Evaluating the Cognitive Load of the People with Dementia via Remote EyeTracking

Abstract

The purpose of this research is to understand the cognitive load and emotional response of the people living with Dementia when interacting with digital health information. People rely on information on the internet nowadays a lot. So we wanted to study how different types of digital health information affect the cognitive load and emotional health of people living with mild dementia. Specifically, we want to investigate four types of digital health information: 1) dementia advocacy websites, 2) blogs written by people with dementia about dementia, 3) medical articles about dementia, and 4) large hospital systems online dementia information. We plan to record the eye-movements and facial expressions of the participants to understand and calculate the cognitive load they experience while they see each of the four types of online dementia information. As we've found in previous qualitative analysis, people with dementia are going to these platforms in search of reliable information about their condition due to a lack of information provided by physicians upon diagnosis. However, searching online for health information can be problematic, as in past qualitative work we've found that online dementia information is largely pessimistic, harsh, and extremely negative. This can add to the depression and hopelessness most people who are diagnosed with dementia experience. Given this qualitative information, we now want to study how this information is being processed by the participant when they see and read difficult, negative and harsh dementia information. With the help of eye tracking we would like to calculate the cognitive load, and emotional status of their reaction to different types of online dementia information. Also we would like to ask them a few questions about the articles- website- and blogs they see. If they were able to understand them or not,what they took away from the article as important information and their overall perceptions of the cognitive and emotional accessibility of the information

Introduction

Dementia is a chronic neurodegenerative disorder that affects millions of people worldwide. As dementia progresses, it can impact an individual's ability to communicate and engage in everyday activities, leading to social isolation and reduced quality of life. Eye-tracking technology is a non-invasive method that can provide insight into how individuals with dementia process visual information, including their attentional focus, visual scanning patterns, and cognitive load. This review aims to explore the existing literature on the use of eye-tracking technology in people with dementia and its potential for enhancing our understanding of this condition.

In today's digital age, people often turn to the internet to seek information about their health conditions. The internet has become an important source of information for people seeking information about their health conditions. However, not all online health information is accurate, reliable, or trustworthy. In the case of dementia, people often turn to the internet to find reliable

information about their condition due to a lack of information provided by physicians upon diagnosis. Previous qualitative analysis has shown that online dementia information is largely pessimistic, harsh, and extremely negative. However, the online dementia information available to patients is often negative, pessimistic, and harsh. As a result, people with dementia are likely to experience depression and hopelessness, leading to a negative impact on their cognitive and emotional health. The purpose of this research is to understand the cognitive load and emotional response of people living with mild dementia when interacting with digital health information. Specifically, this study aims to investigate four types of online dementia information and how they affect cognitive and emotional health.

Research has shown that cognitive load, or the mental effort required to process information, can impact memory and learning. In the context of dementia, cognitive load can affect the ability of people with dementia to process and retain information about their condition. Emotional response, on the other hand, can affect the overall mood and well-being of people with dementia. Thus, understanding the cognitive load and emotional response of people with dementia when interacting with online dementia information is critical to improving their cognitive and emotional health.

In this pilot study, we plan to investigate three types of online platforms: dementia advocacy websites, blogs, and medical articles. We will record the eye movements and facial expressions of participants to understand and calculate the cognitive load they experience while they see each of the three types of online dementia information. Additionally, we will ask participants a few questions about the readability of articles, websites, and blogs they see to understand their overall perceptions of the cognitive and emotional accessibility of the information. Overall, this study will contribute to a better understanding of the impact of online dementia information on the cognitive and emotional health of people living with mild dementia.

Literature Review

Several studies have investigated the use of eye-tracking technology in individuals with dementia, focusing on different aspects of visual processing. One study found that people with dementia had shorter fixations and fewer saccades compared to healthy individuals when viewing pictures of faces, indicating a reduced ability to process emotional and social cues (1). Another study found that people with dementia spent less time looking at visual stimuli related to their current task, suggesting a decreased ability to maintain attention and prioritize relevant information (2).

Eye-tracking technology has also been used to explore how individuals with dementia navigate complex visual scenes. One study found that individuals with mild cognitive impairment and Alzheimer's disease had reduced exploration of complex visual scenes compared to healthy controls, indicating a decreased ability to plan and execute complex visual search strategies (3).

