Acoustic prominence in Parkinson's disease

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Overall, talkers with & without PD produced longer, louder, & higher pitched prominent words, though PD talkers modified pitch less. Stop voicing contrasts were not mediated by prominence for either group, though PD talkers showed atpyical voicing contrasts.

INTRODUCTION

- English speakers tend to make words that carry new or contrastive information more ***prominent.*** This is important, for example, when giving instructions or directions, especially when words are confusable.
- **Prominent words tend to be longer, louder, higher pitched, and hyperarticulated** compared to non-prominent words (e.g., Cole 2007).
- Prominence can result in greater **phonetic distinctiveness** for SOME contrasts, but not others, at least in young healthy talkers. For example, prominence tends to lead to *increased stop voicing but not place contrasts* (Cole 2007; Cho, 2003).
- **Parkinson's disease** (PD) is associated with alterations in duration, intensity, f0, as well as stop voicing contrasts (e.g., Kent & Kim 2003; Tjaden et al., 2013; Whitifeld et al., 2018).
- Some studies suggest attenuated use of duration & pitch in prominence marking in PD (Tykalova et al., 2014), but others have not found a clear difference (Cheang & Pell, 2007; Thies et al., 2007; Gaviria, 2015). A limitation of previous research is the lack of a communicative task with another person (limited ecological validity).
- How prominence affects acoustic-phonetic contrasts in PD is unknown.

Research Questions

1. When giving verbal instructions to another person, how do older adults with and without PD convey prominence?
2. Does prominence lead to enhanced stop voicing contrasts in older adults with and without PD?

METHODS

- **Participants**: 11 PD & 11 age/gender matched controls (7m, 4f in each group)
- **Verbal instruction task:** Participants read aloud instructions to a researcher that directed them where to move picture cards on a game board.
- Target onsets were always *voiced or voiceless bilabial stops*. Prominent words differed by voicing.
- **Analysis**: Linear mixed effects models quantified effect of Group, Condition & their interaction on prosodic markers (word duration, intensity, f0) and stop voicing contrasts (voice onset time, voicing during stop closure) of final target word.

Repeat: "Move the bot above the chair, now move the [bot]$_{target}$ above the window."

Prominent: Move the bot above the chair, now move the [pot]$_{target}$ above the chair."

RESULTS & DISCUSSION

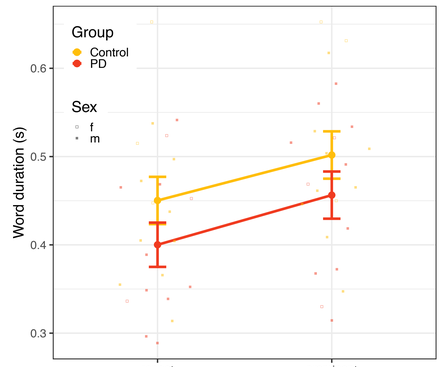
- **RQ1:** Both groups manipulated prosodic markers as expected in prominent words, but PD participants showed less variation in pitch compared to controls.
- **RQ2:** Neither group demonstrated enhanced stop voicing contrasts in prominence. VOT & closure duration followed expected pattern of overall strengthening, but not increased distinction. VDC showed and unexpected *decreased distinction* in prominence in both groups.
- ***PD groups tended to show less voicing contrast overall*** compared to controls across both conditions. PD had longer voiced VOT and closure durations, and shorter voiceless VOT and closure durations than controls.
- **Take-home:** People with PD appear to signal prominence similarly to healthy controls, but to a lesser extent with certain cues. Voicing contrasts were not enhanced in older adults.
- **Next steps:** impacts on intelligibility and perceived prominence?

EFFECTS OF PROMINENCE ON PROSODIC MARKERS

Word duration

Both groups produced LONGER prominent words.

