Motivation and Speech Category Learning: A Dual-Learning Systems Approach

Y. Catherine Han¹, Seth Koslov¹, W. Todd Maddox¹, Bharath Chandrasekaran¹, 2

¹The University of Texas at Austin Department of Psychology; ²The University of Texas at Austin Department of Communications Sciences and Disorders

Introduction

Second language (L2) learning: nonnative speech categories are difficult to learn in adulthood

Motivation influences learning. A 3 factor motivation-cognition framework for the interaction between global motivation, local motivation, and task demands suggests: 3, 6

- Global motivation to approach an overall positive outcome (promotion focus) or to avoid a negative outcome (prevention focus)
- Local motivation to maximize task correctness (gains) or to minimize task mistakes (losses)
- Regulatory fit: a regulatory fit between a global and local motivation (promotion-gains & prevention-losses) enhances an individual's cognitive flexibility and reflexive learning
- Regulatory mismatch between a global and local motivation (promotion-losses & prevention-gains) attenuates flexibility and enhances reflexive learning

Dual-learning systems ⁵

- Reflexive learning is explicit and mediated by the prefrontal cortex; dependent on working memory; rule-based category learning optimal
- Reflexive learning is implicit and mediated by dopamine modulation in the striatum; not dependent on working memory; information-integration category learning optimal
- Prior research shows that nonnative speech category learning is primarily mediated by the reflexive learning system ⁷, 8

Predictions

- Individuals in a regulatory mismatch will show enhanced reflexive learning than those in a regulatory fit, thereby increasing the frequency and speed of utilizing optimal learning strategies and resulting in increased performance on a speech category learning task

Methods

Speech Categorization Task

- 5 syllables ([bi], [di], [ri], [mi], [li]) x 4 talkers (2f x 4 Mandarin tones = 80 natural speech sounds
- Stimuli mainly vary on pitch height and pitch direction⁹
- 80-stimulus x 6 blocks training
- Criterion is defined as performing at or above 70% accuracy on the "last block" of training. Subjects were not aware of when the last block would be.

Motivation Manipulation

- Global promotion focus: participant tries to earn a raffle ticket for $50
- Global prevention focus: participant tries to prevent losing a raffle ticket for $50
- Local gains: earn points in a task, earn more points for correct answers than incorrect
- Local losses: lose points in a task, lose more points for incorrect answers than correct answers

Design

6 blocks of mixed presentation of all 80 stimuli with full feedback provided after each trial

Behavioral Results

- Each point represents the average performance over the past 80 trials. For trials preceding 80, a cumulative average was used.
- There was a significantly better learning rate for regulatory mismatch conditions than regulatory fit conditions

Results compare performance across conditions

- Promotion conditions, p<0.0001
- Prevention conditions, p>0.0001

Discussion

- The results support our prediction that inducing a regulatory mismatch will lead to faster and more accurate speech category learning
- Computational modeling analysis showed that the optimal reflexive strategies were used sooner and in more blocks when the participants were in a regulatory mismatch than a regulatory fit
- Results from this study extend previous work in motivation, which found that a regulatory mismatch enhanced reflexive learning while a regulatory fit enhanced reflexive learning, to real-world auditory stimuli ¹, ²

Future Directions

- Test motivation framework in a population with depressive symptoms
- Add a social component to look at situational and social motivation factors

References


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