

The Influence of Learned Versus Instructed Target Features on Attentional Control Settings

Markus Grüner¹, Florian Goller², Ulrich Ansorge¹



markus.gruener@univie.ac.at

<https://homepage.univie.ac.at/markus.gruener/>

 <https://orcid.org/0000-0002-0869-4081>

¹ University of Vienna, Austria

³ Austrian Marketing University of Applied Sciences



Top-down Influences on Visual Attention

- Visual Attention
 - Selective processing of visual information, facilitating some aspects over others (e.g., Carrasco, 2011)
- Top-down influence = influence of knowledge
 - Controlled orienting of attention (e.g., Helmholtz, 1894; Posner, 1980)
 - Involuntary orienting towards target-matching stimuli (Folk et al., 1992)

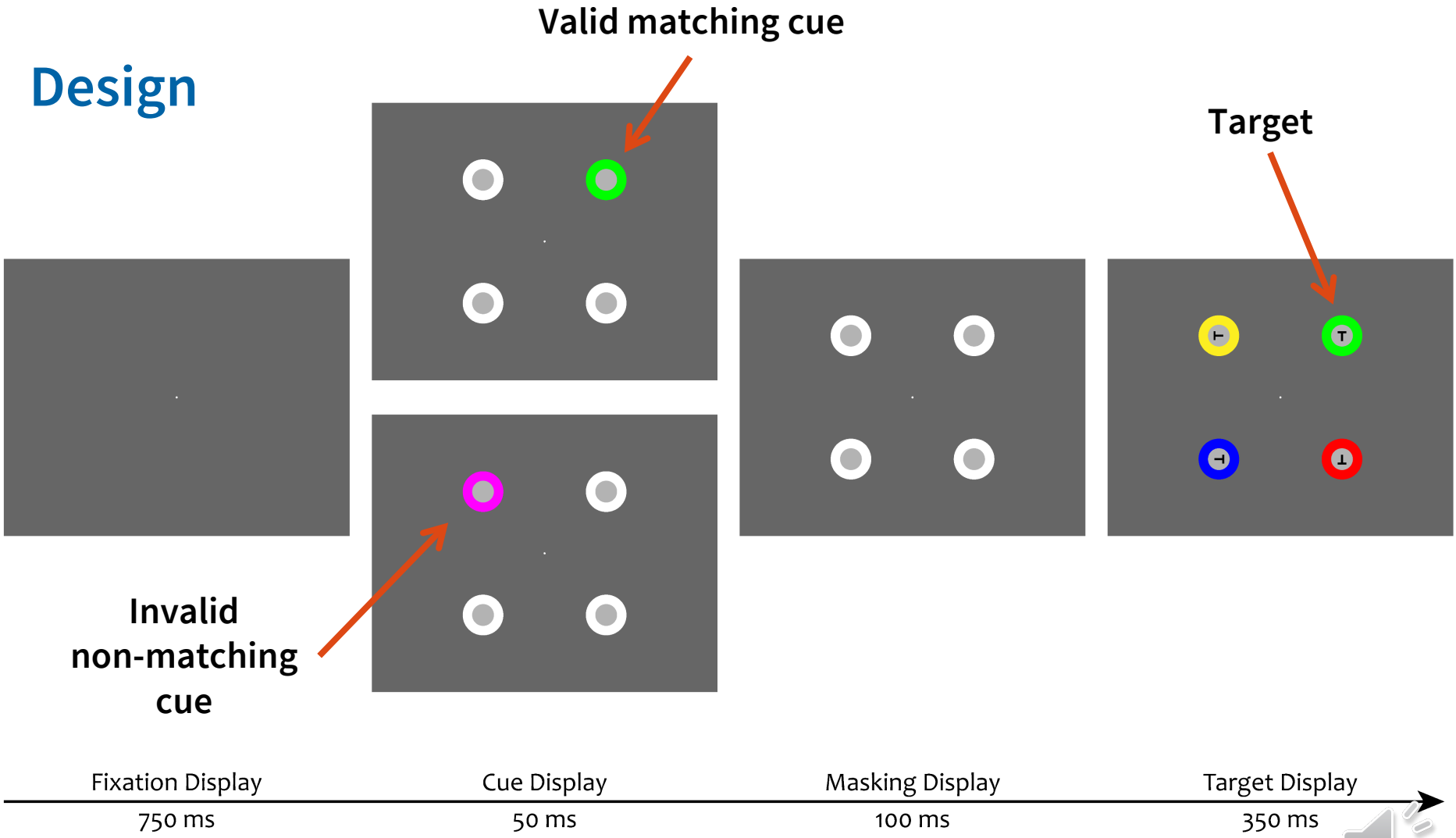
Difference between learning and instruction?

