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Design Frictions for Mindful Interactions: The Case for Microboundaries

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Abstract
Design frictions, a term found in popular media articles about user experience design, refer to points of difficulty occurring during interaction with technology. Such articles often argue that these frictions should be removed from interaction flows in order to reduce the risk of user frustration and disengagement. In this paper we argue that, in many scenarios, designing friction into interactions through the introduction of *microboundaries*, can, in fact, have positive effects. Design frictions can disrupt "mindless" automatic interactions, prompting moments of reflection and more "mindful" interaction. The potential advantages of intentionally introduced frictions are numerous: from reducing the likelihood of errors in data-entry tasks, to supporting health-behaviour change.

Author Keywords
Design frictions; microboundaries; lockouts; wellbeing; slow technology.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Design frictions, a term found in popular media articles about user experience (e.g. [29,35]), are points of difficulty encountered during users' interaction with a technology. The standard argument is that they should be removed from technology in order to reduce the risk of user disengagement. Usability best practice follows this line of thought, prioritising ease of interaction between the user and the device or application. This is often supported by arguments made in academic research papers such as Wiseman et al. [34] who present a case for how to design safety-critical interfaces to make device use easier and thus reduce the potential for error.

Efforts to minimize design frictions are often motivated from a desire to increase and maintain user engagement with a product. This desire stems from a vision of the world where technology is so embedded in our everyday life that our attention burden is lessened [33] so that, for example, notifications tell us which communication channels we should turn our attention towards at any particular moment. Similarly, automatic data capture from wearables, household technologies and Internet of Things devices mean that we are often interacting with technology without conscious effort.

The problem with this design approach is that it can also result in mindless forms of interaction that can have negative consequences. Two examples of such consequences are: a) speed accuracy trade-offs which result in errors due to quick responses, and b) responding to cues to interaction, such as email notifications, that results in behaviour that does not align with a particular user's values, such as checking email outside of work.

The contribution of this paper is a case for designing-in small – *micro* – moments of friction that can have positive impacts by providing a small obstacle that results in a small change in the cognitive strategy employed to perform a task. We present this case by first discussing design traditions that seek to move away from traditional usability approaches and then outlining examples of micro-level frictions that exist in the academic literature.

Related Work

There are several design traditions that seek to address the pervasive emphasis on effortless, efficient interaction. Slow technology [17] and reflective design [30] focus on how design can encourage and aid reflection. *Chatterbox* [17] was an informative art piece that stored emails in a database, generated novel sentences from the emails, and then displayed the sentences on a screen in a public office space. The goal was to encourage people to reflect on the nature of messages produced in office environments and thereby gain an understanding of the current work conducted by those in the office.

Others have argued that technology can be designed to facilitate "uncomfortable interactions" [2], where negative emotions server to enrich the user experience [14]. The aim of this approach is not to create long term discomfort or pain. Instead, the approach is based on the idea that many activities that make us uneasy are nonetheless worthwhile. This approach is particularly useful for drawing people's attention to important but difficult issues that they might naturally want to avoid. For instance, the game Nurse's Dilemma [20], where players take on the role of a nurse faced with a series of difficult decisions, has been used to invoke reflection on themes such as responsibility and blame within healthcare.

In addition, “critical design” approaches promote reflection and critique by subverting assumptions and expectations, often through making technology “unfriendly” to users [12]. For instance, within the context of personal informatics, critical design was used by Khovanskaya et al. [24] to raise awareness about the scope of data mining through the creation of an interface that displayed personal web data to users in ways that were deliberately creepy, strange or malfunctioned. This example demonstrates how “undesign” [28] can be achieved through inhibiting particular interactions in order to promote reflection.

Mindful everyday interactions

These approaches are broadly successful, but work by going to extremes to prompt and provoke certain behaviours. Might it be possible to elicit these kinds of thoughtful interactions in less extreme ways?

In this paper we argue that there are times when we need to design small frictions into interactions. This approach offers us a new way to think about improving everyday interactions with technology. Potential improvements with this approach are wide-ranging and include reductions in human error and helping to create more effective digital behaviour change interventions. These are in addition to the suggestions made by some UX designers that introducing design frictions can sometimes improve the overall user experience [9,31].

