CLBoundaryManager: A System Facilitating Boundary Management and Border Crossing between Life Domains

Moritz Maleck[0009-0006-5551-8386], Tom Gross[0000-0001-8353-7388]

Human-Computer Interaction Group, University of Bamberg, 96045 Bamberg, Germany
hci@uni-bamberg.de

Abstract. Interruptions from non-work domains, such as family, can disrupt work tasks, particularly during periods of high cognitive load, leading to reduced efficiency and increased stress. We introduce the CLBoundaryManager concept for optimising the timing of interruptions based on relevance indications of communication requests and user workload. The implemented system uses cognitive load data from eye tracking to manage communication between work and family domains. This allows users to stay connected with family during work.

Keywords: Boundary Management, Connectedness, Interruptions, Interruption Management Systems, Cognitive Load, Eye Tracking.

1 Introduction

Interruptions during work disrupt primary tasks and result in time-consuming resumption efforts and thus increase task completion time. They also affect task accuracy and efficiency [1]. This is especially the case when interruptions have a high dissimilarity to the primary task and a high complexity [2]. In offices, social codes are applied to communicate the current openness for interruptions, like opening or closing doors [3].

Such social codes are more complex to integrate when it comes to non-work interruptions, such as by other domains like family. When other family members call or message the currently working person, reasons might be diverse—asking to buy something at the supermarket before coming home, telling some irrelevant news about the neighbour, or informing about a car accident happened a few moments ago. All reasons for inquiries are of different relevance, and without prior knowledge before accepting a call from non-work, relevance assessment is nearly impossible.

Interruptions can have a positive effect, such as leading to faster completion of simple tasks or fostering creativity [1]. They strengthen social connections between individuals, including non-work social connections to strengthening family connections and foster feelings of closeness and psychological proximity [1, 4]. Yet, daily technology interruptions may also lead to negative effects if the number of interruptions is too high [5]. This highlights the need for an optimised interruption management.

Self-management of interruptions, such as disabling notifications before tasks requiring high cognitive load, may fail due to discrepancies between objective measures of effort and subjective self-assessment [6]. Moreover, managed—compared to randomly timed—interruptions lead to better performance [7, 8].

Previous research has shown that interruptions are more harmful during phases of high cognitive load [3, 9]. Eye tracking, particularly the measurement of pupil diameter, has proven effective for assessing cognitive load—the pupil dilation does not only reflect changes in light but also cognitive processes [10]. Various systems already use the pupil diameter for real-time cognitive-load scenarios [8, 11].

Cognitive load has already been used in systems to manage interruptions, optimising the timing of interruptions to minimise disruption. [3] used signals at doors to indicate whether someone is interruptible or not, by inferring cognitive load using consumer wearables. [8] identifies low-workload moments by analysing the pupil diameter of users and tested their method in a single user scenario.

In this paper, we describe the architecture and functionality of the CLBoundaryManager, with its two core components: a work and family user interface for managing communication requests, and the communication gateway for handling the requests based on cognitive load of the working user. The key contributions of this work are:

- A novel conept—the CLBoundaryManager—for managing communication requests and thus optimising interruption management between family and work domain.
- An implemented system that makes informed decisions based on the cognitive load derived from real-time eye tracking measurements. It does not focus on the negative effects only of interruptions and instead increases creativity by interrupting in right moments; and fosters connectedness between working and non-working family members.
- An evaluation of the CLBoundaryManager system with a user study and an in-depth discussion of the results.

To best of our knowledge we are the first to introduce an intelligent interruption management system relying on the pupil diameter to manage communication between work and family domains. The structure of this article is as follows: first, we provide a brief overview over related work. Then, we present our CLBoundaryManager concept, followed by the description of its implementation. Finally, we provide details on our evaluation of CLBoundaryManager and discuss the results and findings. We conclude our work with a conclusion and an outlook for future work. This work contributes to the development of intelligent interruption management systems to foster social connectedness.

