Dynamic Anticipation of Driving Scenarios

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Anticipation in Traffic

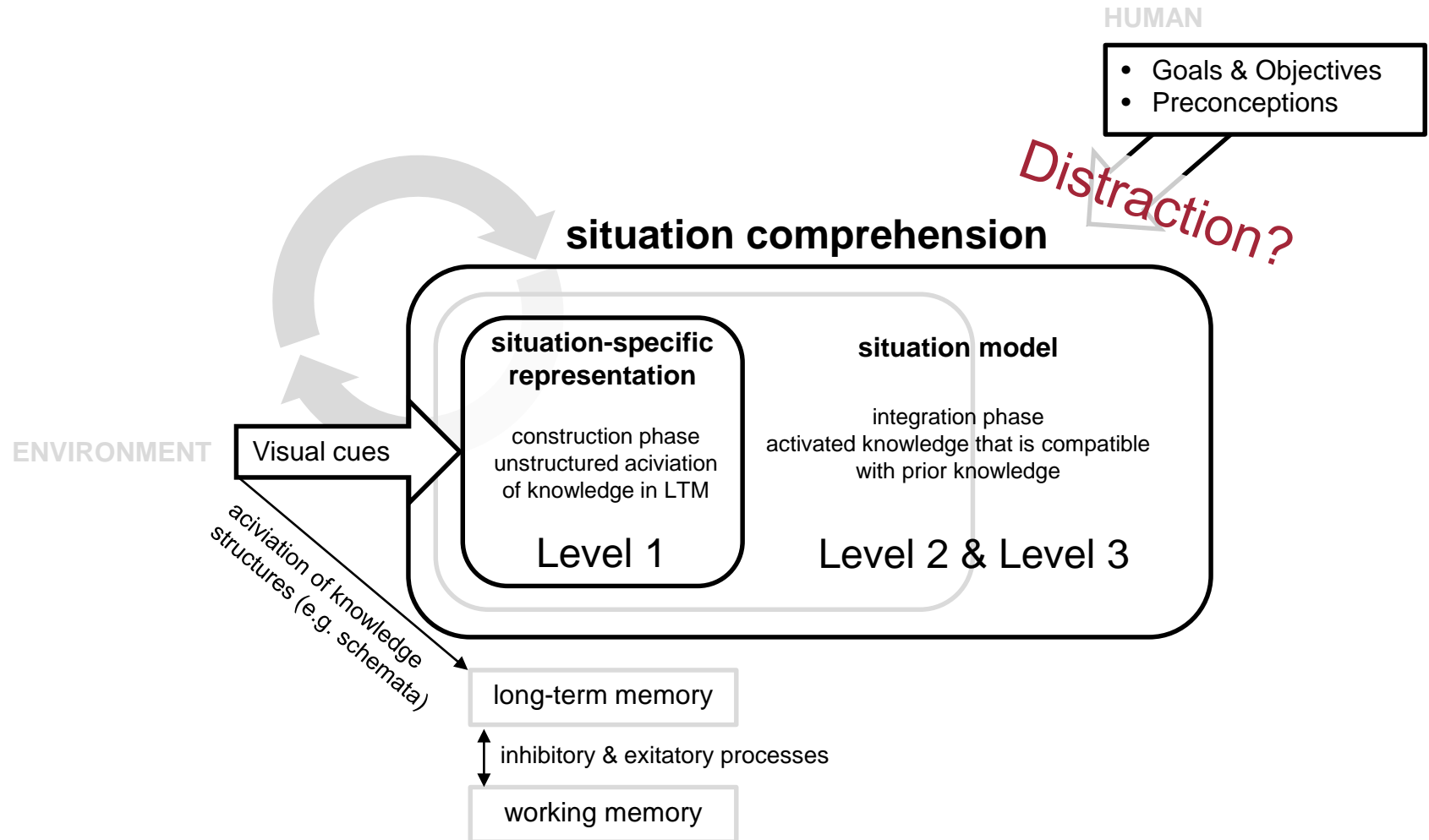| increases the space and time for acting | reduces conflicts with traffic participants | increases performance & safety |

Situation Awareness

Continuous extraction of environmental information, integration of this information with previous knowledge to form a coherent mental picture, and the use of that picture in directing further perception and anticipating future events.

