

Effects of musical interventions on brain and behavior in healthy elderly people

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BACKGROUND

Cognitive decline: a main threat among negative effects of aging

- Impacts quality of life, social behavior, functioning & autonomy
- Working memory (WM) is particularly affected: holding & manipulating information for further processing [1]
- But also, episodic memory (past/recent experiences) and fine motor skills

Hypothesis: musical practice may countervail age-related decline

- Older adults can learn new skills : behavioral and brain plasticity [2]
- Piano practice may improve cognition particularly WM in elderly [3, 4]

METHODS

A Swiss-German randomized control trial in healthy older adults [5]

- 150 healthy older adults, 62-78 years old & musically naïve
- Randomization: age, gender, education and COGTEL¹¹ score (general cognition)
- Teaching by professional musicians: 1-hour/week for 12 months
- Homework: 30 minutes 5 days a week for 12 months
- MRI: **MP2RAGE, diffusion, task/resting-state fMRI, ASL**
- **Psychometric testing: 15 instruments**

AIM & HYPOTHESES

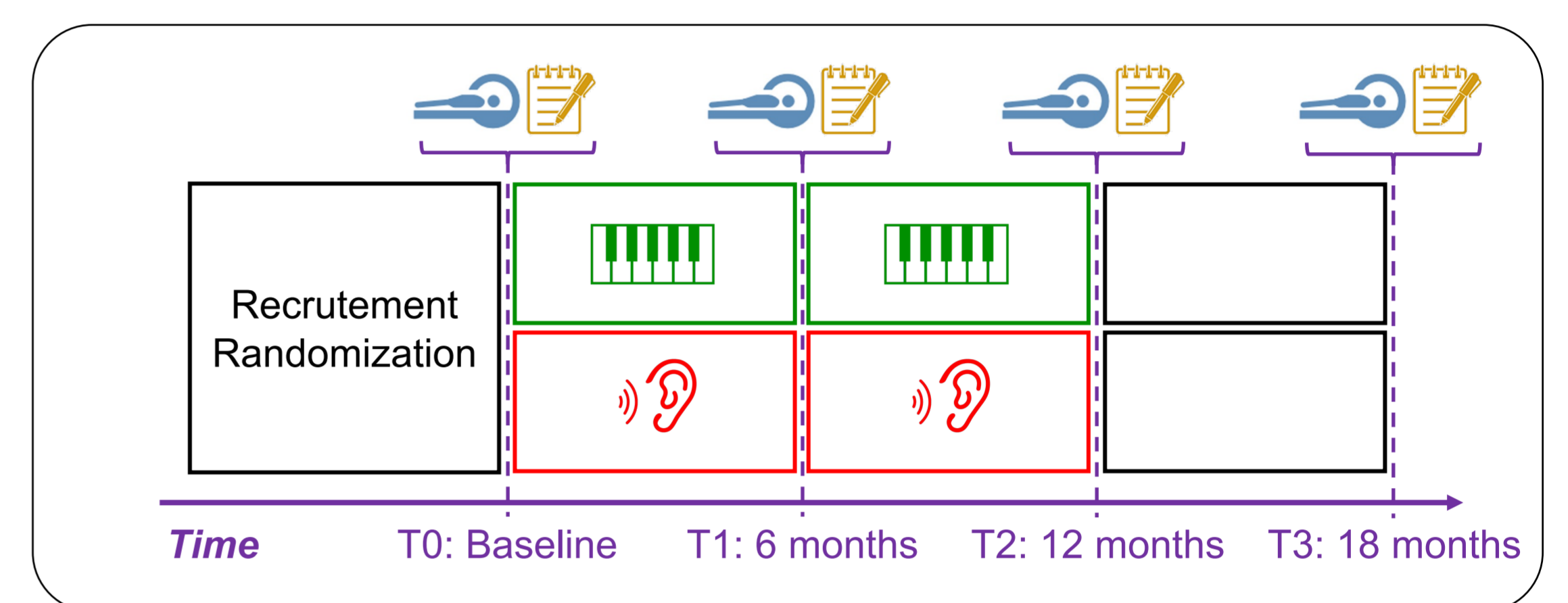
Aim

- Investigating the potential benefits of piano practice versus sensitization to music on cognitive, sensorimotor and brain structural and functional plasticity in healthy elderly in a 1.5-year