2 Related Work

Interruptions disrupt primary tasks and often require significant time to resume them [1]. The extent of this disruption depends on factors such as the complexity of the interruption and its nature, including its similarity to the primary task [2]. The process of handling interruptions involves three main phases: first, the interruption lag, during which the user becomes aware of the secondary task; next, engaging with the secondary task itself; and finally, resuming the primary task afterward [12]. While much of the research highlights the negative impacts of interruptions, they can also have positive effects, such as enabling faster completion of simple tasks or fostering creativity through incubation periods [1]. Yet, in work settings, interruptions often negatively impact task completion time, as well as task accuracy and efficiency [1]. This effect is particularly pronounced in team environments, where collaborative processes may be delayed, affecting not only individual performance but also the overall performance of the team [1]. Additionally, interruptions can diminish productivity and well-being among office workers [3].

Interruptions have been found to increase the cognitive load. This is mostly due to the resumption lag (that is when someone has to determine where the previous task had been interrupted to figure out the next steps) [1]. Interruptions are more harmful during phases of high cognitive load [3, 9], which gives us the design implication for interruption management systems to detect phases of low cognitive load and deliver notifications during these. Several studies exist that aim at optimising the timing of interruptions to minimise disruption by the use of the cognitive load, e.g., through the usage of workload-aligned task models [9] or measuring cognitive load through consumer wearables [3].

Social cues, such as opening or closing a door, are often used to signal openness to interruptions, while color-coded indicators (e.g., red/orange/green) can represent interruptibility [3]. However, these analogue methods become impractical without physical proximity, such as in the separation between family and work domains. For example, a family member working in an office cannot implicitly communicate interruptibility to others at home. Instead, digital solutions like switching off the phone or enabling ‘Do Not Disturb’ (DND) modes are commonly used. These modes often include features to define exceptions, such as allowing notifications from close family members or specific user groups or domains [13, 14].

While useful, such systems are limited—for example, they may allow all notifications from a group regardless of priority, preventing effective filtering. Additionally, users must remember to activate DND before engaging in cognitively demanding tasks, potentially reducing its effectiveness. To address this, systems often incorporate features like predefined time windows or context-aware functionalities, such as detecting a user’s location, to automate interruption management [13, 15]. Extending DND functionalities could be promising, but excessive options might discourage use [14]. Furthermore, recent studies show that users fear missing critical notifications or forgetting to disable DND, adding another layer of complexity [14].

An increasement in non-work interruptions during working hours has been found by [16], specifically in the context of home-office in COVID-19. Therefore, not only an interruption management between work-from-office and family makes sense. Yet, the previously described social cues could be used, but still with the limitation of manually applying it without automated mechanisms.

Literature mostly focusses on the work-family conflict, i.e., where the family domain is disturbed by the work domain [17]. On the other hand, the family-work conflict, defined by the disruption of the work domain by the family domain, also holds negative effects. These can be on-job constructs such as lower job satisfaction or higher levels of job role conflict, and off-job constructs such as lower life satisfaction [18]. Therefore, systems should handle interruptions is in a less-disruptive way to minimise the family-work conflict. Boundary management aims at optimising the overlapping of different domains, mainly work and family domains [19].

The conflict between life domains cannot always be resolved by strictly separating them. Connectedness between life domains is often perceived very positively. Fostering connectedness (esp. with family or friends) is related to another term from the literature: 'presence-in-absence', which is to provide the sense of presence even due to physical absence [20]. Presence-in-absence further exists of themes (contact, content and context) and constituent elements (such as common ground or staying in touch for contact, personal effort for content, and unobtrusive for context) [20]. Systems to foster connectedness and presence-in-absence may derive requirements from these.

Eye tracking by the measurement of pupil diameter has shown to be a highly reliable non-invasive, real-time indicator for cognitive load, also compared to other eye-tracking features [21, 22]. Furthermore, the pupil diameter cannot be controlled consciously [10]. The pupil diameter changes with differing cognitive load—increasing with greater cognitive load and vice versa [10, 22-24]. Other external factors (e.g., light, emotions) also have an effect on the pupil diameter. Thus, controlled environments are required for an accurate measurement of cognitive load based on the pupil diameter [10]. There is already a broad range of systems available that depict on the pupil diameter for assessing real-time cognitive load, such as differentiating between truthful and deceptive answers [25], optimising time management during work [11] or optimising interruption management for delivering mails during work [8].

