

Task Irrelevant Semantic Relationships Between Sounds and Images Modulate Attention



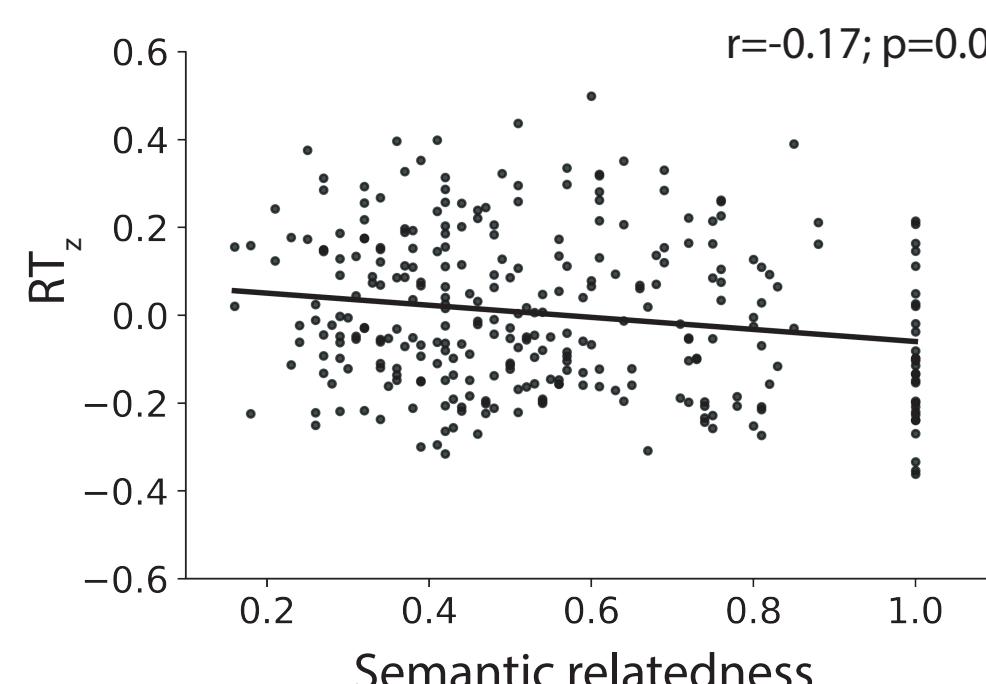
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Is audiovisual semantic guidance automatic or does it depend on task?

Semantic information is crucial for attention in real world environments¹

Visual targets are found more quickly in a search task when participants hear a semantically related sound²

