

Comprehension of focus – adults

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Comprehension of focus

Introduction

wh-test for focus

- (1) a. What did you give to the woman?
b. I gave some TEA to the woman.
c. #I gave some tea to the WOMAN.

Focus can be used for contrast:

- (2) Give me the GREEN ball.

Eberhard et al

- reference resolution task in contrastive vs non-contrastive visual context

Touch the LARGE/large blue square

In the contrastive stress condition, the latency of eye movements to the target referent was significantly shorter in the contrastive visual context

Ito and Speer (2008, 2011)

Hang the blue ball.

Next, hang the green/GREEN ball.

- confirmed the processing advantage of contrastive accents on the modifying adjective when used in a contrastive context
- showed that the use of such accents leads to anticipatory looks to the previously mentioned entity type (i.e., balls) and to 'garden path' effects if used in infelicitous contexts (e.g., blue angel followed by GREEN ball). They thus demonstrated early interpretation of contrastive prosody.

Pragmatic effect

- reference resolution task can also be carried out without the presence of the contrastive accent. In other words, were the instructions read out with a different intonation, the reference resolution task could still be carried out correctly. The presence of the contrastive accent is facilitatory and its absence informative, but ultimately, it only has a pragmatic effect: it does not contribute to the sentence meaning directly as it does not change the truth conditions of the sentence.

Only is focus-sensitive

(1) I only gave some tea to the woman.

(2) a. I only [gave some tea to the WOMAN]. = The only person I gave some tea to was the woman.

b. I only [gave SOME TEA to the woman]. = The only thing I gave to the woman was some tea.

Only takes scope

(3) Only [the WOMAN] gave a banana to the monkey.

(4) a. The only person that gave a banana to the monkey was the woman.

b. *The only event that took place was the woman giving a banana to the monkey.

Meaning of *only*-sentences (Rooth 1992)

(5) Indirect Object Stress

- a. I only gave some tea to the WOMAN.
- b. I gave some tea to the woman AND
- c. For all x [$x \neq$ the woman], I did not give some tea to x .

(6) Direct Object Stress

- a. I only gave SOME TEA to the woman.
- b. I gave some tea to the woman AND
- c. For all y [$y \neq$ some tea], I did not give y to the woman.

Focal meaning component

(7) a. {I didn't give any tea to the man
AND I didn't give any tea to the boy AND I
didn't give any tea to ...}

b. {I didn't give any coffee to the
woman AND I didn't give any biscuits to the
woman AND I didn't give any ... to the
woman}

Research questions

- How are *only*-sentences processed?
- Do people follow the semantics of *only*-sentences described above when they comprehend such sentences?
- Do they compute the focal meaning component incrementally?
- What is the earliest point that we can find evidence that focus is computed?

Two possibilities

- *very fast and incremental:*
match the Ito and Speer (2008) findings about contrastivity; non-focal meaning considered at the earliest possible point. Given the semantics of only-sentences described above, that is when the proposition is complete.

Two possibilities

Slower, later:

Perhaps pragmatic effects of contrastivity would be manifest, as found by Ito and Speer (2008), at the point of the occurrence of the prosodic focus itself. But semantic integration of the prosodic focus information would be delayed.

Paterson, Liversedge, Filik, Juhasz, White and Rayner 2007

- reading times with eye-tracker
- *Jane passed only the salt to her mother*
- *Jane passed the salt to only her mother*
- congruous vs incongruous replacives as continuations to the utterances:

but not the pepper / but not her father

Results: longer reading times for the postreplacive region, rather than the replacive region itself

Discussion of Paterson (2007)

- a reading study cannot reveal participants' sensitivities to stress placement, and to the disambiguating potential of stress placement
- the focus effect is measured by participants' sensitivity to the congruity vs incongruity of the replacive, so later than the point where focus can be determined at the earliest

Gennari, Meroni and Crain 2005

- Visual-world eye tracking

(9)a. Neutral stress FALSE

The mother only gave some milk to the *boy*.

b. Marked stress TRUE

The mother only gave SOME MILK to the boy.

- Results:

– N° of correct responses: MS > NS

– RT: MS=NS

BUT: comparing TRUE with FALSE

Gennari et al 2005 continued

- Only overall proportion of looks
- ‘boy’s milk’: $MS > NS$
- ‘boy’: $MS = NS$
- ‘the man’s coffee (as well as on the set of contrasting elements such as the teapot taken as a whole)’ (Gennari et al 2005: 256): $MS > NS$
- ‘the man’s milk’: ???

