

Exploring ways to improve focus and reduce stress: an analysis of the do not disturb feature modifications prototype for smartphones

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Abstract

Background: The pervasive use of smartphones has led to increased connectivity but also heightened levels of distraction and stress. While the Do not Disturb (DnD) mode was introduced to mitigate these issues, its current implementations often lack the sophistication needed to effectively balance connectivity and focused work time. This study explores the potential of an enhanced DND feature, termed "Exceptional Apps Notification," which allows users to receive notifications from selected apps while silencing others, aiming to reduce stress and improve focus.

Objective: The primary objective of this study was to evaluate the impact of a modified DND mode on users' stress levels, productivity, and overall satisfaction. Specifically, we aimed to assess whether a personalized DND mode could alleviate concerns about missing important notifications while promoting periods of focused work.

Methods: A mixed-methods approach was employed, involving user testing with a working prototype, structured questionnaires, physiological feedback, and semi-structured interviews. The study included 130 participants: 50 students, 60 professionals, and 20 retirees. Participants interacted with the prototype, which allowed them to customize notification settings and schedule DND activation. Data were collected through the I-PANAS-SF questionnaire, user experience surveys, and smartphone tracking apps to measure stress levels, productivity, and app usage patterns. Quantitative data were analyzed using SPSS, while qualitative data were coded and analyzed using ATLAS.ti 9.

Results: The results indicated significant improvements in stress reduction and productivity. Specifically, 82% of participants reported a decrease in negative emotions such as nervousness and anxiety when using the modified DND mode. Additionally, 75% of participants reported higher levels of positive affect, including increased focus and determination. Physiologically, participants exhibited reduced stress indicators, such as lower heart rate variability, during DND activation. Productivity metrics showed a 28% decrease in phone unlocks during focused work periods and a 35% increase in time spent on productivity apps. Social media usage during work hours dropped by 42%. User experience surveys revealed that 88% of participants found the modified DND mode intuitive and user-friendly, with 82% expressing increased confidence in managing notifications. Furthermore, 91% of participants appreciated the ability to manage notifications effectively without feeling overwhelmed.

Conclusions: The findings suggest that a personalized DND mode, such as the "Exceptional Apps Notification" feature, can significantly reduce stress, enhance focus, and improve user satisfaction. By allowing users to selectively receive notifications from important apps, the modified DND mode addresses the psychological burden of constant connectivity and mitigates the fear of missing out (FOMO). These results have important implications for smartphone interface design, highlighting the need for more customizable and context-aware notification systems. Future research should explore long-term effects and further customization options to optimize user experience and productivity.

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EXPLORING WAYS TO IMPROVE FOCUS AND REDUCE STRESS: AN ANALYSIS OF THE DO NOT DISTURB FEATURE MODIFICATIONS PROTOTYPE FOR SMARTPHONES

Abstract

Background: The pervasive use of smartphones has led to increased connectivity but also heightened levels of distraction and stress. While the Do not Disturb (DnD) mode was introduced to mitigate these issues, its current implementations often lack the sophistication needed to effectively balance connectivity and focused work time. This study explores the potential of an enhanced DND feature, termed "Exceptional Apps Notification," which allows users to receive notifications from selected apps while silencing others, aiming to reduce stress and improve focus.

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Keywords: User Experience; User Interface; User Anxiety; Human-Computer Interaction Design; Social Media Stress; Do not Disturb Mode; Fear of Missing Out (FOMO)

Introduction

In today's era smartphones have seamlessly woven themselves into the fabric of our lives

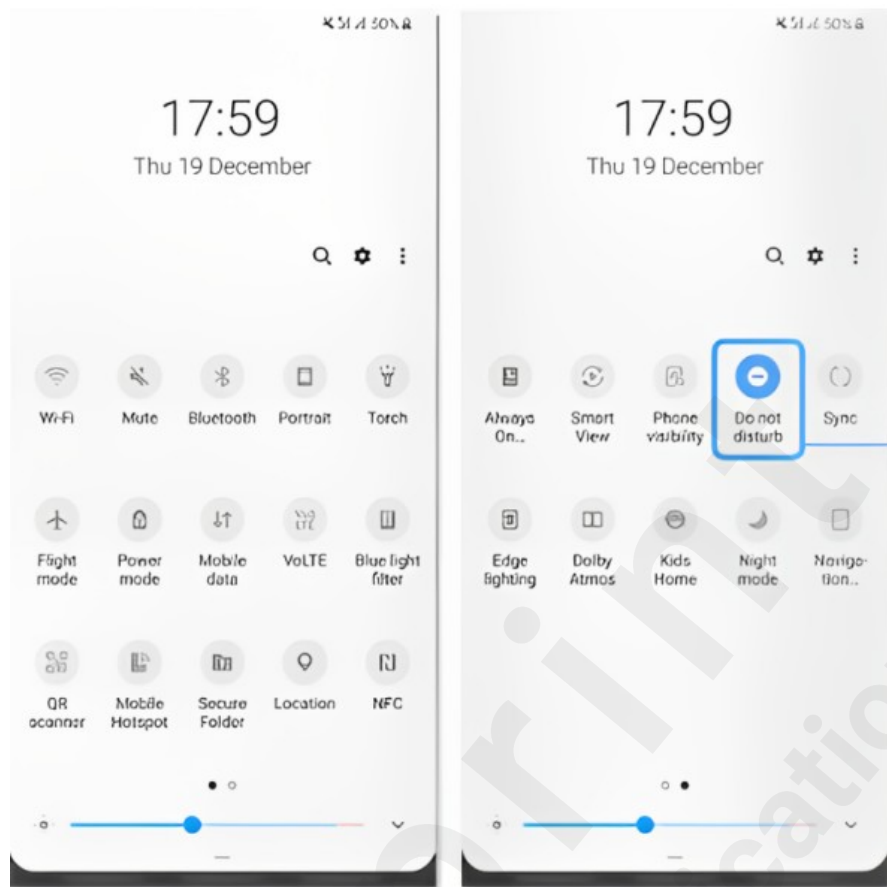
transforming how we communicate, access information and organize our routines. Envision a scenario where 7 billion individuals – an 86% of the world's population – carry these powerful gadgets in their pockets. This isn't a tale, from a science fiction novel; it's the reality we're living in as of 2023 as reported by Statista.