- Top-down attentional guidance is often investigated using visual search tasks
 - With adult humans: Instruction to search for a target (feature)
 - With pre-verbal humans and non-human animals: Learning the target (feature)
- Learning effects can influence visual attention independent of top-down effects
 - Statistical learning (Wang & Theeuwes, 2018)
 - Contextual cueing (Chun & Jiang, 1998)
 - Value-driven attentional capture (Anderson et al., 2011)
- Comparison might be flawed

Experiment 1

- Comparing the influence of learning and instruction on visual attention
- 21 participants (15 women, 6 men) between 19 and 39 years ($Mdn = 24$)
- Block 1: Learning the target feature
 - Via trial and error (positive feedback as reward)
- Block 2: Instruction to search for the target feature

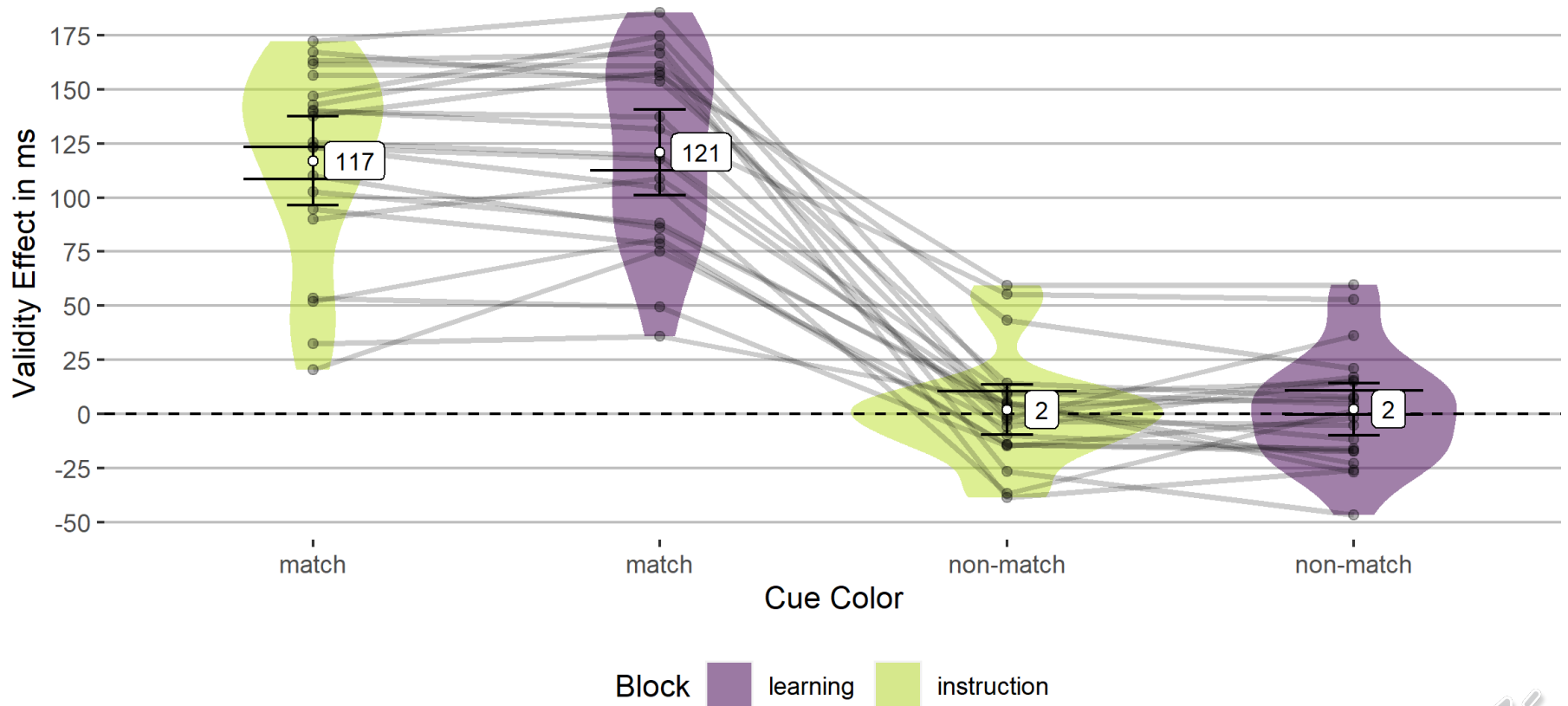
Design



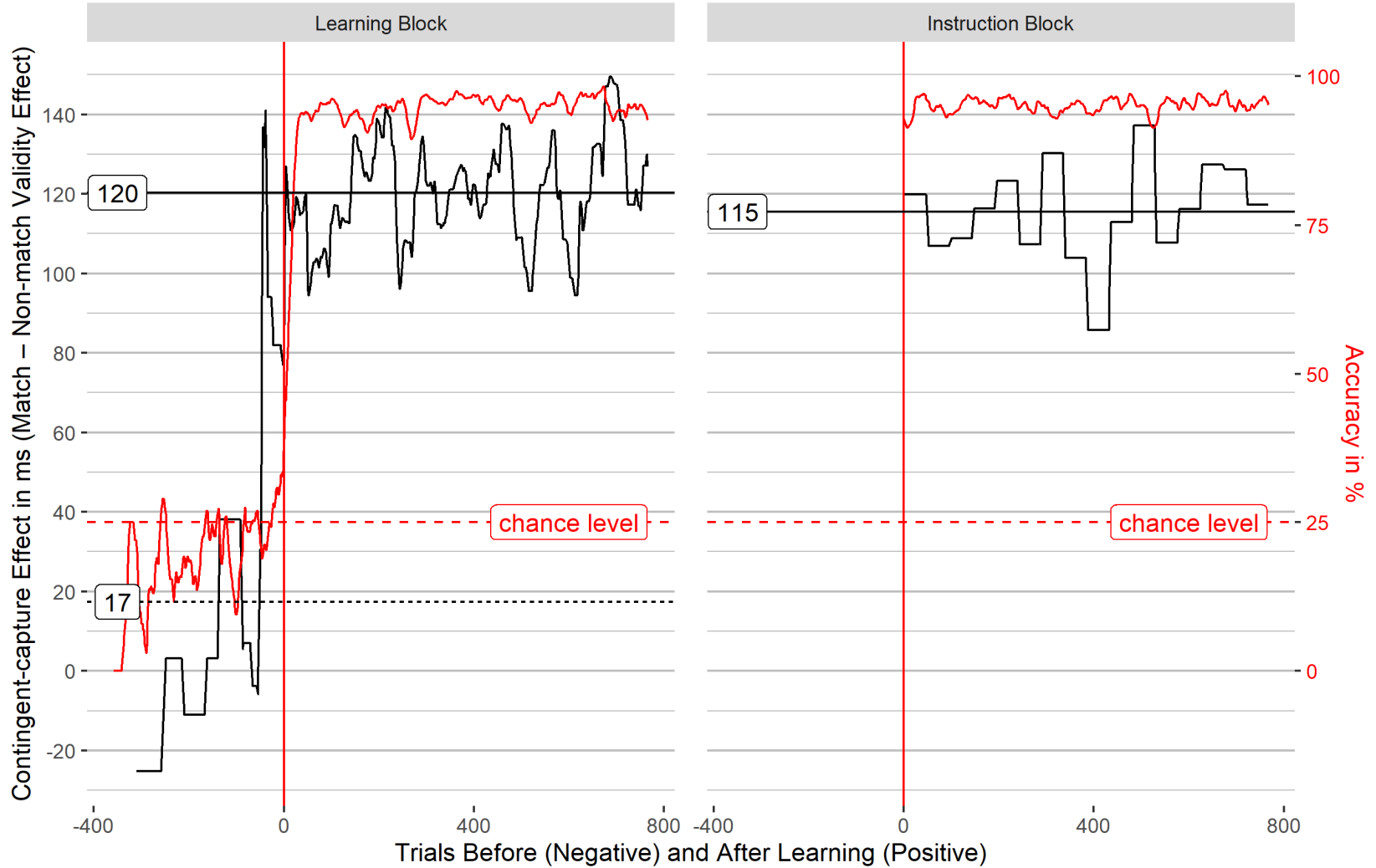
Data Analysis

- Validity effects for each cue condition (match vs. non-match)