Cognitive load, independent from the method for measurement, has already been used in systems to manage interruptions, optimising the timing of interruptions to minimise disruption. By the usage of workload-aligned task models, right moments for interruptions can be determined [9]. [3] used smartphones mounted at each office door to display a red or green background, signalling whether the office worker is interruptible or not, by inferring cognitive load using consumer wearables. [8] identify low-workload moments by analysing the pupil diameter of users and tested their method in a single user scenario with an email-answering task with interruptions during working. Their method showed to improve performance compared to interrupting at random times.

In the next section, we provide our CLBoundaryManager concept, leveraging on the most important findings from related work.

3 A Concept for Cognitive Load Boundary Management

We present CLBoundaryManager, a boundary management concept for communication between the domains work and family. Our concept contains three components (cf. Figure 1): a *family interface* for sending out communication requests to the family member in the work domain; a *communication gateway* for handling communication requests from the family domain to the work domain, considering the cognitive load level by the use of eye tracking of the family member in the work domain to decide on whether to pass communication requests or to delay these; and a *work interface* to accept or decline incoming communication requests.

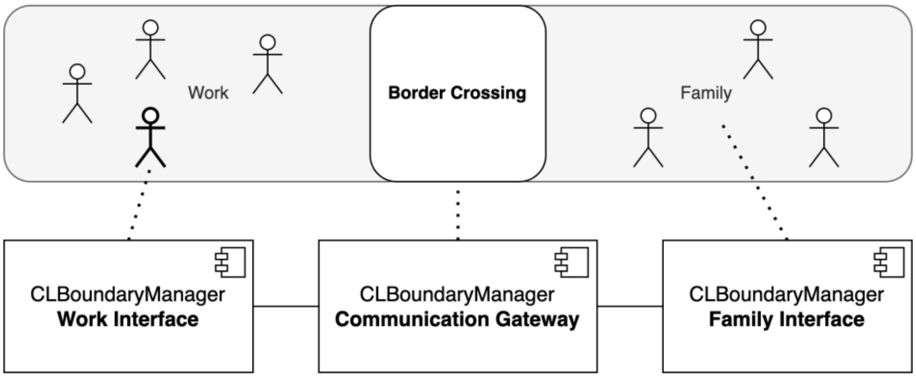

Fig. 1. The CLBoundaryManager system with its three components—the work interface, the family interface and the communication gateway.

If family members want to communicate with the working family member, they access the family interface to set up a communication request, including a relevance indication (e.g., important, neutral, not important) and optionally few describing words. They can further see the current state of the working member (e.g., being in a cognitively demanding task or being potentially available interruptions), which helps them understand the appropriateness of the timing for their request. This feature draws from the concept of social cues for signalling interruptibility, adapted for a digital environment without physical proximity.

Once a communication request is submitted, the communication gateway evaluates the cognitive load of the working family member. If the cognitive load level is high and the relevance indication is low, the request will be delayed until the cognitive load level decreases. In other cases, e.g., with a lower cognitive load level or higher relevance indications, the gateway will pass the request to the work interface. This ensures that interruptions are aligned with moments of low cognitive load, minimising disruption as suggested in prior research on interruption timing optimisation. Furthermore, by targeting moments of low cognitive load, the system creates opportunities for incubation, fostering creative processes and enhancing problem-solving abilities. This approach highlights how the CLBoundaryManager not only reduces disruptions but also leverages interruptions to optimise work and thought processes.

Based on the above-described variables, the request will be displayed differently; and in any case, the working member has the chance to accept or decline the request. In case of denial, the request will be put back to the waiting queue. This approach addresses the limitations of existing 'Do Not Disturb' modes, as it incorporates context-aware interruption management and prioritisation of notifications.

The cognitive load is assessed using real-time pupil diameter measurements from eye tracking. The use of pupil diameter for assessing cognitive load is highly reliable, as it is an unconscious, real-time indicator, though its accuracy benefits from controlled environments. By interpreting the measurements as cognitive load levels, thresholds can be defined in the communication gateway to support informed decisions.