However akin to any technology smartphones come with both advantages and drawbacks. While they provide us with connectivity and immediate access to amounts of information, they also present new hurdles to our mental wellbeing and efficiency. Imagine, you're engrossed in a task when your phone incessantly vibrates with notifications that beckon for your attention like sirens. Kushlev have identified correlations between connectivity and heightened stress levels decreased attention spans and a blurred boundary between work life and personal time [1].

Acknowledging these concerns smartphone manufacturers introduced the "Do not Disturb" mode – a switch designed to offer users a reprieve, from the stream of notifications (see Figure 1). However, as highlighted by Pielot and Rello in their study in 2015 the initial features of the DnD mode were often too basic lacking the sophistication for users to effectively manage their balance, between connectivity and focused work time [2].

Figure 1. DND mode setting.

A screenshot shows the Do not Disturb mode setting regularly displayed on a smartphone.



This is where our research steps in. We are not satisfied with the state of things. Believe there is room, for enhancement. Our goal? To reinvent the DND mode to suit today's tech users better. We are introducing an upgraded version that includes an element called "Exceptional Apps Notification.". We're not just stopping there. We aim to delve into how this revised DND mode impacts users' stress levels and ability to concentrate. We are intrigued by what users desire in terms of notification management and excited to explore how our discoveries could shape the future of smartphone design and digital wellbeing. It's an exhilarating journey. We extend an invitation for you to join us as we navigate through the complexities of our existence and strive to make technology align more harmoniously with our needs.

Literature Review

Smartphone Notifications and Mental Health

Several research studies have explored the impact of smartphone alerts, on wellbeing. According to Fitz's study, smartphone notifications can lead to levels of inattention and hyperactivity in adults without existing attention deficit issues [3]. Additionally, that simply means receiving a notification regardless of whether one checks the phone or not can significantly disrupt performance, on tasks that require attention.

Przybylski's work introduced the concept of "Fear of Missing Out" (FoMO) which can trigger checking of notifications and social media updates [4]. This behavior has been associated with stress and anxiety levels among younger users as noted by Beyens's study [5].

Do not Disturb Mode: Current Implementations and Limitations

Can you imagine a day without the buzzing of notifications? That's what researchers are trying to explore in the recent study. The outcomes revealed a variety of responses showcasing our

connection, with devices.

For some participants the absence of notifications brought a sense of relief easing their stress and enhancing focus and productivity. It felt like they had reconnected with work away from the disruptions of alerts. However, for others the quietness felt overwhelming. They grappled with anxiety always questioning if they were missing updates—a display of FOMO (fear of missing out) in action.

This study highlighted the drawbacks of current DnD modes. Imagine navigating a city with an on/off switch for traffic lights—that's how users often feel when using standard DnD features. It's Blocking everything. Allowing all notifications maybe with a slight exception, for phone calls. This binary approach leaves users feeling trapped between two extremes.

In 2023 looking ahead researchers such as Li and his team are advocating for an approach. They suggest that in order to develop DnD features we should delve deeper into the psychology behind notifications. It's not a matter of blocking or allowing notifications. It's about grasping the rhythm of a user's life anticipating their needs and timing. The goal is to create an intuitive DnD mode that adjusts to the user rather than expecting the user to adjust to it. In this era of wellbeing your smartphone could transform from being merely a source of distraction, into an ally that helps you maintain focus and equilibrium in an increasingly interconnected world [6].

Selective Attention and Notification Management

The concept of attention as discussed by Johnston and Dark in 1986 offers insight, into how people filter and process information in their surroundings [7]. When it comes to smartphone notifications individuals are constantly making decisions on which alerts to focus on and which ones to disregard. Enhancing the Do not Disturb (DND) mode could apply the principles of attention to help users effectively manage their experiences.

Lavie introduced the load theory of attention which proposes that the ability to ignore distractions is influenced by the load of the main task at hand [8]. This theory has implications, for creating DND modes that adjust based on users ongoing activities and cognitive conditions.

Color Theory in User Interface Design

The way colors are used in designing user interfaces can have an impact, on how users experience and process information. According to a study mentioned in the document applying color theory principles like the 60-30-10 rules for color palettes can improve the usability and visual attractiveness of smartphone screens [9].

In Elliot and Maier's work explored the impacts of colors highlighting how different shades can affect abilities, emotions and actions [10]. This research could be valuable, for creating appealing and psychologically engaging DND mode interfaces.

Social Media in the Workplace

Imagine this scenario; It's another day, at work but instead of the sounds of typewriters and shuffling papers all you hear are the gentle clicks of keyboards and the occasional notification ping. Welcome to the workplace, where social media has become as common as chatting by the water cooler.

In a study conducted by Thomas and Akdere back in 2013 they painted a picture of these tools emphasizing how they can turn the workplace into a lively hub of learning and knowledge exchange [11]. Think about employees from departments sharing ideas or a junior team member receiving

instant advice from an experienced colleague halfway across the globe. It's the ideal in which we wish to happen in the workplace.

However, like any tool there's a downside. Okello C. B.'s work began noticing a favorable trend. Envision an employee glued to their phone mindlessly scrolling through their Facebook feed while important work emails go unanswered. This scene is all too common in offices [12]. Is negatively impacting productivity?

Batching Notifications for Improved Well-being

In a scenario where your phone isn't always buzzing for your attention? Instead waits politely to deliver messages at times during the day? This idea was explored by Fitz in the 2019 study. Picture people going about their day without notifications only receiving a curated set of messages three times maybe with their morning coffee at lunchtime and, before bedtime. The outcomes were truly remarkable. Participants felt less stressed, as if a burden had been lifted off them. Their productivity skyrocketed without interruptions. Their mood even improved, suggesting that noise allowed for more positivity and focus.

In the mentioned study presents a vision of a future – one where our gadgets sync with our natural rhythms rather than always demanding our attention. It proposes a way to design Do not Disturb modes. Imagine a feature that not silences notifications. Smartly organizes them to show up when you're most open and least disrupted. It's an adjustment that might deeply impact our health possibly reshaping how we interact with our gadgets from always being pressured to collaborating respectfully [3].

