

Eye Tracking Proves Useful In Improving Dyslexia Screening For Danish Adults

The standardized test currently used in dyslexia screening leaves a large percentage of people in a gray area without the aids they need. New research adds a corpus of eye tracking data from dyslexic readers to the CopCo dataset, showing potential for becoming the new norm for dyslexia screening.

By **Mie Jonasson, Sebastian A. B. Andersen, Sarah D. Ramezanpour & Carl A. Wismer**

The standardized tests currently used in Denmark are based on decoding words, yet it is designed for children and does not account for the different degrees and ways of being dyslexic. Dyslexia diagnosis in Danish adults can be challenging, as dyslexic people often develop coping mechanisms as they get older. This makes them able to mimic reading and decoding text the same way as non-dyslexic people. Former Research Assistant Marina Björnsdóttir from the IT University of Copenhagen, describes the goal of their research:

“I thought it would be very interesting to find a topic that would have a positive impact on a group of people here in Denmark. For instance, some people that would need assistive tools, or something that technology could help enhance in any way.”

The new research adds a collection of eye tracking data from natural reading of Danish texts to the CopCo dataset, recorded from 18 diagnosed dyslexic

people. The CopCo dataset is a collection of eye tracking recordings in Danish and is the first of its kind. Similar datasets exist in other languages and have proven useful for detecting dyslexia both amongst children and adults. The research uncovers the potential for using eye tracking data as the basis for detecting dyslexia from natural reading in Danish with high accuracy.

The Problems With Standardized Dyslexia Screening

Improvements are needed in standardized dyslexia screenings due to two main reasons; the number of late diagnoses and the large uncertainty in existing tests. The uncertainty in test results largely stem from symptoms of dyslexia occurring in varying degrees and some dyslexics having developed techniques to compensate, making the defining characteristics harder to ascertain.

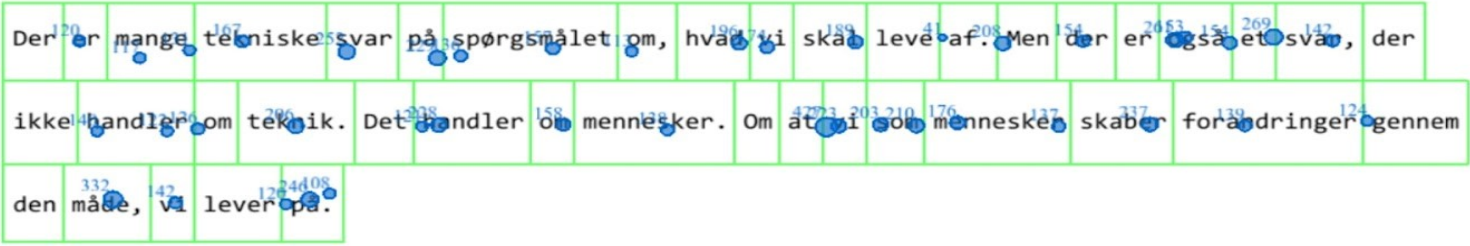
Compared to other Nordic languages, reading comprehension skills have proven to be poorer in Danish. The Danish language proves harder to decode than the languages of its neighboring countries due to its deep orthography. The orthography of a language is considered deep when decoding combinations of letters into sounds is harder and/or inconsistent. A high number of phonological challenges often follow deep orthographies, making it important to assert reading difficulties and provide aids early.

Eye Tracking : The Future for Dyslexia Screening

Eye tracking data can help determine clearer characteristics of dyslexic reading patterns, as each data point tells us something about what goes on inside our brain. We can track how many times a particular word was revisited during reading as well as the amount of time spent focusing on each word. Both of these have proven to be valuable features in dyslexia classification.

The new collection of eye tracking recordings from natural reading produced a high accuracy overall, yet a number of dyslexic samples were misclassified as non-dyslexic. During their research into the misclassifications of dyslexic readers, it was discovered that readers with high reading speed would be

Non-Dyslexic



Dyslexic



The difference between dyslexic and non-dyslexic readers become apparent by the amount and length of fixations recorded through eye tracking in above three example sentences.

misclassified more often. In these cases, using the pseudohomophone test as supporting evidence proved useful, as Marina Björnsdóttir describes:

“The pseudohomophone test, the nonsense word test, was a big help [in] supporting the evidence of the groups being dyslexic or not dyslexic.”

Danish dyslexia screening is largely based on the pseudohomophone test, which asserts the decoding of nonsense words to determine which real word it sounds like when pronounced.

Collections of eye tracking data in other languages show high accuracy in diagnosing dyslexia, indicating this as a possible future improvement on standardized tests. One example of such an experiment was posed by Raatikainen et al. (2021) for the Finnish language. The study proved the usefulness of using machine learning to detect dyslexia by achieving an accuracy of 89,7%, meaning detecting whether an individual had a diagnosis correctly for approximately 9 out of 10 people.

Where Do We Go From Here?

The main challenge in current dyslexia detection research is the lack of variety in the data as it is sampled from a small group of individuals. This means that a machine learning algorithm based on the data might pick up patterns of the individuals that are not necessarily indicative of dyslexia. Marina Björnsdóttir describes what needs to be done in the future to create a better alternative for dyslexia screening;

“The project would definitely need to be a lot larger. We would need a lot more data, [including] data from people who do not necessarily have a diagnosis of dyslexia, but report reading difficulties.”

There is plenty of work to be done for different population groups with reading difficulties, for which eye tracking can be utilized. Differentiating the characteristics of reading patterns for subgroups such as attention deficit and learning disorders could improve the accuracy of dyslexia screening.

Another recent addition to the CopCo dataset considers natural reading in Danish for non-native speakers, expanding the possibilities for adding more variation to the dataset and machine learning models. This is just another small step towards creating a representative collection of data capturing the entire range of readers - from neurotypical to various learning disorders. The corpus will keep expanding, bringing us closer to creating a new norm within dyslexia screening in the future.

About the Researcher:
Marina Björndóttir, Research Assistant
The IT University of Copenhagen
E-mail: marina.bjorns@gmail.com
LinkedIn: <https://www.linkedin.com/in/marina-bjorns>
Paper: <https://aclanthology.org/2023.nodalida-1.7/>

Additional Resources:
CopCo: <https://cst.ku.dk/english/projects/copco>
Raatikan et al. (2021): <https://www.sciencedirect.com/science/article/pii/S2590005621000345>

Facts on Dyslexia in Denmark

