Audio-visual interactions during motion adaptation modulates the perceived duration of the motion aftereffect and the brain activity in hMT+

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1 Introduction

In our previous psychophysical study[1] exploiting the motion aftereffect (MAE), an illusionary motion caused by adaptation to physical motion, [2], adaptation to visual motion accompanied by auditory motion with the congruent direction enhanced the intensity of the subsequent visual MAE, suggesting audio-visual interactions relatively early in the visual pathway.

2 Methods

Participants
9 participants (3 males, ages: 23-30)

Stimuli
[Visual Stimuli]
- Random-dot kinematogram (RD麻将) moving leftward or rightward presented in a circular aperture (4 degs of visual angle; 100% coherence)

[Auditory Stimuli]
- 2s of moving sound (leftward or rightward) generated by simulating inter-aural intensity differences in white noise (sampling rate: 44.1kHz)

Sound conditions
- Congruent (C)
- Incongruent (I)
- Stationary (S)
- No-sound (N)

Session 1: Practice for the main task outside the scanner
Session 2: Localizer scans [MT+, Retinotopy, Left/Right direction]
Session 3: Main task scans

3 Results

Behavioral Results

- Results showed statistically significant audiovisual congruency effect (F(2, 16) = 3.86, p = .024).
- The MAE was experienced more frequently in the congruent compared to the other conditions (F(3, 24) = 2.89, p = .056).
- Congruent direction of sound strengthened the visual motion during adaptation, resulting in the longer MAEs.

MVPA Results

- Classification accuracy showed a marginally significant difference from the chance level (50%) in the congruent condition (t(8) = 2.10, p = .06) and significant difference in the stationary condition (t(8) = 3.04, p = .01).
- Similar pattern of classification results was observed in V1 (n=3).
- Audiospacial direction congruency of motion during adaptation sharpened the representation of visual motion direction.

Univariate Analysis Results

- BOLD signal amplitude in the MAE+ didn’t show statistically significant differences across the audiovisual conditions.

Multi-voxel Pattern Analysis (MVPA, [4])
- Performed with a linear support vector machine (LIBSVM) toolbox [5].
- Performed using radial basis function kernel (RBF kernel) of a classifier.
- Training dataset: “Left/Right localizer scan” dataset to discriminate representations of Left/Right physical motion.
- Testing dataset: Periods of “Test” in the main scans (MAE task).

4 Conclusion

- Audiospacial integration based on the audiovisual direction congruency during adaptation lengthened the perceived duration of visual MAE and left neural signatures in the visual areas of hMT+ and V1.

References & Acknowledgements

[1] Park, M., Blake, R., Kye, Y., & Kye, C.-Y. (under revision)
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