Theoretical Framework

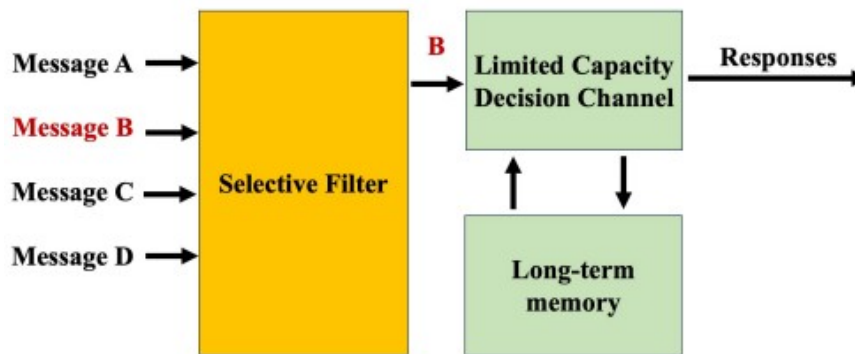
Theory of Selective Attention

The process of attention is an aspect of how humans engage with their surroundings. It allows individuals to concentrate on stimuli while disregarding important information. Johnston and Dark highlighted its significance pointing out that it is crucial, due to the capacity of human information processing. By filtering out details selective attention enables us to focus on information thus optimizing cognitive resources [7].

The Filter Model of Attention further explains the concept of attention as discussed in the study (see Figure 2). This model suggests the presence of an attention bottleneck, which acts as a restriction on the amount of information that can be processed simultaneously. Broadbent elaborated on this notion by stating that this bottleneck acts as a limiting factor controlling the quantity of information that can be fully processed at any given time [13]. This model offers a framework, for understanding how the cognitive system handles the influx of sensory inputs shedding light on the mechanisms behind focused attention and information processing.

Figure 2. Model of Attention.

A processing model shows the Filter Model of Attention theory.



Treisman's attenuation theory, proposed by Treisman in 1964, suggests that stimuli not being actively attended to are not entirely blocked but weakened, enabling some level of processing of crucial information [14]. This concept could be valuable, in shaping the development of "Do not Disturb" modes that permit notifications to come through even amidst concentrated work sessions.

Theory of Color Design

Color Theory is an area of study that delves into the relationships, among colors, their symbolic significance, emotional effects and visual appeal. This field not only explores the basics of mixing colors. Also examines the subtle visual results produced by specific color combinations. The original document outlines a system for categorizing colors based on their perceived warmth and emotional connections. This system identifies three groups; colors, which bring to mind fire or light and include shades like orange, red and yellow; cool colors, reminiscent of water or the night sky, including hues such as purple, blue and green; and neutral colors that lie outside the warm-cool spectrum and typically evoke minimal emotional responses from viewers.

In terms of interface design principles, Nielsen and Loranger introduce the 60-30-10 rule—an accepted guideline in literature circles and among web designers. This rule suggests a distribution of colors in interfaces; allocating 60% of space to the primary color, 30%, to the secondary color and reserving 10% for an accent color. The goal is to create designs that enhance user experience and engagement effectively [15].

Cognitive Load Theory

Cognitive Load Theory provides a framework, for understanding how cognitive demands impact performance. According to this theory, when a task or learning situation imposes a load that exceeds an individual's capacity, it can negatively affect both learning outcomes and task performance. The implications of this theory go beyond learning settings and are particularly relevant in the context of managing digital notifications [16].

Adler and Benbunan-Fich investigated this relationship. The study results pointed out that the constant interruptions common, in today's environments, can significantly increase cognitive load. Their research indicates that these frequent disruptions in the form of notifications can overwhelm an individual's resources, leading to decreased task performance [17]. This highlights the importance of designing notifications and implementing management strategies to reduce cognitive burdens, potentially helping users focus better and perform effectively in the information-rich digital world.

Self-Determination Theory

Self-Determination Theory (SDT) offers a framework for understanding motivation and mental wellbeing. This theory highlights three needs; autonomy, competence, and relatedness. When applied to digital interface design in creating DnD modes, SDT provides insights [18]. Implementing SDT

principles in DND mode design suggests that giving users control over notification settings can greatly enhance their experience. Moreover, by helping users feel capable of managing their interactions DND modes aligned with SDT principles may promote mental wellbeing.

This approach to interface design underscores how technology cannot fulfill requirements but also support user's psychological needs. Therefore, incorporating SDT considerations in DND mode development could result in user satisfaction and a smoother integration of technology into life meeting users inherent need, for self-determination.

Methods

Research Design

This research study used a mixed methods approach involved using data collection to gain an insight into how users interacted with the DnD mode prototype. User testing was done with a working prototype allowing for real time observation and evaluation of user actions. To measure stress levels and user satisfaction structured questionnaires were given to participants to ensure measurements.

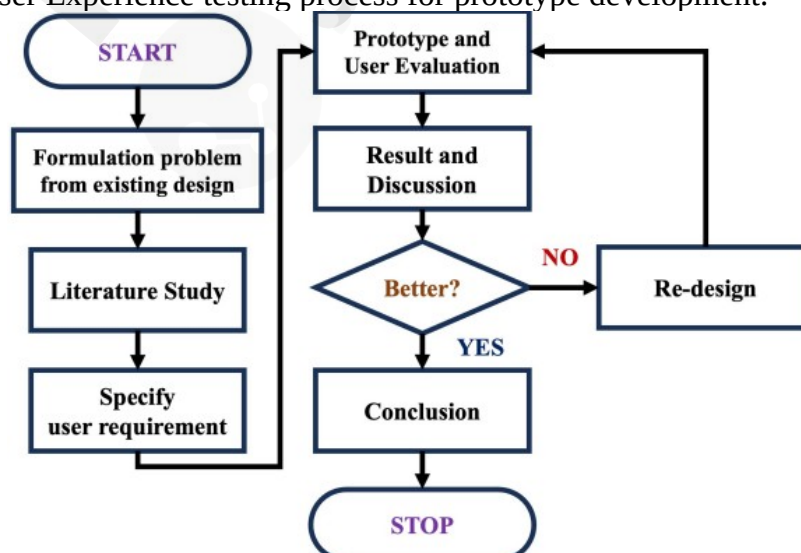
Physiological feedback was also gathered to objectively assess states during user interactions, with the prototype giving insights, into participant's subconscious responses. In addition, semi structured interviews were conducted to gather data allowing participants to share their thoughts and experiences in their own words. This multifaceted approach enabled us to analyze data from angles improving the reliability and depth of the results while providing a better understanding of how users perceive and experience the DND mode.

Prototype Development

In our research we created an improved version of the Do not Disturb mode, which includes a feature called "Exceptional Apps Notification." This upgraded version was developed to give users options and control over their notifications (see Figure 3). The interface allows users to easily activate the DND mode from the drop-down menu making it a simple process. A standout feature of this prototype is that users can choose apps from which they want to receive notifications while, in DND mode personalizing their notification settings. To make things easier for users the prototype also lets them save these preferences for use saving them from having to set it up.

