Losing control: An investigation of lexical processing in adult second language learners

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Background

There have been contrasting hypotheses regarding the role of cognitive control in second language (L2) processing, e.g.,

- The BIA-1 proposes that cognitive control becomes vital later in L2 acquisition
- To allow L2 words direct access to the non-linguistic conceptual store

The convergence hypothesis suggests that L2 learners initially utilize areas associated with cognitive control more, with activation in these areas decreasing as learners gain more proficiency in the L2.

Aims

1. To test these contrasting predictions about L2 lexical processing
   - Using fMRI and behavioral measures
   - Tracking learners over an academic year
2. To examine whether individual differences in cognitive control ability would modulate the degree of activation elicited by the L2.

Methods

Participants

Initial sample of 36 native English speakers learning Spanish.

Final analyses include 19 participants after attrition and exclusion due to head movement.

Procedure

Pretesting

- Language history questionnaire (LHQ)
- Handedness questionnaire
- Spanish vocabulary test (TIVP)
- Letter-number sequencing (LNS)
- 1tw156 + tw156
- Flanker task

MRI Testing Procedure

- Mock scanner: L2 animacy judgment task
- MRI task: Single language lexical decision task (Spanish word or not; er-fMRI design with jittered ISI)
- Word Type
  - Unambiguous L1
  - Unambiguous L2
  - Homograph
- Example
  - mesa (table)
  - mesa (boot)

Spanish words were taken from the classroom textbook.

Post-experiment questionnaire evaluated participants’ familiarity with the target words.

Behavioral analyses

- Participants’ reaction times significantly decreased from Time 1 to Time 2
- Flanker task

Results

fMRI-ROI analyses

- Time 1: stronger activation in the ACC and MTG
- Time 2: more activity in the IFG and MFG

fMRI-Individual Differences

Results from the Spanish>English (S>E) ROI analysis at Time 2 are positively correlated with the size of participants’ Flanker effect.

Conclusions

Our results align with the predictions of the convergence model. Findings from our ROI, functional connectivity, and individual difference analyses have revealed that not only do learners rely less on their executive control systems over time (as their proficiency increases), but that this pattern is affected by individual differences in executive control function.

References

1. Granger, J., Midgley, K., & Hubert, P. J. (2013). Re-thinking the bilingual interactive activation model from a developmental perspective (BIA-d). In M. Kail & M. Holoubek (Eds.), The interface between syntax and the lexicon in second language acquisition (pp. 197-208). Amsterdam: John Benjamins.

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