Another study found that people with dementia demonstrated increased cognitive load when viewing complex visual scenes, indicating a reduced ability to process and integrate multiple sources of visual information (4).

Overall, the use of eye-tracking technology in people with dementia has provided valuable insights into how visual processing is affected by this condition. By identifying specific patterns of visual processing, eye-tracking technology can help to develop more effective interventions and support strategies for people with dementia. However, further research is needed to explore the potential clinical applications of this technology and to investigate the relationship between visual processing and other cognitive and behavioral domains affected by dementia.

The paper investigated the effectiveness of positive psychology interventions (PPIs) on the mental health of children and adolescents. It involved a meta-analysis of 17 studies and found that PPIs had a moderate, positive effect, particularly those focusing on positive emotions, gratitude, and strengths-based approaches. The study emphasized the need for more rigorous and standardized research on PPIs to establish their effectiveness and optimal delivery methods. Overall, PPIs may be a promising addition to current interventions for promoting mental health among children and adolescents. However, the study's limitations include the small number of studies and the relatively short follow-up periods. (5)

Methods

The sentence "To do the virtual eye tracking, realeye.io was used here" means that the process of tracking where a person's eyes move on a computer screen was done using a software called realeye.io. Realeye.io is a virtual software that can be used from anywhere, and to use it, a person needs access to a webcam. To create a survey using this software, a version of the software needs to be purchased. The author of the text purchased a student version of the software that allowed them to modify a survey and had a participant limit of 20 and a duration of one month.

The survey created by the author consisted of images of three platforms: blogs, websites, and medical articles. Each image was shown for 20 seconds, and after that, four questions were asked to the participants. The questions were designed to evaluate if the participants were able to view the entire image, if they scrolled through it, if they were able to read the content, and if it was difficult to read the content. These questions are:

- Were you able to look at the whole image?
- Did you scroll through the image?
- Were you able to read the content?
- Was it difficult to read the content?

The survey had a specific flow. When a participant opened the survey, they needed to calibrate it. This process involved following 40 dots on the screen with their eyes and then focusing on four more dots. After this, the survey began. The images were shown randomly, and each section consisted of a set of images, questions, and a pause. After each image was shown, four questions were asked, and the participants had three seconds to answer each question. The results were presented in a results section with heatmaps, which showed where the participants' eyes moved on the screen. Before each section, instructions were given to the participants regarding the type of image that would be shown, whether it was a blog, website, or medical article. The text also mentions that there were limitations to the student version of the software, which are discussed in a separate section.

In the present study, the images used in the survey were taken from online dementia platforms. However, these images were not created by the researchers; they were obtained from existing websites and blogs. It is worth noting that these platforms contained ads that could have potentially distracted the participants during the study. Therefore, the researchers removed the ads from the images using photoshop to make them clean and distraction-free for the participants. Once the survey was designed and the images were cleaned, the data collection process began. The researchers distributed the survey link via email and WhatsApp to participants from the USA and India. While most of the participants were from the USA, the study included participants from both countries. It is important to note that the participants completed the survey on laptop, desktop, or iPad devices. Due to limitations, mobile devices were not supported.

By recruiting participants from both the USA and India, the present study provides a more diverse perspective on how individuals interact with digital content on different platforms. Additionally, removing the ads from the images used in the survey helped to ensure that the participants were focused on the content presented in the images, rather than any distracting elements. Overall, the methods used in the present study were designed to minimize any potential distractions and ensure that the data collected provided insights into how participants interact with specific areas of interest on computer screens. The recruitment of participants from different countries and the cleaning of the images used in the survey were important steps in achieving this goal.

