Task Irrelevant Semantic Relationships Between Sounds and Images Modulate Attention

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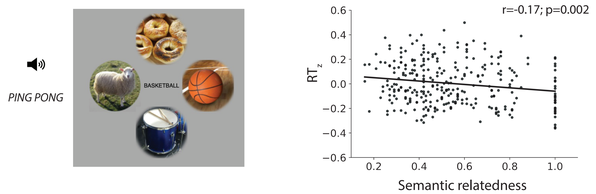
Is audiovisal semantic guidance automatic or does it depend on task?

Semantic information is crucial for attention in real world environments[1]

Visual targets are found more quickly in a search task when participants hear a semantically related sound[2]



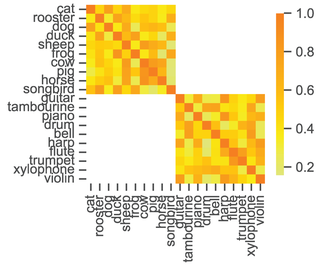
Does this guidance depend on search for a semantic identity or is an automatic and ongoing prioritization of semantic related images?

Quantifying audiovisual semantic relatedness

Human judgments

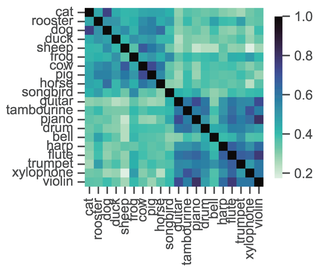
Sight Sound Semantic Database[3]

osf.io/v9rgy



Text Corpora Similarity

pretrained large language model[4]



Measuring sound's influence on orthogonal task

Task: Is the Gabor clockwise or counterclockwise of vertical?

PREREGISTERED

1000 ms

Sound matches either cat or drum

Until response or 5000 ms

Time

Between category (n=150)
- 1 instrument, 1 animal

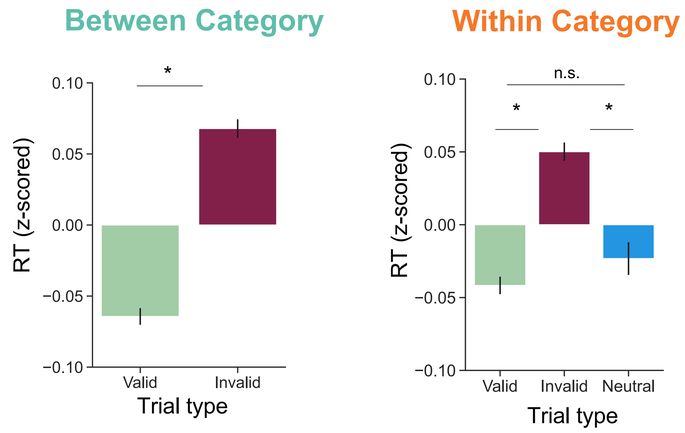
Within category (n=200)
- 2 instruments or 2 animals,
- Neutral condition

• 400 trials

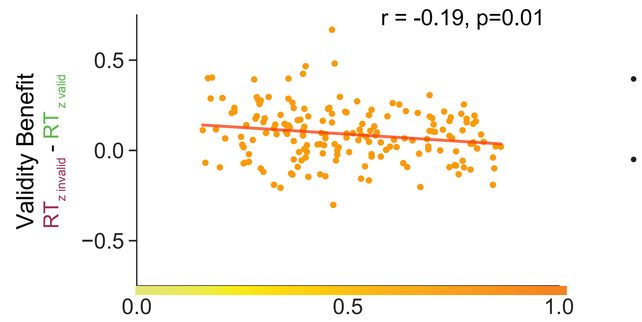
Sound congruent

Target

Faster response for targets at sound congruent locations



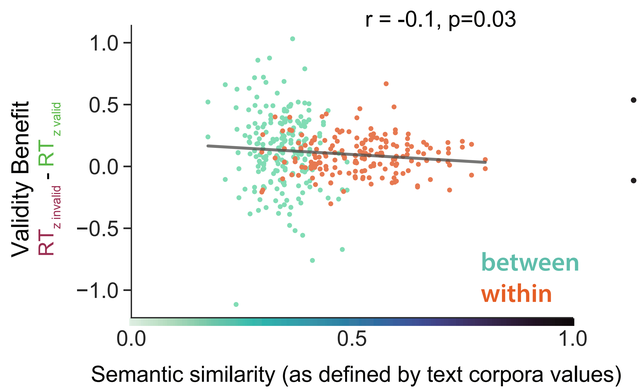
Validity benefit scales with semantics, within category



• Each point is a sound-image pair

• Relatedness is between sound & incongruent image

Validity benefit scales with semantic similarity, within and between category



• Each point is a sound-image pair

• Similarity is between sound & incongruent image

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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