – visual world eyetracking

- 42 experimental sentences (3 conditions, 14 each), plus 14 positive fillers.
- 1.5 second preview time. Then the audio starts. Between the question and the answer, there is a 1.5 second gap.
- Participants press a key that corresponds to the correct picture after they've heard the answers. The trial is terminated as soon as they press the response.
- The eye movements and responses are recorded.

Results – Question phase

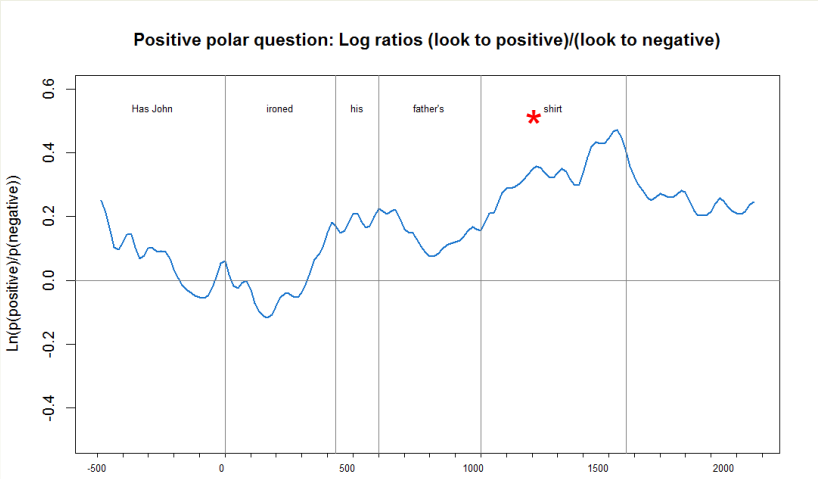
Results – Question Phase



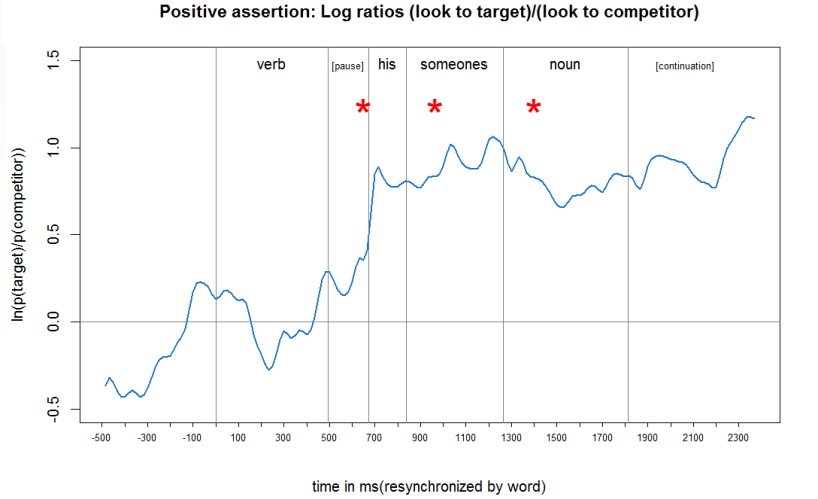
Results – Early timecourse

Comparison with positive assertion

Positive Question



Positive Assertion

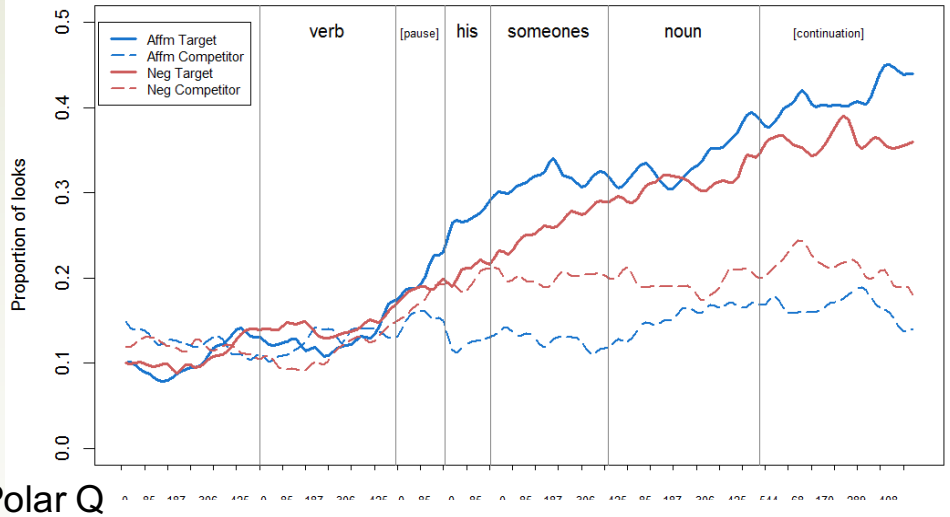


Note: Different task for Assertion data! But same items

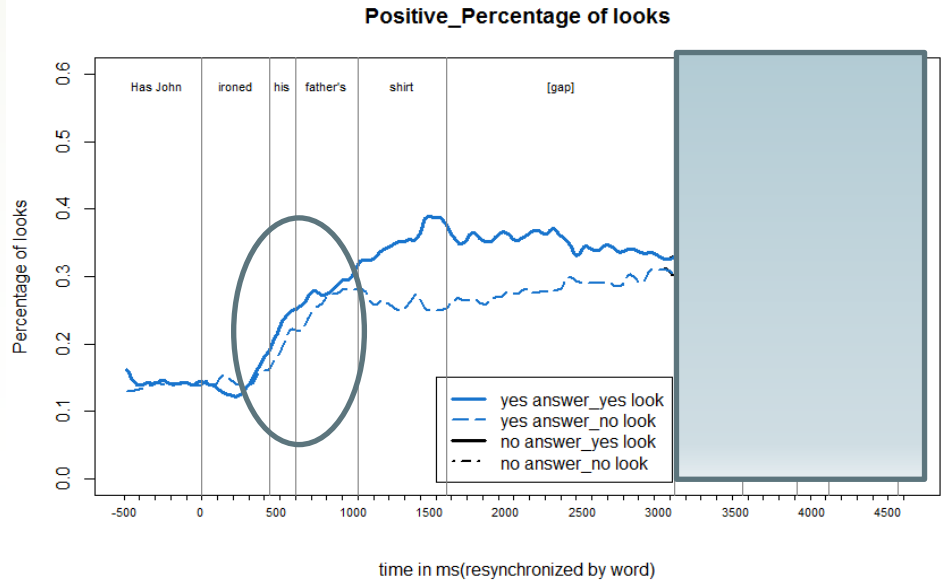
Tian, Ferguson and Breheny, (2016), Language Cognition and Neuroscience

- Delay in bias formation implies prolonged inspection of negative state of affairs for positive questions.