Motivation

- focus seems to be interpreted in an incremental fashion (Ni et al 1996, Gennari et al 2005, Paterson et al 2007)
- none of these studies reported the time course of looks accompanying the comprehension of *only*-sentences involving different prosody
- → 3 RT and visual-world eye tracking experiments to investigate these issues

Comprehension of focus

Mulders & Szendroi (2016)

Present study

- Adaptation of Gennari et al 2005
 - Expected responses: YES/NO in Experiment 1, YES/YES in Experiment 2; NO/NO in Experiment 3
 - Report eye tracking throughout not just overall
 - Visual stimuli better balanced
 - More precise predictions of expected looks as utterance unfolds

Experiment 1

Method 1

- *Participants:*
- 20 adult non-dyslexic Dutch native speakers paid for their participation
- Age: mean 22;8 years (range: 19-29)
- 18 females and 2 males
- 17 participants were right-handed

Method 2

- *Materials:* Sixteen items were constructed in two conditions

(10)a. Late Stress condition (LS): *Expected answer: NO*

Ik heb alleen selderij aan de BRANDWEERMAN
gegeven

*I have only celery to the fireman
given*

‘I only gave celery to the FIREMAN.’

b. Early Stress condition (ES): *Expected answer: YES*

Ik heb alleen SELDERIJ aan de
brandweerman gegeven

I have only celery to the fireman given

‘I only gave CELERY to the fireman.’



Early Stress condition

- a. Example in English: I only gave CELERY to the fireman
- b. Non-focal meaning: I gave celery to the fireman
- c. Focal meaning: I did not give anything else to the fireman
= {I didn't give x to the fireman AND I didn't give y to the fireman AND I didn't give z to the fireman. . . , where x, y, z, . . . are objects that could have been given to the fireman in the context}
- d. Potentially relevant entities for verification of focal meaning in visual context: fireman and his objects

Late Stress condition

Example in English: I only gave celery to the FIREMAN

b. Non-focal meaning: I gave celery to the fireman

c. Focal meaning: I did not give celery to anyone else = {I didn't give celery to x AND I didn't give celery to y AND ...}

d. Potentially relevant entities for verification of focal meaning component in visual context: any other participant in the picture and their objects

e. Falsifying proposition in Experiment 1: I gave celery to the diver.

f. Entities relevant for the falsifying proposition in Experiment 1: diver, diver's celery

Method 3

- Verbal stimuli pre-recorded by a female native speaker
- Stimuli checked for the placement of pitch accents using PRAAT (Boersma and Weenink 2006).
- names of target objects and people that were used in the sentences were matched in length as much as possible; ≥ 3 syllables
- no significant differences between conditions in the overall lengths of the audio stimuli ($t(16) = 0.95$, $p = .925$)
- Visual stimuli: falsifying entity appeared in 4 corner of picture in 4 items; so balanced for top-left and left-right preferences

Method 4

- 98 filler items were constructed
 - involving various quantifiers: *niet iedereen* ‘not everybody’.
 - balanced for YES/NO expected responses
 - with either early marked stress on the direct object or late marked stress on the indirect object
 - included a set of 32 control items involving *alleen*, 16 with early and 16 with late stress, where the expected response was different from the expected response of the corresponding test condition.
 - half of these control items referred to the ‘doctor’

Method 5

Procedure:

- participants tested individually in a sound-treated booth
- instruction sheet providing pragmatically appropriate context
- task was to indicate whether the sentence matched the visual scene by pressing a button on a buttonbox.
- The experiment was programmed in FEP (Veenker 2005)
- right eye were recorded with an EyeLink 1000 eye tracker in remote mode using a target sticker; 500Hz sampling rate
- Participants were seated 600-650mm from the screen

Method 6

- 13-point calibration and validation procedures initiated from the control room and repeated if necessary
- Every stimulus was preceded by a fixation target in the middle of a blank screen
- Automatic drift check was applied and a recalibration initiated if the drift check indicated a drift of more than 20 pixels.
- Participants were allowed 1000ms to explore the visual scene before the utterance was presented
- The whole procedure, including instruction and calibration, took about 20 minutes for each participant.

