Random delay boosts musical fine motor recovery after stroke

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Background

Motor impairments are among the most common and most disabling results of stroke worldwide. Previous studies have revealed that learning to play the piano helps to improve motor function of these patients (Schneider, Schönle, Altenmüller, & Münte, 2007; Rodriguez-Fornells et al., 2012; Rojo et al., 2011). It has been hypothesised that the effectiveness of this therapy relies on the fact that the patient's brain receives a time-locked auditory feedback (a musical tone) with each movement (keystroke) (Altenmüller, Marco-Pallares, Münte, & Schneider, 2009). Indeed, studies with healthy individuals have shown that the presence of auditory feedback can benefit motor control (Keller & Koch, 2006), although perhaps not learning (Conde, Altenmueller, Villringer, & Ragert, 2012).

Aim

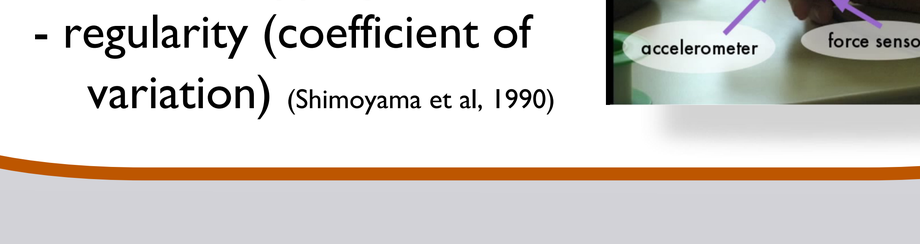
Does the stroke patient's brain use the **temporal information** contained in the auditory feedback in the process of music-supported motor rehabilitation?

Patients

15 patients in early stroke rehabilitation:
- No previous musical training,
- Light to moderate motor impairment,
- Capable of moving the index finger independently,
- No other neurological or psychiatric condition.

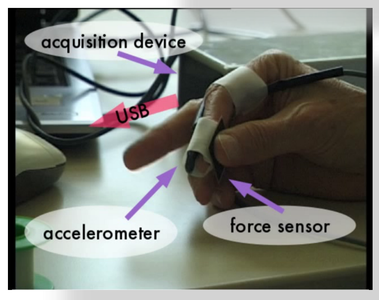
Therapy: learning to play simple finger exercises and familiar children's songs on the piano during 10 sessions of 30 minutes.

- **normal** group (n=7), the keyboard emitted a tone immediately at keystroke.
- **delay** group (n=8), the tone was emitted after a time interval between 100 and 600ms, chosen randomly at each keystroke.