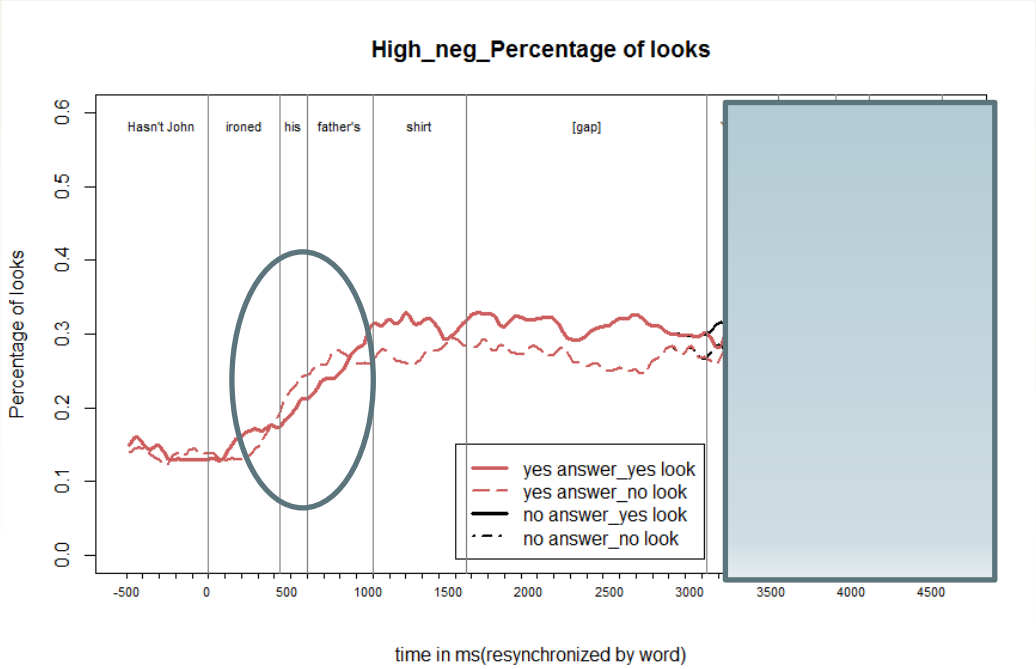
assertions



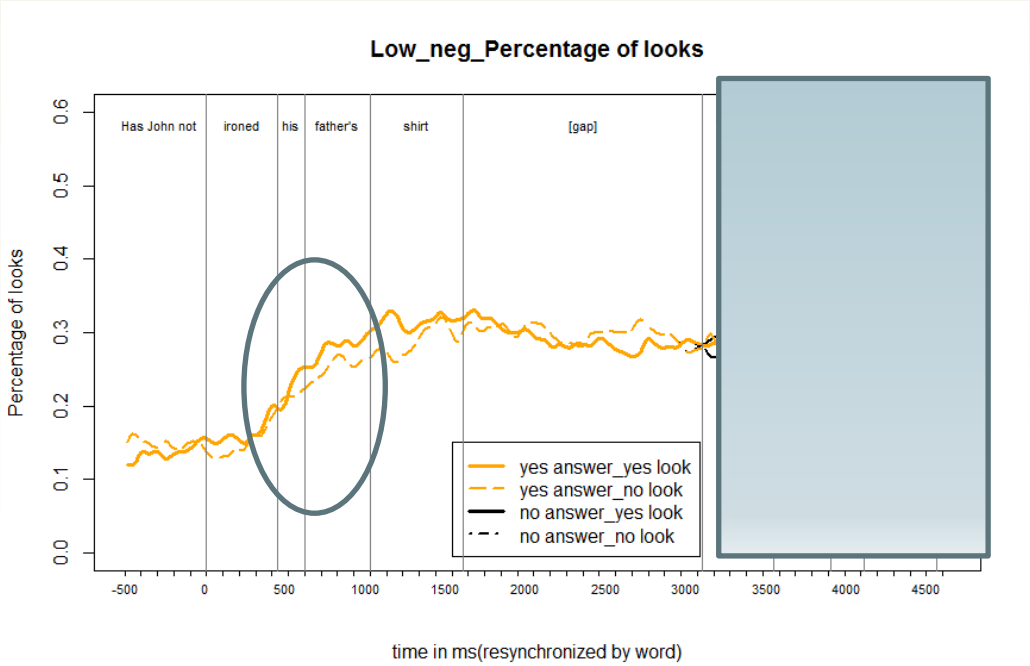
Polar Q



- Delay in bias formation implies prolonged inspection of positive and negative state of affairs for high-neg questions.

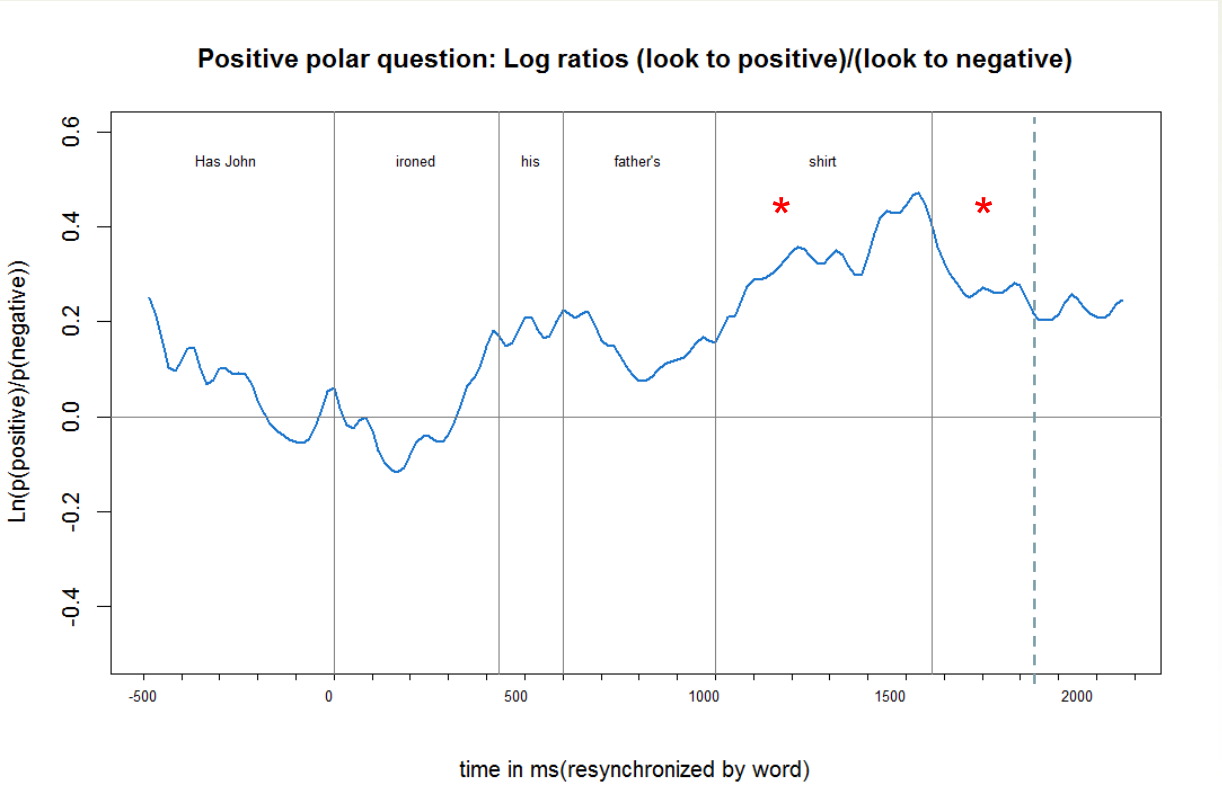


- Delay in bias formation implies prolonged inspection of positive and negative state of affairs for low-neg questions.