- **Piano practice (PP)** vs. **musical culture (MC, control = active listening)**

Hypotheses

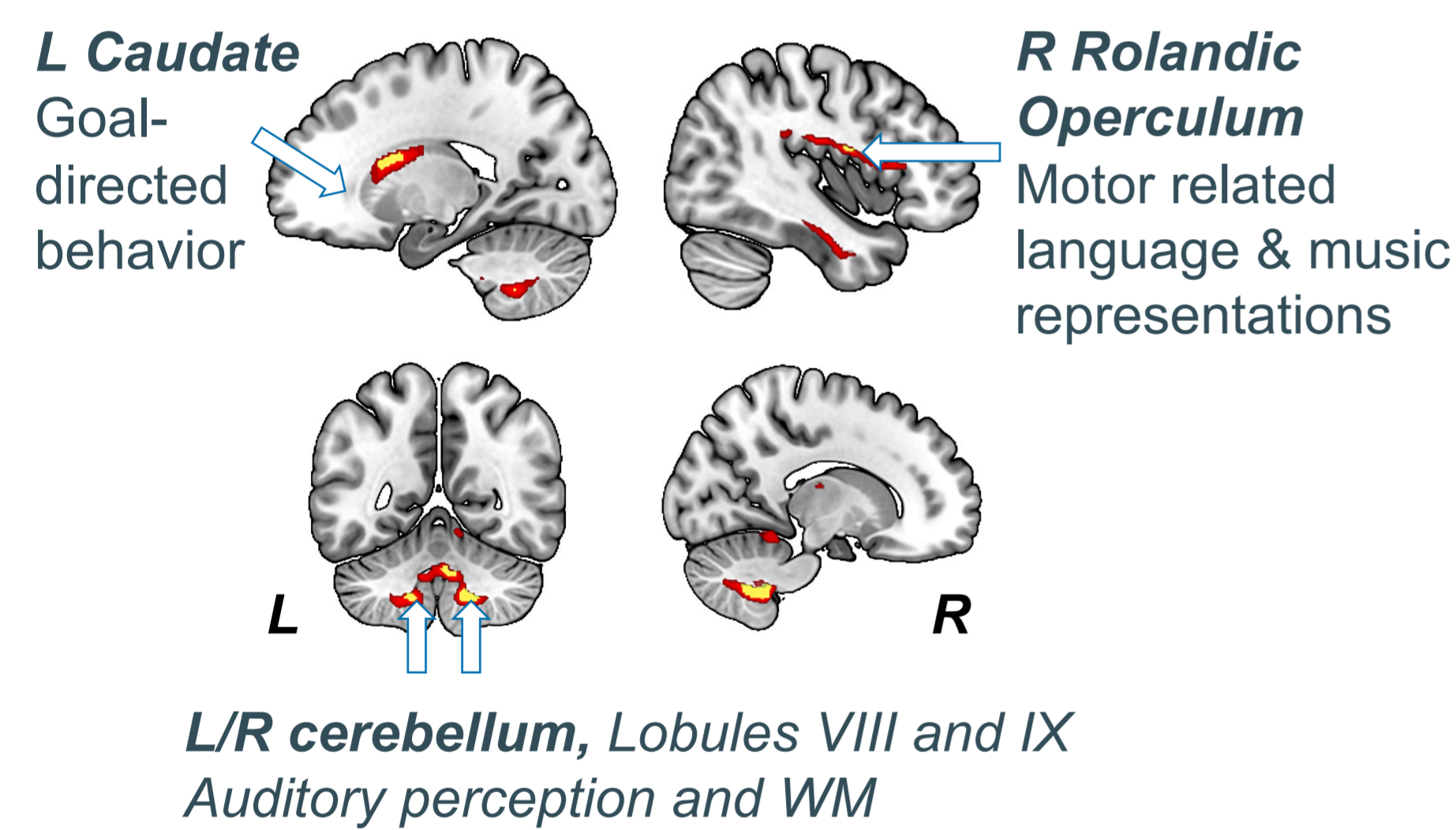
- Outcome 1 : **PP > MC** for brain plasticity effects
- Outcome 2 : brain plasticity will relate to cognitive benefits/stability following the same gradient (**PP > MC**)