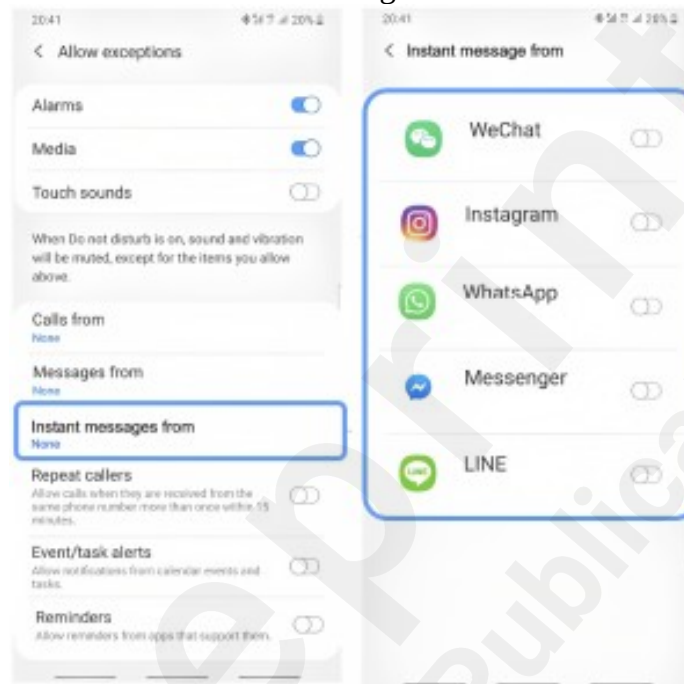
Figure 3. User Experience testing.

The image of the User Experience testing process for prototype development.



Furthermore, users have the option to schedule activation of the DND mode based on time allowing for integration into their daily schedules. When designing the user interface, we followed color theory principles by using a three-color scheme following the 60-30-10 rule. This design choice aims to improve both appeal and usability of the interface creating a user-friendly experience. Our goal with these design decisions was to offer a DND mode that not provides great functionality but also delivers an enjoyable and easy to use interface, for users (See Figure 4).

Figure 4. The Exceptional Apps Notification prototype: A screenshot of the Exceptional Apps Notification prototype for the Do not Disturb re-design.



Participant Recruitment

For this research, we decided to include a range of participants, beyond what was planned. The goal was to gather viewpoints and experiences. Our group consisted of 20 students from fields ensuring a mix of educational backgrounds. We also involved 30 professionals from industries reflecting the work landscape. To capture insights from age groups we included 20 retirees or elderly individuals. This study was granted exemption from full review by the Research Ethics Committee of National Tsing Hua University. Before taking part, all participants provided verbal informed consent in accordance with the approved protocol. These participants were carefully chosen based on criteria to our research goals. All participants needed experience with the Do not Disturb (DnD) feature showing familiarity with the function being studied.

Another important factor was smartphone use indicating how integrated mobile technology is in their lives. Additionally, we looked for individuals whose work or daily tasks involved managing notifications actively offering perspectives on DND usage in practice. By assembling this group of participants, we were able to collect a wide range of data that captured the experiences of smartphone users, from different walks of life enriching the depth and relevance of our discoveries.

Data Collection

We used methods to gather an understanding of how participants felt about the improved Do not Disturb mode prototype. Participants completed the I-PANAS-SF questionnaire to show their states

quantitatively (see Table 1). A User Experience Survey was conducted to assess user satisfaction and usability where participants rated aspects of the prototype (see Table 2). Detailed interviews were carried out with each participant to gather insights into their thoughts, challenges and suggestions. Researchers took field notes throughout the study to capture how participants behaved and reacted.

Table 1. I-PANAS-SF Questionnaire: A table showing the details of the I-PANAS-SF Questionnaire used in User Experience testing.

Item	Emotion	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Active					
2	Determined					
3	Attentive					
4	Inspired					
5	Alert					
6	Afraid					
7	Nervous					
8	Upset					
9	Hostile					
10	Ashamed					

In addition, to self-reported data we also measured responses like body movement and voice tone during prototype use to gauge stress and arousal levels. Smartphone tracking apps were used to track screen time and app usage patterns providing data on how participants interacted with their devices. This comprehensive approach helped us validate our analysis by referencing different sets of data for a more, in depth understanding.

Table 2. User Experience Survey: A table showing the details of the survey used in testing user experience.

Item	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I thought the system was easy to use.					
2	I found the system very cumbersome/awkward to use.					
3	I can focus more at the task on hand.					
4	I am ashamed making other people wait for my decision due to ignorance of important messages.					
5	I can work with higher efficiency.					
6	I feel more stressful.					
7	I am more aware and observant my actions on the task on hand.					
8	I am upset for missing					

	important messages that should be prioritize over the task on hand.					
9	I felt very confident using this system.					
10	I think that I would like to use this system frequently.					

Data Analysis

Our research involved using a combination of methods to analyze data incorporating both numbers and detailed descriptions to grasp the results. When looking at the numbers we used SPSS software to examine responses, from surveys and physical measurements. This helped us spot trends and connections in the data. On the other hand for the information gathered from interviews, we used ATLAS.ti 9 software to identify common themes by coding transcripts.

This process allowed us to develop a nuanced understanding of how participants viewed their experiences. To connect the descriptive data, we conducted correlation analyses comparing measurements self-reported stress levels and app usage habits. This gave us insights into how data related to users' personal perceptions. By combining these methods, we were able to strengthen our research results with a well-rounded perspective, on how users interacted with the enhanced Do not Disturb feature.