The CLBoundaryManager concept fosters better boundary management between work and family by using context-aware features to optimise the timing of interruptions, reducing family-work conflict. By leveraging these mechanisms, it minimises the impact on job satisfaction and well-being, while promoting effective communication. Furthermore, the system aligns with the themes und constituent elements of 'presence-in-absence' by ensuring reciprocal contact, supporting expressiveness through relevance indicators, and maintaining a private, closed communication channel. The shared interface creates common ground by showing the status of the working family member (e.g., cognitive load or availability) and the presence of other family members in the system. Symbolic codes (e.g., importance levels) simplify communication, and the system remains unobtrusive by delivering requests asynchronously during low cognitive load to minimise disruptions and maintain connectedness.

In the next section we introduce the implementation of our CLBoundaryManager.

4 CLBoundaryManager Implementation

The implementation of the CLBoundaryManager system consists of two components: a client-side web application, implementing the family and work interface, and a communication gateway on server-side. Each component was developed to adhere to the conceptual design outlined earlier, focusing on context-aware communication management and seamless integration between work and family domains.

4.1 System Overview

We implemented the CLBoundaryManager system using a client-server architecture (cf. Figure 2). The family and work interfaces are web applications developed in JavaScript Svelte (version 3.59.2) and Python (version 3.13.1), while the communication gateway operates on a Node.js (version 23.5.0) server. This architecture facilitates real-time data exchange between components, ensuring effective handling of communication requests and cognitive load assessment.

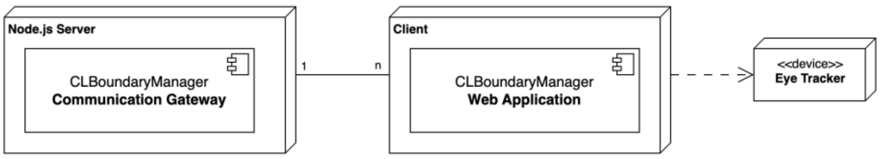

Fig. 2. System overview of CLBoundaryManager.

4.2 Family and Work Interface

While the concept introduced the family and work interface as two separate components, the implementation contains both interfaces in a single web application. When starting the web application, users can choose their role (respectively, worker or family member; cf. Figure 3). Based on this, the user interface will be presented differently. Apart from their role, users are asked to provide their name and are required to allow notifications, so that communication requests can be properly transmitted once all requirements are fulfilled (e.g., that the cognitive load of the working family member must be below a defined threshold).

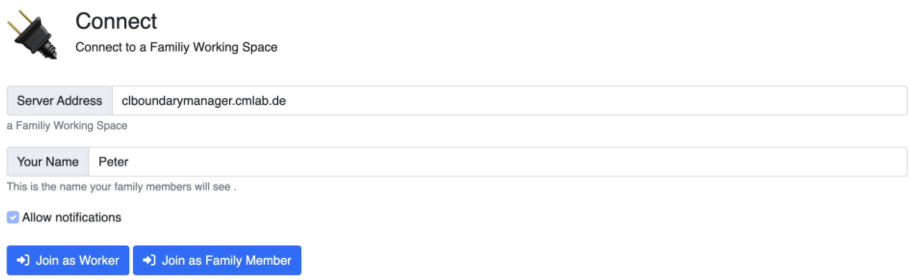

Fig. 3. The connect screen shown at startup of the CLBoundaryManager web application.

Fostering connectedness by showing all active users in the family and work domain. Both work and family interface (cf. Figure 4) use visually distinct 'bubbles' to represent family members, fostering a sense of connectedness by providing an intuitive and personalised view of who is currently logged into the system. Each bubble is labelled with the family member's name, making it easy to identify who is available. The current user's bubble is distinctly marked to help them orient themselves within the interface. The bubbles are grouped into two life domains—work and family—clearly separated but displayed side by side, reinforcing the dual focus of the application while highlighting the current context. This dual-domain structure ensures users always understand their role and connection to others in the system.

The work interface and the family interface share a similar design language, emphasising consistency and ease of use. However, a key distinction lies in functionality: while family members can initiate communication requests through the family interface, workers cannot send such requests back. This asymmetry reflects the lack of cognitive load measurement tools (i.e., eye trackers) available to family members, which are essential for determining interruptibility. The worker's role is primarily to receive and manage requests based on cognitive load and priority. The design of the work and family interface, implemented as a responsive web application, bridges digital and social cues, ensuring accessibility and adaptability across devices while fostering a continuous sense of connectedness within the family.