6-MONTH GREY MATTER VOLUME INCREASE & WORKING MEMORY (SUBMITTED)

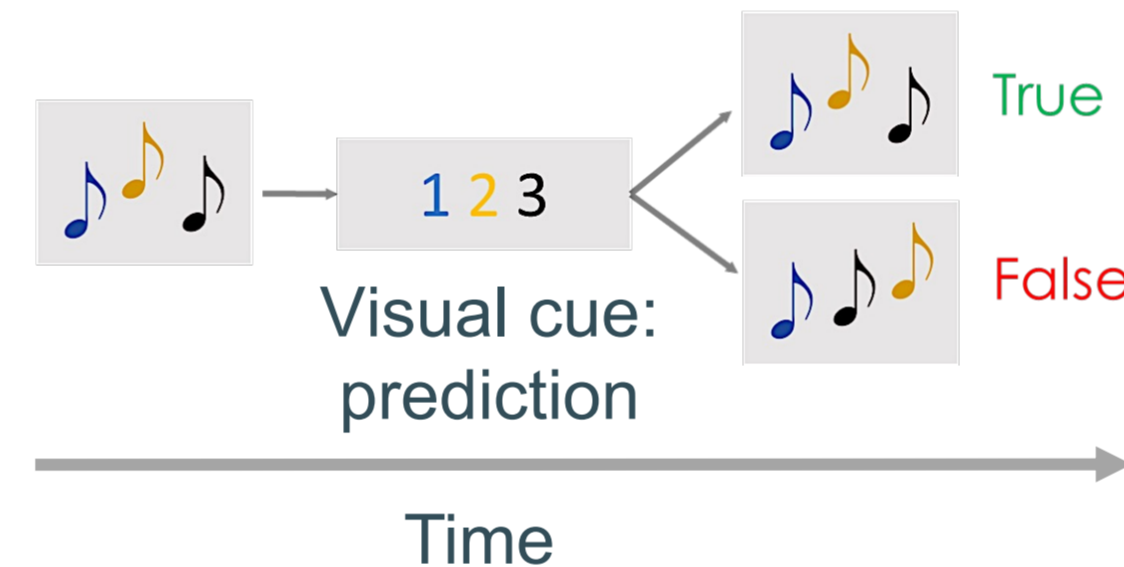
Voxel-based morphometry (MP2RAGE)

- 132 individuals (PP & MC)
- No significant group differences
- Both group combined



