

Designing Interaction to Support Sustained Attention¹

Naile Hacıoglu¹, Maria Chiara Leva² and Hyowon Lee^{1,3}

¹ School of Computing, Dublin City University, Glasnevin, Dublin 9, Ireland

² School of Food Science and Environmental Health, Technological University Dublin, Grangegorman, Dublin, Ireland

³ Insight Centre for Data Analytics, Dublin City University, Glasnevin, Dublin 9, Ireland

naile.hacioglu2@mail.dcu.ie

Abstract. The impact of digital technology on human cognition has become a topic of significant interest in recent years, with various studies highlighting the adverse effects on cognition, particularly attention. While the negative impact of digital applications on our attentional processes is well-documented, practical solutions to mitigate these detrimental effects are rare. In this paper, we propose Attention Mode as a design solution that aims to minimise the negative impacts of digital technology on attention by creating easy-to-understand and navigate user interfaces. This approach can help users focus on tasks, reduce cognitive load, and minimise distractions, ultimately improving their overall experience. We developed interaction mock-ups incorporating the Attention Mode and conducted a preliminary one-to-one sharing with 5 participants to analyse to get early feedback. It resulted in valuable feedback on how such a design focus could help users to focus on the content without distractive elements. By integrating the issues from the start of the design process instead of handling it as an afterthought, this work offers new insights into crafting user interfaces in a way that the negative impact of digital technology on attention is mitigated.

Keywords: Sustained Attention, Cognition, User Interface Design, Usability, Digital Technology, Smart Devices, Distraction, Task Switching, Notifications

1 Introduction

The impact of digital technology on human cognition has been a topic of significant interest and concern in recent years. Various studies have reported negative impacts on cognition in different abilities, such as memory and decision-making. However, the

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negative impact of smart devices and digital applications on attention is studied the most. A significant amount of evidence in the literature shows the harmful effects of digital technology use on our attentional processes (Table 1).

Specific technology usage behaviours might lead disruptions in our attentional systems and executive control in both short- and long-term. For example, adolescents who frequently use technology are more likely to develop ADHD symptoms due to multitasking behaviour and repetitive attentional shifts [1]. Ophir et al. [2] demonstrated heavy media multitasking behaviour was associated with lower performance of voluntary attention allocation in the presence of distractions.

Table 1. Key papers referring attention and executive control effects of digital technology and solution type proposed or hinted if any.

Study	Effect on Attention	Proposed (or Hinted) Solutions	
		Cognitive Training or CBT ²	Behavioural Intervention
Barasch et al., 2017 [3]	↑ ³		
Cardoso-Leite et al., 2021 [4]	↓		
Davis, 2001 [5]	↓	✓	
Du et al., 2019 [6]	↓		
Freytag et al., 2020 [7]	↓		
Green and Bavelier, 2003 [8]	↑	✓	
Madore and Wagner, 2019 [9]	↓		
Madore et al., 2020 [10]	↓		
Misra and Stokols, 2012 [11]	↓		✓
Ophir et al., 2019 [2]	↓		
Rosen et al., 2012 [12]	↓		✓
Rosser et al., 2007 [13]	↑	✓	
Schacter, 2022 [14]	↓ ↑		
Small et al., 2020 [1]	↓ ↑	✓	
Uncapher & Wagner, 2018 [15]	↓		
Throuvala et al., 2020 [16]	↓	✓	✓

Despite the growing awareness of this issue, practical solutions to mitigate the detrimental effects of digital technology on attention are rare. The proposed solutions include pre-commitment of the users to self-limit digital technology use [11] and cognitive training [13]. Although these solutions could be useful to reverse or prevent the adverse effects on attention, there are several downsides to the strategies. First, users

² Cognitive Behavioural Therapy.

³ “↑” icon refers to improvement in attention and executive control whereas “↓” refers to deterioration.

should be aware of the negative effects in the first place. Second, many users leverage digital applications and devices for their professional and personal needs even if they are aware of the negative effects. Thus, for personal intervention, users need to find alternative methods to handle these, which is not a trivial effort. Third, users should know where to find cognitive training to use the second strategy. These disadvantages make it unlikely for users to start or sustain practicing above interventions over time as they need to invest significant amount of time and effort, even money.