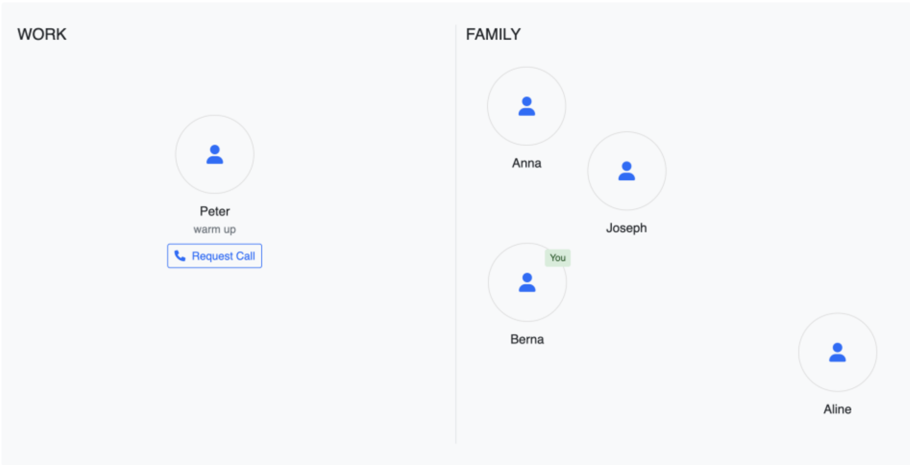

Fig. 4. Interface for user Berna in the family domain. Berna can see that Peter has just arrived in the office (warmup phase). Later Peter's bubble will show the current cognitive load.

Creating communication requests. Users in the family domain can create communication requests, but only for users in the work domain. A request contains a title summarising the request, a short description offering additional context, and a priority level (1–4), where 1 is the top priority and 4 is the least. Once submitted, the request is sent to the communication gateway for processing.

If the user in the work domain has a low cognitive load, the request is displayed immediately. The worker receives a push notification, and the request details are shown when opening the CLBoundaryManager web application. The worker can then either accept the request or postpone it. If postponed, the request is deferred for a fixed time (configurable in the system settings) and re-evaluated later. If accepted, the systems informs both users to meet. At the end, any of the users can end the meeting so that the user in the work domain is not blocked for further communication requests.

Requests are handled differently depending on their priority. For priority 1, requests bypass cognitive load considerations and are shown immediately, regardless of the worker's current cognitive load. For remaining priorities 2–4, the requests are displayed only if the worker's cognitive load is below specific thresholds. For instance, a priority 4 request requires a lower cognitive load than priority 2. These thresholds can be configured.

The visual representation of the request (cf. Figure 5) also varies by priority. Each priority level has a distinct colour and warning symbol, ensuring the worker can quickly gauge urgency. This differentiation is applied both in the web application and in the system's push notifications.

When multiple requests are submitted in the same timeframe (e.g., from different family members), the system ranks them by the provided priority, processing higher-priority requests first. This ensures that the most critical communication receives attention promptly, even during busy periods.

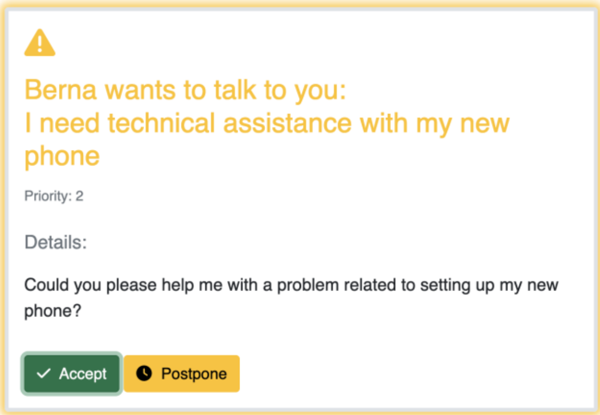

Fig. 5. A communication request displayed to a user in the work domain.

