

IMPACT OF GROUP VS. SOLO MUSIC EDUCATION ON COGNITIVE DEVELOPMENT IN DISADVANTAGED CHILDREN

Gaelle ROUVIER^{1 2}, Lorna LE STANC¹, Indiana WOLLMAN², Grégoire BORST¹

¹Laboratory for the Psychology of Child Development and Education (LaPsyDÉ, UMR CNRS 8240), Université Paris Cité, France

²Démos, Cité de la Musique – Philharmonie de Paris, France

BACKGROUND & OBJECTIVES

- Actively **making music entails enhanced cognitive activity** and even cortical transformation (1)
- In children, it fosters enhanced **cognitive development of various cognitive abilities** such as IQ (2) or executive functions (3)
- It has a **privileged impact** on cognition over other leisure activities (4)
- Group music activities have a **positive impact on social cognition** (5)
- And group music programs seem to **positively counter-act the developmental effects of a low socioeconomic (SES) background** on cognitive development (of phonological awareness for instance, 6) – although the SES variable is never precisely controlled for.
- But a **comparison of cognitive effects between modes of music training is lacking**.
- Yet, given that to learn properly :
 - Being actively engaged is critical (7)
 - Social interaction is critical (8)

we wonder whether, controlling for the SES variable, all modes of music training (especially the contrasted solo vs. group ones) have the same cognitive impact :

- **Is there an impact of music in general on the cognitive development of children** (i.e. are the effects observed in solo training also present in group training and *vice versa*) ?
- **Is there a differentiated impact according to the group or solo form of music learning ?**

- 1 Musical cognition** : music training (in solo and group) might have an immediate impact on musical skills (perception and production). This impact is probably different between modes of training.
- 2 Executive functions** : the demanding activity in which music training (in solo and group) consists might entail transfer effects on executive functions. This impact is probably different between modes of training.
- 3 Social cognition** : music training in group or solo might entail different transfer effects on social cognition skills.

