Implicit Learning in Stuttering and Parkinson's Disease: Event Related Potentials

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Agenda

- Introduction and purpose
- Methods
- Results
- Discussion and Conclusions

Introduction

"***What to do***"

Speech therapy programs typically require learning facts, conscious self-monitoring and cognitively-based skills (e.g., think LOUD). These strategies rely on declarative or ***explicit*** learning and memory.

"***How to do it***"

Speech therapy programs also typically require unconscious procedural skills that are learned over practice and are difficult to verbalize (e.g., easy onsets). These strategies involve ***implicit*** learning and memory (Schmidt & Lee, 2011).

Introduction

"***What to do***"

Explicit learning and memory rely on medial temporal structures and the hippocampus.

"***How to do it***"

Implicit learning and memory rely on striatal circuits (Peigneux et al., 2000; Rauch et al, 1997).

Introduction

There are extensive studies of the implicit learning of persons with Parkinson's disease, cerebellar disease, amnesia and Alzheimer's disease.

Knowledge of learning system strengths and weaknesses will help us plan more effective therapy (e.g., implicit vs. explicit focus).

The implicit learning of persons who stutter remains relatively uninvestigated

Purpose:

The current study investigated the integrity of implicit learning of persons who stutter by comparing them to a population with established implicit learning deficits (PPD).

Stuttering vs. Parkinson's Disease

(Alm, 2005; Smits-Bandstra & De Nil, 2007)

- Cortico-striatal-thalamo-cortical circuits?
- Repetitive speech phenomena
- Reduced reaction time and slower movement durations
- Impaired movement sequencing
- Impaired ***implicit*** learning?

- Basal Ganglia Impairment
- Repetitive speech phenomena (54%)
- Reduced reaction time and slower movement durations
- Impaired movement sequencing
- Impaired ***implicit*** learning

Why compare PPD and PWS?

Extensive research regarding implicit learning deficits (specifically sequence learning) in PPD due to basal ganglia dysfunction.

If PWS and PPD demonstrate similar deficits on an implicit learning task - known to involve the striatal circuit - this would provide information regarding possible etiological factors of stuttering.

Method

- Participants
  - 14 PPD (7 females; 65.1, SD 6.9).
  - 14 PWS (6 females; 65.1, SD 5.7).
  - 14 Control (6 females; 65.0, SD 5.8)

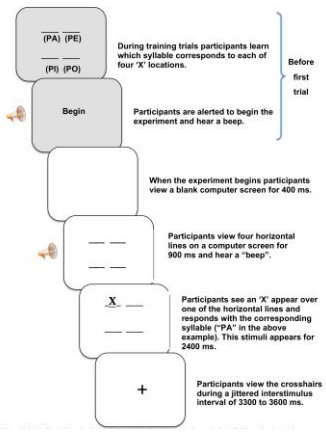
Screened for mental state (MMSE), depression (BECK), speech and language (SSI-3, dysarthria), digit span, hearing, vision, and medications

Method

- Implicit Sequence Learning Task

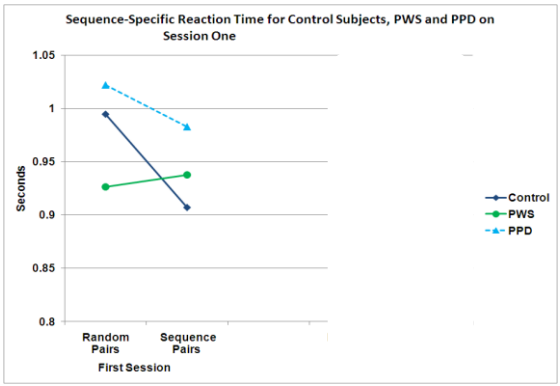
Serial Reaction Time Task
(Nissen & Bullemar, 1987)

The subject anticipates and performs each part of a sequence more and more quickly over practice, without realizing there is a sequence.



Method: Implicit Sequence Learning

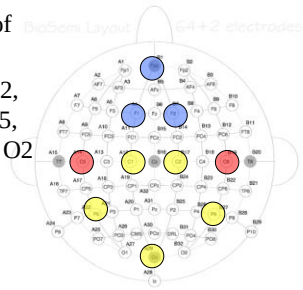
- Unbeknownst to participants, the syllables formed a repeating 8-item sequence (***PO PI PO PE PI PA PE PA).***
- Longer reaction times for PWS ($F(1, 26) = 7.3$, $p = .01$, $\acute{\eta}^2 = .22$) and PPD ($F(1, 26) = 3.2$, $p = .08$, $\acute{\eta}^2 = .11$) relative to Controls indicated ***less efficient implicit learning abilities in these two populations***.



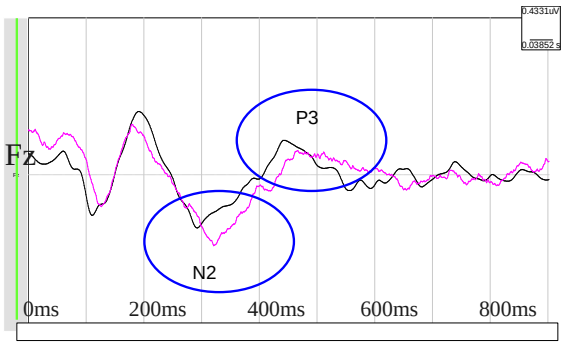
Method: Event-related potentials

10 Sites of Interest:

Fpz, F1, F2, C1, C2, C5, C6, P5, P6, O2

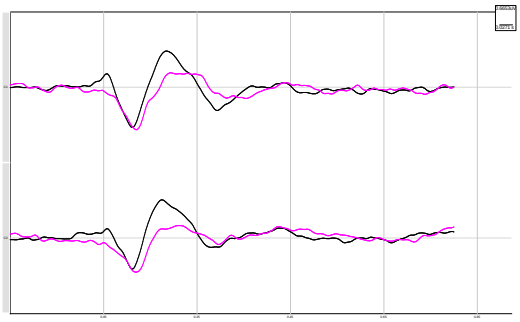


ERP Results



Control = black, PWS = red,

ERP- Results



ERP- Statistical Results
N2 latency & area, P3 latency & area

- PPD and PWS were significantly different from controls but not each other for 27/37 sig. comparisons (73%) (always C1, C2)
- PPD and PWS were significantly different from each other AND controls for 4/37 comparisons (10%)
- PPD more F1, F2, and FPZ
- PWS more C5, C6

Clinical Implications

- More practice/drill required to reach optimum performance?
- More focus on explicit strategy use and conscious self-monitoring (e.g., LSVT)?