4.3 Communication Gateway Processing Communication Requests Based on Cognitive Load Data

The communication gateway is implemented as a Node.js server and is the central processing point for all communication requests. It maintains a record of all active users across both the family and work domains and contains the decision-making logic for request handling. For users in the work domain, where it is required to have an eye tracker connected, the web application transmits the user's current cognitive load level to the gateway within configurable floating time windows.

The cognitive load level is calculated based on the user's pupil diameter during the observed time window. Specifically, the current pupil diameter is compared to the minimum and maximum pupil diameters within the same window. The cognitive load level is determined by subtracting the minimum pupil diameter from the current pupil diameter, dividing the result by the difference between the maximum and minimum pupil diameters in the time window. This results in a value between 0 and 100, with 100 representing the highest possible cognitive load.

The communication gateway is designed to be independent of the specific eye tracker hardware. While within this article, we utilise the Tobii Pro Spectrum eye tracker, the system allows for integration with other devices if the client-side implementation provides the necessary interface. This design ensures flexibility and adaptability for future use cases or hardware changes, with no impact on the gateway itself.

The gateway processes communication requests based on priority and cognitive load data. For requests with the highest priority (i.e., priority 1), the system bypasses cognitive load considerations entirely, thus delivering communication requests immediately to the worker. For the remaining priorities (2-4), cognitive load thresholds are configured for each priority level. The higher the priority, the more cognitive load a worker can sustain before the request is delayed. Requests are sorted by priority, and within the same priority, they are processed on a 'first come first serve' (FIFO) basis.

The architecture relies on real-time communication using bi-directional WebSocket channels between the clients (users in the family and work domains) and the communication gateway. Clients send data packets to the gateway containing user-specific information, the calculated cognitive load level (for work domain users), and the details of the communication request, such as title, description, and priority. The gateway processes these requests and responds to clients with relevant updates, including notifications for workers when new requests are available. This bi-directional communication ensures seamless and dynamic interaction between users and the gateway.

In the next section, we evaluate the effectiveness of CLBoundaryManager in managing interruptions between work and family domains.

5 Evaluation of the CLBoundaryManager

The introduced CLBoundaryManager concept and its implementation provides an interruption management to foster optimal communication between the two domains work and family. In this section, we will evaluate the system based on a user study to determine the effectiveness CLBoundaryManager in managing interruptions based on the cognitive load of users in the work domain.

5.1 Method

This section describes the method of the user-study, including the used materials and apparatus, an overview of the recruited participants and finally a description of the procedure with a data analysis afterwards.

We used a similar study design to [26] and [8]. [26] analysed the role of interruptions in task performance and cognitive load, which we also want to determine; and [8] evaluated a similar concept to CLBoundaryManager, as they also used the pupil diameter to postpone interruptions based on the current cognitive load of a participant.

Materials. The study included a prebriefing and informed consent. Further, the *Brief Resilience Scale* (BRS) was used to "assess the [participants'] ability to bounce back or recover from stress" [27]. We used the German version of the BRS as provided by [28]. [26] found the cognitive load to not differ in case of task interruptions for participants with medium and high resilience, because they "mitigate cognitive overload induced by task interruptions through efficient allocation of attentional resources, resilience, and effective coping strategies" [26]. By assessing the BRS in our study, we may observe possible differences on the effectiveness of CLBoundaryManager based on the individual resilience of the participants.

As main task for the participants, we used the *Continuous Performance Task* (AX-CPT). AX-APT is a broadly used paradigm in cognitive research to measure cognitive control and working memory [29, 30]. It involves sequences of five letters, where participants press "yes" only when an X probe follows an A cue (AX trials, 70%), with other letters presented in between. AY trials (10%) involve an A cue followed by a non-X probe, BX trials (10%) involve a non-A cue followed by an X probe, and BY trials

(10%) involve neither an A cue nor an X probe [26, 30]. In our study we applied the AX-APT task as described by [30] and implemented it in *OpenSesame*, an “open-source, graphical experiment builder” [31].

To measure the cognitive load after each experiment (cf. Procedure), we used a German translation of the *National Aeronautics and Space Administration Task Load Index* (NASA-TLX) scale, that is capable of indirectly determining cognitive load [26, 32].