 - Mean reaction time differences between invalid and valid trials
 - Valid = cue appeared at the **same** position as the target
 - Invalid = cue appeared at the **different** position as the target
- Positive validity effects indicate attentional capture by the cue
- Accuracy
 - Rolling mean of correct responses during the last 20 trials.

Validity Effects (Invalid Minus Valid Reaction Times)



Learning Curve and Contingency Effect in Experiment 1



— Accuracy — Contingency Effect — learned - - - - not learned

Discussion

- Only matching cues captured attention
- No difference between learning and instruction
- The learned stimulus had no other value except defining the target
- Learning this association results in knowledge about the target feature
 - As does the instruction
- Learning via trial-and-error might work as an indirect instruction

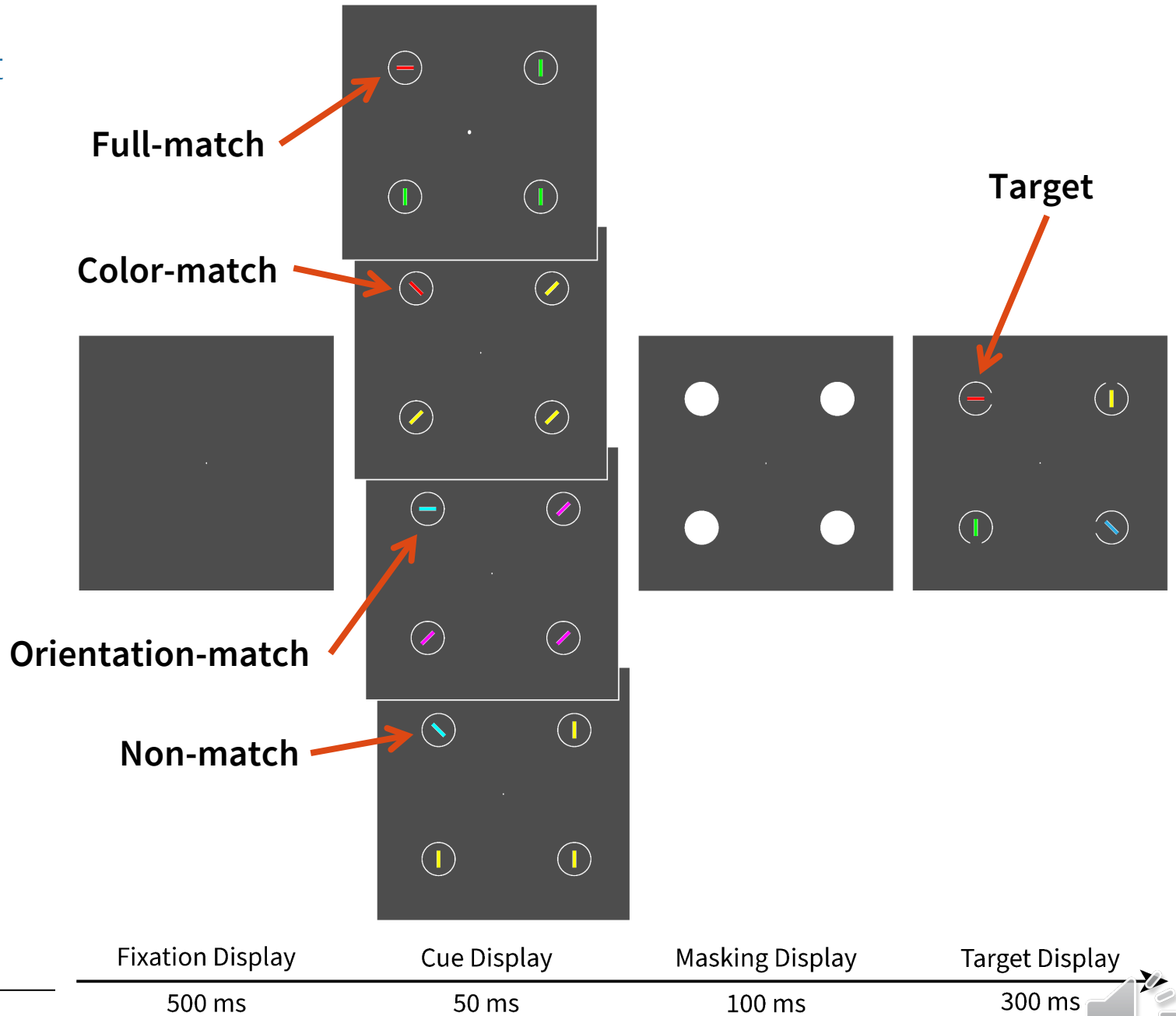
What aspects distinguish learning and instruction?