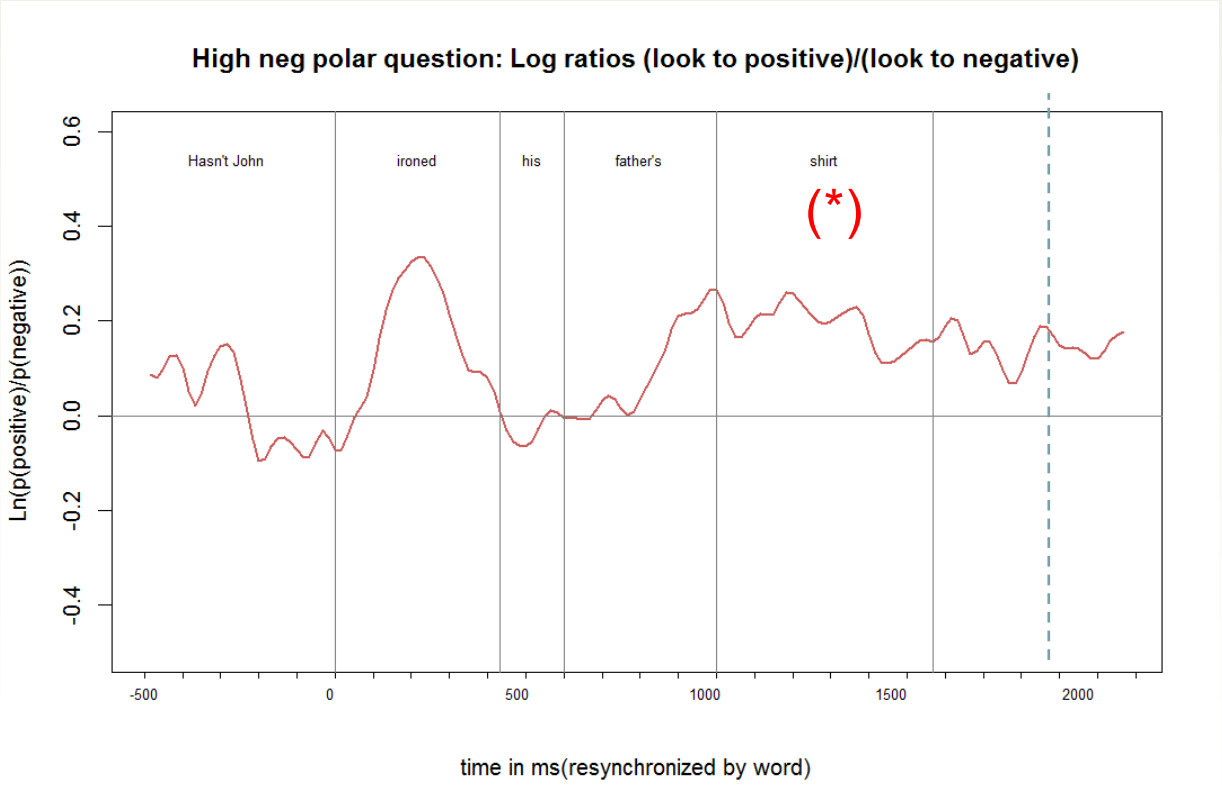


Results – Late timecourse

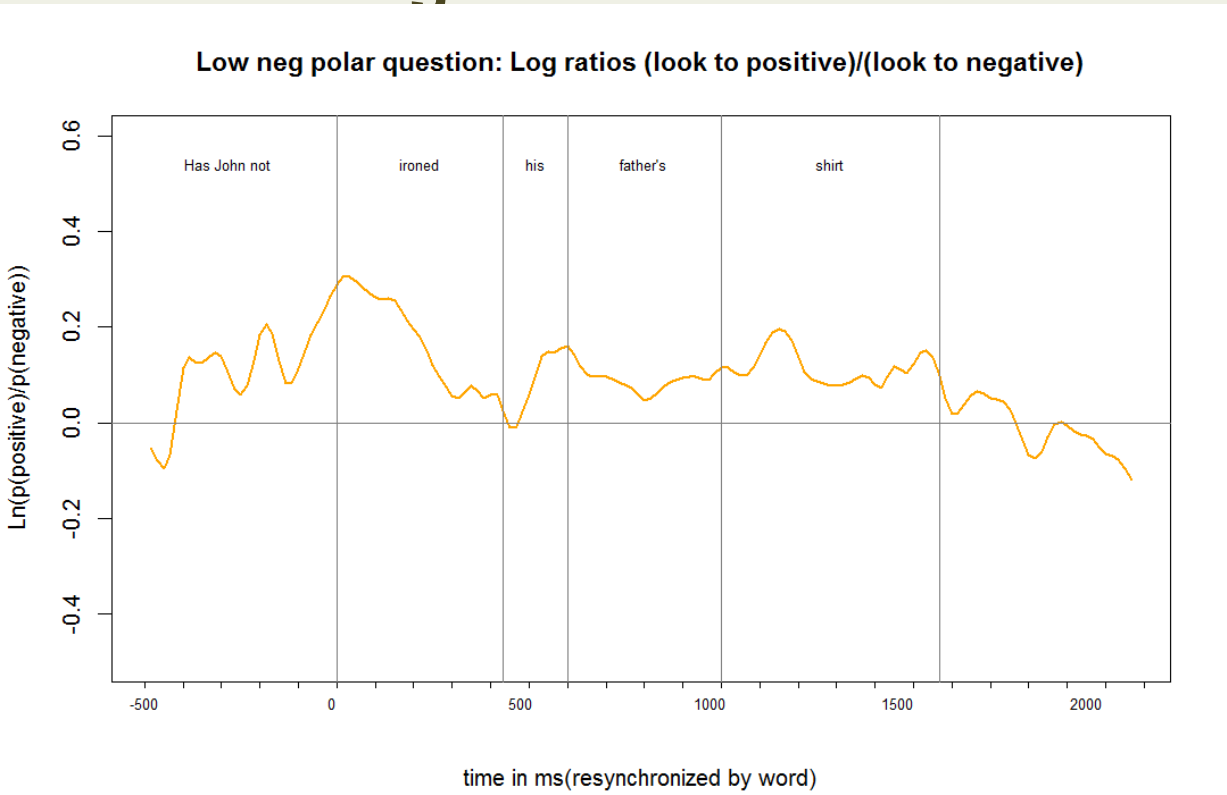
Question Phase: Positive



Question Phase: High neg



Question Phase: Low neg



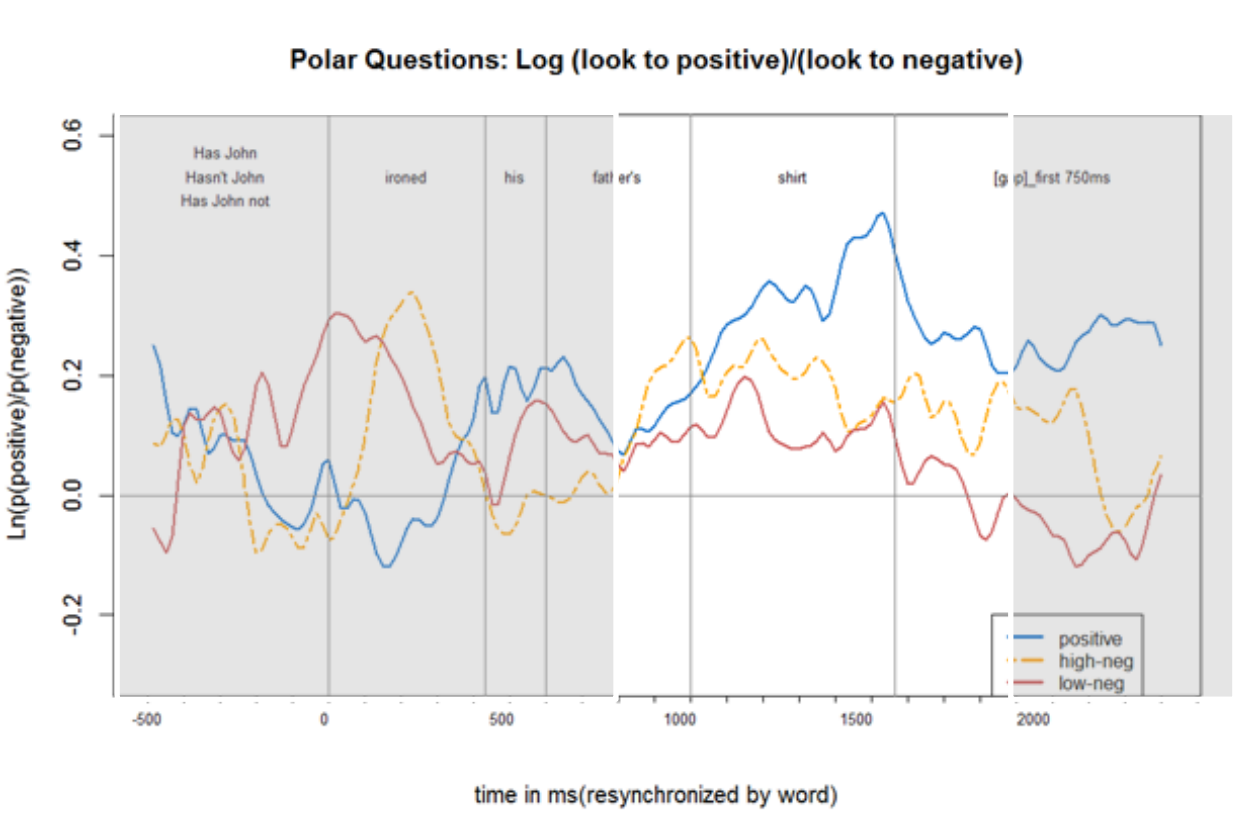
Results for each condition

Mixed effect models on natural log ratios of looks to the positive and negative pictures. The looks are averaged per trial for a region. The random effects are subjects and item, the fixed effect is condition.

