

Multilingualism and Rule Extraction in the Linguistic and Visual Domains

ESR: Dávid György¹

Supervisors: Julie Franck¹, Doug Saddy², Antonella Sorace³

1.

Université de Genève, Geneva, Switzerland
2.

University of Reading, Reading, UK
3.

University of Edinburgh, Edinburgh, UK



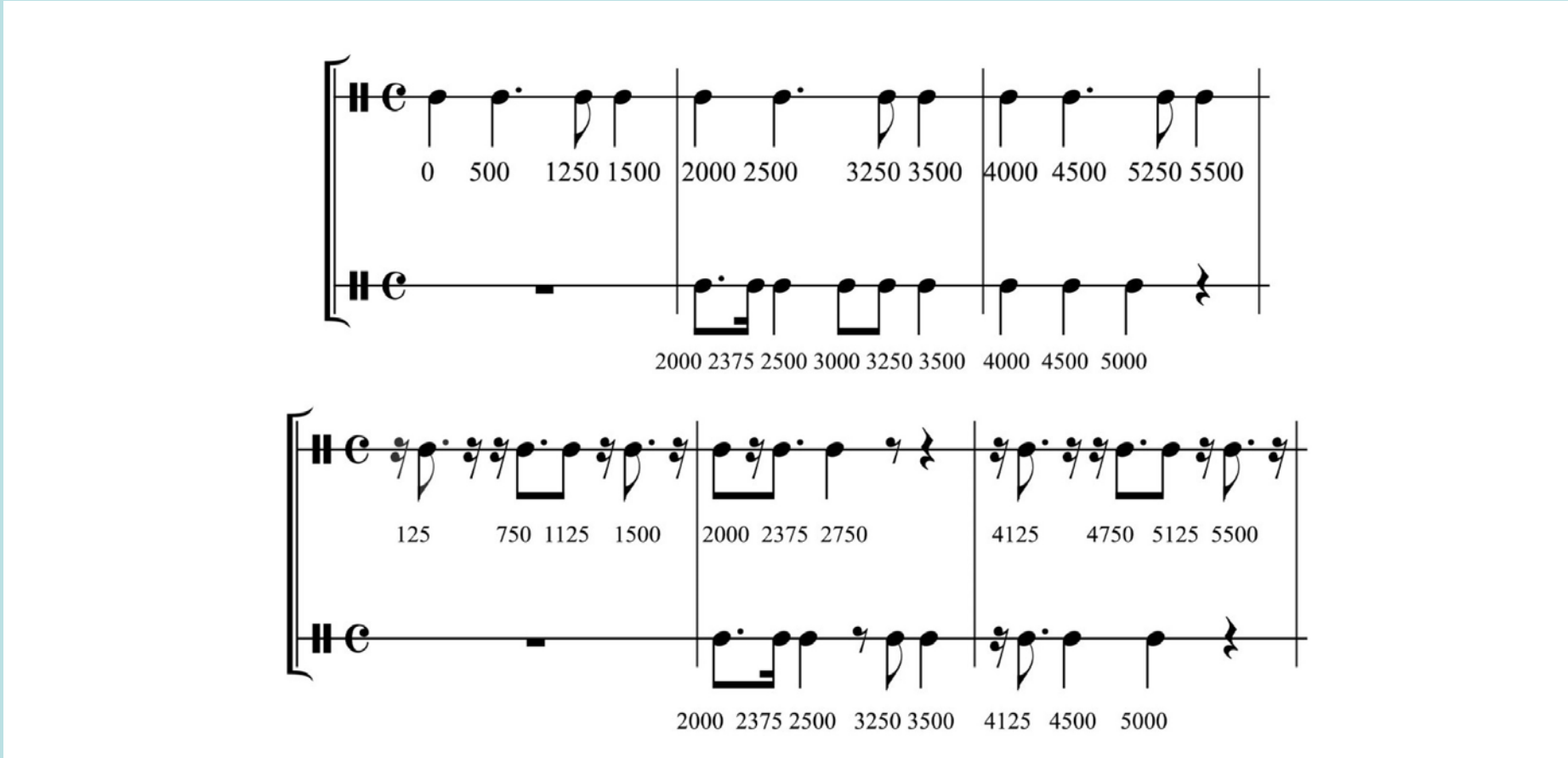
This project has received funding from the European Union's Horizon2020 research and innovation programme under the Marie Skłodowska Curie grant agreement No 765556.

Aims of the project

- Explore the hypothesis that bilinguals/multilinguals, being exposed to various implementations of natural language syntax, are able develop increased abilities to process natural language structure and to learn abstract properties in new natural or artificial languages.
- In particular, we aim to explore the interplay between multilingualism, structural processing, and rhythm processing.

Rhythm and language processing

- Rhythm is found in both music and language, albeit with different characteristics¹
- Performance on rhythmic tasks found to correlate with performance at various linguistic levels in TD children, children with SLI, and children with dyslexia^{1,2}
- Comorbidity of rhythm and language processing deficits has been observed in SLI, dyslexia, basal ganglia lesion, and Idiopathic Parkinson’s Disease^{1,2}
- A musical prime with a regular rhythmic structure can facilitate subsequent language (syntactic) processing²⁻⁶
 - Improving grammaticality judgements in TD children, children with SLI, and dyslexic children



- Restoring the P600 in adults with IPD and BG lesions

Research questions

1. Does level or type of multilingualism influence structural processing in a semi-artificial Jabberwocky language?
2. Both bilingualism and musicianship have been suggested to influence language processing. Is there a link between multilingualism and general rhythmic skills?
3. Does rhythm also affect language processing in a semi-artificial language in healthy adults? If so, does this effect depend on level or type of multilingualism?