- Instruction creates knowledge about the search criterion
 - Influence should be highly dependent on using that search criterion
- Learning influences attention independent of the used search criterion
 - Learning effects do not vanish when the search criterion changes

Experiment 2

- Combining spatial cueing with a redundant relevant cue task (Trabasso & Bower, 1968)
- The target is defined by two features, color and orientation
 - Each feature is enough to identify the target
- 23 participants (19 women, 4 men) between 18 and 30 years ($Mdn = 20$)

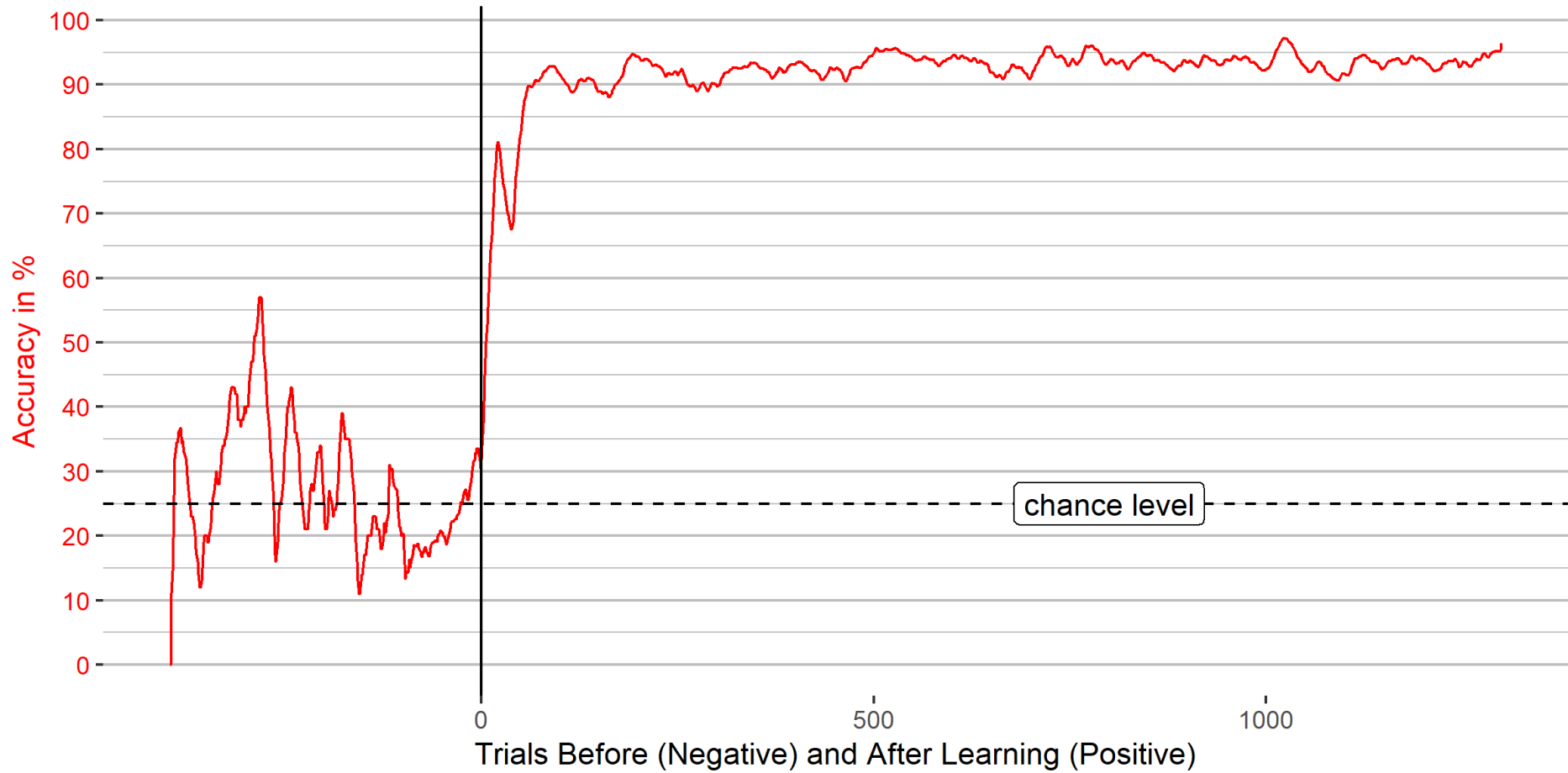
Design



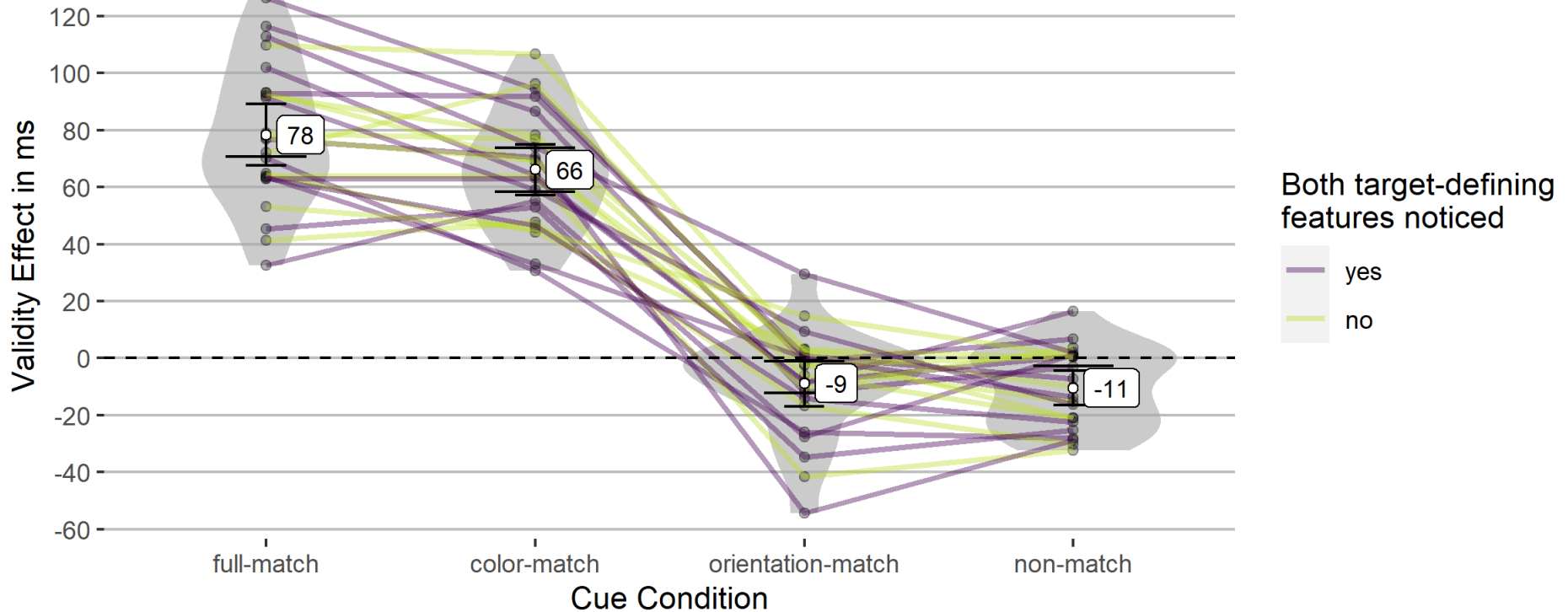
Learning Results

- All participants reported learning first the color as target-defining
- 13 (from 23) noticed additionally orientation as target-defining

Learning Curve in Experiment 2



Validity Effects (Invalid Minus Valid Reaction Times)



Influence of noticing both target-defining features

Contrast	<i>M</i> (<i>SD</i>)	95% CI	<i>t</i> (<i>df</i>)	<i>p</i>	<i>d_{unb}</i>	95% CI
full-match – color-match						
Both features noticed	18 (20) ms	[6, 30]	3.17(12)	.032	0.82	[0.22, 1.51]
Only color noticed	5 (14) ms	[-5, 15]	1.11(9)	.595	0.32	[-0.3, 0.98]
orientation-match – non-match						
Both features noticed	-2 (18) ms	[-13, 9]	-0.45(12)	.662	-0.12	[-0.67, 0.42]
Only color noticed	7 (12) ms	[-2, 15]	1.78(9)	.327	0.51	[-0.12, 1.22]