It is important to be clear that we are not advocating for design frictions in their most traditional sense. We are not suggesting that principles of good design be abandoned. Instead we are arguing that frictions that are designed with intention, and introduced with care, have the potential to elicit interactions that are reflective, informed and safe.

How can introducing friction to interactions improve the overall experience? Work from cognitive psychologists [23] suggests that we have two modes of thought: System1 and System2. System1 is the fast, automatic system that guides most of our behaviours and is employed during the automatic, mindless interaction that we are concerned with in this paper. System2 is the slower, more deliberate system that is employed when we are more mindful and conscious of what we are doing. We are arguing that System2 could and should be invoked through careful interaction design in a way that advantages users. Here we define *mindful* as deliberate and intentional rather than as an awareness and non-judgmental acceptance of the experience of the present moment, as is meant by the term “mindfulness” (e.g., [22]).

Various factors determine whether a System1 or a System2 process is used, such as the task at hand or the context. People generally complete day-to-day tasks on ‘autopilot’ (driven by System1), as they automatically react to their environment. However, System2 processes are used when a situation requires focused attention. One way to influence behaviour is to facilitate the transition from System1 to System2 to leverage more deliberate conscious processes.

An example of how System2 behaviour can result in better human-computer interaction is provided by Soboczenski et al [32]. In their experiments, participants were required to transcribe numbers from a source to an interface. They manipulated the clarity of the font, making one condition less clear than the other. They show that having poorer-quality rendering of the to-be-copied information leads to increased accuracy in their transcription tasks. Moreover, they demonstrate that this is not a consequence of speed-accuracy tradeoffs as there was no measurable difference in task completion metrics between high and low quality fonts. Instead they argue that the difference in performance can be accounted for by the poorer quality representation invoking a (marginally slower) more deliberate, transcription strategy than might usually be employed in such tasks. The lower quality fonts prompted the more deliberate System2 strategy to be employed over the System1 strategy.

Perhaps the most frequent observation of designed friction is in video games, where user challenges are an integral part of game design [25]. These challenges involve players cycling through different types of breakdowns and breakthroughs [19] in order to overcome impasses within the game [3]. As noted by Iacovides et al. [21] however, there is a key difference between breakdowns that negatively interrupt gameplay (e.g. poor interface design) and those that are considered part of the designed experience (e.g. in-game challenges). In the latter case, a fine balance of challenge against expertise or skill-level helps to increase player involvement leading to immersion [7] or flow [11] and contributing to the overall experience [21]. In this way, purposefully designed-in friction can help people transition to mental states where they experience deeper levels of involvement.

Towards designed friction

Soboczenski et al's study [32] employed a technique that made the whole interaction of reading the text more effortful. Similarly, in games a fairly substantial amount of friction is normally required. However, effortful interactions that have similar benefits can be created through even smaller, single moments of friction. In the rest of this paper we demonstrate that just one step in a procedure that takes slightly longer than necessary can provide an opportunity to a) avoid speed accuracy trade-offs in memory processes and therefore increase accuracy, b) avoid being induced into performing behaviours that might not align with personal values, and c) guide the user towards a particular course of desired action without having to rely on willpower alone. We provide examples of each of these by describing how design frictions can be included in interaction as *microboundaries*.

Microboundaries

A microboundary is an intervention that provides a small obstacle prior to an interaction that prevents us rushing from one context to another. It does this by creating a brief moment in which we might reflect on what we're doing. This small barrier to interaction can be implemented via a short time cost and prompts a switch from System1 behaviour to that of System2. Microboundaries slow us down before acting. They are a smaller version of the effect of having a credit card in a block of ice: you can still get it out and use it, but the time it takes for the ice to melt provides an opportunity to think about whether you really want to spend your money and thus can prevent you from acting hastily and regretting it later. A microboundary provides a micropause in which the more mindful System2 is prompted to take over control of behaviour.

This definition of a microboundary generalises and extends a previous definition provided by [8] and contrasts with the idea of dark patterns of design [e.g., 37]. Dark patterns of design nudge users into behaviours which are not necessarily desired, by making sure the users do not leave System1. Microboundaries instead are used to actively support the user into shifting from System1 to System2 driven behaviours.