Therefore, considering the attention issue from the time of designing the technology may be a more holistic solution. In this context, we propose a design solution that aims to minimise such negative impacts on attention by helping easily control major factors that will make the user more prone to distractions directly available on the user interface of the application currently used. This approach can help users to disable potential distractions more readily from the tasks thus remain focused on their tasks, reduce cognitive load to improve sustained attention, ultimately improving their overall experience.

2 Designing to Support Sustained Attention

We developed the concept of an “Attention Mode” which takes the necessary measures to support minimal distractions in different contexts. The Attention Mode is activated when an “Attention Button” is clicked/dragged or tapped/swiped depending on the modality supported in the platform. This might be considered as the collection of the features found in “Focus” [17] and Adblockers with additional attributes. However, it takes many steps to activate these features since they are scattered in different locations, and they only eliminate some part of distractions whereas the Attention Mode turns off designated media distractions collectively in one step. Furthermore, it is intended to be integrated into the user interface of an application so that the user can trigger it during performing the task.

Attention Mode involves using a single button placed in a suitable location on UI and displays quick sub-options that can be selected within a second when interacted. Options displayed when the button is pressed allow users to select between two different modes, Attention Mode Level 1 and 2, to exclude different kinds of distractions. Additionally, the interface allows for customisation in the settings menu in some cases. The mode is activated as soon as a level is selected, or it is turned off without a need for confirmation. For first-time users a brief explanation of Attention Mode is provided.

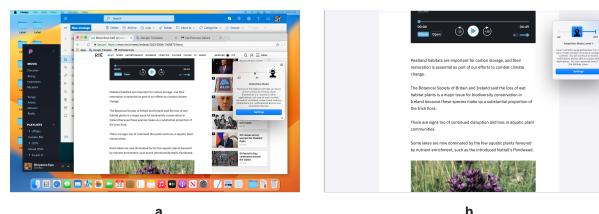


Fig. 2. (a) Attention Mode options are displayed when Attention Button is clicked on with general information. (b) Attention Mode maximises the main content and removes irrelevant visual distraction when set to Level 1.

To illustrate Attention Mode, we developed a news website prototype. Here, the user's task was to read an online newspaper article in a desktop environment. Content such as recommended articles, advertisement on the website and other settings on the browser, and desktop view and other open applications on the computer are all considered as distractions since they are irrelevant to the article itself. These distractions are hidden or prevented when the user turns on Attention Mode to concentrate (Fig. 2). Level 2 cannot be personalised as it involves the elimination of all kinds of distractions present, irrelevant visual content, notifications and switching to other applications. Eliminating visual distractions that imply potential switching of tasks as well as blocking external notifications during the task helps users to allocate their attention more effectively [2] and reduces occurrence of attention lapses [10] as the opportunities for multitasking behaviour decreases. We also integrated Attention Mode on an eBook application on a tablet and a video streaming application on a smartphone to demonstrate how universal it can be. Although we cannot describe them here due to the limitations of the poster paper, we leveraged the same interaction strategy in these two prototypes.

3 Feedback and Evaluation

We conducted one-to-one preliminary feedback sessions with 5 participants ($M_{\text{age}}=29.4$, 3 females, 2 males) shown design prototypes and discussed to gather feedback on different aspects of the mode. The news website was particularly well-received, with all participants acknowledging the benefits of having a mode that helps them focus more by removing distractions from their desktop environment. This feedback suggests a perceived need for such a feature in desktop applications or environments, and users see value in having a dedicated mode for enhancing their attention. However, there were differing opinions on the customisation of mode levels. One participant expressed interest in the idea of customising the level of distraction settings, while another participant raised concerns about potential confusion for less technologically inclined users. This feedback highlights the importance of considering the balance between customization and simplicity in the design of the Attention Mode.

The feedback on the tablet e-book and video applications indicated that users value flexibility, simplicity, and ease of use in the design, and careful consideration should be given to the options and features included in the mode to minimise user errors.

Overall, the feedback from the participants indicated that the proposed design approach of Attention Mode was positive, with participants expressing sentiments about the concept of reducing distractions and creating awareness about their digital technology use. Participants also expressed interest in having analytics to understand how their sustained attention has improved over time. This feedback provides valuable insights for further refinement and development of the Attention Mode design approach.

In this paper, we tried to illustrate a proactive stance by redesigning day-to-day applications to reduce such adverse effects on attention. By considering the effects of technology on our attentional well-being and examining how the design knowledge in the form of guidelines available today could address these aspects, we can create digital environments that further enhance our productivity and cognitive well-being.

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