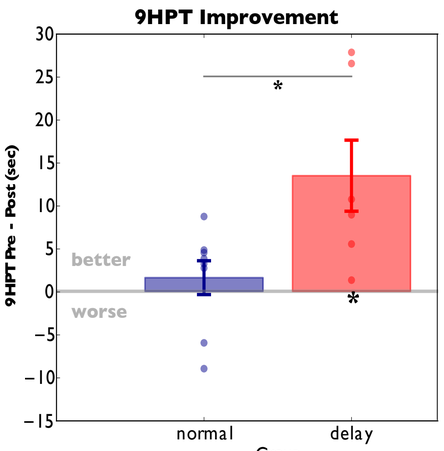


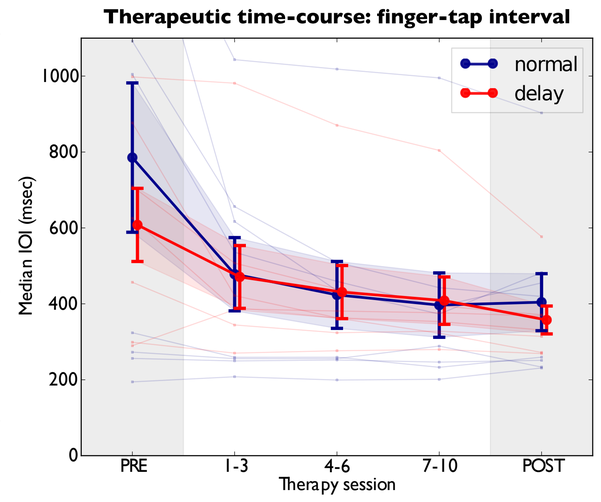
Clinical Tests

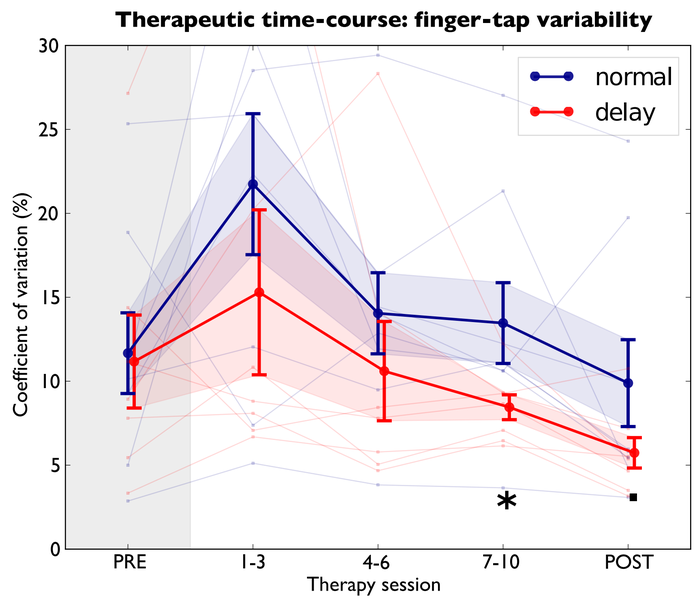
- 9 hole pegboard test
  (Mathiowetz et al, 1985; Heller et al, 1987)
- Profile of Mood States (POMS)
  (McNair et al, 1971)
- Index finger tapping:
  - maximal tapping rate
  - regularity (coefficient of variation) (Shimoyama et al, 1990)

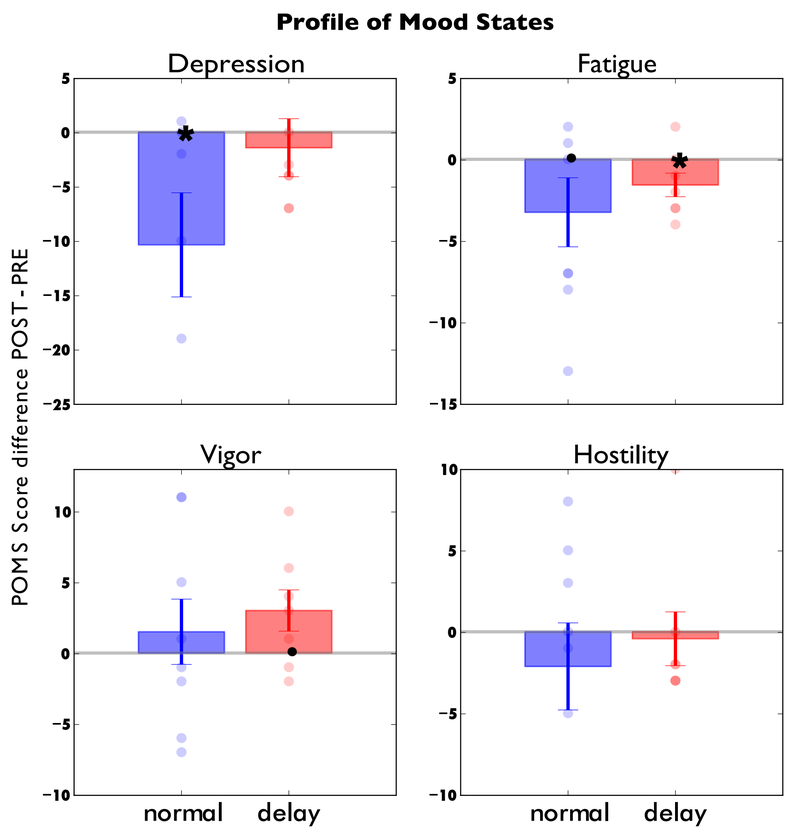


Results









Conclusion

- Auditory feedback influences musical stroke rehabilitation of fine motor functions.
- Delayed auditory feedback boosts therapeutic effect, perhaps by rendering patients independent of feedback (*guidance hypothesis,* Salmoni, Schmidt, & Walter, 1984).