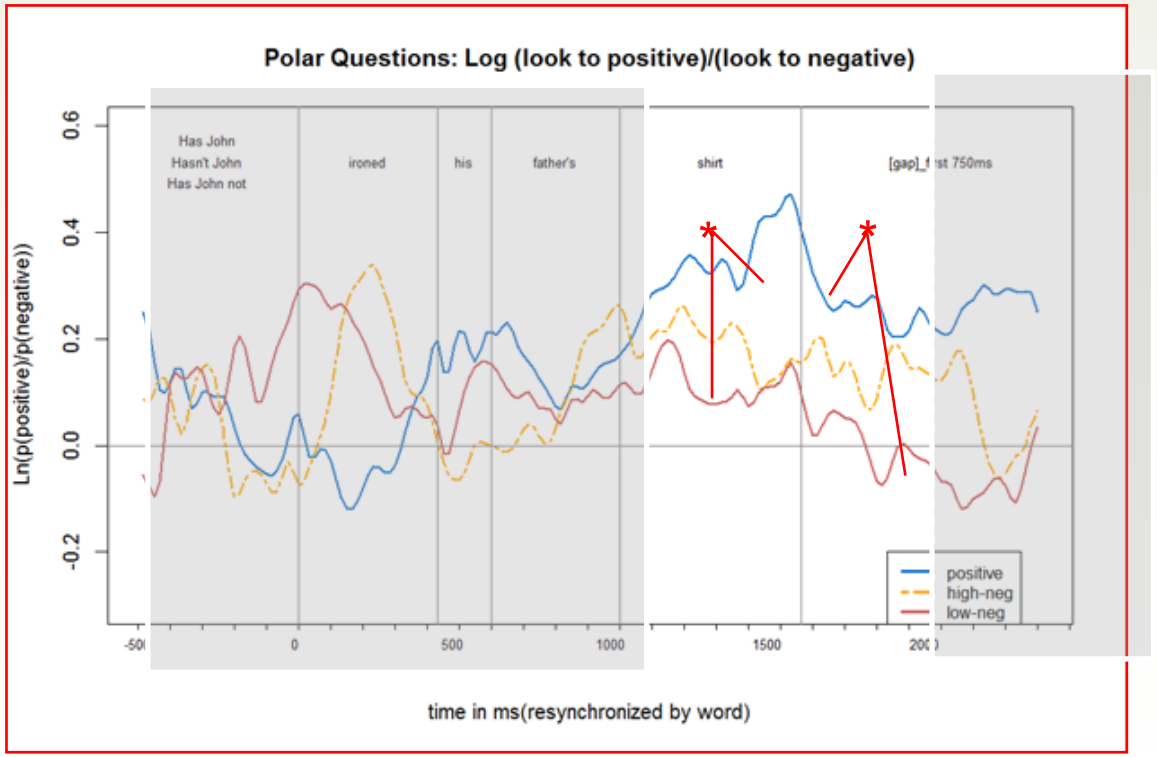
Ln(positive/negative)				p values		
Period	**Positive**	**High-neg**	**Low-neg**	**Pos**	**High Neg**	**Low Neg**
Noun	0.5	0.22	0.13	p<0.001 *	(p=0.06*)	n.s.
gap 0-750ms	0.5	0.21	0.02	p=0.01	n.s.	n.s.
gap 750-1500ms	0.24	0.2	-0.08	n.s.	n.s.	n.s.

Results comparing three conditions

Results – Question Phase



Results – Question Phase



Results – comparing pos, high and low neg

Mixed effect models on natural log ratios of looks to the positive and negative pictures. The looks are averaged per trial for a region. The random effects are subjects and item, the fixed effect is condition.

Ln(positive/negative)						
Period	**Positive**	**High-neg**	**Low-neg**	**pos vs. high**	**pos vs. low**	**high vs. low**
Noun	0.5	0.22	0.13	p=0.10	p=0.049 *	p=0.73
gap 0-750ms	0.5	0.21	0.02	p=0.09	p=0.01*	p=0.42
gap 750-1500ms	0.24	0.2	-0.08	p=0.71	p=0.09	p=0.18

Summary Q- Phase

- Experimental procedure allows for rapid discrimination of positive and negative states.
  - No cost of inferring negative soa.
- We show rapid attention to **both** positive and negative images in all question forms.
- **Late bias** to positive image for **Positive** and **High Neg**
  - Surprising given equal likelihood for upcoming 'yes'/'no' answer

Follow up – control for task effect

- Experimental procedure allows for rapid discrimination of positive and negative states.
  - No cost of inferring negative soa.

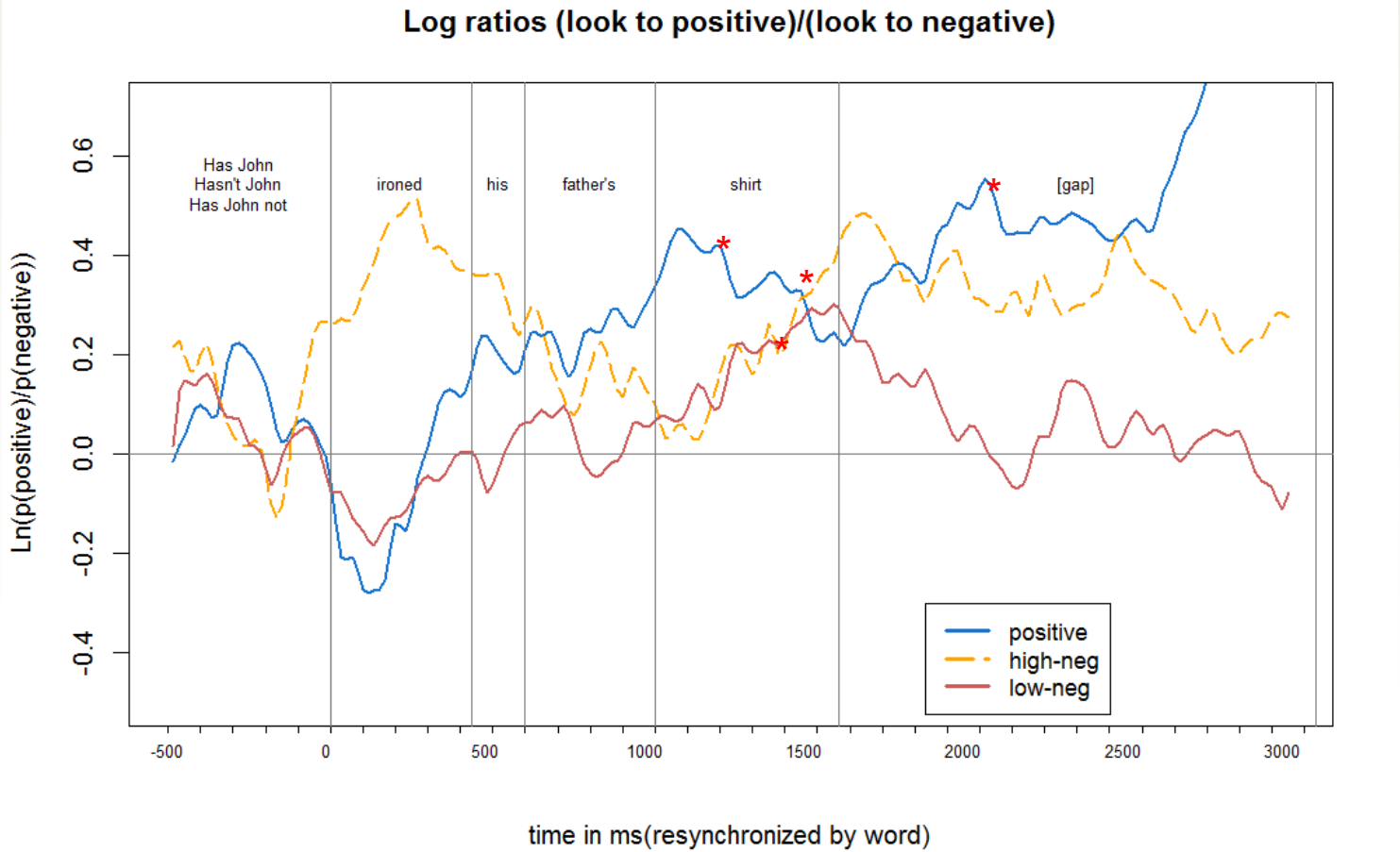
- We show rapid attention to **both** positive and negative images in all question forms.