Method 7

- 12 practise items (fillers, 2 of those resembling experimental items) followed by a small pause in which the participants could ask questions about the task (if necessary).
- The remaining 118 trials (32 test items, 32 controls, 54 fillers) were presented in two blocks; each block was preceded by a calibration
- All target objects in experimental items were mentioned in the first 16 filler trials (including the practice block)
- All participants saw all the test items in both conditions.
- pseudo-randomized order where experimental items never followed each other or a filler involving *alleen* 'only' with any stress pattern
- no consecutive items had different stress patterns
- not more than 3 consecutive trials with the same stress pattern

Predictions 1

- (13) Early Stress condition:
- a. Example: I only gave CELERY to the fireman
 - b. Non-focal meaning: I gave celery to the fireman
 - c. Focal meaning: I did not give anything else to the fireman
- (14) Late Stress condition:
- a. Example: I only gave celery to the FIREMAN
 - b. Non-focal meaning: I gave celery to the fireman
 - c. Focal meaning: I did not give celery to anyone else

Predictions 2

	Early Stress	Late Stress
Example:	I only gave CELERY to the fireman	I only gave celery to the FIREMAN
Exp. Resp.:	YES	NO
Non-focal meaning:	I gave celery to the fireman	I gave celery to the fireman
Expected looks:	fireman, fireman's celery	fireman, fireman's celery
F o c a l meaning:	I did not give anything else to the fireman	I did not give celery to anyone else
Expected looks:	fireman, (fireman's empty tray)	diver, diver's celery, (diver's corn)

Predictions 3

- Time course: earliest point where nonfocal and focal meaning can be verified is at the indirect object
- *I gave only CELERY to the...*
 - Looks are expected to diverge between conditions during Indirect Object sound frame

Kim (2010): nonfocal meaning is verified first

Predictions summary

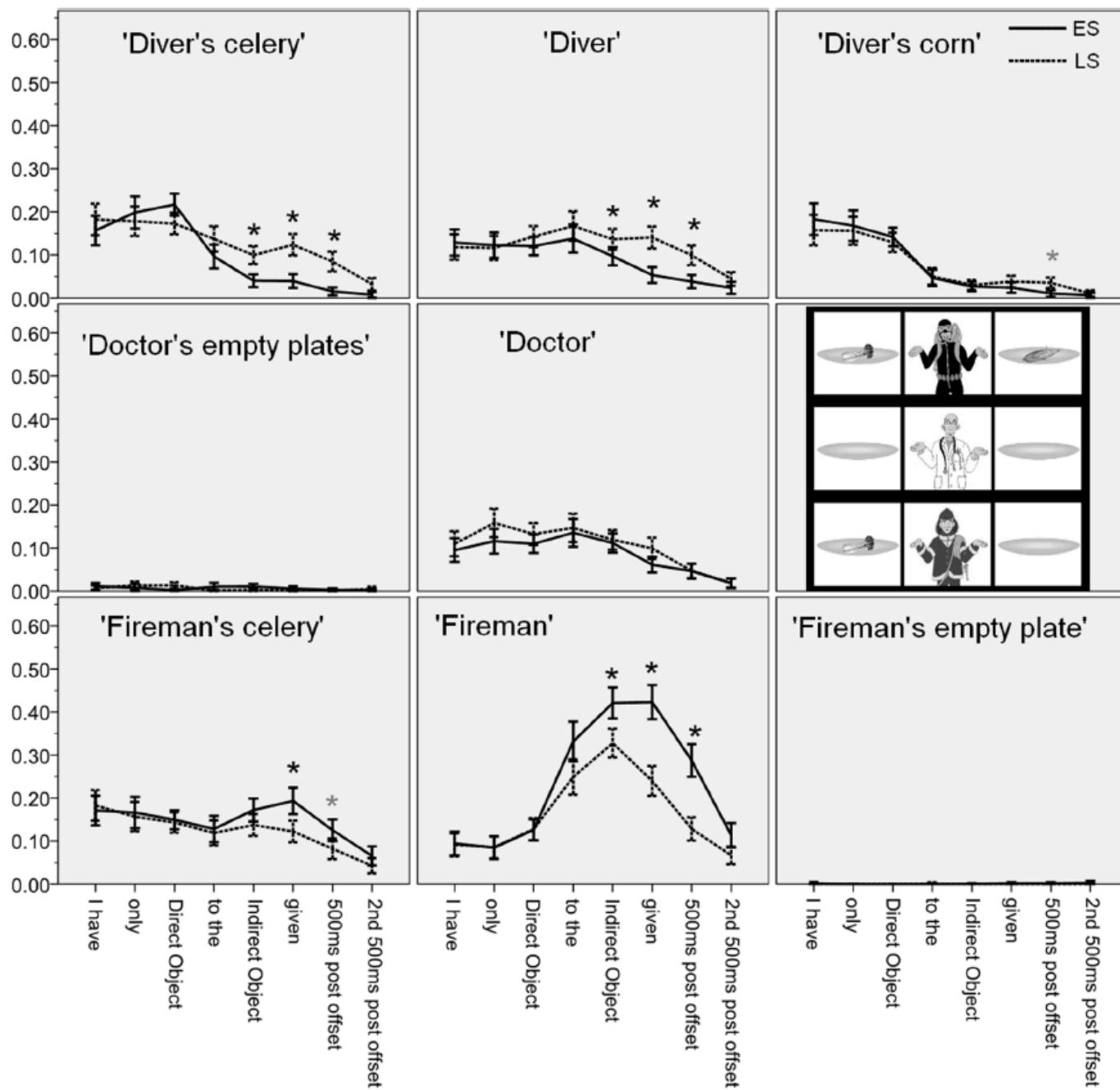
- (i) utterance verification is expected to start when the indirect object is heard
- (ii) the nonfocal meaning is expected to be verified first, so a high proportion of looks is predicted to target 'the fireman' and 'the fireman's celery' during the indirect object audio segment
- (iii) in the Early Stress condition looks will stay on the 'fireman' and the 'fireman's celery', while in the Late Stress condition, looks will shift to the 'diver', the 'diver's celery' and to a lesser extent to the 'diver's corn'. This should take place during the sentence final verb *gegeven* and after the utterance offset

