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Speech synchronization abilities in people who stutter

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► **To cite this version:**

Maëva Garnier, Anneke Slis, Pascal Perrier, Christophe Savariaux. Speech synchronization abilities in people who stutter. SMC 2022 - 8th International Conference on Speech Motor Control (SMC2022), Aug 2022, Groningen, Netherlands. , pp.Poster Session I - n° 27. hal-03920114

HAL Id: hal-03920114

<https://hal.science/hal-03920114>

Submitted on 3 Jan 2023

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Context and questions

People who stutter have their fluency improved by :

- a metronome
(Brady 1969; Hanna & Morris 1977; Hutchinson & Navarre, 1977; Kalinowski et al., 2000)
- singing (Perkins et al., 1976; Healey et al. 1976; Glover et al. 1996; Falk et al. 2016)
- choral reading or joined speech
(Adams & Ramig, 1980; Kalinowski et al., 2000; Ingham et al. 2006)
- a delayed auditory feedback
(Andrews et al. 1982; Sparks et al. 2002)

➔ **How to explain these positive effects ?**
What deficits may be « restored » by these rhythmic stimulations/alterations ?

Hyp1: External trigger for the initiation of movements
Hyp2: Imposed « musical » rhythm replacing prosody
Hyp3: Switch from automatized feedback control

Material and method

- 32 participants matched in age, gender and musical training



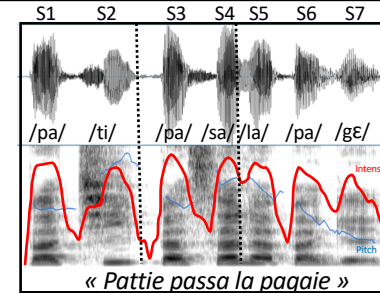
16 Typical adults
PNS



16 Adults who stutter
PWS

- 5 tasks
- | | | | | | | |
|----------------------|---|---|---|---|---|---|
| AUDITORY STIMULUS | • | • | • | • | • | • |
| 7-SYLLABLE SENTENCES | • | • | • | • | • | • |
- 1 reading (no external rhythm)
3 synchronization (predictable) } Isochronous
Medium rate (120bpm)
Fast rate (240 bpm)
1 reaction (unpredictable) } Non-isochronous (not presented here)

Interaction between musical meter and prosody

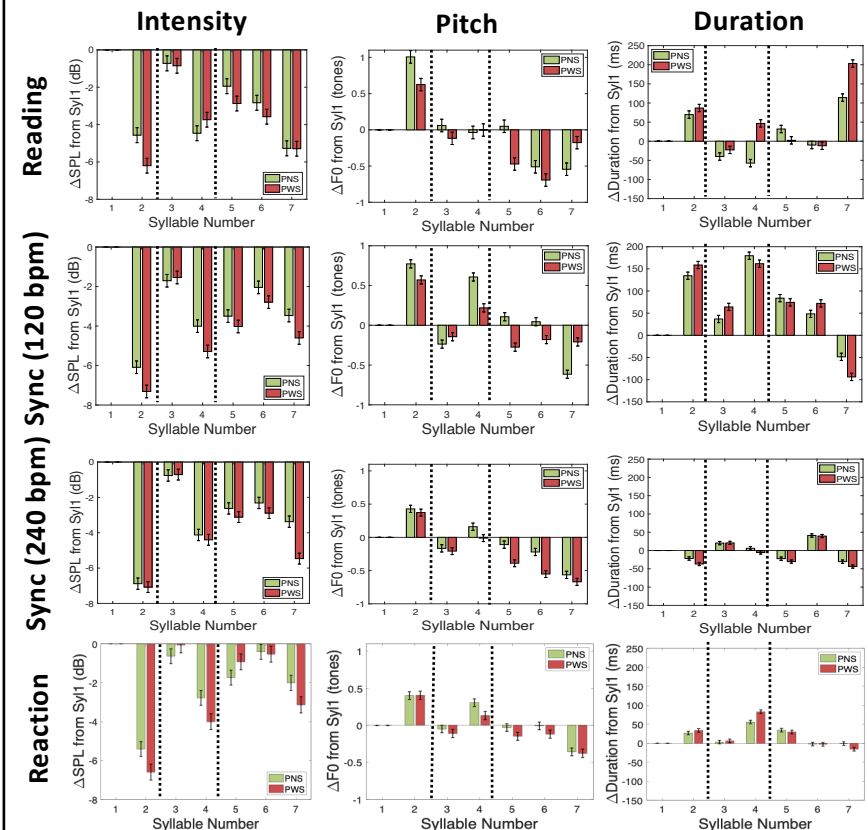


French prosody:

Word stress on the final syllable
Primary accent at the end of accentual phrases (F0 rise + syllable lengthening)
Final pitch fall at the end of an utterance

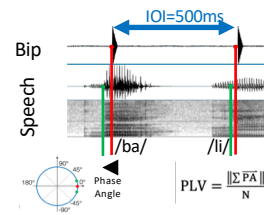
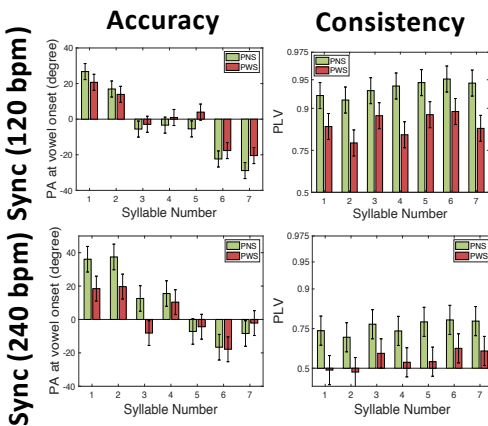
Musical meter

Quadruple, duple or triple meter
Accentuated events every 4, 2 or 3 beats



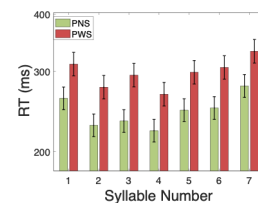
➔ No different syllable pattern in synchronization tasks, compared to Reading and Reaction tasks

Synchronization accuracy and consistency



- PLV influenced by metronome rate, while PA influenced by prosody (for both PNS and PWS)
- PWS as accurate as PNS at medium rate, and slightly more accurate at high rate
- PWS significantly less consistent than PNS at all rates

Voice Reaction Time



- Voice Reaction Time does not depend significantly on prosody or on the type of initial consonant
- PWS demonstrate significantly longer Voice Reaction Times, compared to PNS

Conclusions

- Clear difficulty of PWS with the initiation of speech movements, reflected by longer Voice Reaction Times (Hyp1)
- For both PNS and PWS, synchronized speech does not abandon prosodic marking in favor of musical meter (like finger tapping), nor accentuates prosodic cues → External rhythm does not seem to help with prosody (Hyp2).
- No systematic negative mean asynchrony in speech, like in finger tapping. Unexpected tendency towards improved synchronization accuracy in PWS
- Reduced synchronization consistency in PWS (like finger tapping), especially at high metronome rate