- **Late bias** to positive image for **Positive** and **High Neg**

Follow up – 'Look and listen' to control for task effect

- Same materials as the first study.
- Instead of having to click the picture corresponding to the answer, in the followup, the participants just listen to the question-answer pairs and look at the screen.
- A third of the trials are followed by a comprehension question to check that the participants are paying attention.

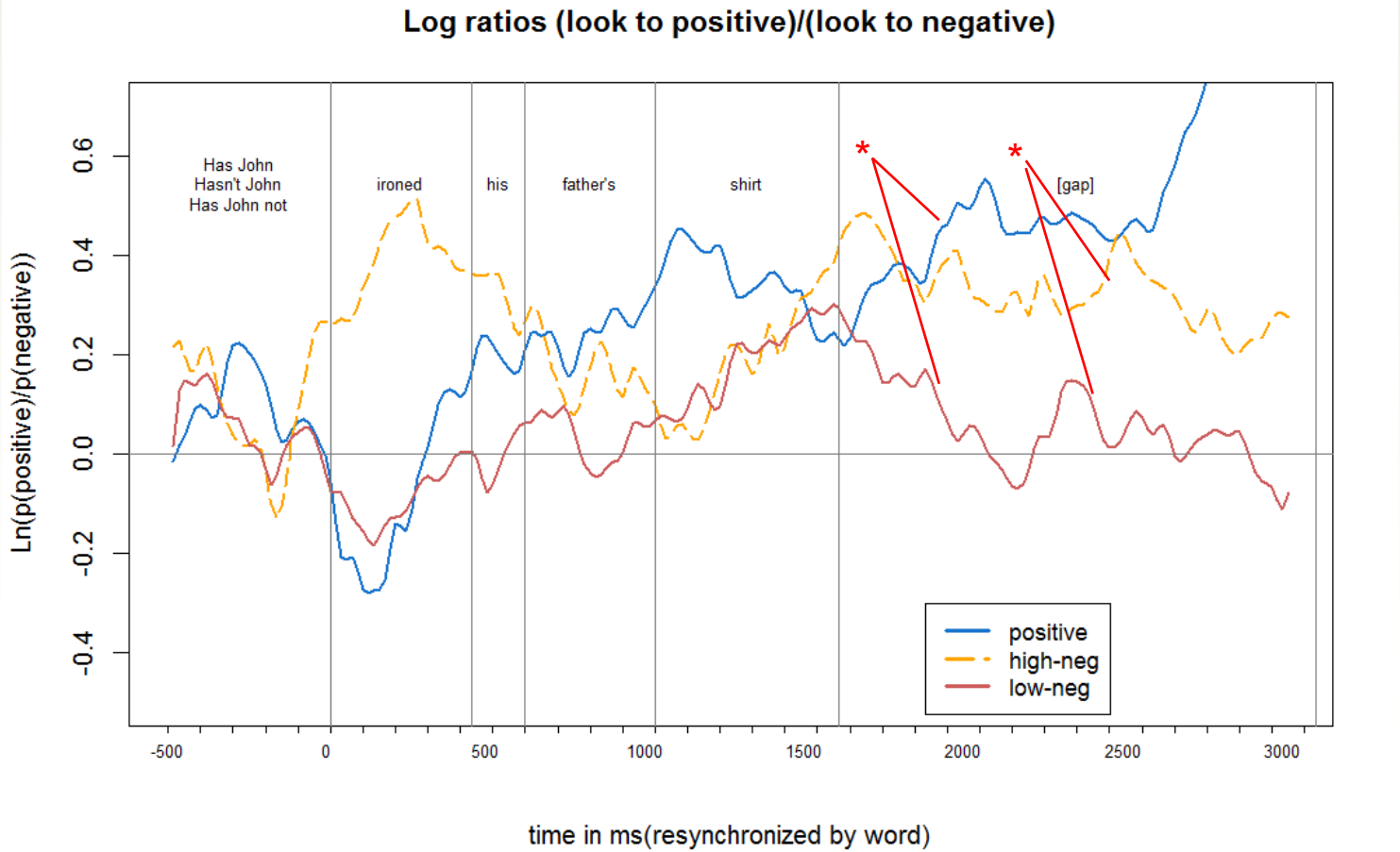
'Look and listen' follow up – similar results



'Look and listen' follow up – similar results

		ironed	his	father's	shirt?	gap
Compared to zero						
	positive	n.s.	n.s.	n.s.	**positive bias, p< .001**	**positive bias, p=0.01**
	high-neg	n.s.	n.s.	n.s.	trending positive bias, p=.06	n.s.
	low-neg	n.s.	n.s.	n.s.	**positve bias, p = .02.**	n.s.
Pairwise comparison					**Ln-ratio positive significantly higher than low-neg (p= .03)**	**Ln-ratio positive high/neg significantly higher than low-neg (p= .03)**

'Look and listen' follow up – similar results



Summary Q- Phase

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  - No cost of inferring negative soa.

- We show rapid attention to **both** positive and negative images in all question forms.

- **Late bias** to positive image for **Positive** and **High Neg**

Discussion

- Evidence suggests processing question form can evoke representations of both positive and negative states
- Late positive bias for positive question *in spite of equal likelihood of 'yes'/'no' in answer phase.*
- Suggests positive questions strongly evoke representations of positive state of affairs.

Discussion

- Polar question study consistent with our conjecture that effects of negation in lab could be due to projection of positive 'QUD'.

But what could explain late bias?

- Frequency of response?
- Traditional taxonomy of usage (Gunlogson & Buring, 2000; Sudo, 2013)?
- State of inquiry

CORPUS STUDY

Percentage of different polar Qs

Polar Questions		
Positive	3733	96.21%
High neg (outside reading)	132	3.40%
High neg (inside reading)	6	0.15%
Low neg	9	0.23%
Sub-total	*3880*	*100%*
Declarative polar questions		
Positive	1016	83.87%
negative	210	17.13%
Sub-total	*1226*	*100%*
All		
Positive	4749	94%
all negatives	357	7%
Total	5006	

Switchboard Dialog Act Corpus

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Sub-total	1226	100%
All		
Positive	4749	94%
all negatives	357	7%
Total	5006	1:20 (polar Q : assertion)
Total assertions:	101,573	

Switchboard Dialog Act Corpus: Polar Q

75145 statement non-opinion + 26428 statement opinion

Probabilities of *P* vs. ¬*P* answers

	P	¬P	Unsure	P : ¬P
Positive	54%	26%	20% *	**2 : 1**
High-neg Out	58%	8%	33%	**6.6 : 1**
High-neg In	33%	50%	17%	**1 : 1.5**
Low neg	11%	44%	44%	**1 : 4**

* Sample estimate

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Difference not apparent in eye-gaze data

Does not square with late bias results.

Probabilities of *P* vs. ¬*P* answers

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Low neg	11%	44%	44%	**1 : 4**

No negative bias in gaze data

Does not square with late bias results.

What questions do we use?

belief/ opinion / evidence	NA	positive	negative
NA	**positive**	**High neg**	**Positive** (marked ironic tone &/or NPI)
positive	**positive**		**positive (marked by 'really', 'actually')**
negative	**Low neg**	**Low neg**	

(Gunlogson & Büring, 2000), Sudo (2013)

What questions do we use?