Results 1

- *Number of correct responses*
 - Late Stress condition: 97.8%
Early Stress condition 99.1%
not significant ($F_1(1,19)=2.923$, $p=.104$; $F_2(1,15)=1.364$, $p=.261$).
 - Overall: 98,1%.
- *Response time:*
 - Late Stress: 3034ms
Early Stress:3048ms
not significant ($F_1(1,19)=.027$ $p=.871$; $F_2(1,15)=.045$; $p=.835$).



Mean proportion of time looking



Discussion

- No behavioural difference, but YES vs NO
 - Eye tracking patterns as predicted at and after *gegeven*
 - No looks to irrelevant entities (e.g. contrast entity) contra Gennari et al 2005
- Focus must be computed by this stage
- Proposition-based semantics of focal utterances is psychologically realistic

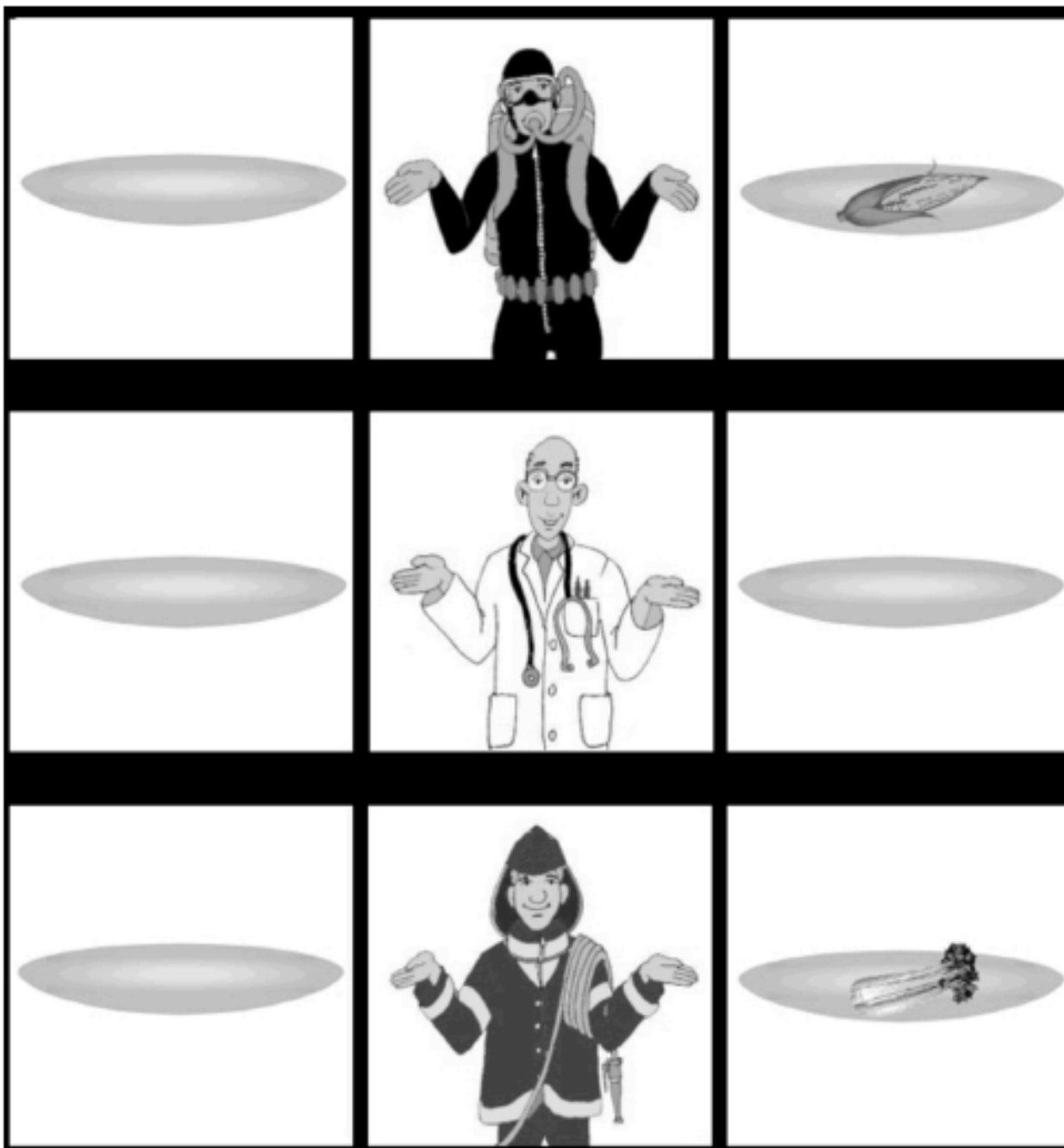
Interim conclusion

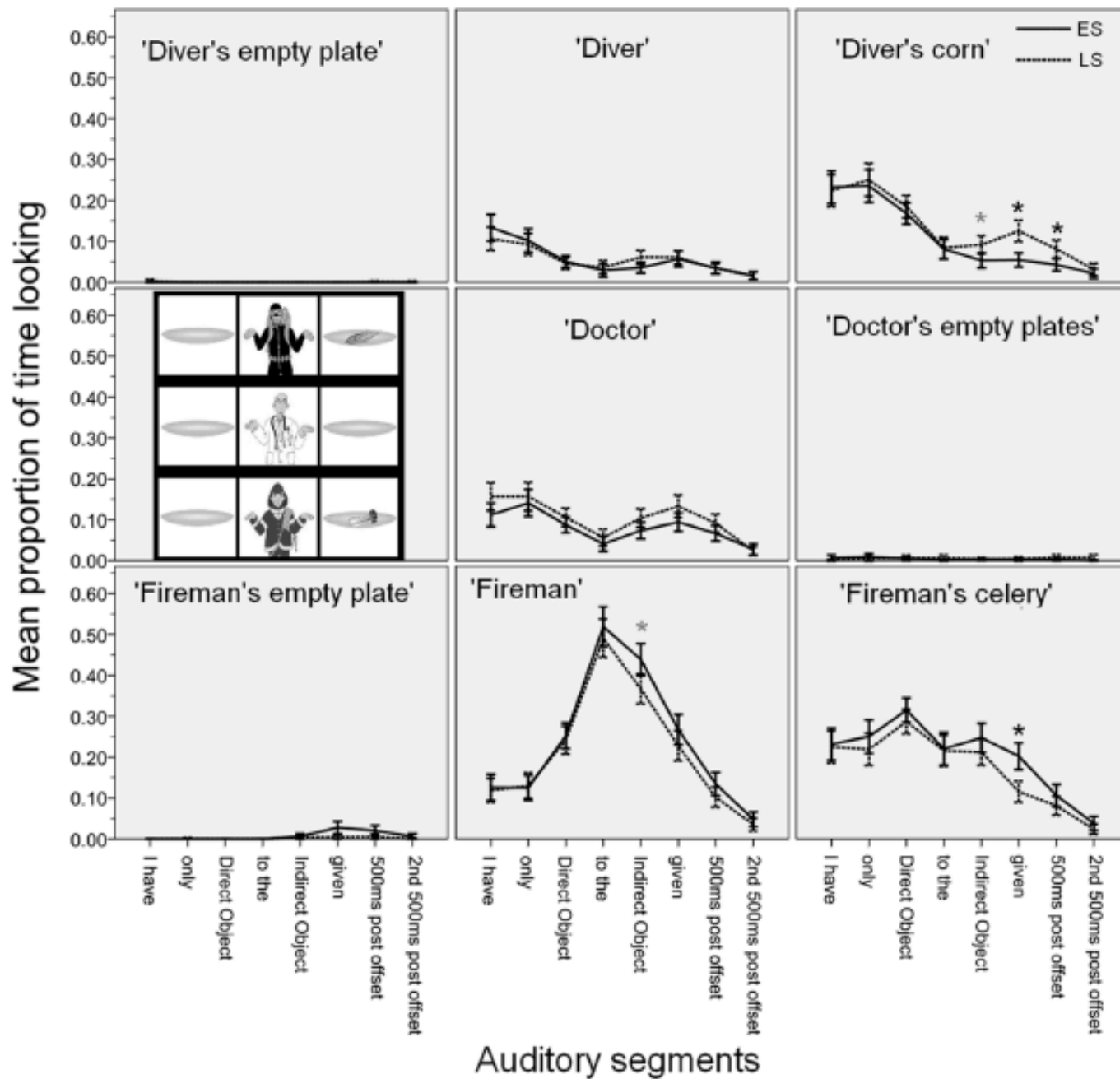
- Focus computation is incremental and fast
- Early looks to 'fireman' are anticipatory →
Experiment 3
- Experiment 2: YES/YES
Results are the same as in Experiment 1