Diskussion

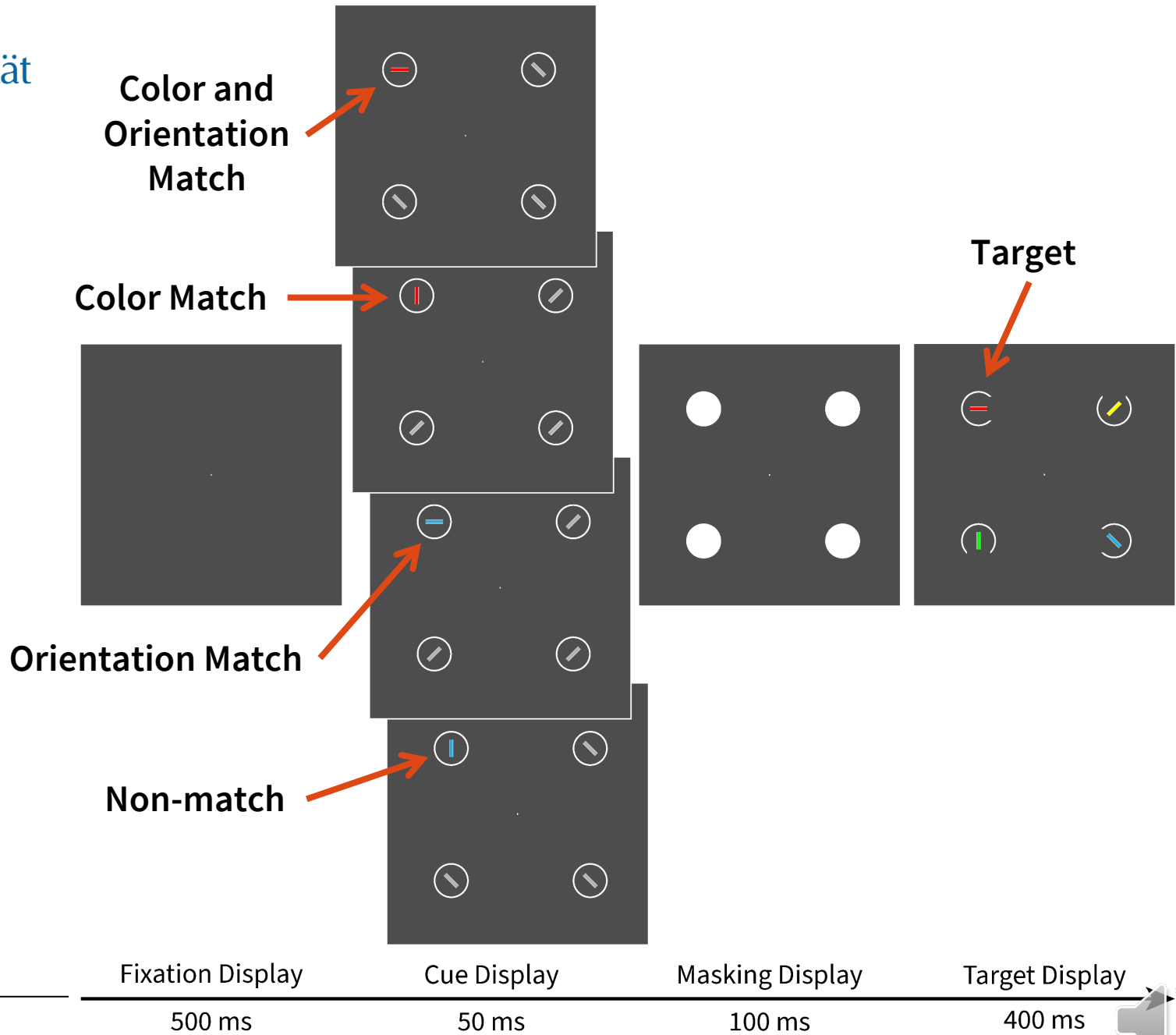
- Attentional capture contingent on search criterion
- Small effect of noticing both target-defining features (a learning effect?)
 - only additionally to the top-down matching feature
- No effect of the non-used target feature
 - No evidence for priming effects

- Learning = indirect instruction?
 - Learning effects have an prolonged influence on attention
 - Top-down effects should change swiftly if the search criterion changes