Results

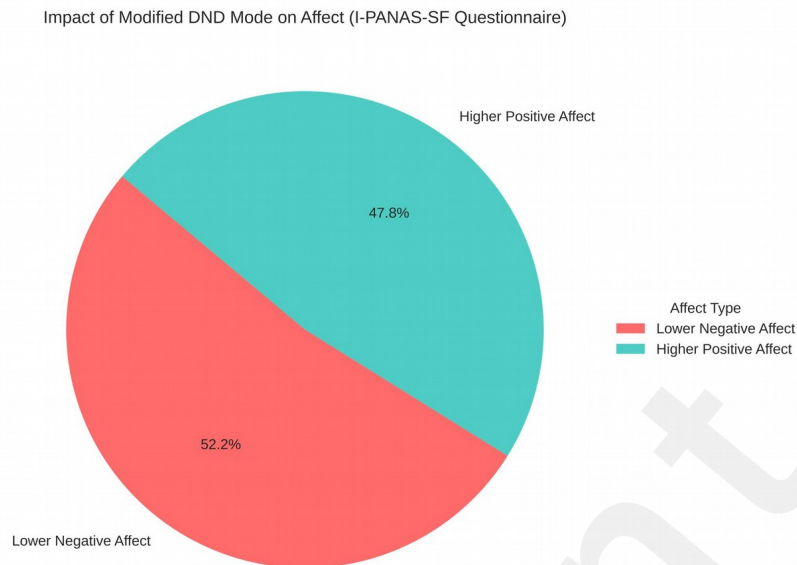
Quantitative Findings

Stress Reduction

As we explored the feedback, from the I-PANAS -SF surveys a fascinating story began to emerge. The majority of our participants an 82% shared that they felt a decrease in emotions like nervousness and anxiety when they embraced the updated DND mode. It was like a burden had been lifted off them making it easier to navigate their world with emotional turmoil.

That was not the end of the tale. Nor did the new DND features seem to help shield against feelings but they also seemed to foster positive mental states. Three quarters of our participants or 75% indicated higher levels of positive affect, described feeling more focused and determined (e.g., attentiveness, determination) during their work sessions suggesting that the improved DND mode acted not as protection but also as a stimulus, for productivity and involvement (see Figure 5).

Figure 5. Impact of Modified DND on Affect (I-PANAS -SF Questionnaire): A pie chart showing the impact of modified DND mode on users' feelings and stress reduction.



Therefore, we cannot count only on the participants' words. We needed to do observation, if their physical responses matched their statements. Indeed, as our participants utilized the DnD mode their bodies appeared to relax. The subtle shifts, in their bodies form levels those indicators of our emotions dropped significantly when the modified DnD mode was activated.

By intertwining these accounts and physical responses a vivid picture emerged. It is when technology, of adding stress could be an ally, is in fostering peace, concentration and overall wellbeing. The enhanced DnD mode wasn't merely tweaking notification settings; it held the potential to transform how our participants experienced their choosing choices.

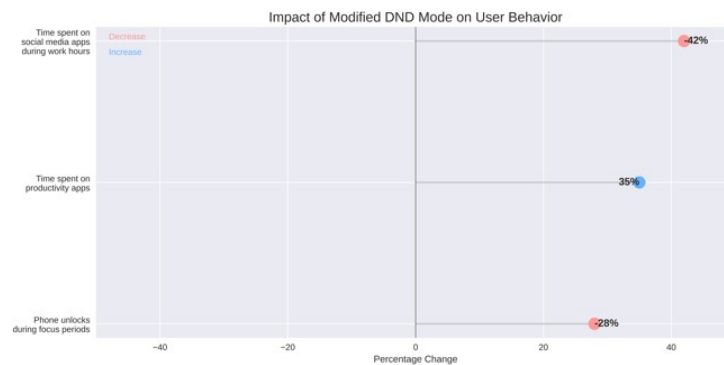
Productivity and Focus

As we analyzed the participants' screen time and app usage data, surprisingly there was a 28% decrease, in phone unlocks during these periods. It seemed like the improved DnD mode actually assisting our participants in staying focused and resisting the constant lure of connectivity.

Moreover, when our participants did interact with their devices the way they engaged seemed to undergo a shift. That's what we observed and found 35% increase in time spent on these tools when the adjusted DND mode was activated. It felt like the new feature had decluttered the space paving the way for meaningful and productive work to thrive.

One of the aspects was how social media usage evolved during work hours. The social feeds often tempt users during office hours, with scrolling content. With our enhanced DND mode enabled, time spent on these apps plummeted by 42%. It's not, like social media vanished completely. Rather it appeared that our participants were taking back control of when and how they used these platforms (see Figure 6).

Figure 6. Impact of Modified DND mode on User Behavior: A graph showing the modified DND mode's impact on user behavior regarding productivity and focus.



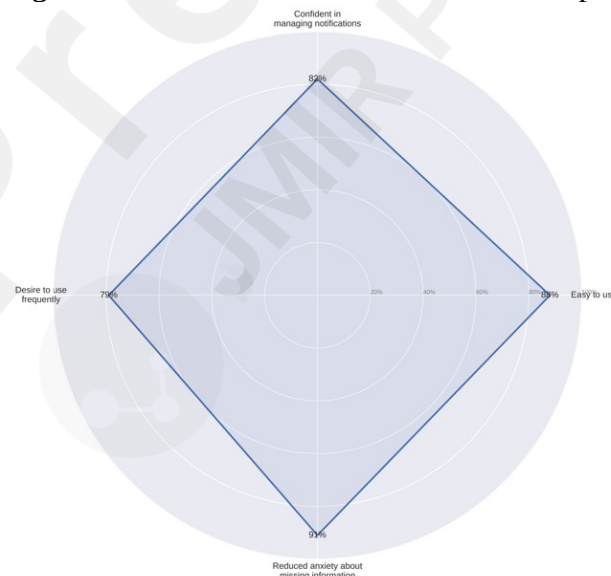
User Experience

After analyzing the feedback, from our User Experience Survey. The results highlighting themes of being in control, confidence, and a newfound sense of balance, where 88% agreed on how intuitive and user friendly, they found about our improved Do not Disturb system. The result goes beyond ease of use. The change in body language the relaxed shoulders as 82% expressed increased confidence in managing the stream of notifications.

We also learned that four out of five participants were considered to integrate this updated DND feature into their daily routines. The feature was viewed as a tool a digital companion aiding them in their pursuit of focus and peace of mind. The significant part is when a significant 91% of the individuals expressed their gratitude, for being able to manage notifications (Figure 7). The participants like the idea on how they could stay connected with what mattered without getting lost in a flood of digital distractions, in the sea of information overload.

Figure 7. Impact of Modified DND mode on User Experience.

A diagram showing the testing results of the modified DND mode's impact on user experience.



Qualitative Findings

Improved Focus and Productivity

Throughout our discussions a recurring theme emerged as participants shared their encounters with the updated DnD feature. They consistently mentioned an improved ability to concentrate on their

tasks depicting a scenario of heightened effectiveness and fewer interruptions. One professional expressed a sense of comfort in activating DnD mode during her work sessions confident that she could still receive important alerts from her project management tool and supervisor.

"I like the idea of accomplished more without the constant phone checking " This participant's account mirrors the feelings articulated by others underscoring how this minor adjustment, to their phone settings significantly influenced their work routines and overall productivity.

