Do sounds affect how you see?

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RATIONALE

Semantically congruent sounds speed up visual search for related object targets in arrays [1] and videoclips of naturalistic scenes [2].

Interactions between visual and auditory inputs could occur via:

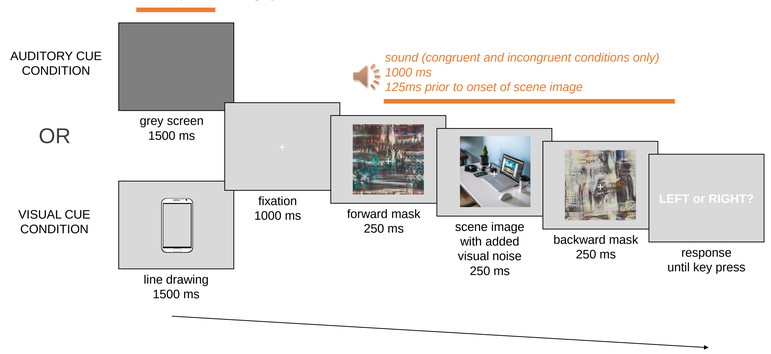
- direct route – sounds directly prime a visual representation [3] or
- indirect route – through an intermediate semantic representation [4].

QUESTIONS

1. Does a semantically congruent sound to a visual target object guide visual search in real-world static scenes?
2. Is an audio-visual cross-modal semantic association the result of a direct link between the modalities or via intermediate a semantic representation?
3. What can a neural network model tell us about cross-modal interactions at the semantic level?

METHOD – BEHAVIOURAL STUDY

- 30 participants (14 males, 16 females, aged 19 to 38).
- 240 real-world scenes, 16 target objects and 21 real-world sounds.
- 2 cue conditions (auditory, visual) for two experimental groups.
- 3 experimental conditions (congruent, incongruent, absent) across 240 trials.



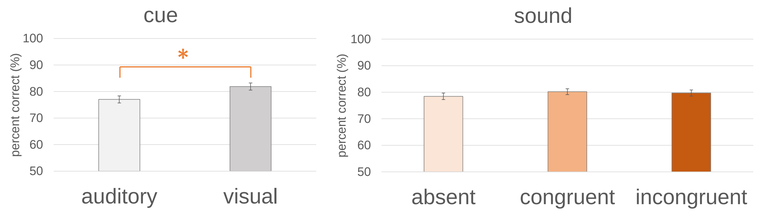
CONCLUSIONS

- Semantically congruent sounds enhance the salience of a visual object, effectively guiding attention during visual search.
- Sounds may activate a visual representation indirectly through an intermediate semantic representation.
- Semantic congruency may only facilitate visual search when audio-visual stimulus is task-relevant [1, 2].
- Semantic audio-visual interactions are the result of learned associations from repeated experiences of semantically congruent audio-visual stimuli.

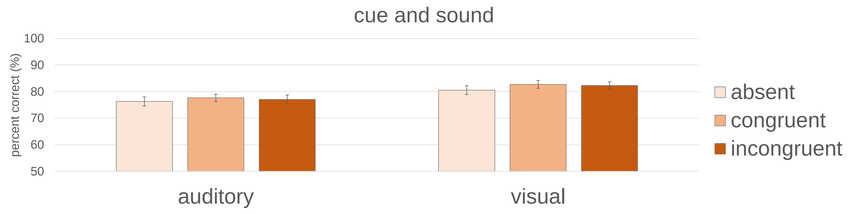
RESULTS – BEHAVIOURAL STUDY

Accuracy:

- Significant main effect of cue condition, F(1, 28) = 7.150, p = .012, η_p^2 = .203.
- No significant effect of sound condition, F(2, 56) = 1.472, p = .238, η_p^2 = .050.

