Phonemic Awareness Goes Hand in Hand with Phonetic Deafness

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Does learning to read merely create meta-linguistic awareness of phonemes, or does it fundamentally restructure speech processing itself [1,2]? Visual-word recognition research has argued that literacy changes pre-lexical representations, making pre-lexical units multi-modal and activated bottom-up during spoken word recognition [3]. Here, I challenge this view, proposing instead that phonemic awareness is a post-lexical phenomenon.

I tested whether orthographic experience affects pre-lexical speech representations by exploiting glottal stops, which have explicit graphemes in Maltese (<q>) and German (the gender-star <*> in gender-fair plurals). Crucially, glottal stops also occur without orthographic coding where they mark prosodic boundaries—often creating meaning differences—as in German gegen(ʔ)arbeiten 'to work against' (no [ʔ]) vs. 'to oppose labour' (with [ʔ]) and Maltese emmen(ʔ)annimal 'he believed the animal' (no [ʔ]) vs. 'believe, animal' (with [ʔ]). A pretest showed that listeners were able to perceive these meaning differences in these utterances. If literacy creates multi-modal pre-lexical units activated by bottom-up input, listeners should identify glottal stops as segments even in uncoded instances. This is what it means to be a pre-lexical, bottom-up unit in speech perception.

German (n=206) and Maltese (n=225) participants were asked to describe auditory differences between utterance pairs in an online experiment. Instruction and example trials involved clear segmental (e.g., *broom* vs. *room)* or prosodic changes (e.g., *'she believed Julia'* vs. *'she believed, Julia'*) and provided example answers such as “a /b/ is missing” (segmental) and "the words are produced closer together in the first case" (prosodic). Filler trials with similar differences were used to measure task engagement.

Critical trials contrasted presence vs. absence of glottal stops, either orthographically coded or not. If orthographic knowledge influences pre-lexical representations, we should observe a modest reduction moving from coded to uncoded glottal stops, comparable to the ~10% reduction for lexically relevant but orthographically uncoded segments (/w/ in *swim* vs. *queen*) as observed in [4]. If orthography does not influence pre-lexical processing, success rates should approach those of illiterate adults in phoneme-manipulation tasks (~10% [2]).

After excluding non-engaged participants (<50% appropriate responses based on independent automated coding), 194 German and 130 Maltese participants remained. Orthographically and lexically coded glottal stops were reported correctly ~80% of the time (vs. ~90% for oral stops, in line with the weaker status of glottal stops as a phoneme as observed in [5]). However, only two German and five Maltese participants identified uncoded glottal stops as such—a dramatic drop from ~80% to ~1-4%, despite similar acoustic strength (≈60ms glottalization). Instead, most participants described the glottal stop as a prosodic difference or failed to hear a difference at all. This drop significantly exceeds reductions reported for lexically relevant but uncoded segments [4] but aligns with pre-reader performance [2].

These results suggest phonemic awareness is post-lexical rather than based on pre-lexical speech representations. Together with findings that listeners report the presence of deleted segments in spontaneous speech despite their phonetic absence [6], this suggests that literacy creates meta-linguistic knowledge while simultaneously rendering listeners less sensitive to phonetic reality when it lacks orthographic coding.

References

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Figures

Figure 1: Proportion of categories of descriptions for the four types of utterance pairs: epenthetic glottal stop (not orthographically coded), glottal stop (orthographically coded) and the two control conditions (segmental versus prosodic difference). Outcome categories code for described differences in terms of a glottal stop, other segmental differences, prosodic differences or answers saying that listeners could not hear a difference.