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Rethinking (Dis)engagement in human-computer interaction

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ABSTRACT

User engagement has become a much-cited construct in human-computer interaction (HCI) design and evaluation research and practice. Constructed as a positive and desirable outcome of users' interactions, more frequent and longer interactions are considered evidence of engagement. Disengagement, when discussed, is considered a best avoided outcome of technology use or a solution to problematic technology use. In the case of the former, disengagement may signal usability issues or user disinterest, while the latter emphasizes that some engaging interactions can result in negative consequences (e.g., addiction) for end-users. In this paper, we draw upon examples from HCI research and digital tools to present a more nuanced understanding of the symbiotic relationship between engagement and disengagement in order to propose a new definition and novel ways to model disengagement. Further, we challenge generalizations that dichotomize engagement (positive, continuous, accompanied by high interactivity and beneficial to end-users) and disengagement (negative, stopping use or detrimental use) and invite readers to interpret engagement in the context of desirability with respect to users' goals and perceived agency. We concluded with implications that invite the reader to make space for disengagement and move beyond usage data in the evaluation of engagement. This paper is a call to step away from the practice of engagement-for-engagement's sake, and to reflect on whether and when engagement is meaningful and desirable for end users.

1. Introduction

Human-computer interaction (HCI) seeks to understand, evaluate and design for a range of human experiences, including fun, immersion, enjoyment, mindfulness, productivity, learning and behaviour change (Blythe & Monk, 2018; Calvo & Peters, 2014; Jennett et al., 2008; Norman, 2004). Central to these explorations is the belief that digital technology can and does play a vital role in enhancing how we work, learn, socialize and accomplish everyday life tasks. At the same time, concerns about the potentially addictive, socially isolating nature of technologies have surfaced (Dow Schüll, 2014; Dwyer, Kushlev, & Dunn, 2018; Turkle, 2017; Wells & Horwitz, 2021) to the extent that excessive Internet use and online gaming have been classified as mental health disorders (World Health Organization, 2018). Although such classifications have been critiqued (e.g., Kardefelt-Winther, 2014), the leaking of internal Facebook (now Metaverse) documents in 2021 by former employee Frances Haugen confirmed what many had long suspected: digital technologies can be harmful to both personal and societal well-being (The Wall Street Journal, 2021).

The drive for novelty and innovation and the financial incentives to collect user data, has created an emphasis on the sustained and active use of technologies— often called user engagement. User engagement is the degree to which a user invests cognitively, emotionally and temporally in an application (O'Brien, 2016), but is typically reduced to metrics related to frequency and duration of technology use, popularity (e.g., social media "likes") and loyalty (e.g., continued use of an application) (Lehmann, Lalmas, Yom-Tov, & Dupret, 2012; Ng, Firth, Minen, & Torous, 2019). Over the past several decades, user engagement has been studied in a number of domains, including social media, digital health, marketing, online communities, learning and online search, and across different types of devices, e.g., smartphone apps, personal computers, wearables and public displays and exhibitions (c.f., Johnston & Taylor, 2018; O'Brien & Cairns, 2016). In much of this work, engagement is viewed as a means to help people monitor and achieve their goals, be entertained or immersed in an artistic or social experience, create more inclusive and democratic societies, and reach personal goals. However, the impetus to engage users has been met with caution and concern from scholars, information technology professionals, and

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users themselves. Specifically, the ethics of systems that engage users to the detriment of their mental, physical and financial well-being (Dow Schüll, 2014), privacy (Tufekci, 2018), and race or gender identity (Noble, 2018) has been questioned, shining a spotlight on how the design of technologies contributes to social injustices and inequities (c.f., Sodden et al., 2019). User engagement has come to be a "double-edged sword" – both desirable and problematic.