(Dominguez, 1994, p. 11)

Level 1   *perception of the elements in the environment within a volume of time and space*
Level 2   *the comprehension of their meaning*
Level 3   *and the projection of their status in the near future*

(Endsley, 1995, p.36)

The cognitive model of situation comprehension

HUMAN

- Goals & Objectives
- Preconceptions

Distraction?

situation comprehension

situation-specific representation

construction phase
unstructured aciviation
of knowledge in LTM

Level 1

situation model

integration phase
activated knowledge that is compatible
with prior knowledge

Level 2 & Level 3

ENVIRONMENT

Visual cues

aciviation of knowledge
structures (e.g. schemata)

long-term memory

↕ inhibitory & exitatory processes

working memory

own graph of the model of Baumann & Krems 2009, based on Endsley, 1995, Kintsch, 1998

Anticipation & Cognitive Distraction

Previous Findings

cognitive distraction (memory updating task) interferes with the processing of warning cues

- larger reaction times
- less adaptive behavior

(Baumann, Petzoldt, Groenewoud, Hogema, & Krems, 2008)

cognitive distraction did only influence higher levels of SA (comprehension and projection), but not Level 1 (perception)

(Rogers, Zhang, Kaber, Liang, & Gangakhedkar, 2011)

Does cognitive distraction influence the processing of visual information in general or just the integration of cues by previous knowledge?
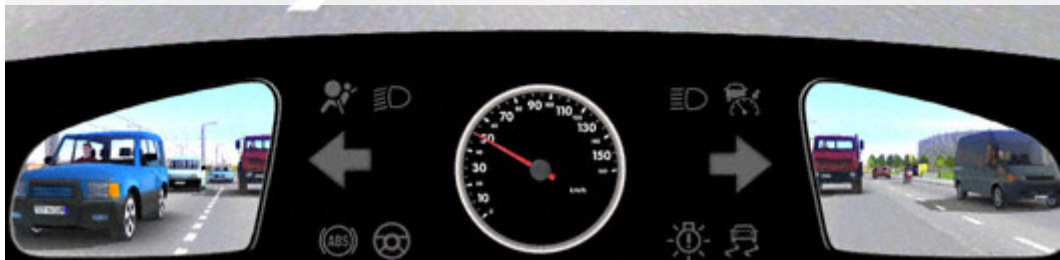
Memory for Visual Information in Traffic