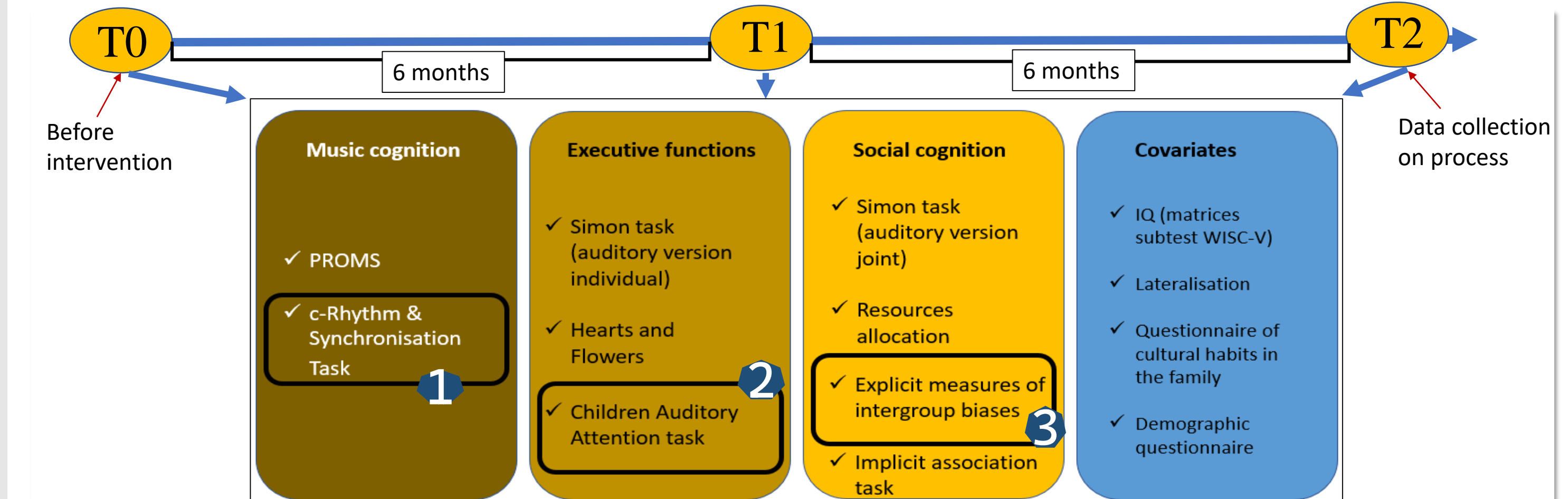
PARTICIPANTS

	groups		
	no music	solo music	group music
N	82	79	57
sex (female/male)	41F/41M	46F/33M	35F/22M
age (mean ± SD) ***	8.91 ± 1.11	8.02 ± 1.12	8.18 ± 1.29
SES (mean ± SD) **	-0.15 ± 0.98	0.32 ± 1	0.07 ± 0.92
IQ (mean ± SD)	7.03 ± 2.72	7.68 ± 2.87	7.62 ± 2.63

*** : significant difference in age between no music and group music and between no music and solo music
** : significant difference in SES between solo music and group music

METHOD

LONGITUDINAL DESIGN



TWO TEAMS

- Quasi minimal group paradigm (9)
- Participants are allocated to one of the two teams to induce a sense of group belonging.

FOCUS ON SOME TASKS

1 children Rhythm & Synchronisation Task (adapted from 10)

INSTRUCTIONS