To evaluate the perceived usability of the CLBoundaryManager system, we used the German translation of the *System Usability Scale* (SUS) [33, 34], a widely adopted, technology-agnostic, and reliable tool known for its high validity and effectiveness, even with small sample sizes [35, 36].

Apparatus. We used a standard PC with Windows 10. Furthermore, a *Tobii Pro Spectrum* eye tracker (firmware version 2.6.1) was installed with 1,200 Hz. The calibration was done with the software provided by the manufacturer (*Tobii Pro Eye Tracker Manager*, version 2.1.2) The version of *OpenSesame* for the AX-APT task was 4.0.24 and the CLBoundaryManager was run in *Microsoft Edge Browser* (version 132.0.2957.115).

Participants. We tested our implementation with 8 participants (4 female, 4 male, 0 non-binary) with age from 23 to 29 years (M = 25.25, SD = 1.85). Participants were recruited with mouth-to-mouth sampling in the university. Three participants were wearing glasses, one participant was wearing contact lenses, and no participant had former eye-surgeries with remaining scars on the cornea.

Procedure. For each participant, separate time slots were arranged. The study was conducted in a lab with identical circumstances for all participants (esp. lighting and noise). Participants were asked to turn off their phones. The study started with the pre-briefing, followed by the informed consent and the printed BRS.

Participants then performed three experiments; accordingly to [8] we used a within-subject repeated-measurement design with three conditions in randomised order. In each experiment, participants were presented with the AX-CPT as main task. Therefore, the AX-CPT was explained once and a short practice phase (AX, AY, BX and BY each twice) was preceding each experiment.

A total of 30 trials were conducted, consisting of 70% AX trials, 10% AY trials, 10% BX trials, and 10% BY trials. Accordingly to [26], each signal was presented for 1000ms, and after each trial a fixation cross in the centre of the screen was displayed for 2000ms. A break of 90 seconds was implemented after every 10 trials to reduce cognitive load (in the experiment using the CLBoundaryManager system, the break facilitated the delivery of interrupting push notifications). The breaks were included across all three experiments to ensure consistent conditions. Participants were instructed to continue looking at the screen during the breaks (so measurement of the pupil diameter was possible).

In experiment I, participants did not receive any interruptions, serving as control condition. In experiment II, participants received interruptions through communication requests delivered using push messages at random times. These requests included reviewing a shopping list for later with a family member, helping set up a new laptop, planning a family celebration, and assisting in subscribing to a new newspaper. All communications had the same priority to have similar conditions for all experiments and participants. In experiment III, participants received the same interruptions; but postponed based on their cognitive load determined by the continuous measurement pupil diameter, triggered by the CLBoundaryManager system. Experiment III in contrast to the other experiments preceded with a calibration of the eye tracker and an introduction to CLBoundaryManager. After each experiment, cognitive load was measured through printed NASA-TLX. At the end of the study, each participant filled out the printed SUS.

5.2 Results and Discussion

A total of eight experimental data were collected in this study, of which descriptive statistics of cognitive load, task performance and reaction time are shown in Table 1.

Table 1. Descriptive statistics for the three experiments.

Experiment	**NASA-TLX score (M, SD)**	**Mean RT ms (M, SD)**	**Mean ACC % (M, SD)**
Experiment I (no interruptions)	6.46, 3.40	888.55, 170.18	97.76, 3.16
Experiment II (random interruptions)	6.25, 3.13	840.47, 140.04	96.27, 2.80
Experiment III (IMS interruptions)	6.52, 2.63	947.55, 332.10	97.56, 1.62

We used a repeated measures ANOVA, but did not find any statistically significant differences across the experimental conditions for any of the dependent variables. For mean accuracy, no significant effect of interruption type was observed ($F(2, 14) = 0.611$, $p = 0.556$, $\eta^2 = 0.060$). For mean reaction time, the analysis showed no significant differences across conditions ($F(2, 14) = 0.333$, $p = 0.723$, $\eta^2 = 0.035$). For the measured workload after each experiment (i.e., NASA-TLX), there was no significant variation between conditions ($F(2, 14) = 0.074$, $p = 0.929$, $\eta^2 = 0.001$). In all cases, the effect sizes were small to negligible, indicating that the experimental manipulations explained only a minimal proportion of the variance in the dependent variables. The assumptions of sphericity were met for all measures ($\epsilon > 0.8$).