…the systematically error to overestimate position changes of an occluded object in direction of movement (Representational Momentum)   (Freyd & Finke, 1984)
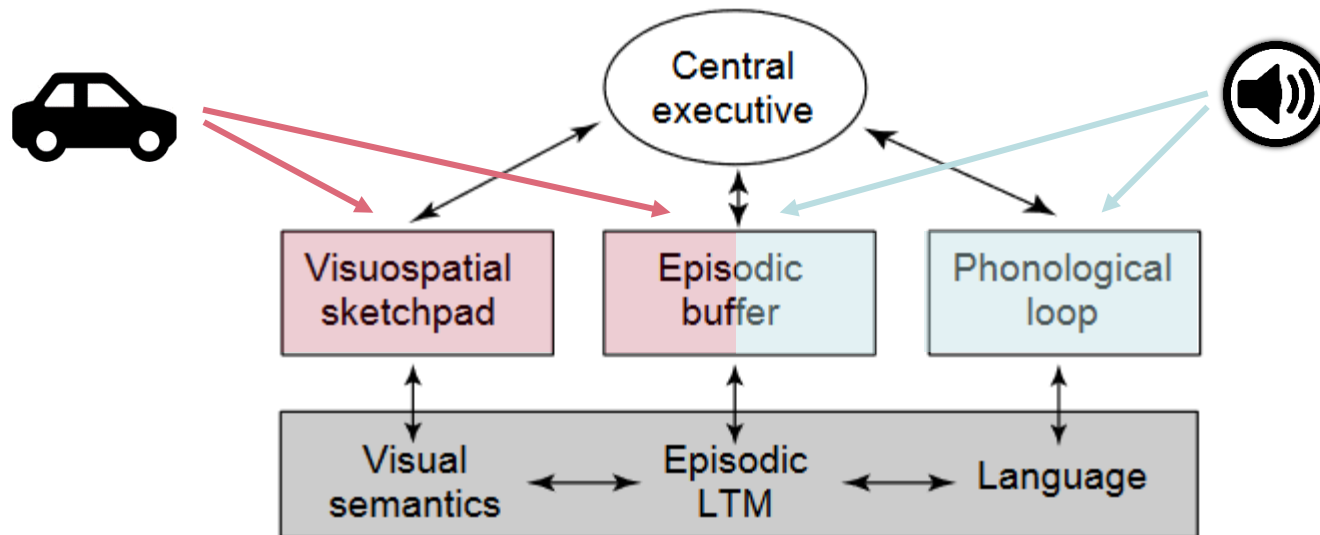
…there is evidence of an increase of that memory error by cognitive distraction

(e.g. Joordens, Spalek, Razmy, & van Duijn, 2004; Henning, 2009)

Distracion of Memory for Visual Information in Traffic

(Baddeley, 2000, p. 421)

- locations of objects are retrieved from the episodic buffer (Zimmer, Speiser, & Seidler, 2003)
- episodic buffer is involved in semantic processing of words (Nobre et al., 2013)
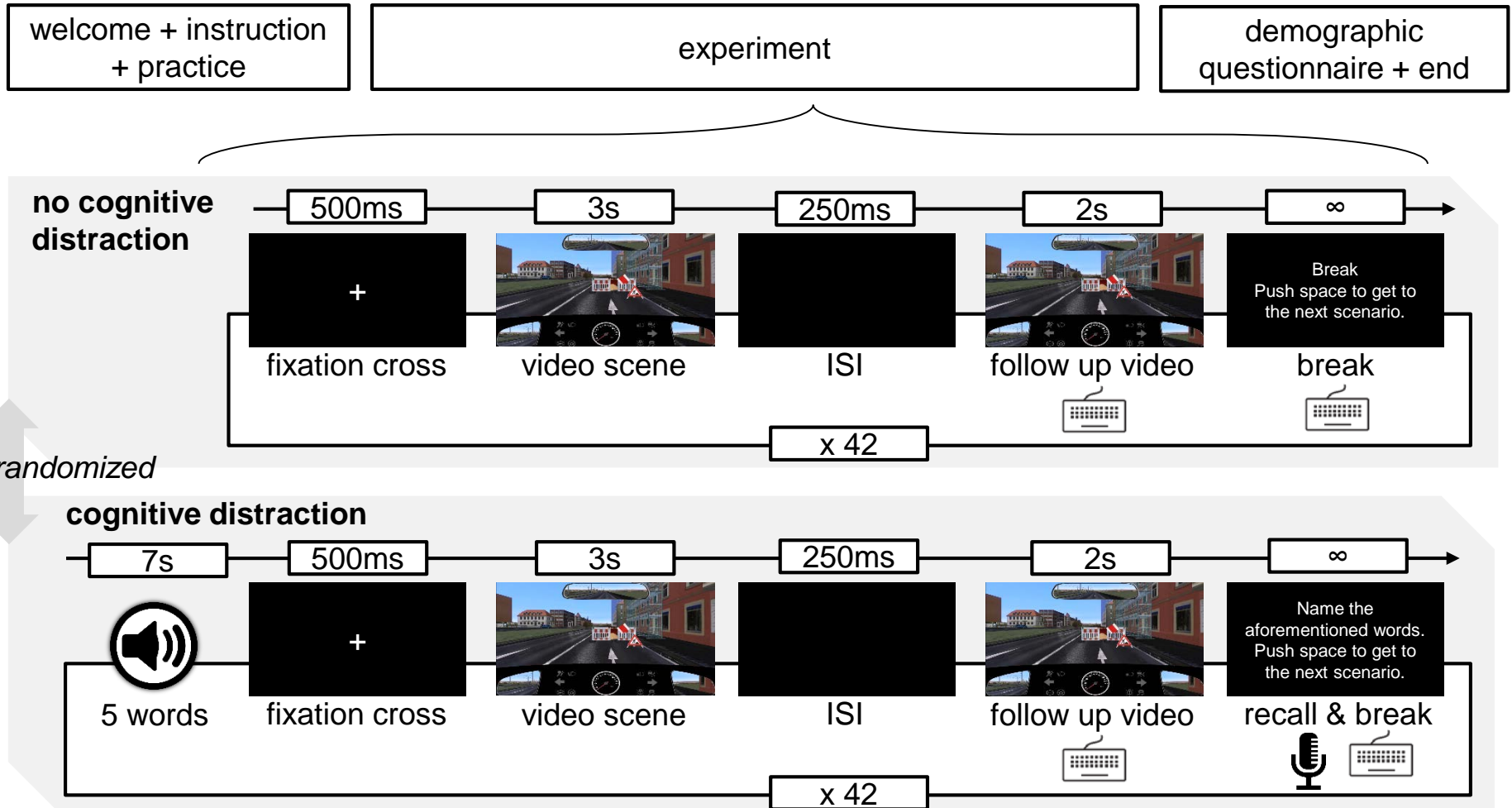
Motion Extrapolation in Dynamic Driving Scenarios