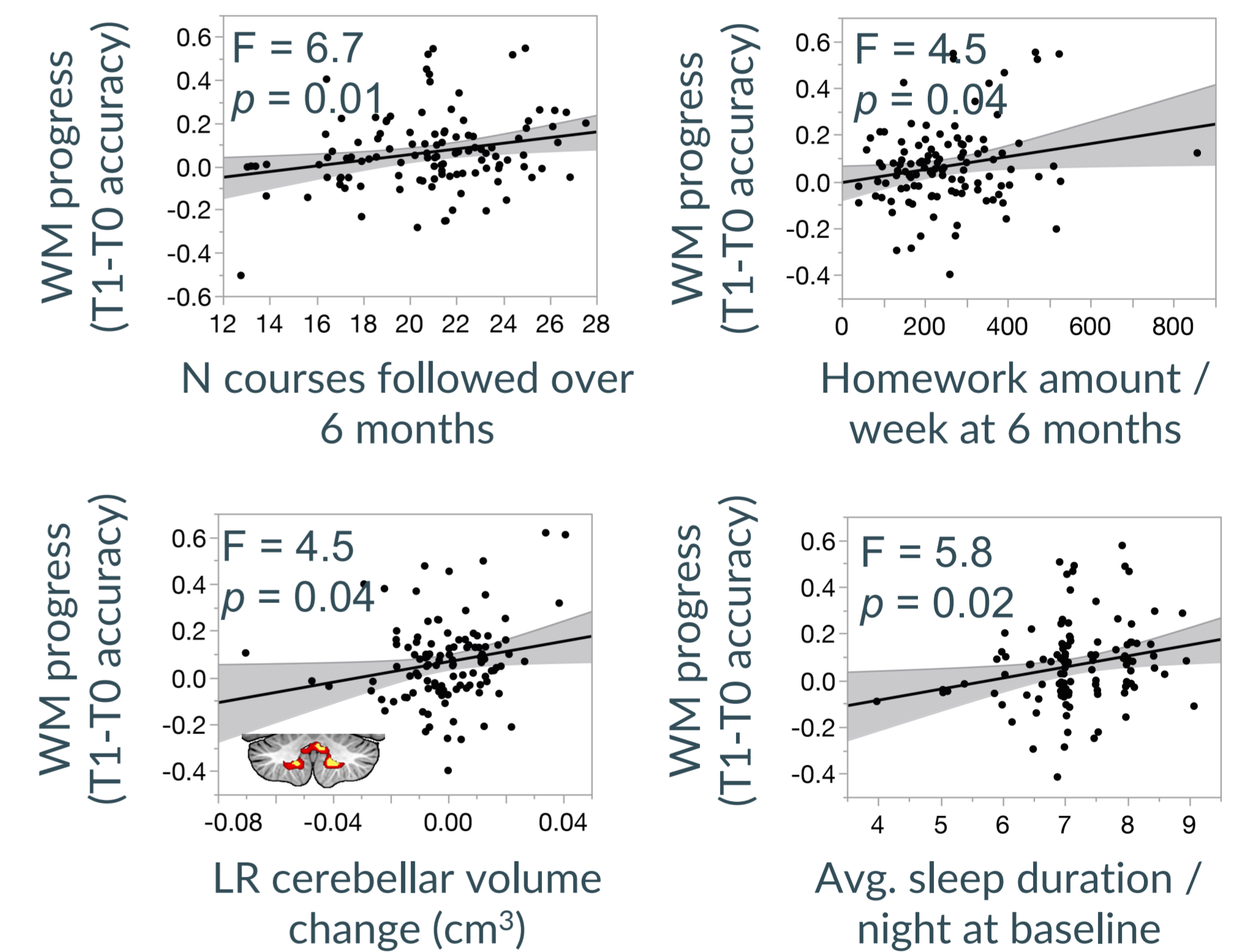
Tonal working memory (WM) task

- All participants (no group differences)
- T1 = 80.6 ± 17 %; T0 = 74.9 ± 19 %
- 6% increase in accuracy (p = 0.001)