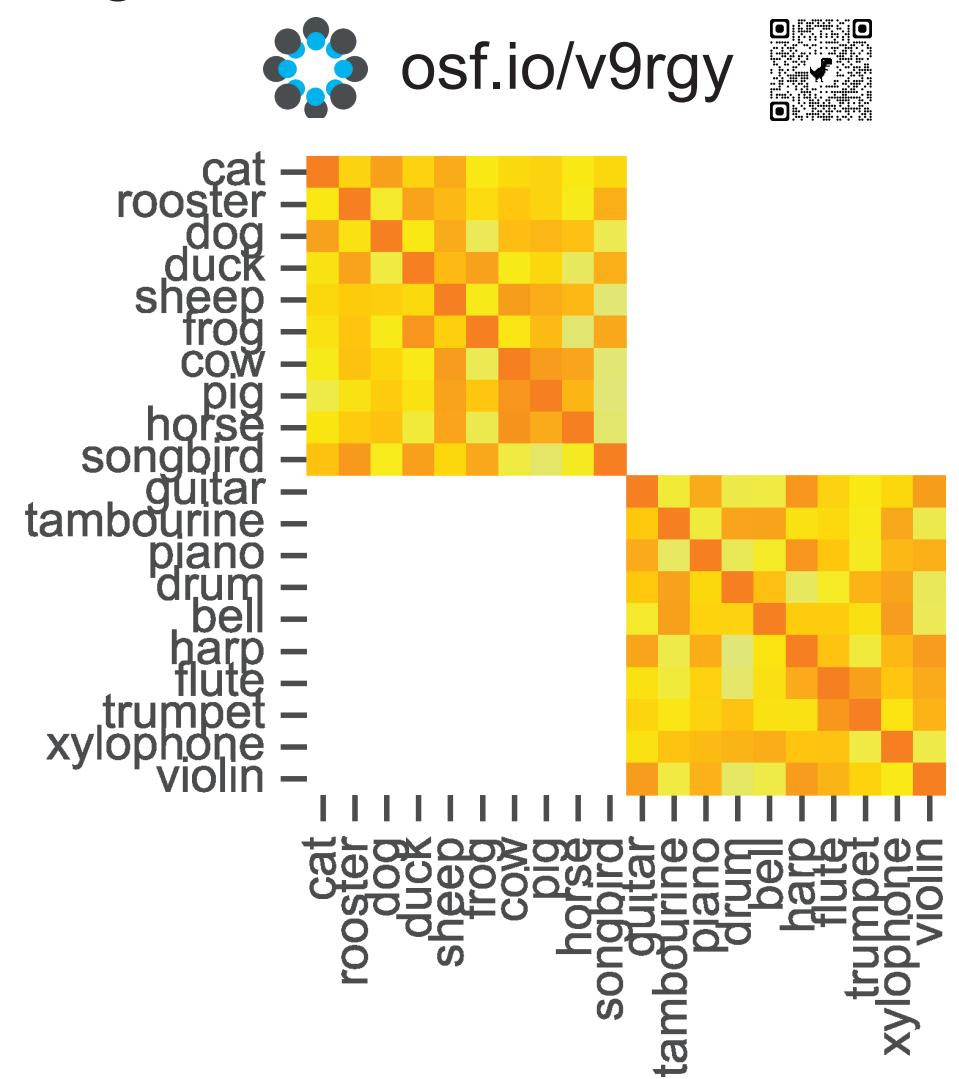


Is semantic influence on attention automatic or task dependent?