Experiment 2

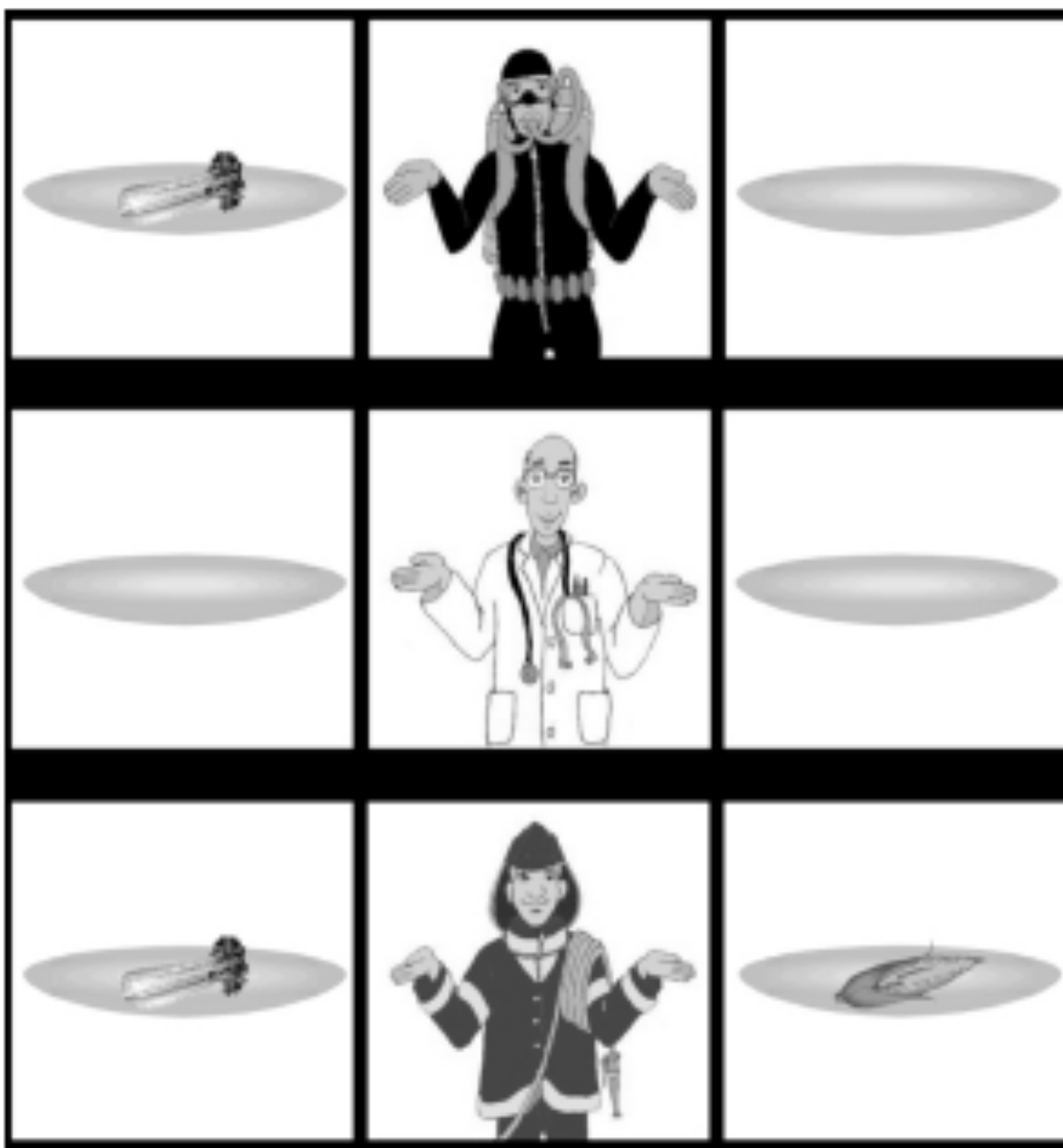
Behavioural results

- *Number of correct responses*
 - Late Stress condition: 100%
 - Early Stress condition 99.1%
 - Overall: 98,1%.
- not significant ($F_1(1,19)=0.322$, $p=.577$; $F_2(1,19)=0.322$, $p=.577$).
- *Response time:*
 - Late Stress: 2843ms
 - Early Stress: 2868ms
 - not significant ($F_1(1,19)=.147$ $p=.706$).





Experiment 3



Method 2

- *Materials:* Sixteen items were constructed in two conditions

(10)a. Late Stress condition (LS): *Expected answer: NO*
Ik heb alleen selderij aan de BRANDWEERMAN
gegeven
I have only celery to the fireman given
'I only gave celery to the FIREMAN.'

b. Early Stress condition (ES): *Expected answer: NO*
Ik heb alleen SELDERIJ aan de brandweerman gegeven
I have only celery to the fireman given
'I only gave CELERY to the fireman.'

- *Procedure:* identical to Experiment 1

Predictions

- our anticipation hypothesis predicts that participants will look more at 'the diver' during the aan de 'to the' auditory segment in the ES condition. This is because the 'diver' has only celery.
- But once they hear the indirect object de brandweerman 'the fireman', their looks are expected to shift to the 'fireman'.
- In addition, we expected that the findings of Experiments 1 and 2 about divergent looks between the two conditions would be replicated, except potentially, due to the potential hindering effect of the anticipatory looks, somewhat delayed.