Results

In eye-tracking research, an AOI (Area of Interest) refers to a specific area on a computer screen that is of interest to the researcher, and they want to track where the participant's eyes move within that area. Realeye.io also allows researchers to define and track AOIs within the images shown to participants. For example, in a study that wants to measure participants' attention to a particular area of a website or an advertisement, the researcher can define an AOI that corresponds to that area. Then, realeye.io will track the participant's eye movements within that AOI and provide data on how much time the participant spent looking at that area, how many times they fixated on it, and other metrics. Defining AOIs in realeye.io involves selecting the image or video, selecting the specific area of interest using a rectangle tool, and naming the AOI. The software then tracks the participant's eye movements within that area during the study, allowing the researcher to gain insights into how participants interacted with that specific area. Here the AOI were fixations and saccades. T

The study was conducted with 10 participants, of whom 8 were male and 2 were female. Their age range was between 23 to 30 years. The researchers collected eye-tracking data from all the participants, which was used to generate heatmaps that indicated where their eyes fixated on the images displayed during the study. The researchers analyzed the data to determine whether the participants were focused on the content or something else. The results showed that the participants were reading the data shown on the images, as evidenced by the concentrated red color in the fixation points. This indicates that the participants were paying attention to the information presented in the images.

The researchers also collected survey data from the participants, which showed that they found the images displayed on blogs platforms to be the most readable, while they had difficulty reading the content on websites and medical articles platforms. This suggests that the way content is presented on different platforms can affect how readable it is. The heatmap also revealed that the participants had trouble viewing the complete image of the website, as it was too long. Consequently, most of the participants focused on the upper half of the image and read the content at the beginning of the image. This suggests that longer images could cause readability issues for participants.

The findings of the present study provide valuable insights into how individuals interact with digital content on different platforms, and highlight the importance of considering the presentation of content when designing websites and other digital platforms. Specifically, the study suggests that the readability of digital content can be influenced by the platform on which it is presented. In this study, participants found the content presented on blogs platforms to be more readable compared to other platforms such as websites and medical articles platforms. The results of this study also indicate that the length of images presented on digital platforms can influence readability. Participants in this study had difficulty viewing the complete image of the website as it was too long, and most of the participants focused on the upper half of the image and read the content at the beginning of the image. This suggests that longer images could cause readability issues for participants.

Defining and tracking AOIs, as done in this study, can provide researchers with insights into how participants interact with specific areas of interest on computer screens. Such insights can be used to improve the design and presentation of digital content and to enhance the overall user experience. By understanding how users interact with specific areas of interest on digital platforms, designers can make informed decisions regarding the layout, size, and placement of content on a web page.

In summary, the present study underscores the importance of considering the presentation of content when designing websites and other digital platforms. By doing so, designers can improve the readability of digital content and enhance the overall user experience. The use of eye-tracking technology to define and track AOIs is a valuable tool for gaining insights into how users interact with digital content, and can provide designers with valuable information for improving the design and presentation of digital content.