Quantifying audiovisual semantic relatedness

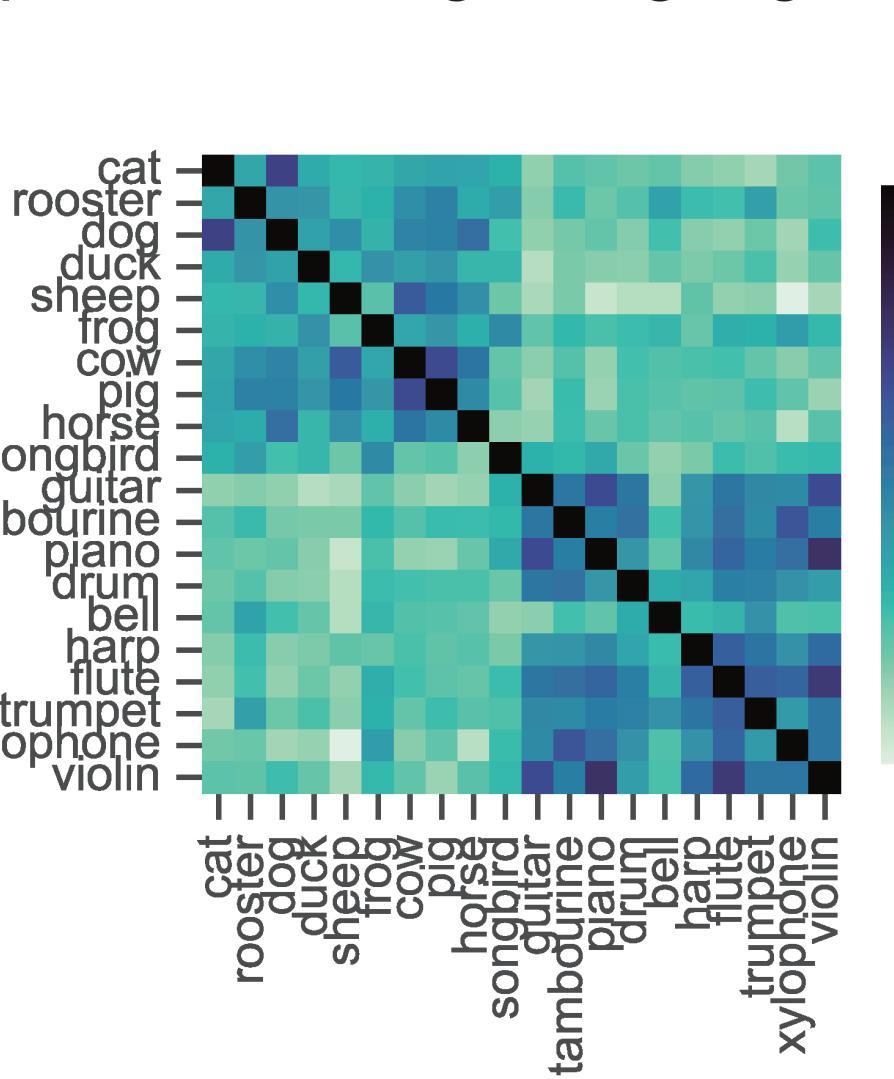
Human judgments

Sight Sound Semantic Database³



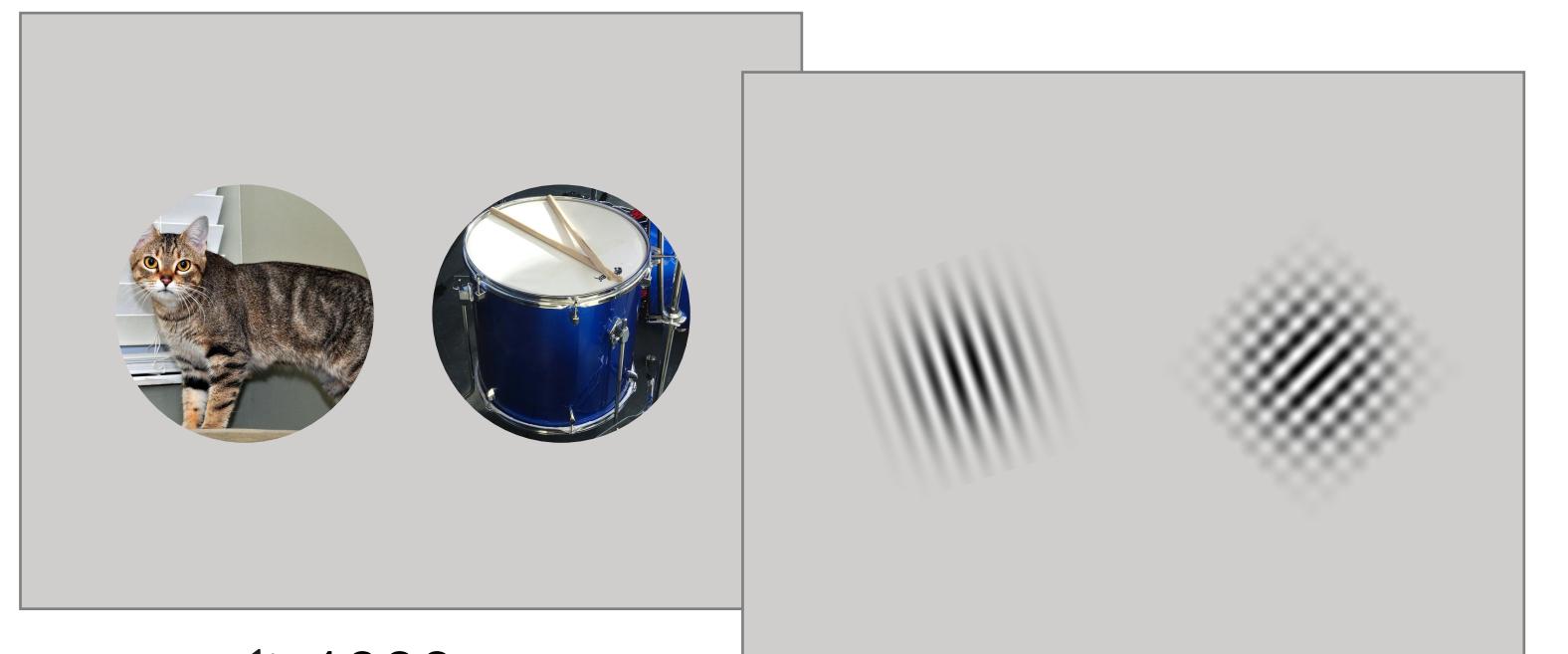
Text Corpora Similarity

pretrained large language model⁴



Semantic sound modulation on orthogonal task

Task: Is the Gabor clockwise or counterclockwise of vertical?