Experimental measures

- Multilingualism: LEAPQ⁷ and LSBQ⁸ questionnaires
- Selective and sustained attention: auditory oddball
- Beat anticipation: Warning Imperative
- General rhythm and beat peception: Profile of Music Perception Skills
- Rhythmic Priming experiment – Grammaticality Judgement

Methods

- **Participants:** 50 L1 French adults with varying levels of multilingualism
- **Linguistic stimuli:**
 - Linguistic stimuli were constructed in a semi-artificial Jabberwocky language based on recent work in agreement attraction⁹.
 - 50% of experimental items were OSV object relatives. The rest contained various simpler syntactic structures. Ex:

Voici les dafrans que le bostron décrit/décrivent.

Here.is the.PL dafran.PL that the.SG.MASC bostron describe.3SG/3PL
 - Ungrammatical sentences always contained a subject-verb number agreement violation.
- **Procedure:**
 - Stimuli were presented auditorily.
 - Each miniblock was preceded by a 32s musical prime or 32 seconds of silence.
 - 8 subsequent miniblocks preceded by the same prime made up one experimental block.
 - The order of the musical primes (Regular-Silence-Irregular, Irregular-Silence-Regular) and sentence-prime pairings were counterbalanced across participants.

Preliminary results

	Grammaticality (%correct)			Prime (%correct)			Block (%correct)		
	Gramm	Ungramm		Reg	Irreg		1	3	
All	0,95	0,89	*t = 4,36	0,91	0,93	t = -1,13	0,90	0,94	*t = -3,58
RSI	0,95	0,91	*t = 3,89	0,90	0,95	*t = -3,38	0,90	0,95	*t = -3,38
ISR	0,96	0,86	*t = 3,31	0,92	0,90	t = 1,63	0,90	0,92	t = -1,63

- Main effect of Grammaticality – Jabberwocky materials are processed like natural language
- We have not found the main Prime effect that we expected.
- Habituation/learning effect – better performance on block 3 than 1.
- This interacts with the order of primes – higher improvement when starting with a regular prime.
- No clear effect of Multilingualism on the language task.

Conclusions

- The block design may have affected/masked a potential priming effect
→ mixed design
- Typical adults may not be sensitive enough to show behavioural priming effects
- Semantics may be the primary locus of the priming effect
- Multilingualism: massively multilingual population – to be compared to different multilinguals or monolinguals

References:
1 Kotz, S. A., Ravignani, A., & Fitch, W. T. (2018). The Evolution of Rhythm Processing. *Trends in Cognitive Sciences*, 22(10), 896–910. <https://doi.org/10.1016/j.tics.2018.08.002>
2 Schön, D., & Tilmann, B. (2015). Short- and long-term rhythmic interventions: Perspectives for language rehabilitation. *Annals of the New York Academy of Sciences*, 1337(1), 32–39. <https://doi.org/10.1111/nyas.12635>
3 Przybylski, L., Bedon, N., Krifi-Papoz, S., Herbillon, V., Roch, D., Lécuyer, L., ... Tilmann, B. (2013). Rhythmic auditory stimulation influences syntactic processing in children with developmental language disorders. *Neuropsychology*, 27(1), 121–131. <https://doi.org/10.1037/a0031277>
4 Bedon, N., Brisseau, L., Molinier, P., Roch, D., & Tilmann, B. (2016). Temporally regular musical primes facilitate subsequent syntax processing in children with Specific Language Impairment. *Frontiers in Neuroscience*, 10(JUN), 1–11. <https://doi.org/10.3389/fnins.2016.00245>
5 Chern, A., Tilmann, B., Vaughan, C., & Gordon, R. L. (2018). New evidence of a rhythmic priming effect that enhances grammaticality judgments in children. *Journal of Experimental Child Psychology*, 173, 371–379. <https://doi.org/10.1016/j.jecp.2018.04.007>
6 Kotz, S. A., & Gunter, T. C. (2015). Can rhythmic auditory cuing remediate language-related deficits in Parkinson's disease? *Annals of the New York Academy of Sciences*, 1337(1), 62–68. <https://doi.org/10.1111/nyas.12657>
7 Marian, V., & Blumenfeld, H. K. (2007). The Language Experience and Proficiency Questionnaire (LEAP-Q): Assessing Language Profiles in Bilinguals and Multilinguals. *Journal of Speech, Language, and Hearing Research*, 50 (August 2007), [https://doi.org/10.1044/1092-4388\(2007\)067](https://doi.org/10.1044/1092-4388(2007)067)
8 Anderson, J. A. E., Mak, L., Chahi, A. K., & Bialystok, E. (2018). The language and social background questionnaire: Assessing degree of bilingualism in a diverse population. 250–263. <https://doi.org/10.3758/s13428-017-0867-9>
9 Franck, J., & Wagers, M. (in revision). Hierarchical structure and memory retrieval mechanisms in agreement attraction.