Near transfer effect of musical training

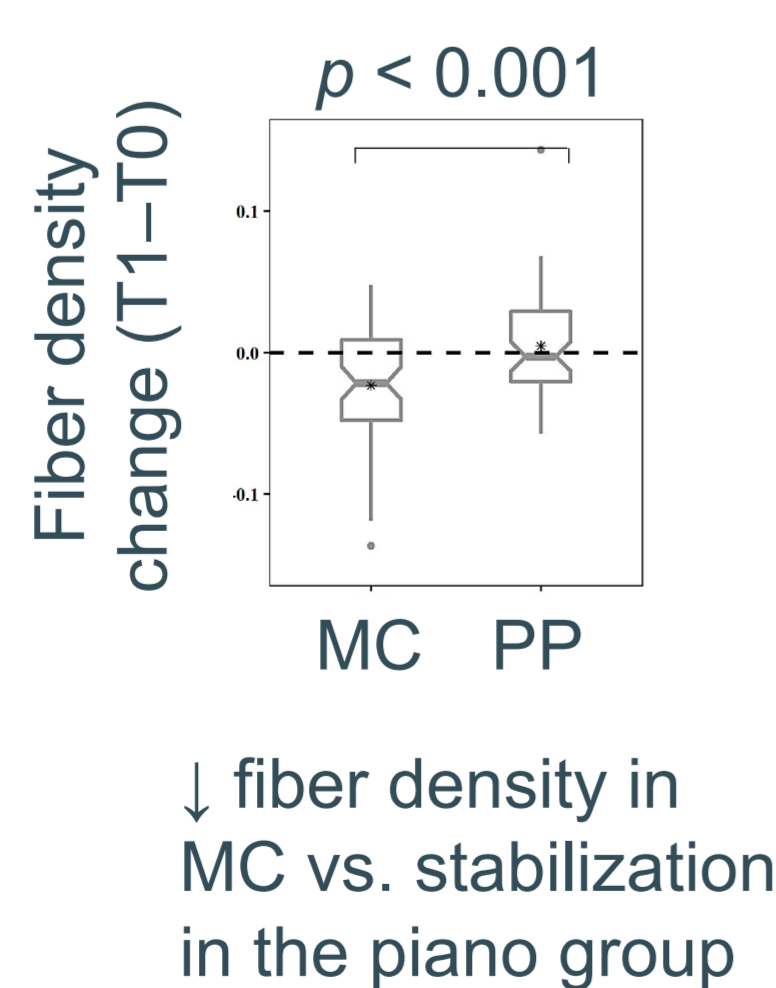
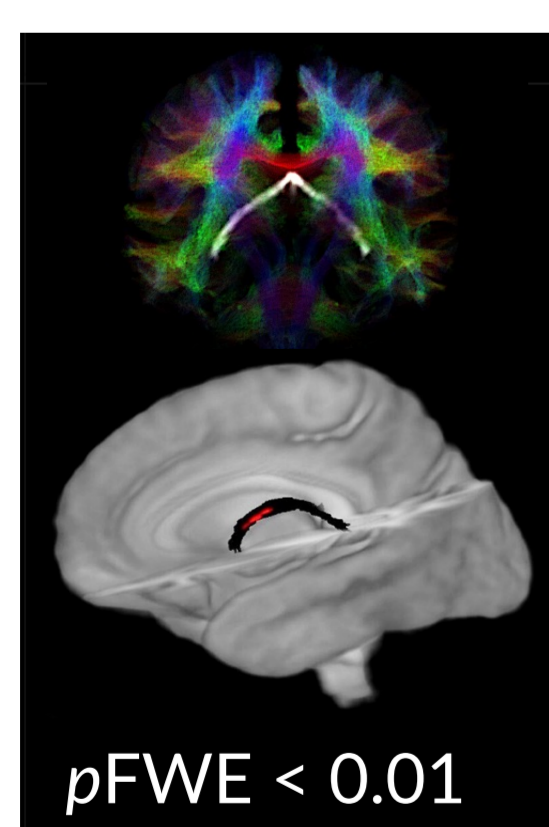
17% (R²) of the progress variance explained by the combination of grey matter volume increase, training intensity & sleep duration



6-MONTH STRUCTURAL CONNECTIVITY & EPISODIC MEMORY [6]