Sound matches either cat or drum
Until response or 5000 ms

Time



Sound congruent

VALID

INVALID

NEUTRAL



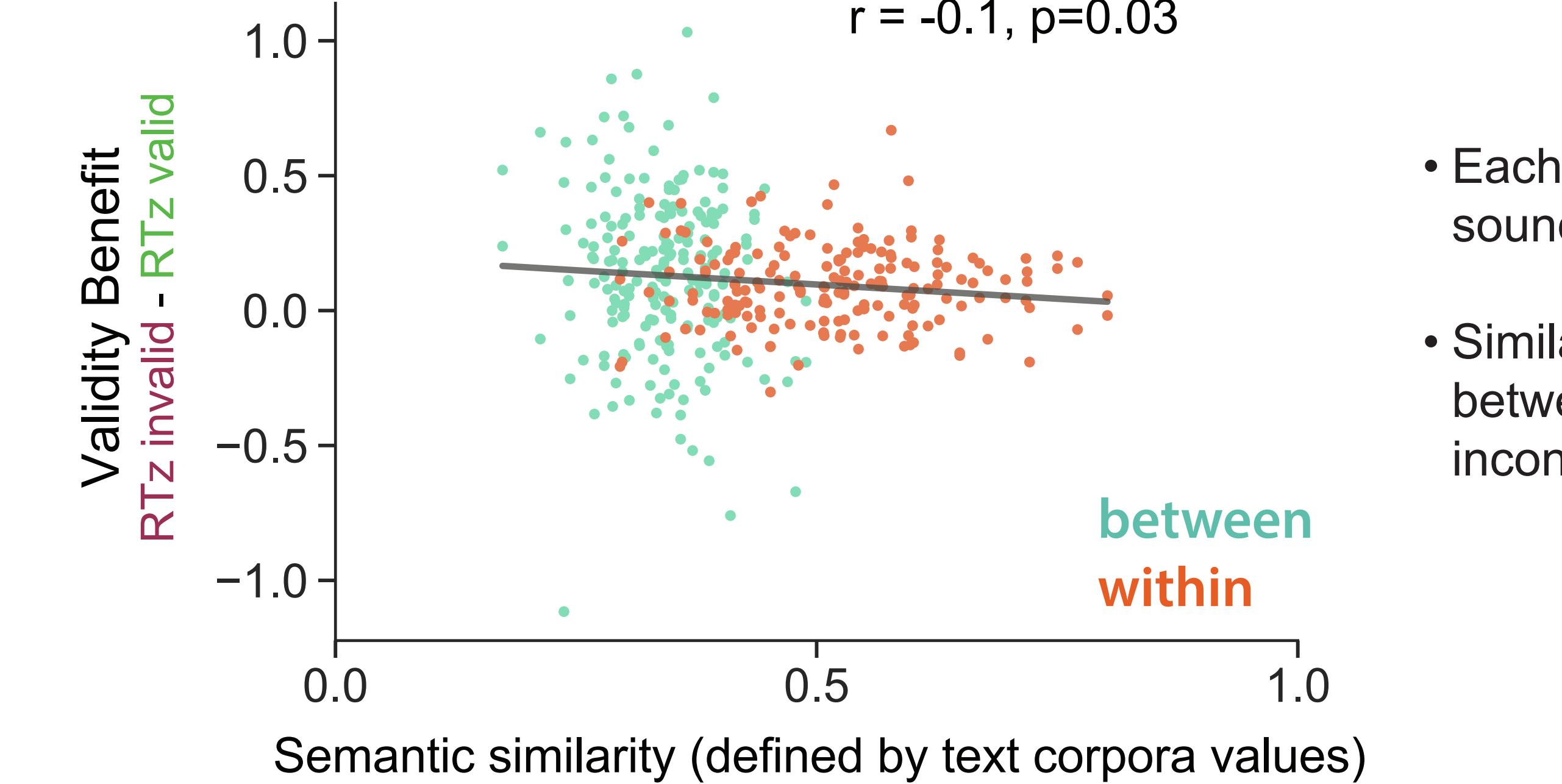
Between category

(n=150)