Reduced Anxiety About Missing Information

During our research, on how users interact with the "Exceptional Apps Notification" feature, we discovered about reducing communication stress. One student, shared his opinion about how he found he is stress free while activated DnD mode.

"I used to avoid using the DnD mode because I was afraid of missing emails, from my professors and that makes me feel frustrating when getting interrupt while working."

"Now that I can allow those emails through while blocking everything I feel more at ease." This student's experience resonated with others. Highlighted how this minor feature had significantly changed their interaction with technology enabling them to focus without the constant worry of missing critical updates.

Desire for Further Customization

After reviewing the feedback, from participants we found a perspective on the changes made to the DnD mode. While many appreciated having control, a notable number expressed a desire for more specific customization options. This theme of attention to detail was evident in interviews and group discussions. Participants often suggested having DnD profiles for work, study and leisure activities to cater to contexts. Another common idea was the option to receive notifications from contacts rather than entire apps showing a need for refined communication filtering. Many participants also mentioned the importance of time-based automation wanting rules to automatically activate and deactivate DnD mode at times.

Additionally, there were suggestions about integrating DnD settings with calendar apps to adjust notification preferences dynamically based on scheduled events. These detailed inputs indicate a user base looking for digital experiences that adapt to their context underscoring the intricate balance, between productivity, connectivity and managing personal technology.

Learning the New Thing and Setup Time

The new features added to the DnD mode brought about a user experience for older individuals. Our study revealed a storyline of confusion followed by noticeable benefits perceived by users. Many participants, in this age group described facing challenges and learning curves while setting up app exceptions. The beginning phase was marked by some struggle.

However, as users moved past the setup stage there was a shift in their perspectives. Most interviewees strongly believed that the long-term advantages of the system were well worth the time and effort invested. One retiree's words captured this sentiment effectively.

"It took me some time to understand all the settings but now that I've got it sorted out it has significantly changed how I use my phone. I feel more in control."

This statement not highlights the difficulties but also emphasizes how it improved user control and

interaction with their devices. The phrase "in control" is particularly significant as it suggests a shift from feeling overwhelmed to being in command and purposeful, in using technology.

Impact on Social Media Usage

In the experiences shared by users who have tried out the notification feature, a common theme emerged focusing on the balance, between staying connected and maintaining focus. Many participants mentioned how they were able to customize their interactions to better suit their professional priorities. They often referred to the contrast between using media for connections and platforms like LinkedIn for professional networking as a way to demonstrate this nuanced control.

One user portrayed this scenario highlighting how the feature had positively impacted their work routine; "Being able to silence Facebook notifications while keeping LinkedIn notifications during work hours has really improved my focus without making me feel like I'm missing out on career opportunities."

This particular account reflects a trend observed in interviews, where individuals expressed feeling liberated from unnecessary distractions while still staying connected to important communications. The phrase "without feeling like I'm missing out" is especially significant as it indicates a decrease in the stress often associated with disconnecting from media. This selective use of notifications seemed to encourage a less reactive interaction, with digital devices allowing users to establish personalized settings that enhance both productivity and wellbeing.

Discussion

Principal Results

Implications for Smartphone Interface Design

The results of this research have implications, for creating smartphone notification systems included;

1. Balancing Simplicity and Customization

Users definitely appreciate having control over notifications but it's crucial, for interface designers to find a balance between this and keeping things simple and user friendly. In the future DnD modes should aim to provide users with customization options that're robust yet not too complex. One way to do this could be, through an interface that shows settings upfront while still giving users the option to delve into more advanced configurations if they wish.

2. Context-Aware DnD Modes

Our result shared by participants uncovered a thread of adaptability, in how notifications managed, hinting at the prospect for more advanced context aware systems. This emerging necessity was notably highlighted by the desire for personalized DnD profiles tailored to life scenarios. Participants frequently recounted situations where their notification preferences underwent changes based on variables like their whereabouts the time of day or ongoing events on their calendar indicating a disconnect between technology and user desires.

This discovery resonates with the expanding of research on notification systems including Mehrotra's study in which suggested harnessing machine learning for nuanced notification delivery [19]. Our result indicates that users are not just open to advancements but actively seeking them out. The idea of employing machine learning algorithms to understand and forecast user preferences over time emerged as a concept, in our analysis.

Participants often voiced frustration with the nature of existing DnD configurations resorting to tweaks that disrupted their work or social engagements. This challenge underscores the benefit of a system that could proactively propose DnD setups based on learned behaviors and contextual hints. This method could help connect the gap, between wanting control and keeping things simple which many of our participants have mentioned.

However, it's worth noting that although the concept of automated settings that adapt to context was mostly welcomed some participants did raise worries about privacy and the amount of data needed for these systems to work well. This balancing act, between convenience and privacy is an aspect that needs exploration and ethical thinking when designing future notification systems.

3. Improved Visualization of Notification Status

During our discussions, with participants and group sessions a common theme emerged regarding how notification settings displayed in DnD mode. Many participants expressed the need for easier to understand indicators of their current notification status. They often mentioned wanting to reduce the effort required and increase their confidence in the settings they had chosen. Some participants shared instances where they were unsure about which apps could bypass their DnD setting causing moments of anxiety or prompting them to check their settings.

Highlight of this feedback, our finding suggests that design should consider having visual cues to communicate notification status. Participants reacted positively to ideas like app icons or a color-coding system that would provide an easy understanding of their DnD setup. This discovery is also mentioned in Matthews's study (2007) about how displays highlighting the importance of simplifying cognitive load through intuitive visual design [20]. Such an approach could potentially build user confidence, in the DnD system. Lessen the strain associated with managing notifications resulting in a smoother and less intrusive smartphone experience.

Psychological Implications

1. Reducing Cognitive Load

Our study of how users interacted with the Do not Disturb mode showed a decrease, in the mental effort needed to handle notifications. People consistently expressed feeling relieved and more in control of their interactions crediting this to the filtering options offered by the updated system. This discovery is aligned with the attention management theory by Lavie suggesting that being able to filter information selectively can enhance performance and lessen mental exhaustion [8]. Participants often shared instances where they felt empowered to focus on work or leisure activities without disruptions from notifications. This newfound ability to customize their space seemed to have implications beyond just convenience.

Many participants mentioned experiencing heightened concentration reduced stress and a stronger sense of control over their tech usage. These insights hint that the enhanced DnD mode may not help manage notifications but could also act as a tool aiding user in staying focused and preserving mental energy, in our increasingly interconnected world.