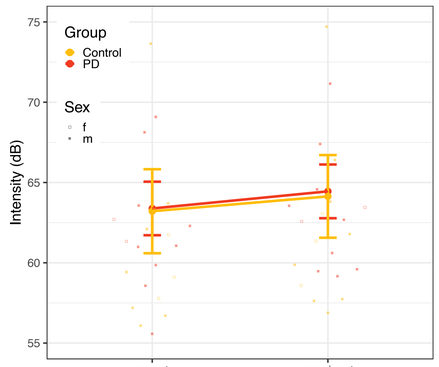
- Main effect of condition ($p < 0.001$)
- No main effect of or interaction with Group



Vowel intensity

Both groups produced LOUDER prominent words.

- Main effect of condition ($p < 0.001$)
- No other effects or interactions

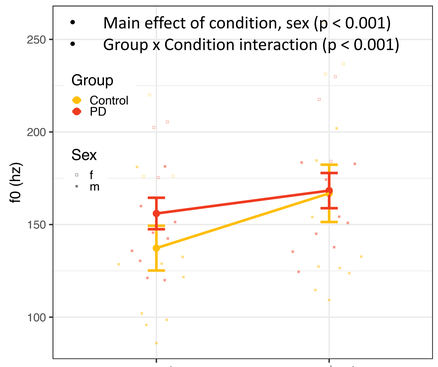


Vowel f0

Both groups produced HIGHER f0 in prominent words.

Smaller change in pitch for PDs.

- Main effect of condition, sex ($p < 0.001$)
- Group x Condition interaction ($p < 0.001$)

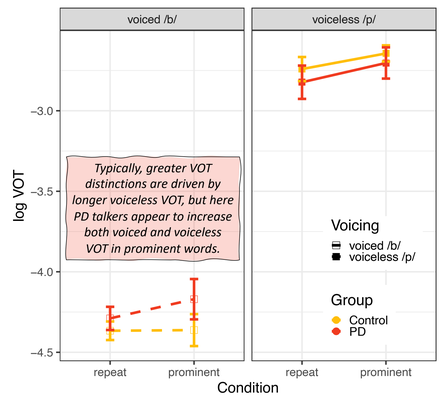


EFFECTS OF PROMINENCE ON STOP VOICING CONTRASTS

Voice onset time

VOT was NOT affected by prominence for either group.

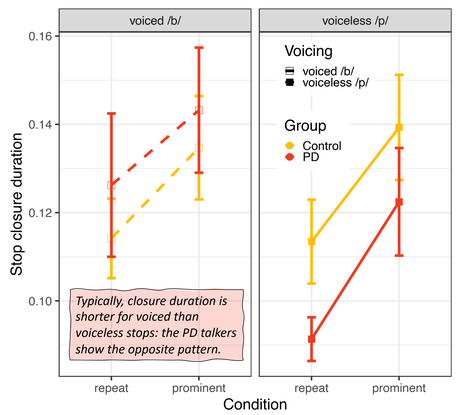
- Main effect of voicing but not condition or group
- Non-significant trend (p=0.14) for less VOT contrast by PD talkers (longer voiced VOT)



Closure duration

Both groups produced LONGER STOP CLOSURES in prominent words.

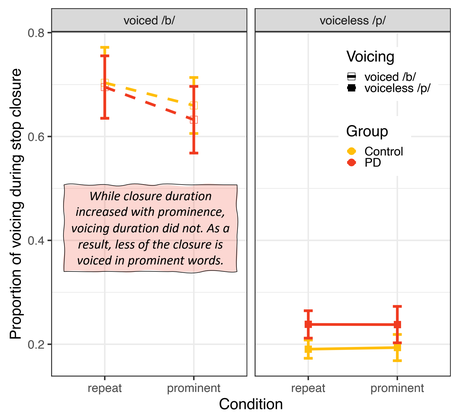
- Main effect of condition ($p < 0.001$) & voicing ($p = 0.004$)
- PD talkers also produced longer voiced closure & shorter voiceless closure than controls – opposite pattern of typical voicing distinctions! (voicing x group, $p = 0.04$)



Voicing during closure

Both groups had LESS CLOSURE VOICING in prominent words.

- Main effect of condition ($p < 0.05$) & voicing ($p < 0.001$).
- Non-significant condition x voicing trend ($p = 0.14$): less voicing in voiced stops in prominent words; no change in voiceless stops.



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