“Listen and then tap in synchrony with the rhythm heard”

PRINCIPLE
Structure of a stimulus
N trials = 18

DEPENDENT VARIABLE
✓ C-RST score, a composite score of :
1) The ability to tap as many times as the rhythm heard
2) The ability to replicate the rhythmical pattern heard

2 children Auditory Attention Task (adapted from 11)

INSTRUCTIONS
“Tap each time you hear the target sound (low long tone)”

PRINCIPLE
N trials = 6

DEPENDENT VARIABLE
✓ d-prime

3 Explicit Measures of Intergroup Biases (adapted from 9)

INSTRUCTIONS
“Who do you prefer
- To play with
- To share your 2 euros with ?”

PRINCIPLE
N trials = 10
“Who do you prefer ?”

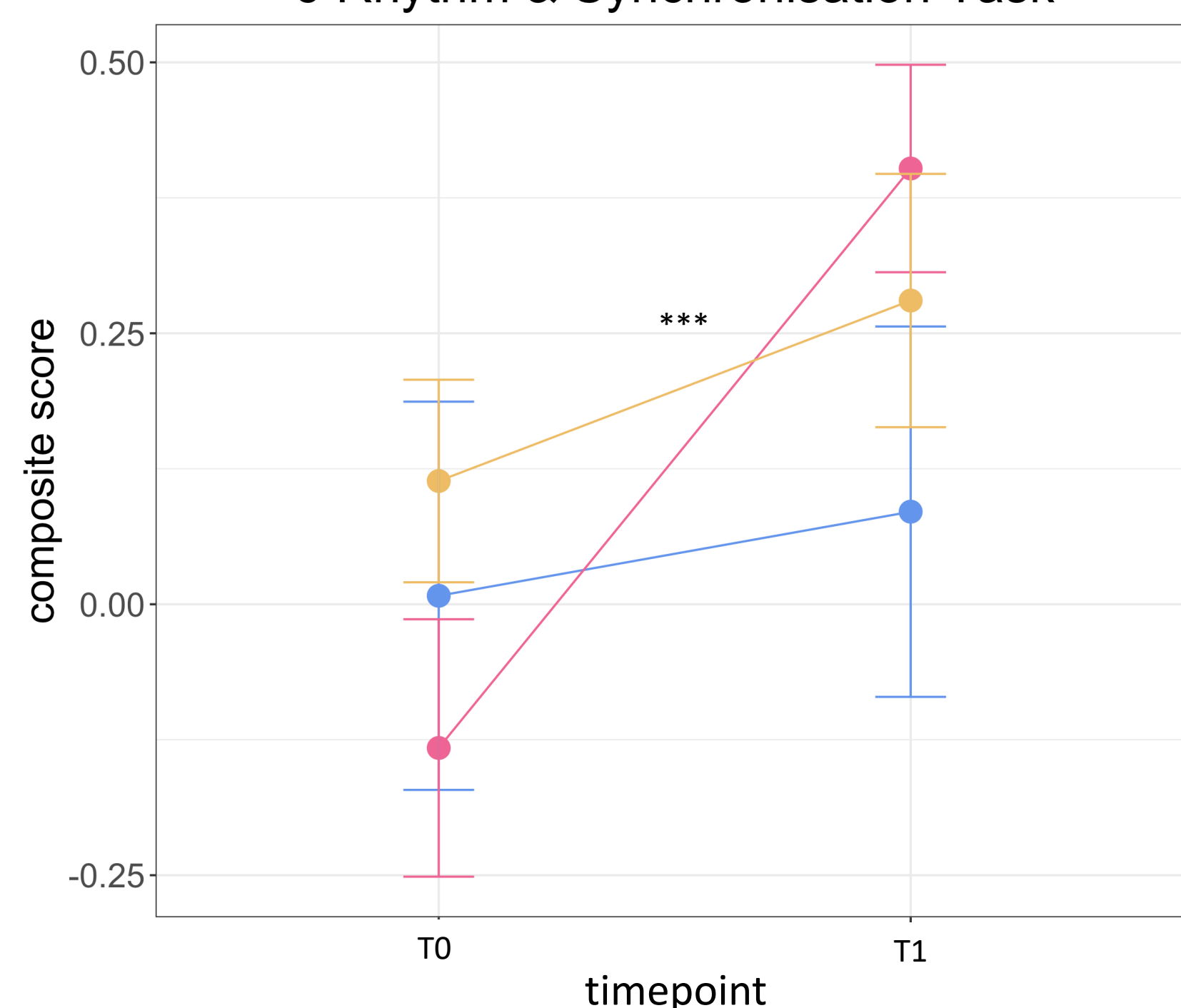
DEPENDENT VARIABLE
✓ Preference (% in favour of the ingroup)
✓ Sharing & Collaboration (% in favour of the ingroup)