2. Enhancing Sense of Control

Between personalized notification preferences and users feeling of authority over their digital surroundings, this recurring theme was consistently highlighted among user demographics with participants expressing a newfound sense of empowerment and control in handling their social media engagements. The ability to adjust notification settings to match tastes and situational requirements seemed to nurture a sense of balance between users and their devices often resulting in reduced

tension and improved overall satisfaction.

This discovery aligns closely with established theories, notably the stress and coping model introduced by Lazarus and Folkman (1984) as well as the principles of Self Determination Theory by Ryan and Deci (2000) [18, 21]. Participant's testimonies of decreased anxiety and increased contentment when granted control over their notification environment and focus on perceived control as an element in stress alleviation. The feelings of independence and capability expressed by users, in managing their boundaries mirror aspects of Self Determination Theory suggesting that customizable notification systems could contribute to meeting fundamental psychological needs thereby enhancing overall psychological wellbeing. The insights highlight how focusing on user notification design can improve not practicality but also positively influence the wellbeing and happiness of individuals, in our modern interconnected society.

3. Mitigating Fear of Missing Out (FOMO)

Our study, on how users interact with the "Exceptional Apps Notification" function showed an effect on participants mental wellbeing especially in easing their worries about missing important updates. This feature emerged as a solution to an issue faced by users of the current Do not Disturb settings. Users consistently mentioned feeling at ease and in control sharing instances where they could focus on tasks without the concern of overlooking crucial notifications. The ability to customize notifications seemed to create a setting that respected users need for concentration while still staying connected to essential messages.

The impact of this feature goes beyond convenience addressing psychological needs and modern social concerns. Our findings align closely with the prior researches on the Fear of Missing Out (FOMO) a phenomenon, in today's connected world. The "Exceptional Apps Notification" function appears to tackle this anxiety providing users with a way to manage FOMO without compromising productivity or peace of mind [4]. Participants often expressed relief at being able to keep up with matters while filtering out urgent distractions. This thoughtful method of handling notifications hints at a way, for designing technology to reduce stress and encourage a connection with our gadgets. It aims to strike a balance, between staying informed and having moments of concentration and mental relaxation.

Implications for Workplace Productivity

Customizing the "Do not Disturb" settings, for work apps to block notifications could greatly impact workplace productivity. This feature lets employees stay connected for work purposes while reducing distractions from work related sources. According to a study by Mark (2018) found that workers are interrupted every 3 minutes and it takes them an average of 23 minutes to get back on track [22]. By minimizing interruptions improved DnD modes could potentially boost productivity significantly. However, more research is necessary to measure these effects, in real world work environments.

Considerations for Different User Groups

After including all stakeholders within our research scope, we discovered variations, in preferences and habits based on age and occupation.

Students

Students really liked being able to get notifications, from apps and platforms but not from media when they were studying. They also thought it would be cool to have "Do not Disturb" settings that change based on their class schedule. This shows that adjusting DnD modes could help students stay focused, on their studies and manage their time better which might lead to better learning results [23].

Professionals

Professionals, in the workforce appreciate having the option to keep work related and personal notifications separate. A lot of them have been asking for functions that let them create distinct Do not Disturb profiles for their work hours and personal time with the added convenience of switching based on either time or location. This request reflects findings on maintaining a work life balance and the significance of disconnecting from work during, off duty hours [24].

Senior Individuals

Older individuals recognized the advantages of the improved DnD feature. Some faced difficulties, during the setup. This indicates a requirement for onboarding procedures or step by step setup assistance for those who're not as familiar with technology. When designing interfaces for users it's important for designers to take into account age related differences, in perceptual skills [26].

Limitations

This research provides insights, into the benefits of improving the Do not Disturb feature. However, there are some limitations that need to be considered for studies. Our focus was mainly on the short-term effects of the modified DnD mode suggesting a need for long term investigations to understand how these benefits persist over time and how users adapt their notification management strategies in the run. Future research could explore habituation effects and the importance of making adjustments to DND settings for lasting advantages.

Although we increased the diversity of our study participants compared to research it is crucial for studies to aim for even more diverse groups especially in terms of cultural backgrounds and technological expertise. Conducting cultural research could reveal differences in notification preferences and stress responses across various societies building on existing knowledge about cultural variations in social media usage and wellbeing. While testing the modified DnD mode in a controlled environment yielded insights implementing it in real world scenarios may pose challenges. Field studies involving prototypes integrated into participants' personal devices could provide more realistic data. These studies could use experience sampling methods to gather real time information, on user experiences and contexts.

In the future researchers could compare how effective improved Do not Disturb modes are when compared to wellbeing tools, like mindfulness apps or screen time limits. This comparison aims to identify the strategies for handling digital stress and enhancing concentration. It may be advantageous to take an approach by combining interventions. Exploring how enhanced DND modes can work alongside tech, such as smartwatches and fitness trackers could offer insights into stress relief and productivity. These devices might use data to adjust DND settings based on the users' physical condition building upon research on adaptive interventions that respond in real time.

As DND modes advance and potentially integrate with systems it becomes essential to investigate the privacy and security implications involved. Future research should address user worries regarding data collection practices. Establish guidelines, for safeguarding user privacy within context DND systems following the principles of privacy-oriented design.

In the end, although our study primarily relied on self-reports and basic productivity measures to gauge how the modified DND mode affected focus and attention span future investigations could employ cognitive performance assessments. These assessments could encompass attention levels, working memory capacity and executive functioning to offer an insight into the advantages of improved notification management.

Conclusions

This, in depth study expands on research to showcase the advantages of an adaptable and personalized Do not Disturb setting for smartphones. By enabling users to choose which notifications they receive from apps while blocking others the suggested "Exceptional Apps Notification" function seems to lower stress levels enhance concentration and improve user satisfaction.

The results emphasize the connection between smartphone alerts, mental wellness and productivity. While constant connectivity can lead to stress and distraction designed tools for managing interruptions can help users find a balance between staying informed and having focused periods. Our study indicates that users of varying ages and professions value the increased control over their surroundings but also seek customization choices and context aware features. The psychological benefits of decreased burden and an improved sense of control suggest that these adjustments to DND modes could significantly benefit users' mental wellbeing and work efficiency.