In the rest of this paper we describe existing research that illustrates how the moments of friction we can create as microboundaries in interactions can be valuable.

Design Frictions to support behavior change
In the context of behaviour change, microboundaries have been used to make people more mindful of their behaviours. However, these microboundaries are at risk of being removed due to advances in technology that seek to automate data collection.

For example, keeping a diary of food eaten has been shown to lead to weight loss [6], particularly when logging is performed within close proximity (15 minutes) of the behaviour [5]. In fact, even just taking a photograph of food has been shown to be effective [36]. We argue that it is this effortful step that creates a microboundary and is a key factor in the intervention - a just-in-time point of friction that guides the user away from an automatic System1 behaviour of "mindless" eating and towards a more mindful System2 moment where they intentionally decide if they want the photograph of the chocolate cake in their diary, or indeed, whether they want those calories in their body.

With the advent of small wearable cameras we are moving towards automated data capture for food intake in a similar way to activity tracking from wearable sensors. Whilst this automatic data capture provides a dataset for reflection, it removes the effortful interaction of taking the photograph or entering data into an app.

Additionally, the microboundary created by the extra steps required to manually enter data leads to further interaction with an application (in this example a food logging app), meaning the user can be exposed to other behaviour change techniques employed by the app, such as social support or rewards for motivation. Without this friction, behaviour change apps and devices need to deliver other ways of motivating engagement, and recent studies have suggested many have struggled to do this effectively [10,18].

Design Frictions to support value-led behaviour
Microboundaries have also been implemented by individuals to slow-down technology use and maintain work/life balance. Cecchinato et al. [8] interviewed knowledge workers about their email habits and found that they often reported mindless interactions with their devices such as finding themselves answering work emails on a Saturday night when they had not intended to. As one might expect, constant connectivity can have stressful consequences [26] and people wanted to limit the negative effects of being constantly connected. As a result, some people created some workarounds with their devices to ensure more control in actively deciding when to be available. For example, participants in this study used separate applications to check work and personal emails on their phones, thus avoiding being sucked into a work cycle when not needed or desired.

As popular smartphones like iPhones come with only one mail application installed by default, users had to actively download an additional app for this purpose.

Users are proactive in creating these microboundaries because current technology does not include them in their final design. We have shown here how people see the value of having an obstacle, a friction that supports them in aligning their behaviour with their values, i.e. avoiding accidental work-life boundary challenges. Supporting people in implementing microboundaries in this context is not suggesting that people need to switch off completely; we are not advocating a digital detox. Rather, this approach uses existing technology solutions to ensure that one's practice aligns with one's values and preferences.

Design Frictions to increase data quality

There are also examples where user interfaces have been explicitly designed to include microboundaries e.g. in the form of task lockouts – where users are prevented from proceeding with a task for a time. Lockouts have been shown to improve attentiveness, partly because enforcing a brief pause stops people clicking mindlessly through modal dialogs (e.g., [13]), and partly because a pause gives people a chance to more carefully plan their actions before they execute them [1,4,27].

The effectiveness of lockouts is contingent on people using the duration of the lockout to plan their next steps. If lockouts are excessively long, people will instead use the time to work on other tasks [15]. This task-switching behavior can be mitigated by carefully controlling the length of task lockouts so that they encourage mindful consideration without inducing users to find other things to do [16].

Conclusions & General Discussion

This paper provides research evidence to support the idea that small frictions can be useful. While other design approaches, such as slow technology and reflective design bring reflection to the fore, they also tend to emphasize whole interventions rather than small scale changes that influence interaction. We argue that small microboundaries can create just enough friction to switch someone from having their behaviour driven by System1 to System2. Thus, as demonstrated by research examples described in this paper, small barriers that are relatively easy to overcome can lead to large impacts. Ultimately, we urge designers to consider the trade-offs between facilitating efficient everyday interface interactions and making people more mindful of their behaviour.

Future work could explore how habituation to microboundaries through frequent exposure could influence effectiveness. In addition, it would be useful to investigate how the level of autonomy a user has over the introduction of the microboundary affects both its effectiveness but also engagement and retention with the technology. We are planning to formalize these ideas and to develop concrete guidelines for designers. These guidelines would enable the integration of microboundaries into interaction flows.

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