Information seeking

evidence \ belief/ opinion	Neutral	positive	negative
Neutral	**positive**	**High neg**	**Positive** (marked ironic tone &/or NPI)
positive	**positive**		**positive (marked by 'really', 'actually')**
negative	**Low neg**	**Low neg**	

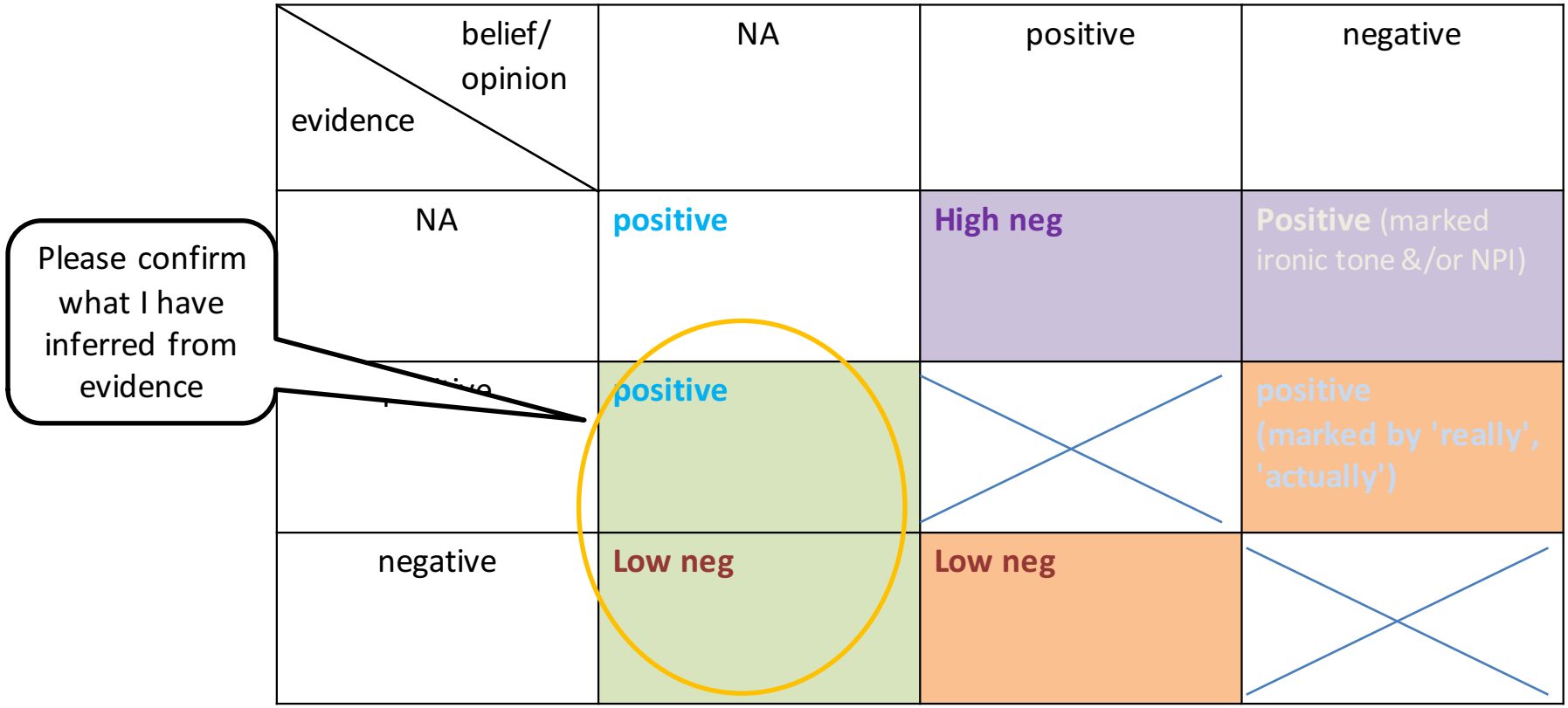
(Gunlogson & Büring, 2000), Sudo (2013)

What questions do we use?

- Information seeking:
  - Have you been to Geneva before?

- No prior expectation, no evidence

What questions do we use?



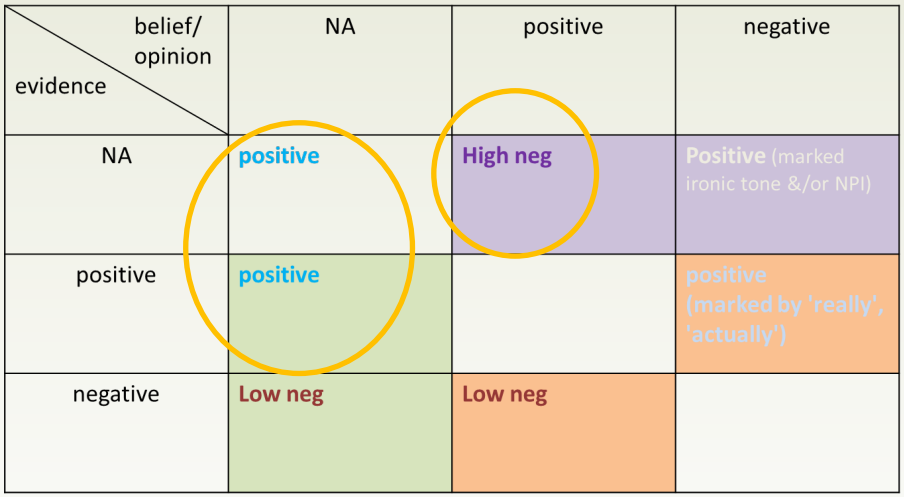
(Gunlogson & Büring, 2000), Sudo (2013)

What questions do we use?

- Information seeking:
  - Have you been to Geneva before?

- Please confirm what I have inferred from *positive* evidence:
  - *(saw you after Christmas): Have you put on weight?*

What question do we use?



evidence \ belief/opinion	NA	positive	negative
NA	positive	High neg	Positive (marked ironic tone &/or NPI)
positive	positive		positive (marked by 'really', 'actually')
negative	Low neg	Low neg	

- High-neg where speaker has positive belief/opinion, neutral evidence (cf Romero & Han, 2004).
  - Explains gaze bias?
- Unmarked positive questions in cases where speaker has neutral belief/opinion.
  - Epistemic stance does not always explain bias

What question do we use?

evidence \ belief/ opinion	NA	positive	negative
NA	positive	High neg	Positive (marked ironic tone &/or NPI)
positive	positive		positive (marked by 'really', 'actually')
negative	Low neg	Low neg	

- Unmarked positive questions in cases where speaker has neutral or positive evidence.
  - Sufficient to explain stronger positive bias?

- Neutral questions less marked

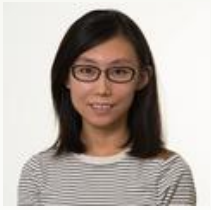
Speculation – State of Inquiry

- *?P* and *?¬P* have same denotations.
- *Wondering about P* is different from *Wondering about not P*
  - Due to 'confirmation bias', we prioritise search for confirming evidence for the target of inquiry.
  - Search for disconfirming evidence has lower priority.
- Cf. Carnap on Questions vs. Topics
  - Russell (2006)