ANALYSES :

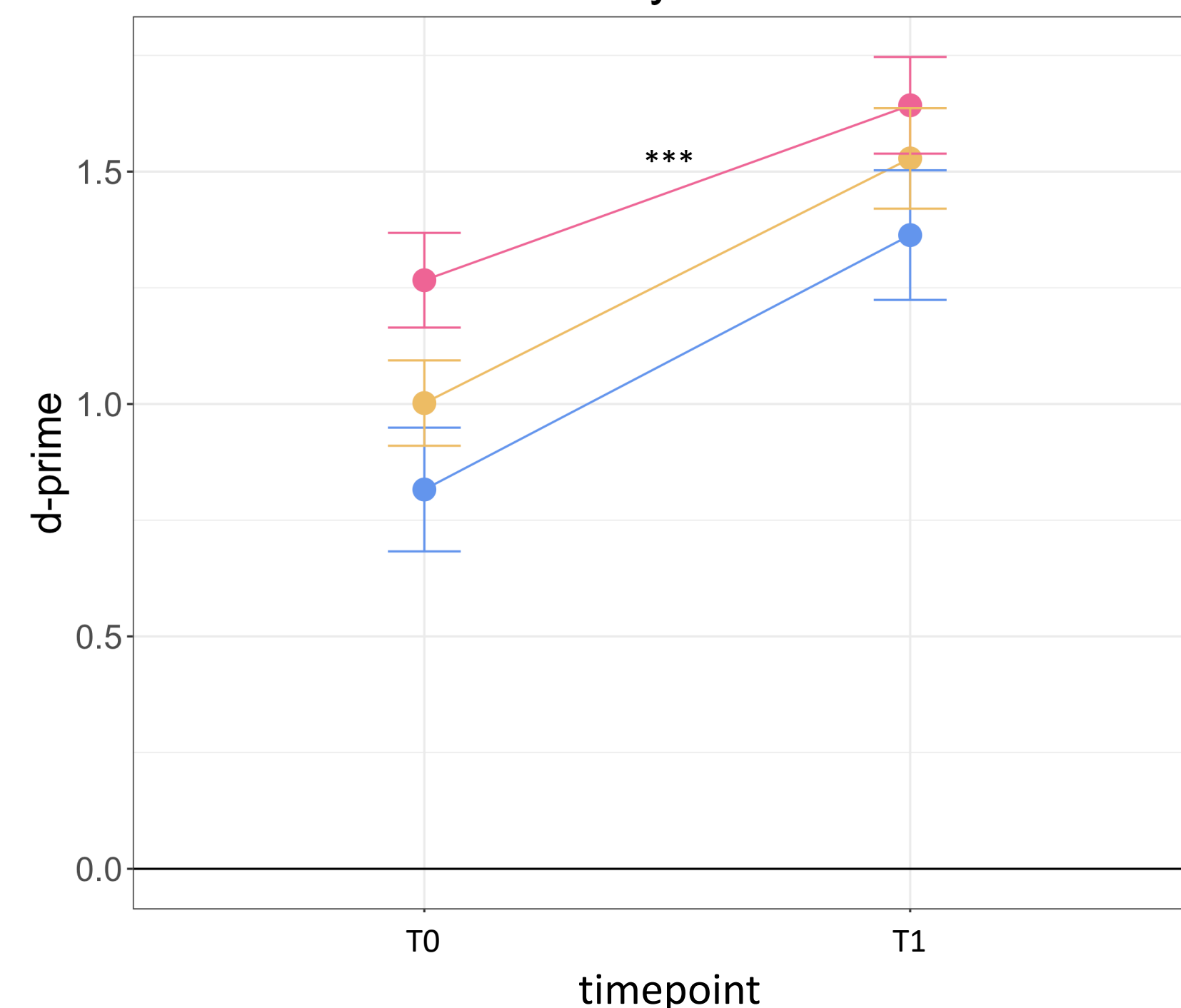
- children Rhythm & Synchronisation Task**
Mixed models to compensate for missing values
 - DV : composite score
 - IV : group, timepoint
 - Covariates : SES, age
- children Auditory Attention Task**
Mixed models to compensate for missing values
 - DV : d-prime
 - IV : group, timepoint
 - Covariates : SES, age
- Explicit Measures of Intergroups biases**
Mixed models to compensate for missing values
 - DV : preference; sharing & collaboration
 - IV : group, timepoint
 - Covariates : SES, age