Does cognitive distraction has an influence on memory of dynamic information in urban space?

Motion Extrapolation in Dynamic Driving Scenarios

Procedure

welcome + instruction + practice	experiment	demographic questionnaire + end

no cognitive distraction

500ms	3s	250ms	2s	∞
fixation cross	video scene	ISI	follow up video	break

Break
Push space to get to the next scenario.

x 42

randomized

cognitive distraction

7s	500ms	3s	250ms	2s	∞
5 words	fixation cross	video scene	ISI	follow up video	recall & break

Name the aforementioned words. Push space to get to the next scenario.

x 42

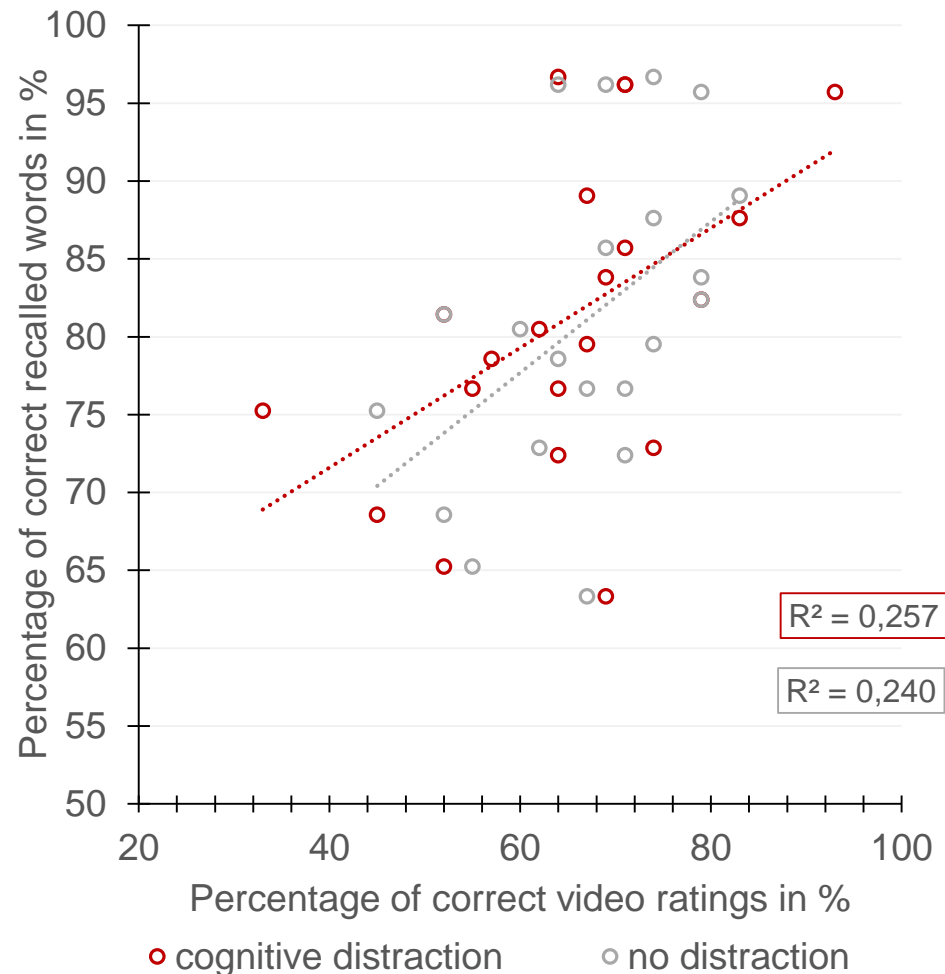# Motion Extrapolation in Dynamic Driving Scenarios