thanks to…

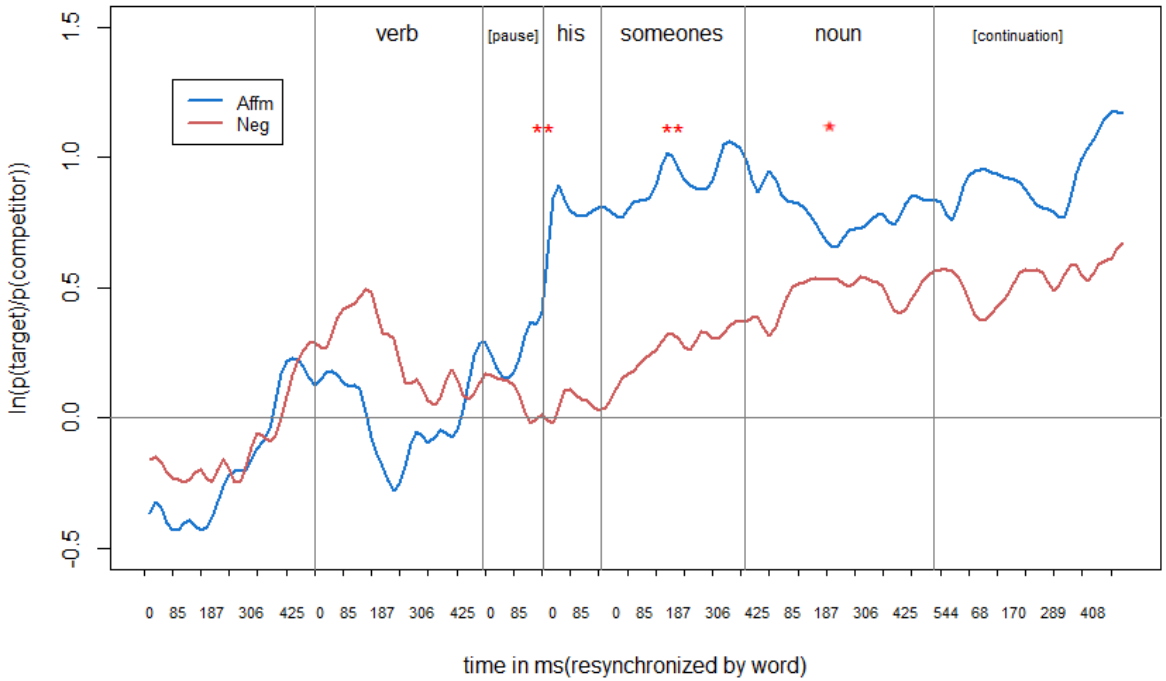
Heather Ferguson

Napoleon Katsos



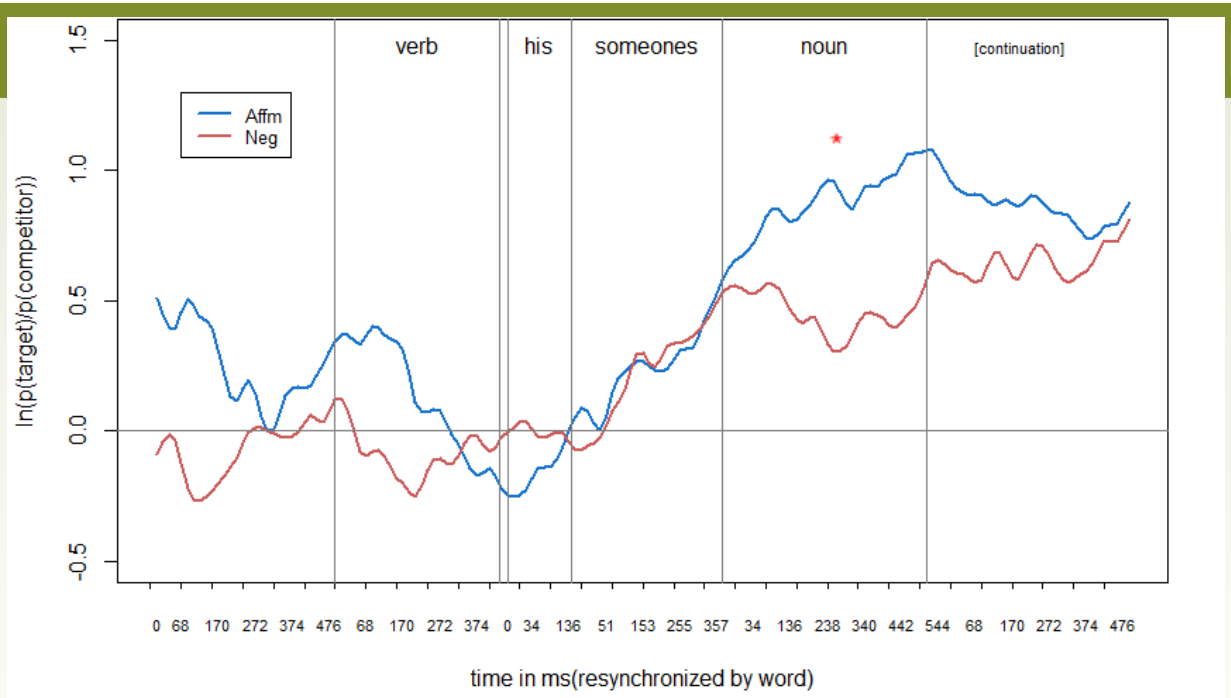
Chao Sun

Simple



- For simple positives, looks to target but not competitor rises after the verb.
- For simple negatives, looks to both rises, and they only start to diverge in "dad's" region.
- In post-verb pause and "his" region, as well as "someone's" region, there is a significant difference between simple positive and simple negative (paired t-test on Ln(p(target)/p(competitor)), all ts>2.8, all ps<0.01).

Cleft



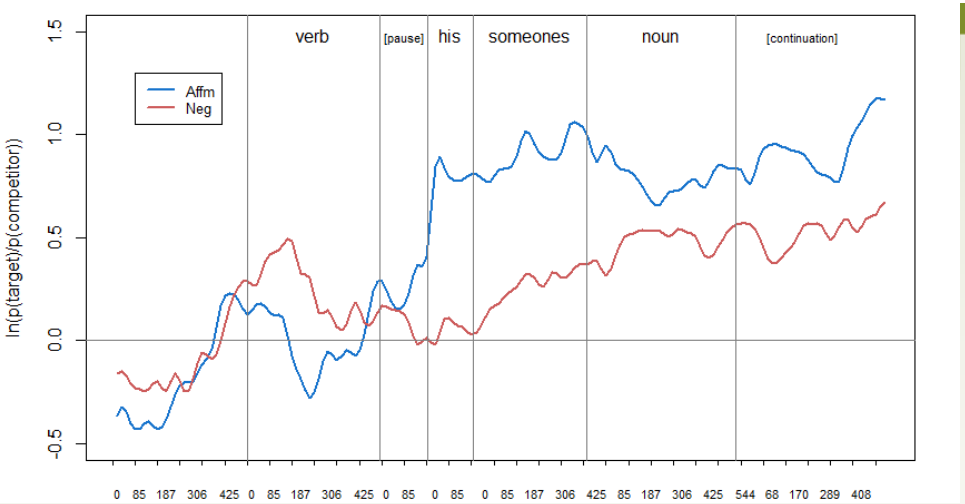
- cleft positive and negatives behaved the same immediately after the verb (all ps>0.4).
- Looks to both target and competitor rises, but start to diverge in “someone’s” region.

Ln(p(target)/p(competitor)

ANOVA shows a significant polarity * cleft interaction in a fixed post verb region.

$F_1(1,35)=8.19$, $p=0.007$.
$F_2(1,38)=6.16$, $p=0.018$.