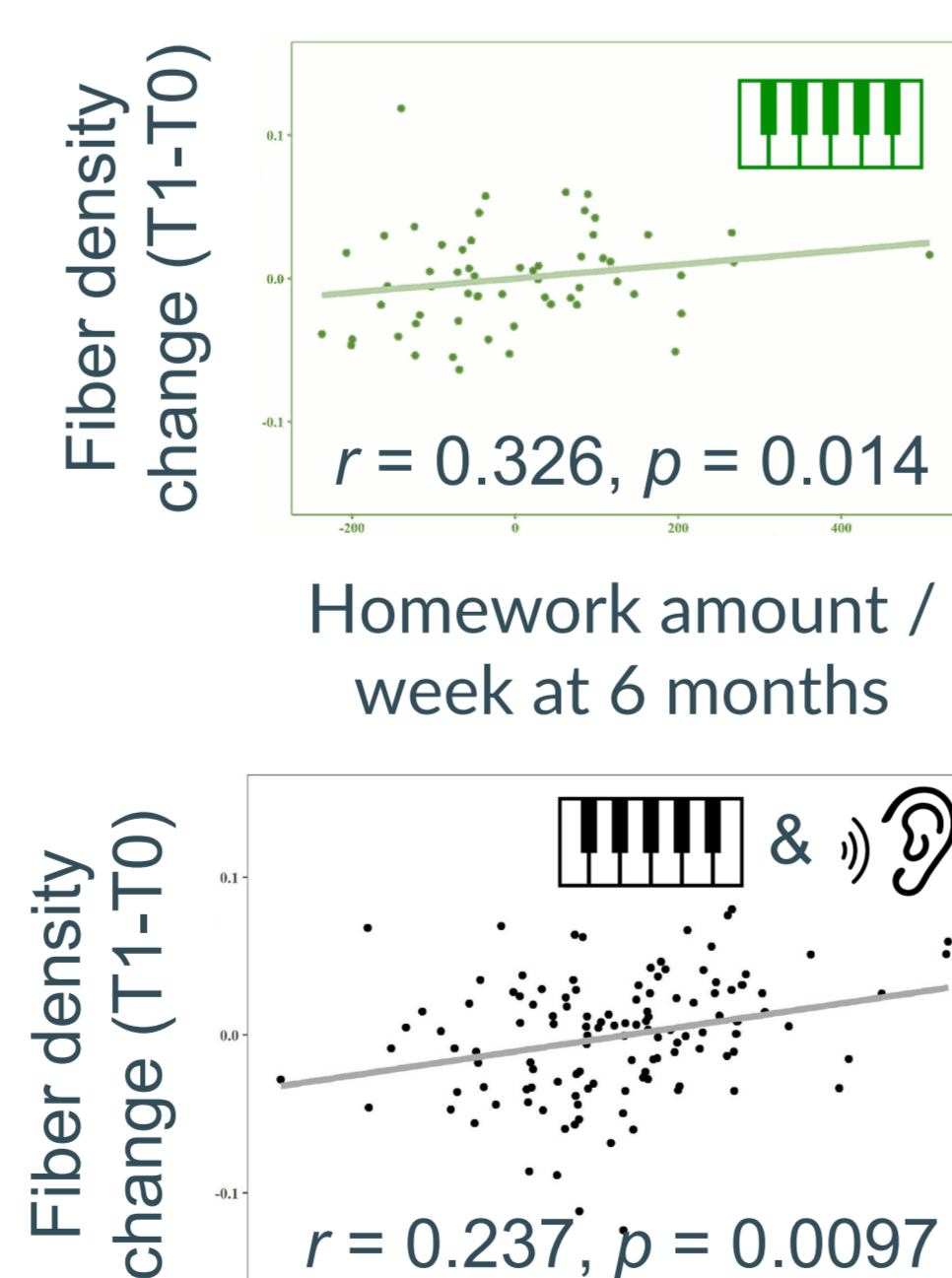
Fixel-based analysis [7] (diffusion)

- 121 individuals
- PP > MC group difference in the fornix, output tract of the hippocampus