Figure 1: Heatmap of Blog

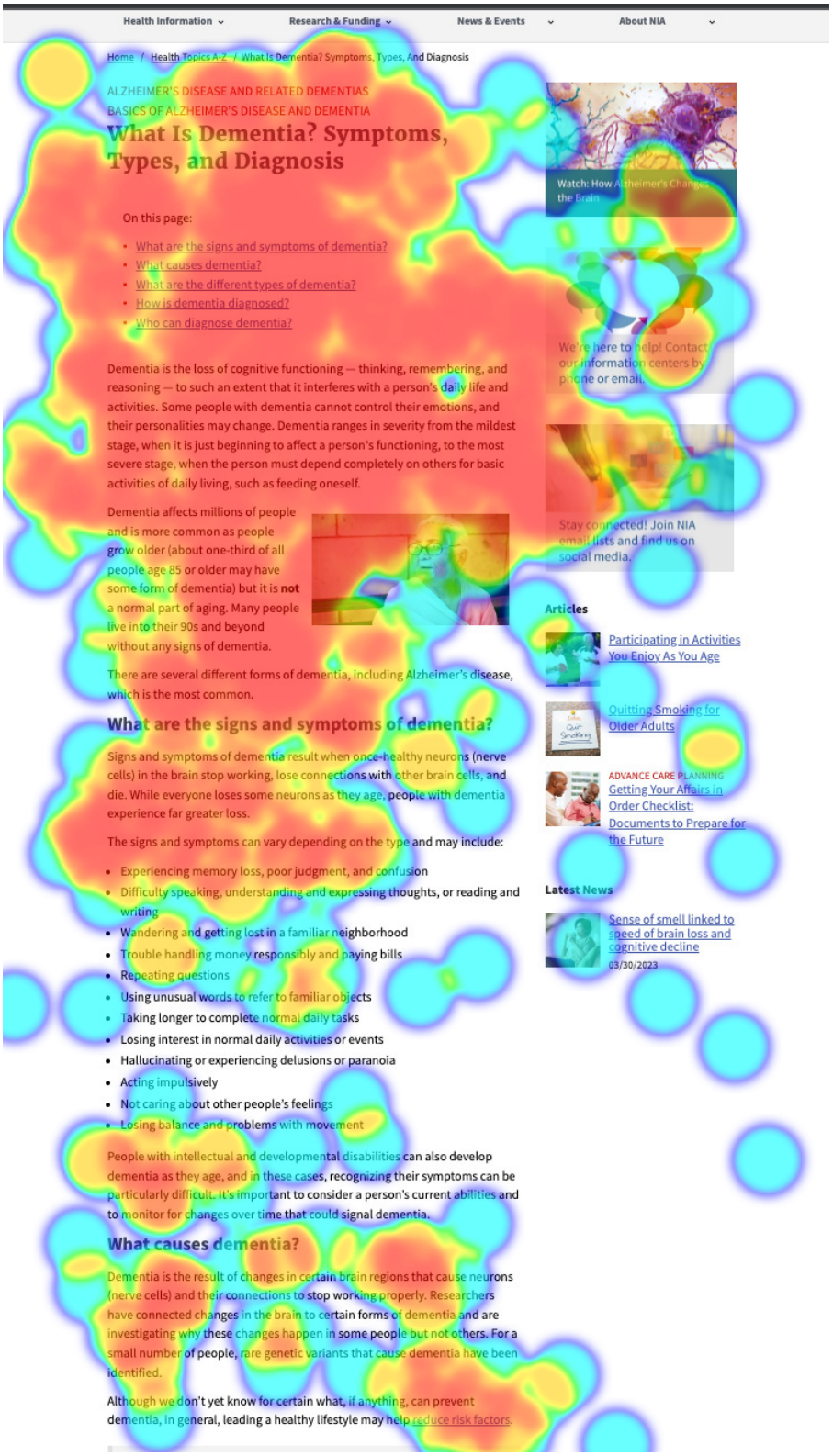

Figure 2: Heatmap of Website of all participants

RESEARCH

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Comparative efficacy of interventions for reducing symptoms of depression in people with dementia: systematic review and network meta-analysis

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Additional material is published online only. To view please visit the journal online.

Cite this as: *BMJ* 2021;372:n532 http://dx.doi.org/10.1136/bmj.n532

Accepted: 15 February 2021

ABSTRACT

OBJECTIVE

To describe the comparative efficacy of drug and non-drug interventions for reducing symptoms of depression in people with dementia who experience depression as a neuropsychiatric symptom of dementia or have a diagnosis of a major depressive disorder.

DESIGN

Systematic review and meta-analysis.

DATA SOURCES

Medline, Embase, the Cochrane Library, CINAHL, PsycINFO, and grey literature between inception and 15 October 2020.

ELIGIBILITY CRITERIA FOR STUDY SELECTION

Randomised trials comparing drug or non-drug interventions with usual care or any other intervention targeting symptoms of depression in people with dementia.

MAIN OUTCOME MEASURES

Pairs of reviewers screened studies, abstracted aggregate level data, and appraised risk of bias with the Cochrane risk of bias tool, which facilitated the derivation of standardised mean differences and back transformed mean differences (on the Cornell scale for depression in dementia) from bayesian random effects network meta-analyses and pairwise meta-analyses.