RESULTS

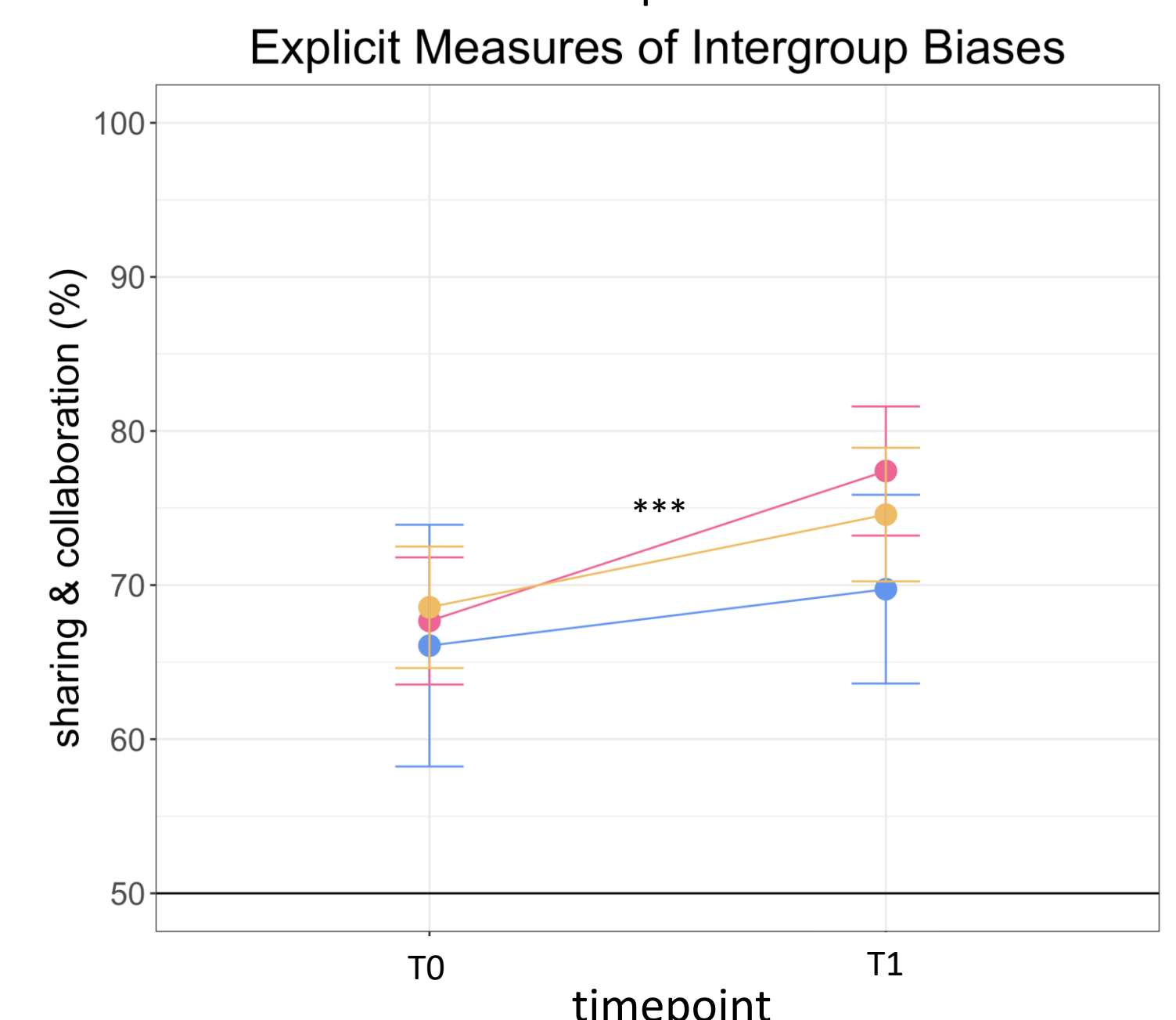
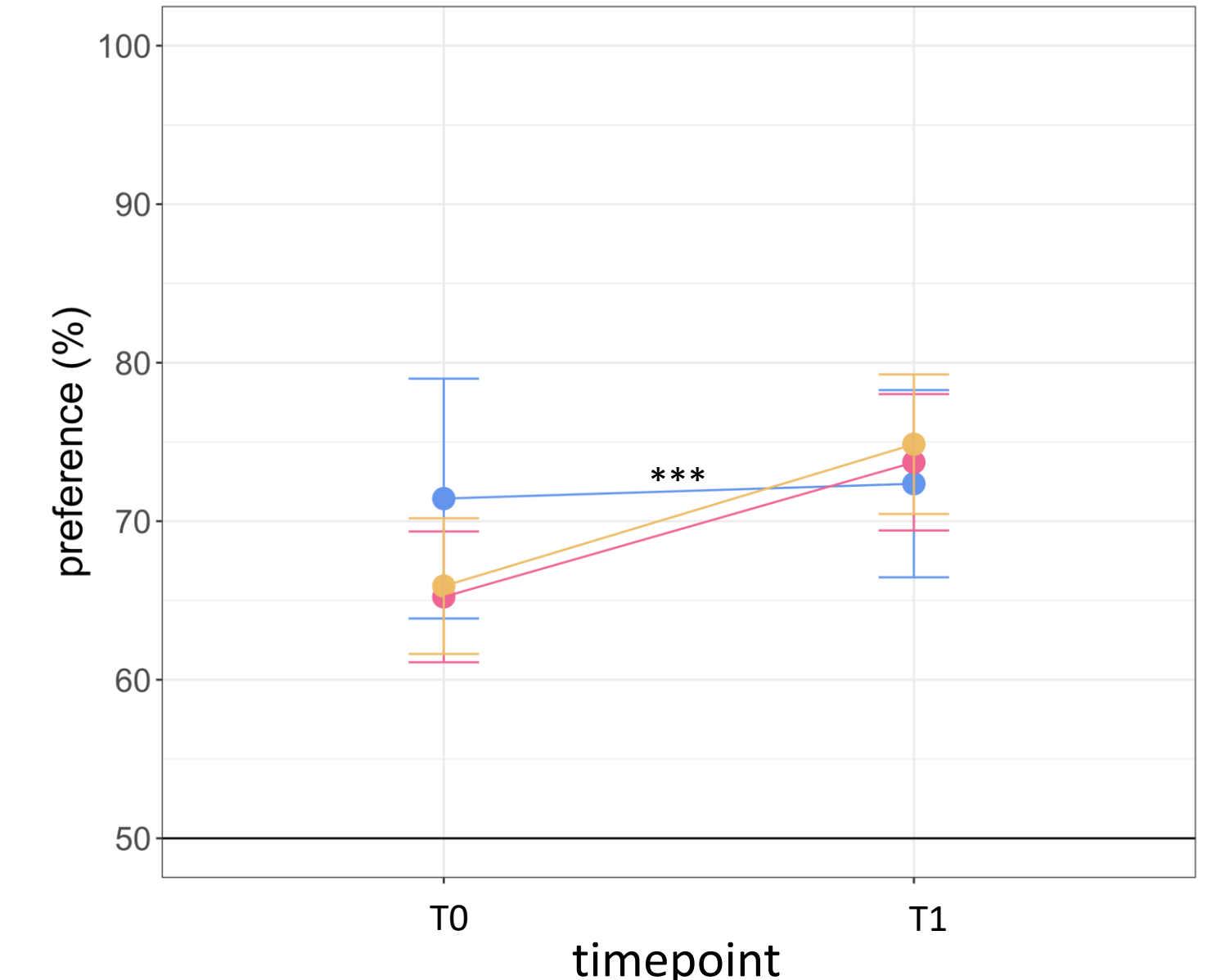
1 c-Rhythm & Synchronisation Task



