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The Relationship Between Phonemic Decoding Ability and Recall Accuracy and Reaction Time

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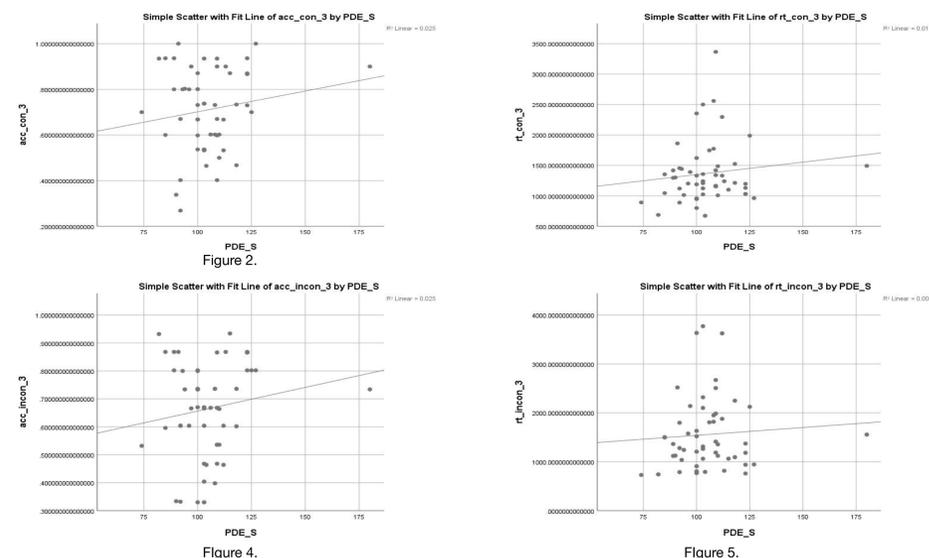
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Introduction

- Prior research suggests that individuals with better phonemic decoding ability will exhibit better performance on working memory tasks related to reading.
- The present study examines the relationship between phonemic decoding efficiency (PDE) and recall accuracy and reaction time in orthographically consistent and inconsistent tasks. We measured phonemic decoding ability via the Test of Word Reading Efficiency, second edition (TOWRE-II) assessment tool. The phonemic decoding task required participants to read as many non-words that are made up of different phonemes (e.g. ip, ta, ko, luddy, dord) as possible within a forty-five second window.
- When the reading task was complete, participants were presented with a word sequence of orthographic consistency (e.g. best, rest, test, nest, vest) or inconsistency (e.g. bone, hone, done, tone, zone), followed by a distraction task and a memory task.
- Event related potentials (ERP) are electrophysiological data that measures neural activity during cognitive processing for a presented task. This type of psychophysiological exam is performed using a head cap, electrically conductive gel, and Ag/Cl electrodes that are placed on the scalp and attached to an amplification device that adapts the data into a readable, wave-like format.
- Due to high temporal resolution, ERP is utilized to collect a variety of sensory processing data, in this case, behavioral data regarding accuracy and reaction time during word recall tasks.
- The objective of this research is to explore the relationship between PDE and working memory, such that participants with higher scores on the phonemic decoding task will have higher accuracy scores in the memory task as well as potentially lower reaction times.

Results



- We used SPSS 25 to run a Pearson's Correlation to measure the relationship between PDE scores with accuracy and PDE scores with reaction time on a task to recall the third word in each sequence after a distraction task.
- Figure 2 represents the correlation of PDE and accuracy on the consistent words trial and revealed an insignificant correlation between the two variables, $r=.236, p=.127$.
- Figure 3 represents the correlation of PDE and reaction time on the consistent words trial and revealed an insignificant correlation between the two variables, $r=.092, p=.556$.
- Figure 4 represents the correlation of PDE and accuracy on the inconsistent words trial and revealed an insignificant correlation between the two variables, $r=.200, p=.198$.
- Figure 5 represents the correlation of PDE and reaction time on the inconsistent words trial and revealed an insignificant correlation between the two variables, $r=.050, p=.749$.

Discussion

- The insignificant relationship between PDE and recall accuracy and reaction time suggests that there may not be as strong of a relationship between PDE and working memory as previous data has suggested.
- Previous research has shown that participants who displayed greater attentional blink periods had poorer phonemic decoding abilities.
- Data suggests that approximately 41% of fifth grade children ($n=35$) with deficiency in phonemic attention and in verbal short term memory had deficient word decoding ability.
- However, other research exploring the relationship between verbal short term memory and decoding efficiency showed no statistical significance between the two variables ($r=0.075$) for third grade children and ($r=0.216$) for fifth grade children.

Conclusions

- The statistical insignificance of the data suggests that further research should investigate the specific nuances of the relationship between memory and PDE. The existing data is mixed.
- Correlational research in this field suggests that phonemic awareness and decoding ability as well as performance on recall tasks can function as predictive factors for reading skill acquisition in younger children. Statistically significant results have yet to be seen in adult participants, likely due to increased prior reading and language experience.
- The implications of these data expand to reading comprehension in an academic setting as well as improving the understanding of learning disabilities such as dyslexia and attention deficit hyperactivity disorder.
- Continued research in the field of language acquisition and development with respect to phonology can prove beneficial for the education and support of early readers because of the predictive factors that relate to phonemic awareness and later success in reading.

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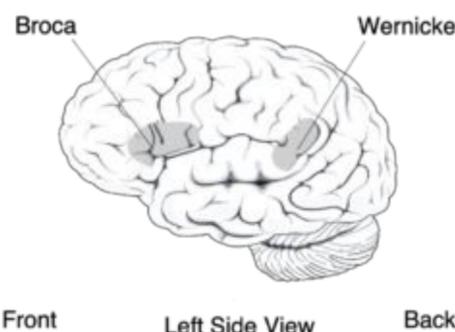


Figure 1.

Figure 1. shows typical neural locations associated with reading and language. Broca's area is associated with expressing language. Wernicke's area is associated with language comprehension. Individuals who struggle with phonemes often have different activity in the cortex. That is, there is less blood flow to the language centers of the brain (e.g. Broca's area and Wernicke's area) which is indicative of less activity.

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