RESULTS

Of 22 138 citations screened, 256 studies (28 483 people with dementia) were included. Missing data posed the greatest risk to review findings. In the network meta-analysis of studies including people with dementia without a diagnosis of a major depressive disorder who were experiencing symptoms of depression (213 studies; 25 177 people with dementia; between study variance 0.23), seven interventions were associated with a greater reduction in symptoms of depression compared with usual care: cognitive stimulation (mean difference −2.93, 95% credible interval −4.35 to −1.52), cognitive stimulation combined with a cholinesterase inhibitor (−11.39, −18.38 to −3.93), massage and touch therapy (−9.03, −12.28 to −5.88), multidisciplinary care (−1.98, −3.80 to −0.16), occupational therapy (−2.59, −4.70 to −0.40), exercise combined with social interaction and cognitive stimulation (−12.37, −19.01 to −5.36), and reminiscence therapy (−2.30, −3.68 to −0.93). Except for massage and touch therapy, cognitive stimulation combined with a cholinesterase inhibitor, and cognitive stimulation combined with exercise and social interaction, which were more efficacious than some drug interventions, no statistically significant difference was found in the comparative efficacy of drug and non-drug interventions for reducing symptoms of depression in people with dementia without a diagnosis of a major depressive disorder. Clinical and methodological heterogeneity precluded network meta-analysis of studies comparing the efficacy of interventions specifically for reducing symptoms of depression in people with dementia and a major depressive disorder (22 studies; 1829 patients).

CONCLUSIONS

In this systematic review, non-drug interventions were found to be more efficacious than drug interventions for reducing symptoms of depression in people with dementia without a major depressive disorder.

SYSTEMATIC REVIEW REGISTRATION

PROSPERO CRD42017050130.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Interest is growing in social prescribing—linking patients with non-drug interventions in their community—to reduce symptoms of depression, isolation, and loneliness

Individual randomised trials have shown that non-drug interventions (eg, exercise) alleviate symptoms of depression in people with dementia

The comparative efficacy of drug and non-drug interventions for reducing symptoms of depression in people with dementia, with or without a diagnosis of a major depressive disorder, is, however, unknown

WHAT THIS STUDY ADDS

In this systematic review, non-drug approaches were associated with a meaningful reduction in symptoms of depression in people with dementia and without a diagnosis of a major depressive disorder

Drug approaches alone, however, were not more efficacious than usual care

Introduction

Fifty million people worldwide have a diagnosis of dementia.[1] About 16% of people with dementia also have a diagnosis of a major depressive disorder, but 32% of those with dementia will experience symptoms of depression (as part of the neuropsychiatric symptoms of dementia) without a formal diagnosis of a major depressive disorder.[2 3] In people with dementia, symptoms of depression manifest clinically as physical (eg, poor appetite, low energy) and behavioural (eg,

Figure 3: Heatmap of medical articles

Limitations

The text describes several limitations that were encountered during a study. Firstly, the software used in the study has several limitations. It is difficult to purchase and obtain approval for the software from the university, as there are many layers of assessment involved. The software has been under review for two months, but it is yet to be cleared. This indicates that the process of obtaining the software is time-consuming and complicated. Secondly, the purchased version of the software has its own limitations. Dr. Dixon and I bought a student version of the software, which has limited facilities compared to the full version. For example, the student version has a limited time period for the survey length. This limitation can restrict the scope of the research and potentially bias the results. Lastly, the accessibility of the collected data is limited in the student version of the software. The inability to download the collected data of the participants can make it harder to analyze the data. This could limit the researchers' ability to draw meaningful conclusions from the study.

Overall, these limitations may have a significant impact on the quality of the research conducted. Therefore, it is important to carefully consider the limitations of the software and data accessibility before using them in research.

Conclusion and Future work

This passage discusses the results of a survey that was conducted to assess the readability of different platforms, such as blogs and others. The conclusion was that the blog was easy to read, while the other two platforms were difficult. This conclusion was based on the analysis of the collected data. The participants' fixation and saccades rate were also examined, and it was concluded that the content was hard to read on any platform based on this analysis. Fixation refers to the duration of time that the eyes remain stationary on a particular point, while saccades refer to the rapid movement of the eyes between different points. However, the study was limited in its ability to determine the emotional status of the participants because the researchers were unable to record facial expressions. The emotional status of the participants would have provided a more complete understanding of their experience with the content. The study highlights the importance of having better accessibility to software in future research to achieve a more comprehensive understanding of participants' emotional status. Overall, the study suggests that the readability of content on different platforms can be assessed through the analysis of fixation and saccades, but emotional responses cannot be fully understood without the ability to record facial expressions.

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