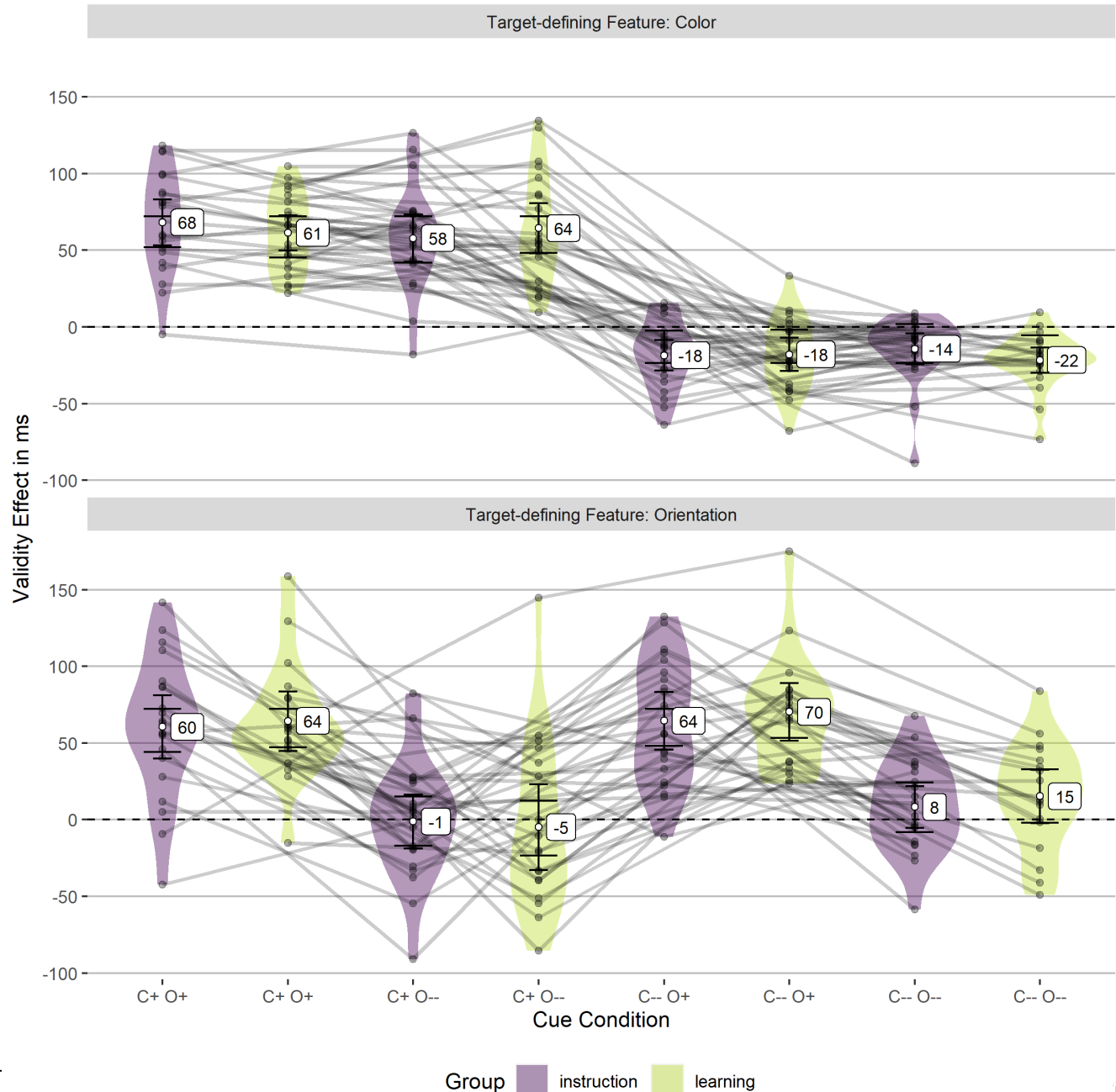
Experiment 3

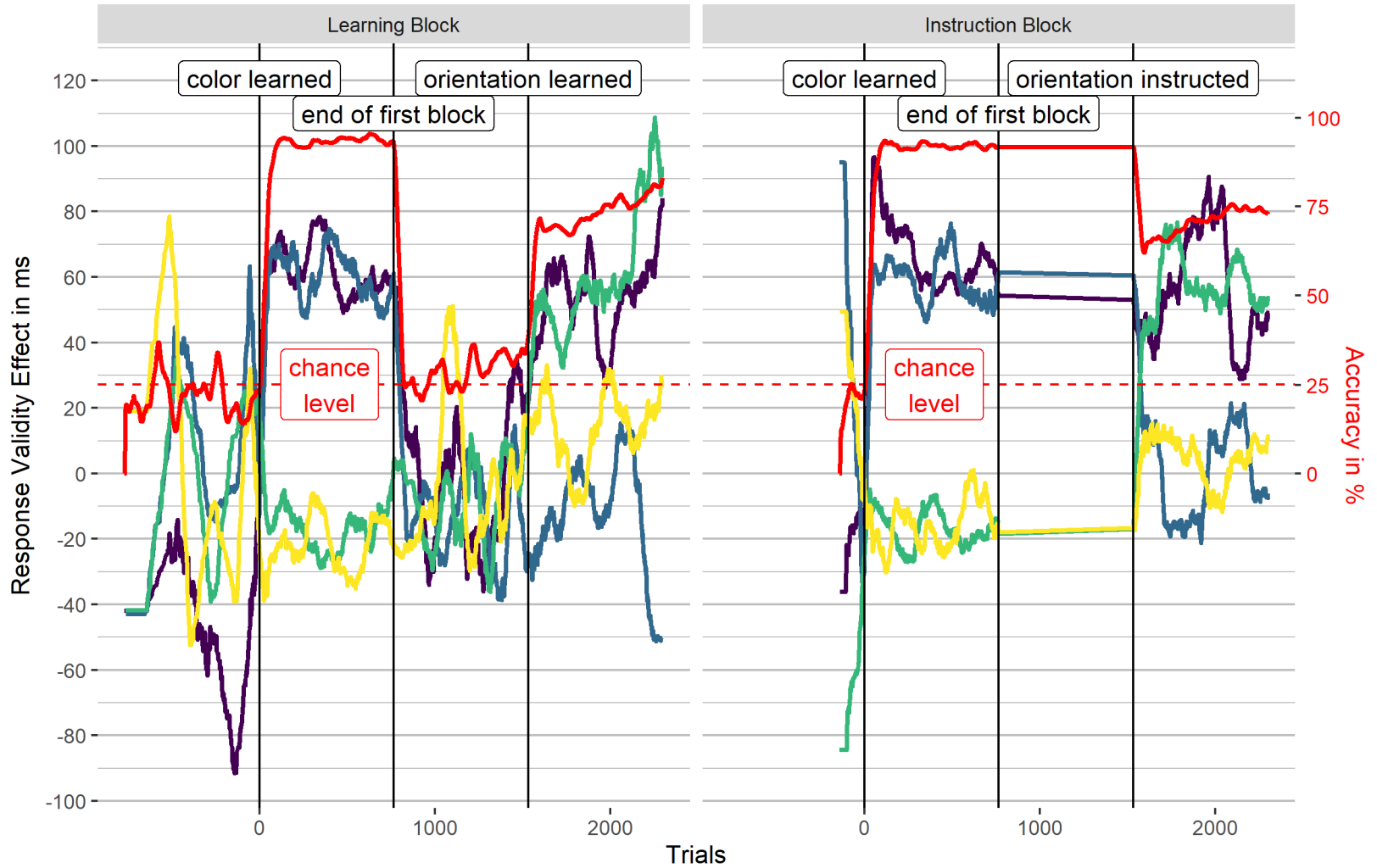
- Changing target-defining feature in Block 2
 - First color, then orientation
- Between-participants groups Learning vs. Instruction
 - Learning new feature (orientation)
22 participants (18 women, 4 men) between 18 and 26 years ($Mdn = 20.50$)
 - Instruction of new feature (orientation)
21 participants (15 women, 6 men) aged between 18 and 30 years ($Mdn = 20$)