Results

N = 20 (13♂)

Age:
M = 26.4 years (SD = 3.1)

Driving License:
M =   8.4 years (SD = 3.4)

Motion Extrapolation in Dynamic Driving Scenarios

Results

$N = 20$ (13♂)

Age:
$M = 26.4$ years ($SD = 3.1$)

Driving License:
$M = $ 8.4 years ($SD = 3.4$)

Overall shift
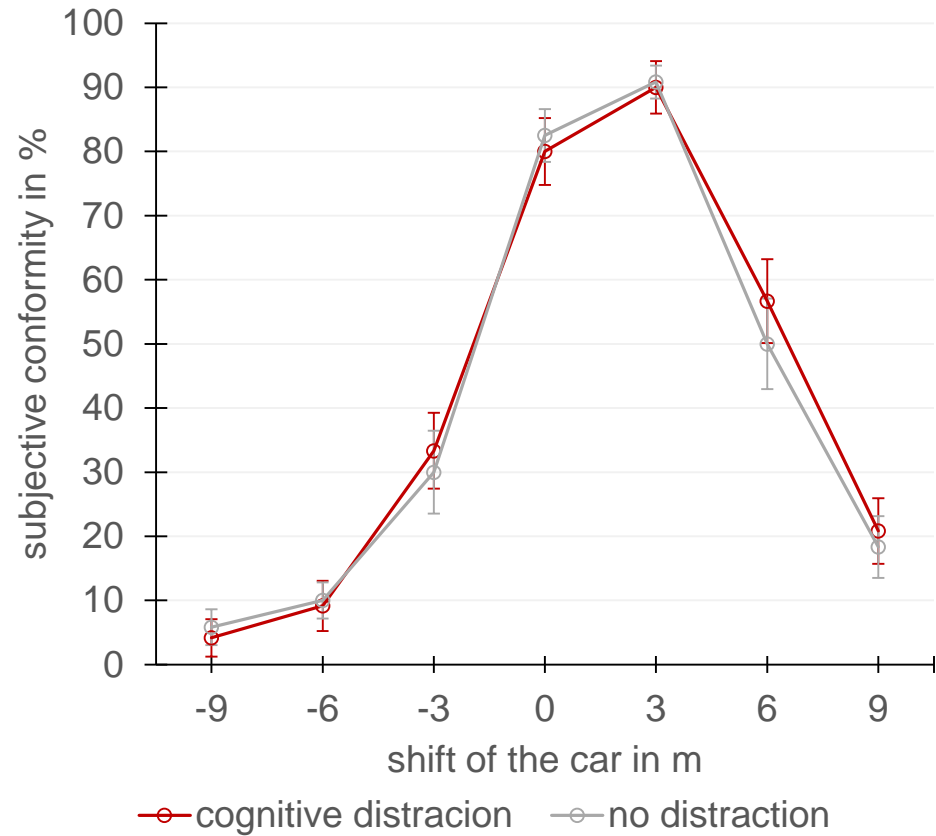*distracted:*   1,21m
not distracted: 1,13m
sign. difference from 0

