Effects of inhibitory stimulation of visual area V5/MT on visual speech recognition

Brian Mathias1, Lisa Jeschke2, & Katharina von Kriegstein2

1University of Aberdeen, School of Psychology, United Kingdom
2Technical University Dresden, Faculty of Psychology, Germany

brian.mathias@abdn.ac.uk

Introduction

How does the brain recognize visual speech?

• Neural pathways for auditory speech processing are well-defined, but pathways for visual speech remain unclear1

• Visual speech recognition relies on the perception of visible articulator movements,2 suggesting a role of visual motion areas of the cortex such as the middle temporal visual area (V5/MT)3

• Hypothesis: If area V5/MT is critical for visual speech recognition, then transcranial magnetic stimulation (TMS) applied over V5/MT should disrupt visual speech recognition response times and accuracy

Methods

Experiment 1: Comparison of effective and placebo TMS of V5/MT

• 28 right-handed native German speakers (M age = 23.2 years, SD = 4.4)

• Bilateral cTBS (600 pulses) at 90% of active motor threshold

• fMRI-localized M V5/MT coordinates (x, y, z) = (−46, −74, 5)

• 2 × 2 within-participants design

• Factors: TMS (effective, placebo) and task (speech, person)

Experiment 2: V5/MT versus vertex stimulation

• 24 right-handed native German speakers (M age = 25.2 years, SD = 5.5)

• Bilateral cTBS (600 pulses) at 100% of active motor threshold

• Vertex coordinates (x, y, z) = (−1, −15, 74)

• 2 × 2 within-participants design

• Factors: region (V5/MT, vertex) and task (speech, motion)

Results

Experiment 1: No effects of V5/MT stimulation relative to placebo stimulation

• No differences in response times and accuracies following effective versus placebo stimulation for either task

• V5/MT > Vertex for both Speech and Motion recognition (p < .001)

• V5/MT < Vertex for speech recognition (p < .05)

Discussion

Experiment 2 findings suggest a causal role of V5/MT responses in the recognition of visual speech

• V5/MT integrity benefitted the speed and accuracy with which speech syllables were discriminated

• Facial motion information may transit through V5/MT14

Several possible reasons for lack of TMS effects on visual speech recognition in Experiment 1

• 40% of participants reported effective stimulation as more intense than placebo in Exp. 1; 10% in Exp. 2

• Lower stimulation intensity in Exp. 1

• Single speaker presented in Exp. 2

Acknowledgements

Research funded by the German Research Foundation and European Research Council

V5/MT may work together with form-based visual processing regions5 and multimodal regions6 to recognize visual speech