Fiber density relates to

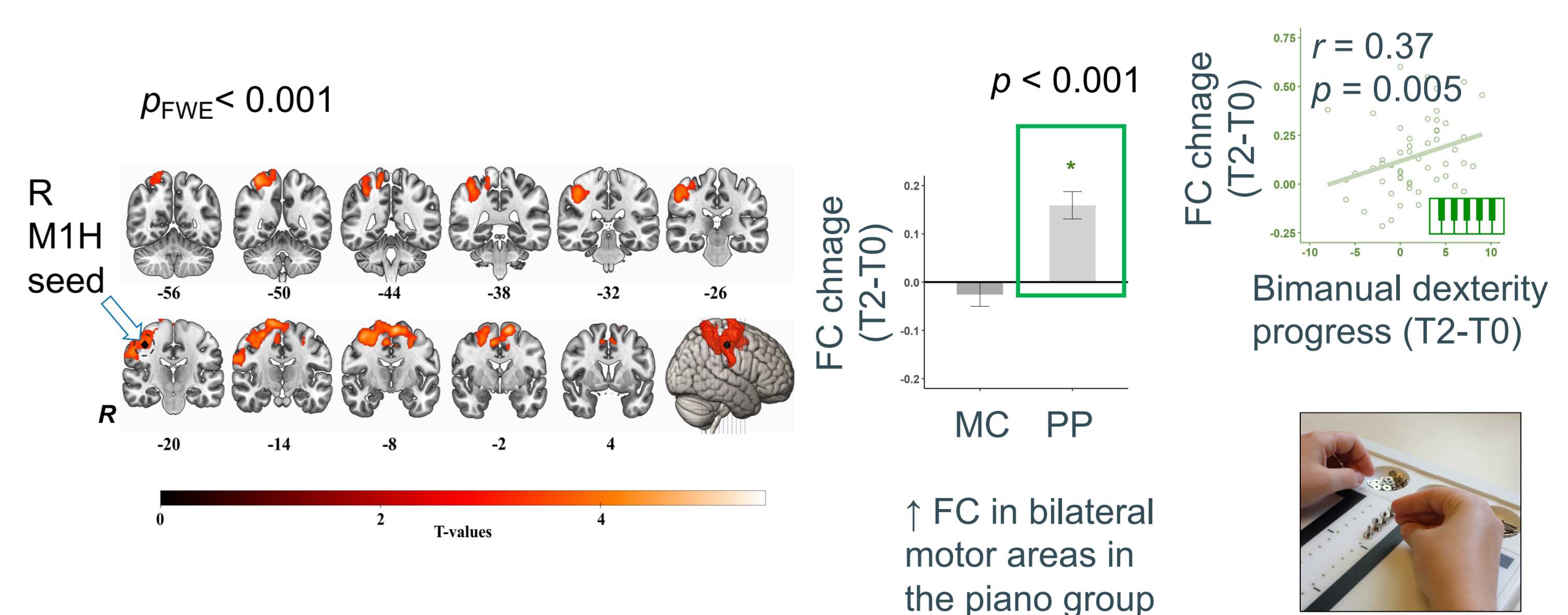
- Training intensity (PP)
- Episodic memory (30-min delayed recall of a word list, RAVL Test [8])



12-MONTH FC & BIMANUAL FINE DEXTERITY (SUBMITTED)

Seed-based functional connectivity (FC) analysis (resting-state data)

- 109 individuals, R motor hand area seed (controlling the left hand)
- FC increase with bilateral motor areas in the PP group only
- Bimanual motor skill progress
- PP group: FC change positively associated with bimanual motor skill progress (purdue pegboard [9] assembly test: assembling pins, washers and collars in a defined order for 60 seconds)



CONCLUSION

- ✓ Music, a promising intervention associated with structural and functional plasticity mediating age-related cognitive decline
- ✓ Music making > listening to foster healthy aging, support functional abilities, independence and well-being