Design



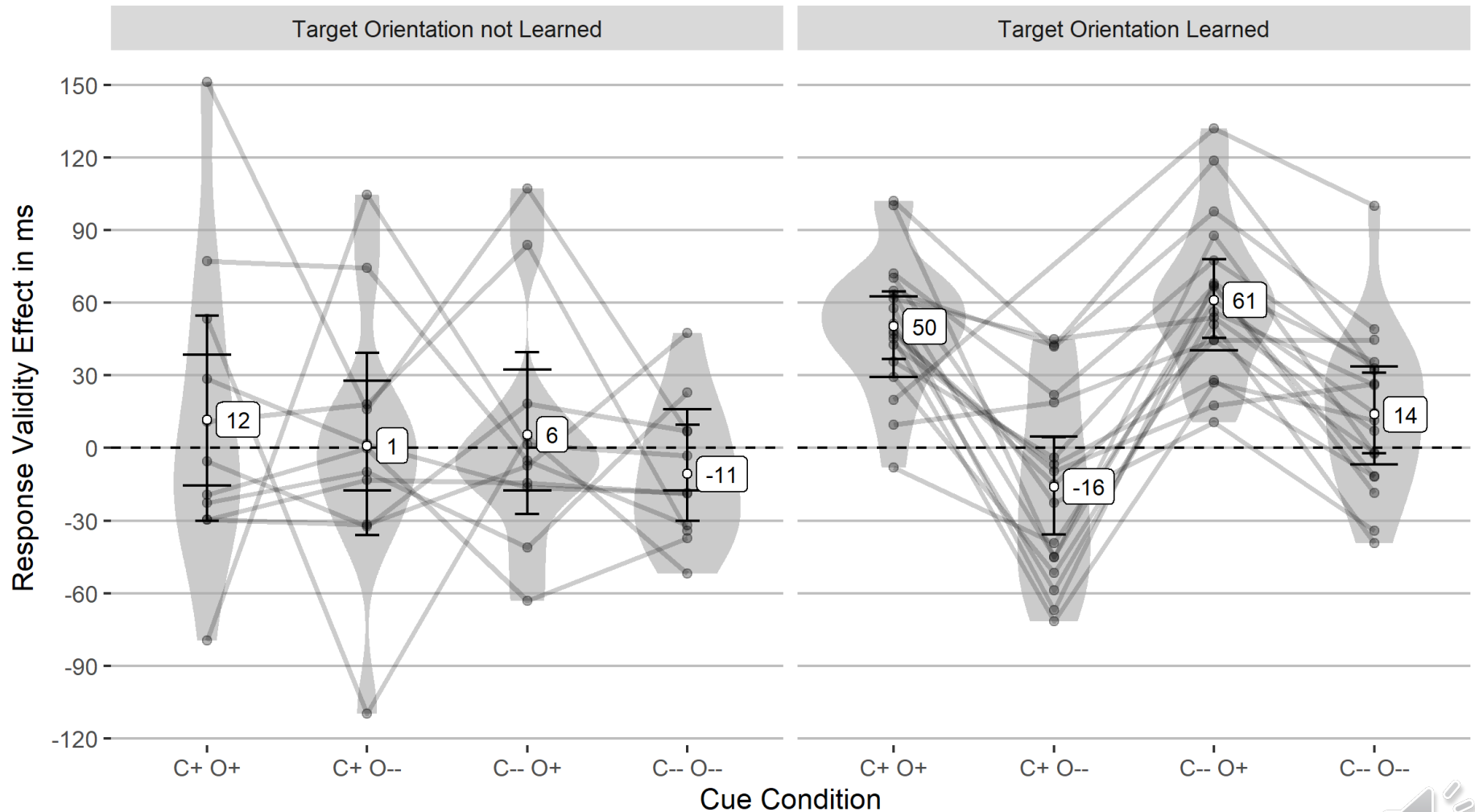
Validity Effect (Invalid Minus Valid Reaction Times)





■ C+ O+
 ■ C+ O-
 ■ C- O+
 ■ C- O-

Validity Effects before and after orientation is learned



General Discussion

- Our results indicate that learning elicited the same attentional control settings as instruction
 - Learning = indirect instruction?!
- Studies using instruction and learning might investigate the same (top-down) attentional mechanisms
 - As long as the target feature is completely predictive
 - The only value of the target feature is being target-defining

References

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