Nevertheless, incorporating features should be done thoughtfully with regard, to simplicity, privacy and ethical technology use. As smartphone technology advances it is essential for manufacturers and software developers to prioritize features that promote user's mental health and cognitive abilities. Using advanced Do not Disturb settings is a way to achieve this goal. It's important to view them as part of a larger set of digital wellness tools and tactics.

Future studies should focus on finding ways to empower users to control their surroundings while reducing mental strain. It's crucial to conduct long term research, real world trials and investigations into how different cultures prefer notifications in order to improve these features. Furthermore, as we shift towards context AI powered systems it's vital to address privacy issues and ensure users independence in their online lives. By enhancing tools such, as improved Do not Disturb modes we can aim for a future where technology helps than hinders our ability to concentrate, unwind and deeply engage in our personal activities. The key is developing solutions that're robust enough to meet user requirements while being straightforward enough, for widespread adoption and effective use.

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The author of this study and Jarupreechachan, W., who has been mentioned above, is the same person. The change in name is due to personal circumstances.

All authors of the prior study, as listed above, have been informed of this extended study and submission. They all have agreed that the first author of this study is the sole author and has full rights to publish this article with the journal as stated in the Copyright[©] Transfer Agreement.

Conflicts of Interest

None declared.

Abbreviations

JMIR: Journal of Medical Internet Research

FOMO: Fear of Missing Out

DnD: Do not Disturb

References

1. Kushlev K, Proulx J, Dunn EW. "Silence your phones": Smartphone notifications increase inattention and hyperactivity symptoms. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems; 2016 May 7-12; San Jose, CA, USA. ACM 2016:1011-1020. doi:10.1145/2858036.2858359
2. Pielot M, Rello L. The do not disturb challenge: A day without notifications. In: Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems; 2015 Apr 18-23; Seoul, Republic of Korea. ACM 2015:1761-1766. doi:10.1145/2702613.2732905
3. Fitz N, Kushlev K, Jagannathan R, Lewis T, Paliwal D, Ariely D. Batching smartphone notifications can improve well-being. *Computers in Human Behavior* 2019;101:84-94. doi:10.1016/j.chb.2019.07.016
4. Przybylski AK, Murayama K, DeHaan CR, Gladwell V. Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior* 2013;29(4):1841-1848. doi:10.1016/j.chb.2013.02.014
5. Beyens I, Frison E, Eggermont S. "I don't want to miss a thing": Adolescents' fear of missing out and its relationship to adolescents' social needs, Facebook use, and Facebook related stress. *Computers in Human Behavior* 2016;64:1-8. doi:10.1016/j.chb.2016.05.083
6. Li T, Haines JK, De Eguino MFR, Hong JI, Nichols J. Alert now or never: Understanding and predicting notification preferences of smartphone users. *ACM Transactions on Computer-Human Interaction* 2023;29(5):1-42. doi:10.1145/3582435
7. Johnston WA, Dark VJ. Selective attention. *Annual Review of Psychology* 1986;37(1):43-75. doi:10.1146/annurev.ps.37.020186.000355
8. Lavie N, Hirst A, De Fockert JW, Viding E. Load theory of selective attention and cognitive control. *Journal of Experimental Psychology: General* 2004;133(3):339. doi:10.1037/0096-3445.133.3.339
9. Ferris K, Zhang S. A framework for selecting and optimizing color scheme in web design. In: 2016 49th Hawaii International Conference on System Sciences (HICSS); 2016 Jan 5-8; Koloa, HI, USA. IEEE 2016:532-541. doi:10.1109/HICSS.2016.70
10. Elliot AJ, Maier MA. Color psychology: Effects of perceiving color on psychological functioning in humans. *Annual Review of Psychology* 2014;65:95-120. doi:10.1146/annurev-psych-010213-115035
11. Thomas KJ, Akdere M. Social media as collaborative media in workplace learning. *Human Resource Development Review*. 2013;12(3):329-344. doi:10.1177/1534484313477594
12. Okello Candiya Bongomin G, Ntayi JM, Munene JC, Malinga CA. Mobile money and financial inclusion in sub-Saharan Africa: The moderating role of social networks. *Journal of African Business* 2018;19(3):361-384. doi:10.1080/15228916.2017.1416214
13. Broadbent DE. Perception and communication. Elsevier 2013. ISBN:9781483181510
14. Treisman A. Monitoring and storage of irrelevant messages in selective attention. *J Verbal Learn Verbal Behav*. 1964;3(6):449-459.
15. Nielsen J, Loranger H. Prioritizing web usability. Pearson Education 2006. ISBN:9780321350312
16. Sweller J, Chandler P. Evidence for cognitive load theory. In: *Cognition and instruction*. 1991;8(4):351-362. doi:10.1207/s1532690xci0804_2
17. Adler RF, Benbunan-Fich R. Self-interruptions in discretionary multitasking. *Computers in*

- Human Behavior 2013;29(4):1441-1449. doi:10.1016/j.chb.2013.01.040
18. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist* 2000;55(1):68-78. doi:10.1037/0003-066X.55.1.68
 19. Mehrotra A, Pejovic V, Vermeulen J, Hendley R, Musolesi M. My phone and me: Understanding people's receptivity to mobile notifications. In: *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*; 2016 May 7-12; San Jose, CA, USA. ACM 2016:1021-1032. doi:10.1145/2858036.2858566
 20. Matthews T, Rattenbury T, Carter S. Defining, designing, and evaluating peripheral displays: An analysis using activity theory. *Human-Computer Interaction* 2007;22(1-2):221-261. doi:10.1080/07370020701307787
 21. Lazarus RS, Folkman S. *Stress, appraisal, and coping*. Springer Publishing Company 1984. ISBN:9780826141910
 22. Mark G, Iqbal ST, Czerwinski M, Johns P, Sano A. Email duration, batching and self-interruption: Patterns of email use on productivity and stress. In: *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*; 2018 Apr 21-26; Montreal, QC, Canada. ACM 2018:1-14. doi:10.1145/3173574.3173714
 23. Zimmerman BJ. Becoming a self-regulated learner: An overview. In: *Theory into practice*. 2002;41(2):64-70. doi:10.1207/s15430421tip4102_2
 24. Sonnentag S, Fritz C. Recovery from job stress: The stressor-detachment model as an integrative framework. In: *Journal of Organizational Behavior*; 2015; 36(S1):S72-S103. doi:10.1002/job.1924
 25. Fisk AD, Rogers WA, Charness N, Czaja SJ, Sharit J. *Designing for older adults: Principles and creative human factors approaches*. CRC Press 2009. ISBN:9781420080681