

Introduction

There is an enormous amount of variability in how successfully adults learn a second language (L2). We investigated the relationship between L2 grammar learning, musical ability, and working memory updating (WMU) using a semi-longitudinal training study.

Tokowicz & MacWhinney (2005): L2 learners of Spanish were more sensitive to grammatical violations in sentences similar to their L1 (English) than in constructions that were differently implemented in English and Spanish, as demonstrated by presence of P600 effect.

Linck et al. (2016): Results of a meta-analysis suggest a positive relationship between L2 processing and working memory, particularly the executive control component (updating).

Ditinger et al. (2016): Learners of Thai vocabulary who were professionally trained musicians displayed a typical N400 effect for mismatched/unrelated words in semantic and matching tasks.

The present study

- Do musical ability and/or WMU affect L2 morphosyntax learning?
- Are learners with higher musical ability or higher working memory updating more sensitive to grammatical violations in the L2, particularly those that are different from the L1 and unique to the L2?

Method

Participants: 58 L1 right-handed English speakers (ages 18-73) with no knowledge of Swedish completed 2 training sessions of Swedish vocabulary learning and 3 training sessions of grammar learning, followed by ERP posttests and musical ability/training tasks

Method

Posttest (ERP): Learners see a sentence in Swedish, 1 word at a time, and are prompted at the end to judge the sentence grammaticality. ERPs collected at 400-600ms and 600-800ms following critical region of the sentence

Musical tasks

Musical Ear Test: Learners listen to a pairs of melodic and rhythmic phrases and decide whether the phrases are identical

Sync with Metronome: Learners must tap along to a metronome beat with a spacebar

Chord Analysis: Learners listen to a single note or a chord and must determine the number of notes played

Mowrer Test of Tonal Memory: Learners listen to melodic phrases and reproduce them using the syllable "da"

WMU Tasks

Keep Track: On each trial, learners track exemplars from between 2 and 5 categories and are presented with between 15-25 exemplars, one at a time, and then report back the most recent exemplar from each category

Spatial N-back: 1 of 12 boxes on a screen flash and the learner indicates if it flashed n trials prior (2 and 3-back versions)

Learners see a series of 9, 11, or 13

Stimuli

(Adapted from Tolentino & Tokowicz, 2014)

Similar

(demonstrative determiner-noun number agreement):

- Den därSING pojkenSING äter. [That boy is eating.]
- *De därPL pojkenSING äter. [*Those boy is eating.]

Different

(singular noun phrase definiteness):

- PojkenDEF äter. [The boy is eating.]
- *EnINDEF pojken DEF äter. [*AINDEF boyDEF is eating.]

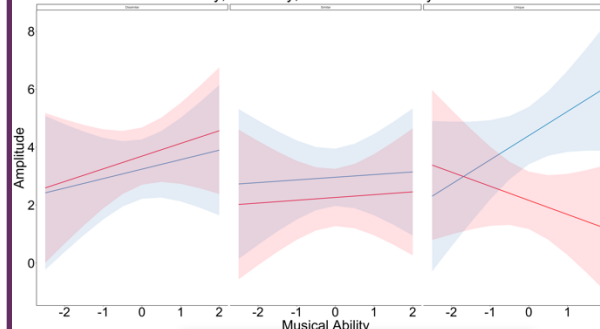
Unique

(indefinite singular article-adjective gender agreement):

- EnCOM ungCOM pojke äter. [A young boy is eating.]
- *EnCOM ungTNEUT pojke äter. [*ACOM youngTNEUT boy is eating.]

Results

Grammaticality, Similarity, and Musical Ability at 600-800ms

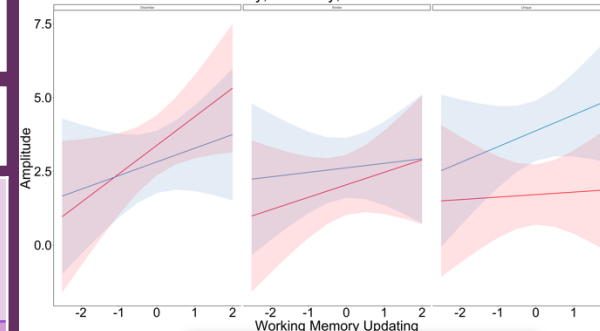


Grammaticality

- Grammatical
- Ungrammatical

Note: Working memory updating and Musical Ability were calculated using confirmatory factor analyses and data reduction techniques

Grammaticality, Similarity, and WMU at 400-600ms



Discussion

400-600 time window

- An interaction between grammaticality, cross-language similarity, and WMU was found. Learners with higher WMU ability showed a positive going waveform for ungrammatical sentences in the unique condition.
- Could be evidence of early P600, but WMU was not a significant predictor for the 600-800ms time window

600-800 time window

- An interaction between grammaticality, similarity, and musical ability was found. Learners with more musical ability showed a positive going waveform for ungrammatical sentences in the unique condition.
- Our results suggest that learners with more musical ability process morphosyntactic violations unique to the L2 differently than learners with less musical ability.
- Tanner et al. (2012):** L2 learners of English were sensitive to grammatical violations in sentences with subject verb agreement violations, as demonstrated by the presence of a P600 effect
- Zheng & Lemhöfer (2019):** L2 Learners of

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