- 1 instrument, 1 animal

Within category

(n=200)
- 2 instruments or 2 animals
- Neutral condition

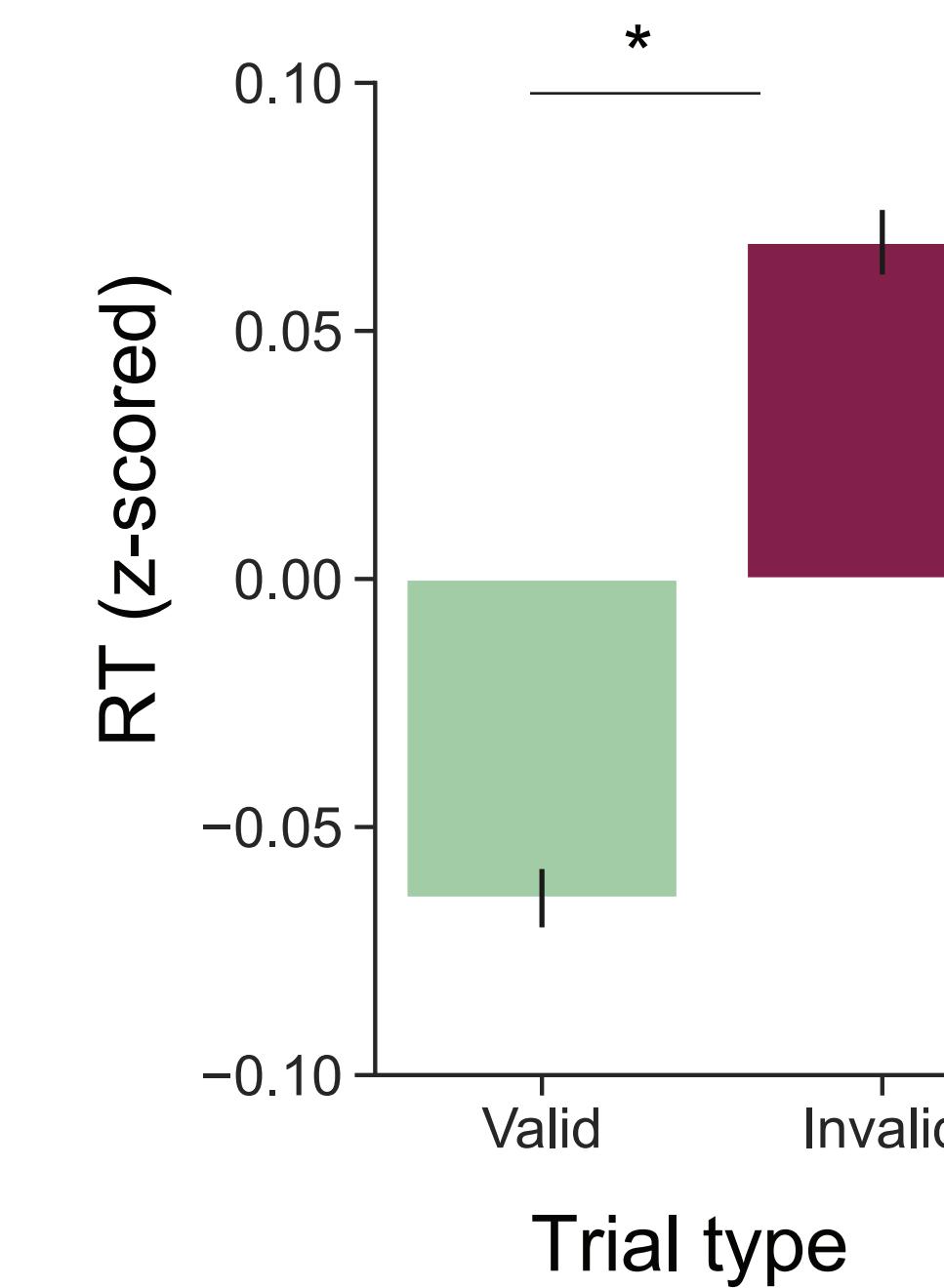
Validity benefit scales with semantics, within category