2 c-Auditory Attention



3 Explicit Measures of Intergroup Biases



DISCUSSION

- Between T0 and T1, there is a significant increase in rhythmic motor synchrony (1), in selective auditory attention (2) and in the propensity to favour members of one's outgroup vs. one's ingroup (3). These **improvements are the same between all three groups (there is no interaction between timepoint and group)**.
- Thereby, **we cannot assess any effect of music on these capacities after only 6 months** of intervention.

➔ As shown in the literature (3, 12), **effects of music intervention might appear after 1 year of training**. We expect an interaction between group and timepoint at the third measurement timepoint.

- REFERENCES :
- Hyde, K. L., Lerch, J., Norton, A., Forgeard, M., Winner, E., Evans, A. C., & Schlaug, G. (2009). The effects of musical training on structural brain development: A longitudinal study. *Annals of the New York Academy of Sciences*, 1169, 182–186.
 - Schellenberg, E. G. (2011). Examining the association between music lessons and intelligence. *British Journal of Psychology*, 102(3), 283–302.
 - Jaschke, A. C., Honing, H., & Scherder, E. J. A. (2018). Longitudinal Analysis of Music Education on Executive Functions in Primary School Children. *Frontiers in Neuroscience*, 12(Febuary)
 - Schellenberg, E. S. (2004). Music Lessons enhance IQ. *Psychological Science*, 15(8), 511–514. <https://doi.org/10.1111/j.0956-7976.2004.00711.x>
 - Kirschner Sebastian, S., & Tomasello, M. (2010). Joint music making promotes prosocial behavior in 4-year-old children. *Evolution and Human Behavior*, 31(5), 354–364.
 - Kraus, N., Hornickel, J., Strait, D. L., Slater, J., & Thompson, E. (2014). Engagement in community music classes sparks neuroplasticity and language development in children from disadvantaged backgrounds. *Frontiers in Psychology*, 5(DEC), 1–9.
 - Gerry, D., Urram, A., & Trainor, L. J. (2012). Active music classes in infancy enhance musical, communicative and social development. *Developmental Science*, 15(3), 398–407.
 - Kirschner, S., & Tomasello, M. (2009). Joint drumming: Social context facilitates synchronization in preschool children. *Journal of Experimental Child Psychology*, 102(3), 299–314.
 - Dunham, Y., Baron, A. S., & Carey, S. (2011). Consequences of “Minimal” Group Affiliations in Children. *Child Development*, 82(3), 793–811.
 - Ireland, K., Parker, A., Foster, N., & Penhune, V. (2018). Rhythm and Melody Tasks for School-Aged Children With and Without Musical Training: Age-Equivalent Scores and Reliability. *Frontiers in Psychology*, 9(APR), 1–14.
 - Hansen, J. C., Hillyard, S. A., & Hansen, J. C. (1980). ENDOGENOUS BRAIN POTENTIALS ASSOCIATED WITH SELECTIVE AUDITORY ATTENTION I. In *Electroencephalography and Clinical Neurophysiology* (Vol. 49).
 - Barbaroux, M., Dittinger, E., & Besson, M. (2019). Music training with Démos program positively influences cognitive functions in children from low socio-economic backgrounds. *PLoS ONE*, 14(5), 1–21.

contact :
gaelle.rouvier@gmail.com