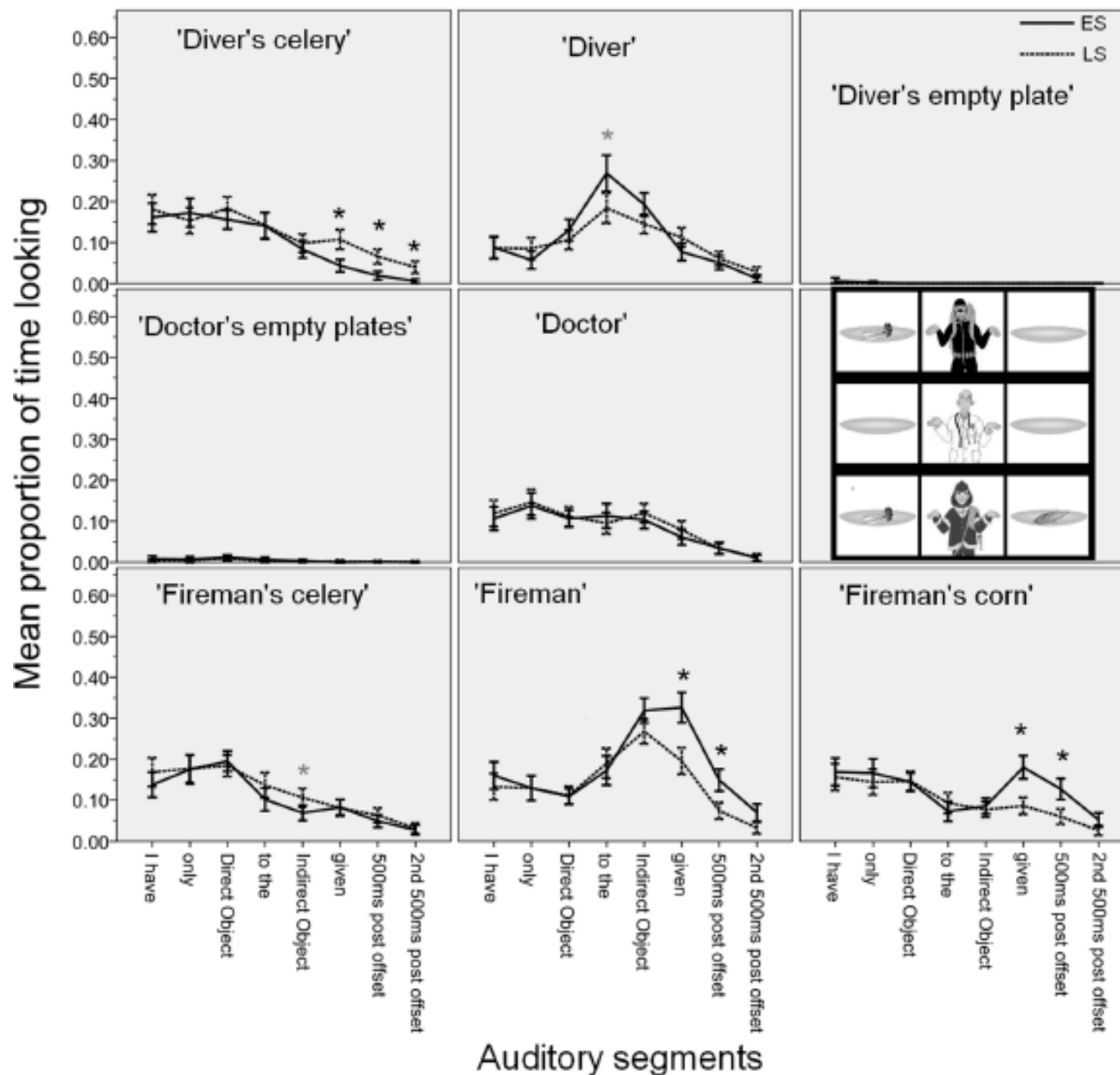
Predictions 2

	Early Stress	Late Stress
Example:	I only gave CELERY to the fireman	I only gave celery to the FIREMAN
Exp. resp:	NO	NO
Anticipated utterance:	I only gave CELERY to the diver.	
Anticip. Looks	diver, diver's celery	
Actual non-focal meaning:	I gave celery to the fireman	I gave celery to the fireman
Expected looks:	fireman, fireman's celery	fireman, fireman's celery
Actual focal meaning:	I did not give anything else to the fireman	I did not give celery to anyone else
Expected looks:	fireman, fireman's corn	diver, diver's celery

Results 1

- *Number of correct responses*
 - Late Stress condition: 97.2%
Early Stress condition 98.4%
not significant ($F_1(1,19)=1.353$, $p=.259$; $F_2(1,15)=1.184$, $p=.294$).
 - Overall: 98,1%.
- *Response time:*
 - Late Stress: 2875ms
Early Stress:2909ms
not significant ($F_1(1,19)=.344$ $p=.564$; $F_2(1,15)=.244$; $p=.629$).





Discussion

- Anticipatory looks were found giving indirect evidence of early focus computation
- Pattern of looks after gegeven followed more or less the same pattern as in Experiment 1

Discussion: overall

- Focus computation is fast and incremental
- Perhaps unexpectedly, focal comprehension starts already before the whole utterance is heard.
- Yet no facilitatory effect on response times
- Anticipation is not enough, given the formal semantics of only-sentences, the participant must wait until the IO to judge sentence

Discussion: overall

- So, we found evidence that participants' looks not only target the falsifying entity in the picture, but rather the falsifying proposition was established.
- Participants' eye movement reveals that they judge sentences in a rational way, following the semantics, rather than by heuristic strategies
- Cautionary note: in these verification tasks the task effect is not negligible

THANK YOU!