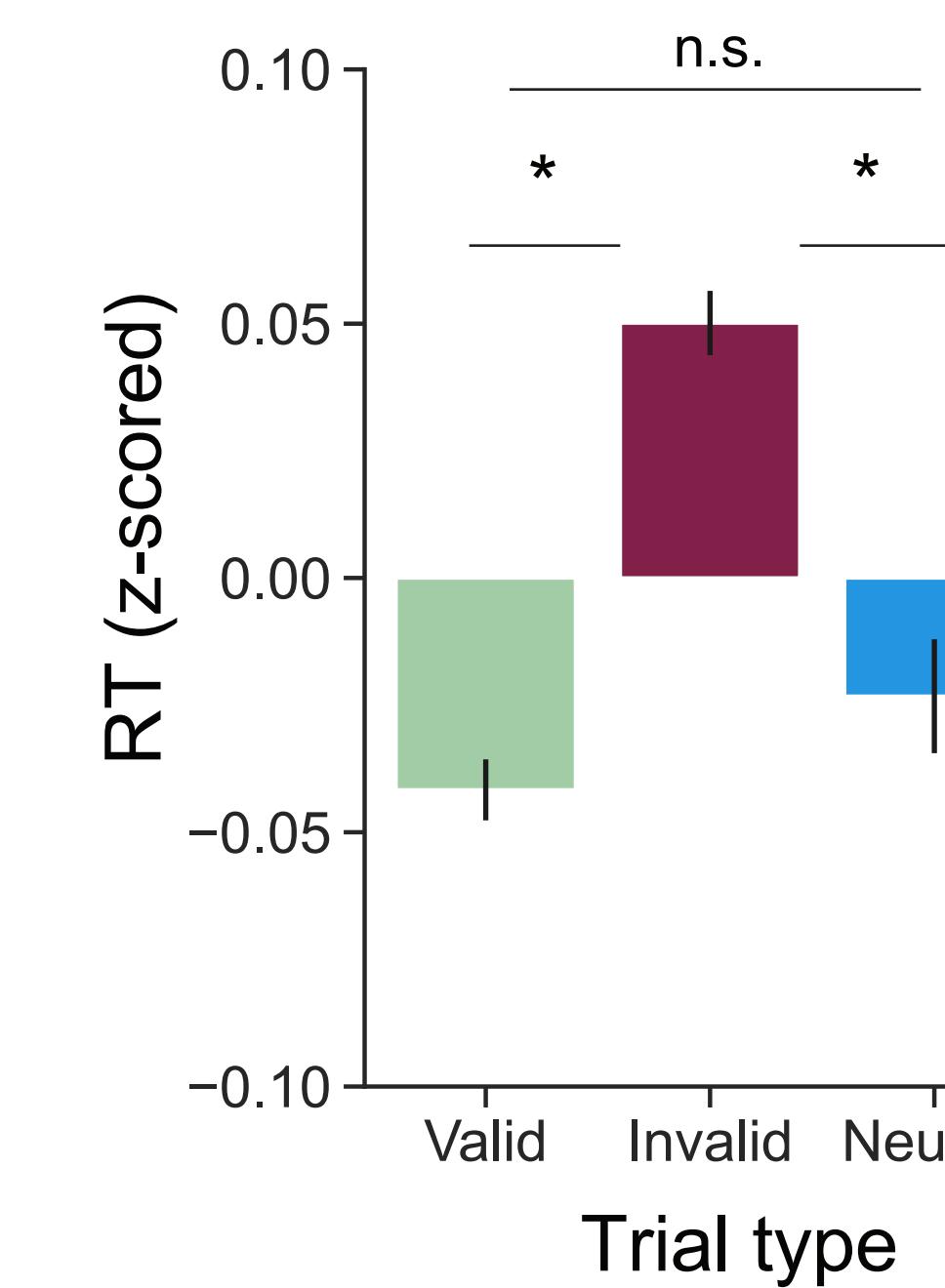
- Each point is a sound-image pair
- Relatedness is between sound & incongruent image