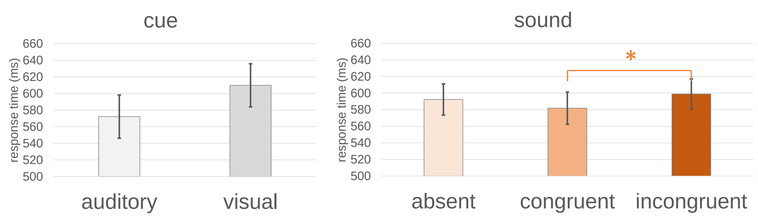


- No significant interaction effect between cue and sound conditions, F(2, 56) = .130, p = .878, η_p^2 = .005.

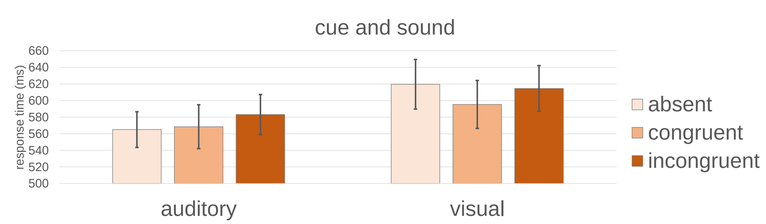


Response Times (RTs):

- No significant main effect of cue, F(1, 28) = 1.046, p = .315, η_p^2 = .036.
- Significant effect of sound, F(2, 56) = 3.346, p = .042, η_p^2 = .107.
- Planned contrasts revealed that RTs for congruent sounds were not significantly faster than for absent sound, F(1, 28) = 2.965, p = .096, η_p^2 = 0.96, but congruent sounds were significantly faster than for incongruent sounds, F(1, 28) = 7.069, p = .013, η_p^2 = .202.

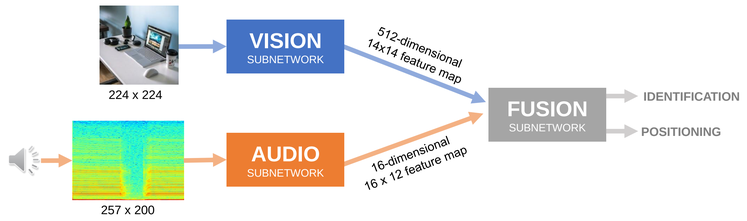


- Interaction effect between cue and sound on RTs for correct responses was close to statistical significance, F(2, 56) = 2.537, p = .088, η_p^2 = .083.
- However, pattern of results indicate a different effect of audio-visual interaction on search depending on the target cue modality.



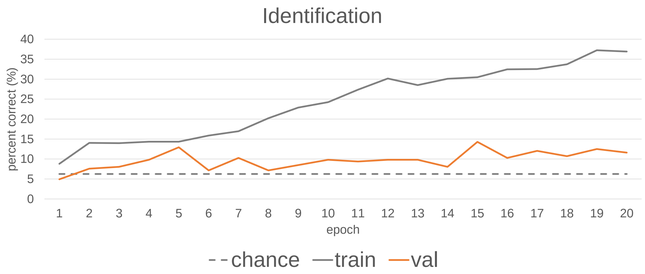
METHOD – COMPUTATIONAL MODEL

- Stimuli from behavioural study (256 images, 21 sounds) were used.
- Neural network inspired by AVOL-Net [5].

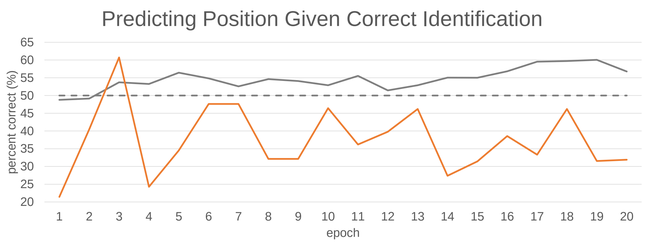


RESULTS – COMPUTATIONAL MODEL

- Model is unable to generalise to the validation set.
- Accuracy for identification during validation does not increase in the same way as during training indicating the network memorises but does not learn.



- Accuracy for predicting position of correctly identified visual targets is at chance.



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