$F(2.95, 55.95) = 72.39$, $p < .001$,
$\eta_p^2 = 0.79$

(Greenhouse-Geisser corrected)

Motion Extrapolation in Dynamic Driving Scenarios

Results

$N = 20$ (13♂)

Age:
$M = 26.4$ years ($SD = 3.1$)

Driving License:
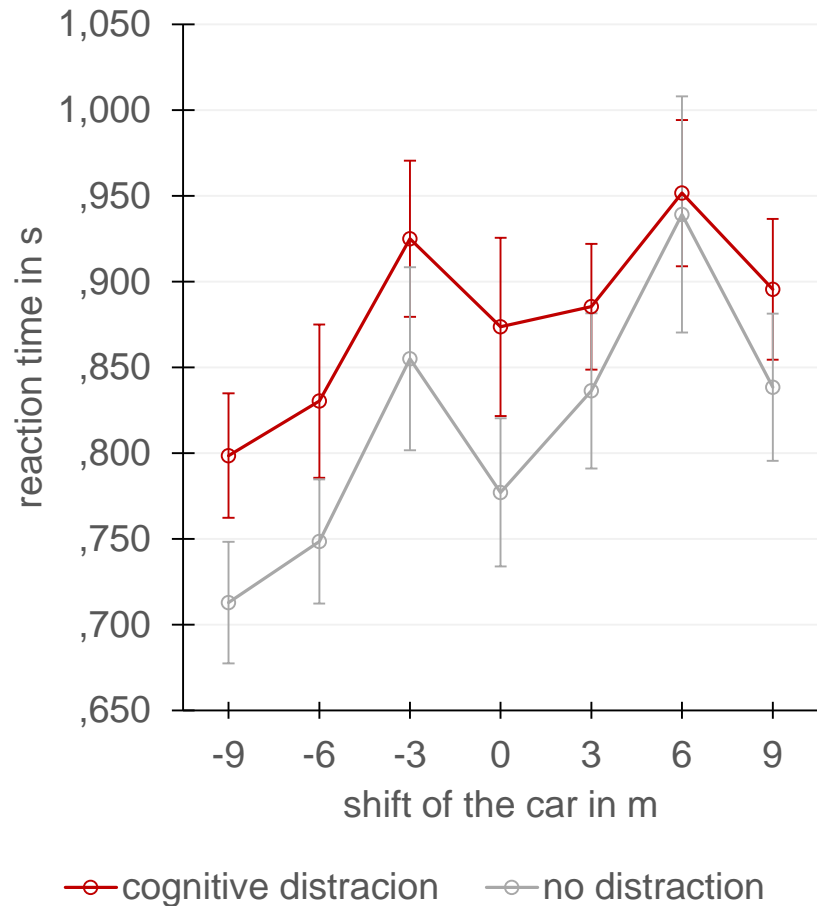$M =$ 8.4 years ($SD = 3.4$)

sign. effect of distraction
$F(1, 19) = 6.23$, $p < .05$,
$\eta_p^2 = 0.25$

sign. effect of shift
$F(3.15, 59.89) = 7.11$, $p < .001$,
$\eta_p^2 = 0.27$

Conclusion

- systematic error in memory for dynamic visual information in direction of motion

- forward shift is independend of cognitive distraction

- matching of visual information kept in memory with directly observable information causes longer reaction times while beeing cognitively distracted

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