Faster response for targets at sound congruent locations

Between Category



Within Category



Conclusions

Search efficiency is modulated by audiovisual semantic relatedness, **even when task irrelevant**

The audiovisual semantic benefit:

- is **not specific to search** for a specific semantic identity
- can modulate behavior on an orthogonal low level visual task

Leading to larger theoretical implications, such as:

- Sound modulates visual attention **automatically**
- Attentional prioritization is **dynamic and highly contextual**

Future questions

What neural mechanisms underpin attentional prioritization for semantically related sounds & images?

Are attentional prioritization maps multisensory in nature?

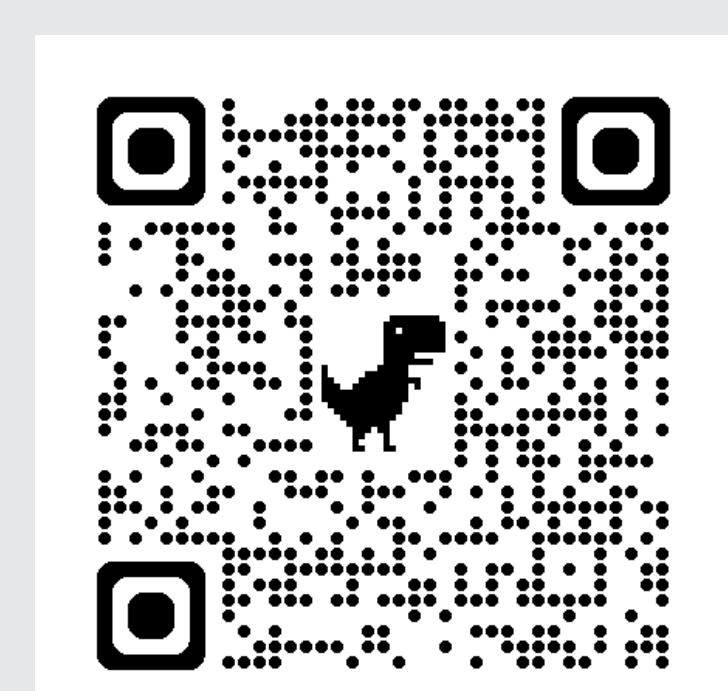
Can visual information modulate attentional priority for auditory signals?

References

- (1) Malcolm, et al 2016 (2) Wegner-Clemens, et al, in prep
(3) Wegner-Clemens, 2022 (4) Mikolov, et al 2017

Acknowledgments

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NSF BCS-1921415 to SS,
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