Simple



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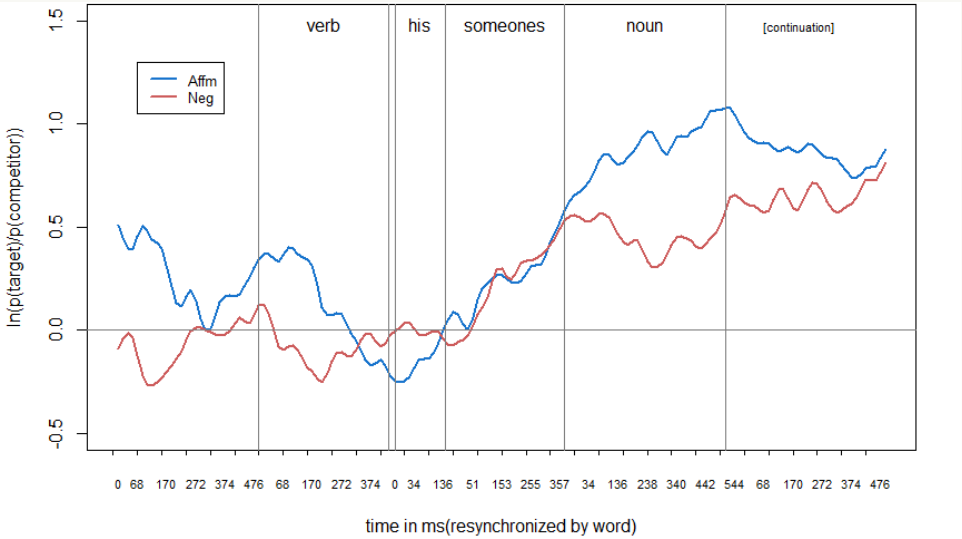
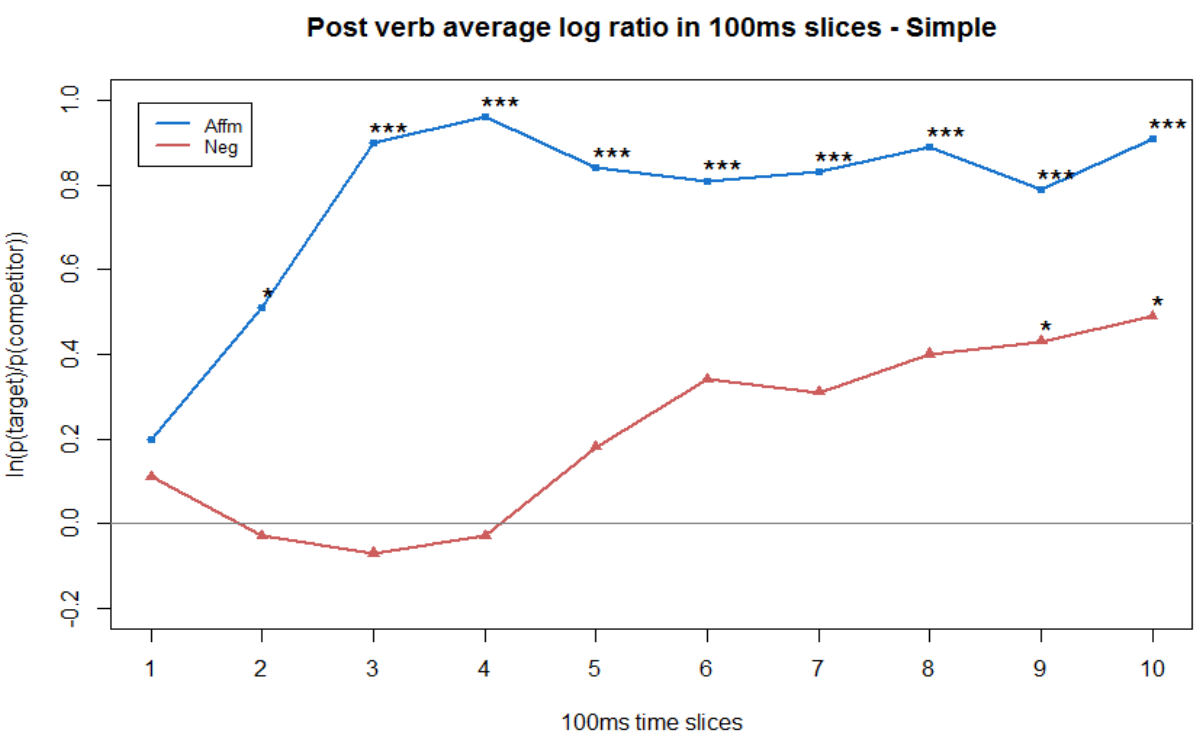
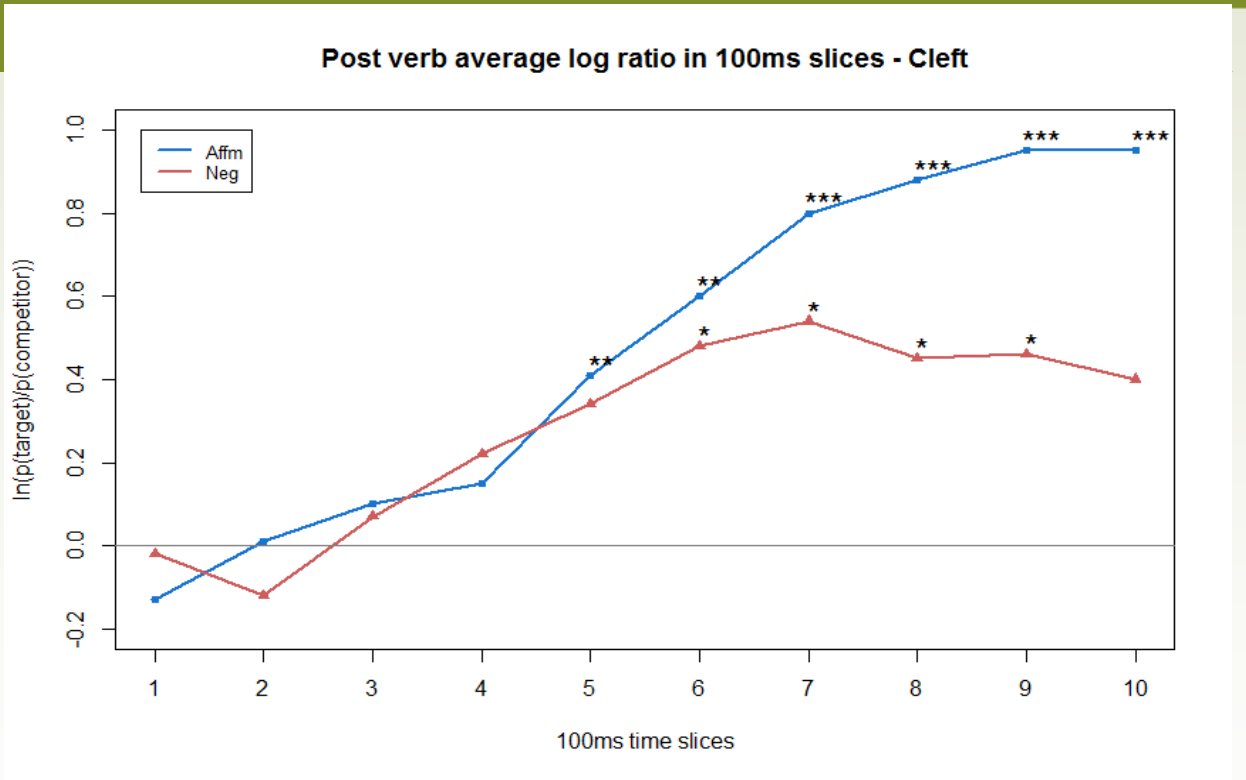


Simple



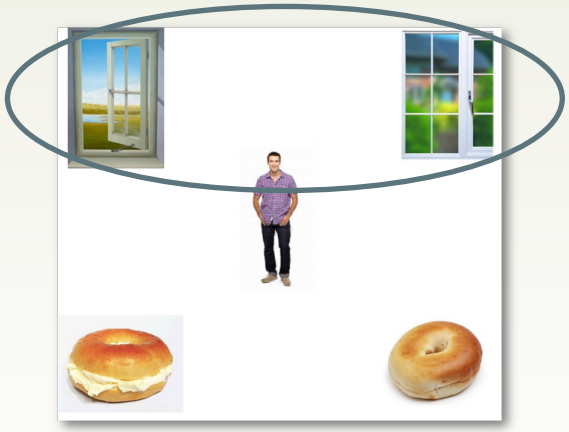
- Time course analysis: 100ms time slices post verb
- Asterisks indicates that the value is significantly different from zero by both subject and item.
- For simple, target bias became significant in the 9th time slice (trending in 7th and 8th .

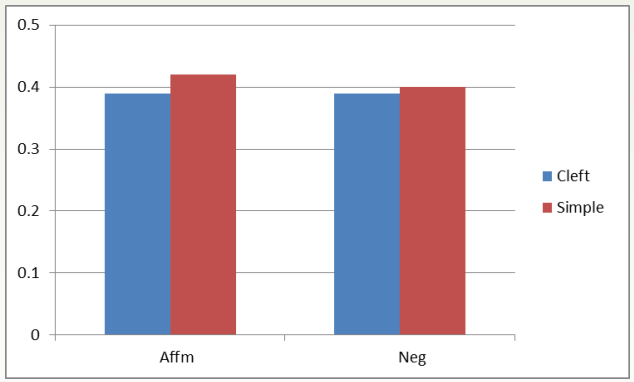
Cleft



- Time course analysis: 100ms time slices post verb
- For cleft target bias became significant in the 5th time slice for positives, and in the 6th for negatives (trending in the 5th) .
- Importantly, target bias was formed **faster** in cleft negatives than simple negatives, despite the fact that cleft negatives are structurally more complex.

No ‘Inhibition’ in Looks to verb-able objects





Cf MacDonald & Just 1989