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# Speech motor chaining and its impact on skill maintenance for an adult with a residual speech sound disorder

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## Introduction

In the field of speech-language pathology, there is a need to investigate the efficacy of different modes of intervention targeting residual speech sounds errors (RSSEs) that will have a significant and sustained impact on individuals with mild intellectual disabilities (ID).

RSSEs are characterized by incorrect positioning and transitioning of the articulators during the formation of a specific sound or sounds (Preston et al., 2019). While RSSEs tend to have a minimal impact on intelligibility, potential negative ramifications include social stigma, limited employment opportunities, and participation in activities (Flipsen, 2015). For individuals with mild ID, RSSEs can pose a major challenge to social, emotional, and vocational adjustments (Shriberg & Widder, 1990).

As firmly established motor habits, the persistent nature of these errors can pose issues in attaining measurable progress when adopting conventional therapy approaches, necessitating the need to explore alternative modes of intervention (Preston et al., 2019).

Recent research has shown positive outcomes for the application of principles of motor learning (PML) from limb motor literature to treatment of motor speech disorders. Specifically, Speech Motor Chaining (SMC) has been proposed as a novel approach to facilitate acquisition, retention, and carry-over of a newly learned speech motor skill (Preston et al., 2019).

## Research Question

Drawing from research on the principles of motor learning (Schmidt & Lee, 2005; Maas et al., 2008; Preston et al., 2019), the **purpose** of this study is to investigate whether incorporating SMC can successfully promote acquisition and skill retention of correct articulation of the /ɹ/ phoneme for a young adult with a RSSE and mild ID.

As speech articulation is an acquired motor skill, the working **hypothesis** is that SMC will facilitate both acquisition as seen in within performance data, as well as learning as seen in maintenance of correct production of /ɹ/ across sessions.

## Target Selection

Targets were chosen based on percent accuracy of >50% across three consecutive trials per variant. A variety of phonetic contexts were considered including use of non-adjacent vowels – /o/ and /i/, and consonants that varied in place and manner for articulation – /f/ and /k/. Four specific treatment targets were selected – (/ɹi/, /ɹo/, /fɹ/, and /kɹ/), along with one untrained generalization target (/ɹɪ/).

## Methods

### Pre-Practice / Elicitation

**Aim:** Target *acquisition* by establishing a reference for correct production through cueing, models, and feedback.

### Speech Motor Chaining

**Aim:** Target *retention* through stabilization and learning of target sounds through structured practice gradually increasing complexity

### Steps:

1. Achieve 6 correct productions for each target variant in the pre-practice phase
2. Advance to structured/blocked practice using SMC data sheet (Preston & Leece, 2016) to follow schedule of feedback
3. Start at syllable-level for each target variant and progress to higher levels of complexity only after 5/6 accurate trials are achieved
4. Advance to random practice or a new chain once 5/6 accurate trials are achieved twice for two variants,

Speech Motor Chaining Datasheet

Clinician: \_\_\_\_\_ Participant: \_\_\_\_\_ Session #: \_\_\_\_\_ Time Period: \_\_\_\_\_ Date: \_\_\_\_\_

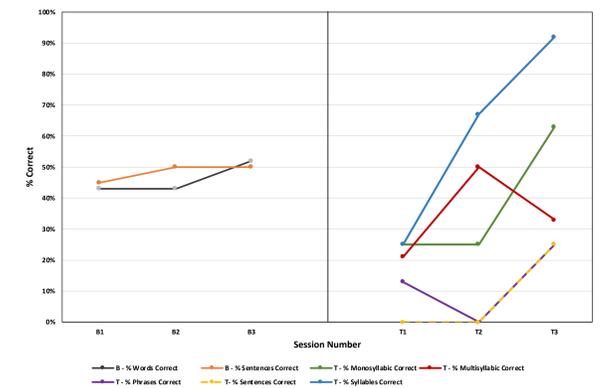
Syllable	Pre-Practice		Elicitation for /ɹi/		Elicitation for /ɹo/		Elicitation for /fɹ/		Elicitation for /kɹ/		
	Feed-back	Self-Rate	Monosyl	Pros Cue	Feed-back	Self-Rate	Multi-syl	Pros Cue	Feed-back	Self-Rate	
/ɹi/	KS, KP	7	reach	KS, KP	7	reaching	KS, KP	7	reaching new heights	KS, KP	7
	KS, KP	7	reach	KS, KP	7	reaching	KS, KP	7	reaching new heights	KS, KP	7
	KS, KP	7	reach	KS, KP	7	reaching	KS, KP	7	reaching new heights	KS, KP	7
/ɹo/	KS, KP	7	reach	KS, KP	7	reaches	KS, KP	7	ugly roaches	KS, KP	7
	KS, KP	7	reach	KS, KP	7	reaches	KS, KP	7	ugly roaches	KS, KP	7
	KS, KP	7	reach	KS, KP	7	reaches	KS, KP	7	ugly roaches	KS, KP	7
/fɹ/	KS, KP	7	frame	KS, KP	7	framing	KS, KP	7	frame the picture	KS, KP	7
	KS, KP	7	frame	KS, KP	7	framing	KS, KP	7	frame the picture	KS, KP	7
	KS, KP	7	frame	KS, KP	7	framing	KS, KP	7	frame the picture	KS, KP	7

(Preston & Leece, 2016), Syracuse University  
<http://speechproductionlab.syr.edu/Resources%20for%20Researchers.html>

	Condition	Options	Description
Practice	Amount	Small / Large	Small: low number of practice trials Large: high number of practice trials
	Schedule	Blocked / Random	Blocked: different targets practiced in separately in blocks, sessions, or treatment phases Random: different targets practiced together within the same block, session, or treatment phase
	Variability	Constant / Variable	Constant: practice of the same target within the same context Variable: practice of different targets within different contexts
	Distribution	Massed / Distributed	Massed: practice across a number of trials/sessions within a short time frame Distributed: practice across a number of trials/sessions within a longer time frame.
Feedback	Frequency	High / Low	High: feedback provided after every production Low: feedback provided after a certain number of trials.
	Timing	Immediate / Delayed	Immediate: feedback immediately follows the production attempt Delayed: feedback provided with a delay
	Type	KP / KR	KP (Knowledge of Performance): specific information about the articulatory movement KR (Knowledge of Results): information on correctness

## Preliminary Results

Within-performance shows general acquisition for four target /ɹ/ variants (/ɹi/, /ɹo/, /fɹ/, and /kɹ/).



*Note:* Decreased accuracy for multi-syllable words is attributed to use of a new chain for the variant /fɹ/ that increased phonetic complexity.

## Discussion

As seen in studies employing SMC (Preston et al., 2019; Preston & Leece, 2017), flexible conditions in practice, feedback, and task complexity can lead to both increased performance and facilitate long-term learning. With continuation of SMC as the primary therapeutic approach, it is hypothesized that maintenance of the correct production of the target variants will be achieved.

SMC provides compelling evidence for incorporation of PML into therapy for individuals with persisting RSSEs for individuals with mild-ID. Larger studies will allow for more precise and generalizable findings.

## Future Recommendations

- Continue with SMC therapy for weekly therapy sessions
- Collect maintenance probes after every 3-4 sessions, including untrained target (/ɹɪ/) to provide a point of comparison and evaluate evidence of generalization
- Develop guidelines for assessing interrater reliability by creating clear parameters for accurate and inaccurate productions of /ɹ/ based off defined perceptual characteristics

## References

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