These findings indicate that the type of interruptions, whether randomly timed or managed by CLBoundaryManager as interruption management system (IMS), did not significantly influence accuracy, reaction time, or perceived workload in this context. However, several considerations must be addressed when interpreting these results.

The simplicity and brevity of the tasks used in this study may have limited the potential for interruptions to disrupt performance or increase workload.

Future studies should investigate these effects in more complex or dynamic task environments, such as those involving multi-tasking or time-critical decision-making.

Furthermore, while IMS did not demonstrate clear benefits over random interruptions in this study, it is possible that its advantages may manifest more strongly in high-stakes domains or real-world applications. Another problem might have been, that in experiment III some of the participants did also receive interruptions during the AX-CPT task and not during breaks (as it was intended).

In the future, we will try to determine possible reasons for the current concept working better for some participants than for others, and based on these findings improve CLBoundaryManager. Reasons might also be found in the study design, since participants reported that they thought about non-study related things during the breaks (i.e., mind wandering), which might also have caused higher cognitive load during breaks and thus leading to non-delivery of communication requests during these.

In future studies, it may be further interesting to see whether the resilience of a participant correlates with the effectiveness of interruption management systems. Studies show that probands with higher resilience scale perceive less stress and have a higher well-being, also in workspaces [37]. The participants of our study all had normal or high resilience (6 normal, 2 high; $M = 3.93$, $SD = 0.44$). A study with participants with a low resilience might hold enriching insights to improve the current system logic. Due to the low sample size of our study, we did not further separate our measured data.

We reached a ‘good’ ([36, 38]) SUS score for the CLBoundaryManager ($M = 75.94$, $SD = 5.86$), with a grade of grade of B (according to [36, 39]). Most users perceived the system as not too complex, easy to use, and felt able to use the system without additional help by experts. In the future, the integration of key functions should be considered for optimisation (‘I found the various functions in this system were well integrated’ with $M = 2.75$, $SD = 0.43$, whereby zero would be the worst value and four the best achievable). Also, the design of the system might be modified to foster a higher confidentiality with the usage (‘I felt very confident using the system’ with $M = 2.38$, $SD = 0.70$), e.g. through improving the onboarding process. Mixed feedback with a high standard deviation was provided for the question, whether users like to ‘would like to use this system frequently’ ($M = 2.13$, $SD = 1.27$). Since we conducted the study in a lab with a non-realistic task scenario, it would be interesting to see how this value differs within a study in the field (i.e., using CLBoundaryManager over a longer time during real work in the field). Extending the findings of this study with future findings may reveal interesting insights in which groups of users see potential in such an interruption management system optimised for the communication between work and family domain. It can also be interesting to compare the acceptance of such a system in other domains, e.g., work-work domain.

6 Conclusions and Future Work

We introduced the CLBoundaryManager as a novel system to manage interruptions between work and family domains, leveraging real-time cognitive load assessments through eye-tracking technology. By aligning the timing of interruptions with moments of lower cognitive load, this approach minimises disruption during demanding tasks while fostering connectedness between domains. The system's design, including context-aware decision-making and a dual-interface setup, demonstrated its potential to balance productivity and social interaction. Initial findings indicate that the system is well-received, with users highlighting its usability and capacity to reduce unnecessary interruptions. However, limitations such as the need for controlled environments and minimal observed effects in the user study suggest room for improvement.

Future work will focus on addressing these limitations through a more comprehensive study with a larger sample size and a more long-term task design, potentially including real-world scenarios to better reflect actual user behaviour. Another key development is the integration of urgency detection derived directly from text inputs, eliminating the need for users to manually assign priorities. Furthermore, additional factors influencing interruptibility will be explored, such as linking the system to user calendars in the work domain to account for scheduled commitments. These enhancements aim to increase the system's robustness, usability, and versatility, ensuring its broader applicability across different domains and contexts.

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