While user engagement has gained a great deal of attention, user *dis*engagement is seldom explored. Since engagement is typically equated with more frequent and lengthy interactions (e.g., clicks, logins and downloads), disengagement is commonly associated with non-use or the withdrawal of time or energy on the part of the user. Since more activity is considered positive, disengagement is often viewed negatively, as it may point to issues of poor usability, waning attention, disinterest and negative emotional experiences. Yet, it may also signal that user needs have been momentarily satisfied (O'Brien & Toms, 2008); this latter point about disengagement – that it can be the result of a successful interaction – is often missed (cf., Gütl, Rizzardini, Chang, & Morales, 2014). Another perspective is that disengagement is a means to deal with problematic technology use, e.g., "quitting" a social media site because we spend too much time using it.

Moving beyond the engagement-disengagement dichotomy has implications for how we design and evaluate user experiences, and provides an opportunity to develop a more robust orientations to user experiences and outcomes. First, rather than evaluating a successful system as one that yields high usage data, affective and cognitive considerations must be taken into account to appreciate the meaningfulness of a technology in the lives of users. Digital technologies that keep people behaviourally engaged may have negative impacts on people's health, well-being and social interactions; thus, personal goal-setting and feelings of agency and control must be part of "successful engagement." Second, we must move away from "engagement-for-engagement-sake" that disconnects tool use from broader personally- and socially-relevant goals, e.g., health behaviour change, civic participation. Failing to do so undermines the notion that engagement should serve a fundamental purpose in human thriving. Finally, we must make space for disengagement to occur and regard it as a potentially valuable component of user experience; pause facilitates reflection and problem solving and invites engagement with other sources of information and experience. In essence, disengagement can be part of moving people forward in their goals, rather than stunting their momentum. Transforming how we think about engagement and disengagement has the potential to "shift the goal posts" when it comes to interacting with user communities, evaluating a technology's success, and designing for contextually-relevant user experiences.

In this paper, we begin with an overview of how engagement and disengagement have been discussed in HCI and related literature and challenge prevailing misconceptions about engagement and disengagement. Next, we propose new models of engagement-disengagement to apply to the design life cycle. Throughout, we draw upon a range of examples (that are by no means exhaustive) to illustrate why a more contemplative approach is needed in this area. We conclude with implications for HCI research, design and evaluation.

2. User engagement and disengagement: an overview

2.1. User engagement

User engagement is not always defined in research or professional literature, and may be used synonymously with usability, immersion and user satisfaction, among others (Ng et al., 2019; O'Brien, 2016). Since the mid-1990s, researchers have emphasized attention, motivation, challenge, control and feedback as attributes or indicators of engagement (Jacques, 1996; Laurel, 1991; Webster & Ho, 1997). Jacques (1996) defined engagement as "a user's response to an interaction that gains, maintains and encourages their attention, particularly when they are intrinsically motivated" (p. 68). He depicted engagement as a continuum, with attention, motivation, perceived time, control, needs and attitudes operating within a low to high range. However,

> A high level of one attribute does not always mean a person is highly engaged, as low levels of the other attributes may out-weigh it. For example, a person may feel motivated, but if the experience is not meeting their needs and they do not feel in control, then they will not feel very engaged (Jacques, 1996, p. 27).

Jacques highlighted the interdependence of engagement attributes, and framed each attribute as moving between negative and positive poles, e.g., attention may be "divided" or "undivided and focused." Jacques's (1996) ideas were influential in O'Brien's (2008; O'Brien & Toms, 2008) later work. She conducted exploratory interviews with online searchers, learners, shoppers and gamers and concluded that different attributes were more salient for some users, experiences or points in time. The Process Model of User Engagement, consisting of a point of engagement, a period of sustained engagement, disengagement and re-engagement, mapped attributes to specific stages of the model (e.g., feeling in control was more important for sustaining engagement) or types of digital experiences (e.g., the aesthetic and sensory appeal of online shopping) (O'Brien, 2008; O'Brien & Toms, 2008).

It is generally agreed that user engagement has affective, behavioural and cognitive components (Jacques, 1996; Laurel, 1993, 1991; O'Brien, 2016; Oh & Sundar, 2015; Webster & Ho, 1997). This emphasis on what people feel, do and think is influenced by related literature on student engagement, the holistic interaction of attitudes, behaviours and feelings in school settings (Fredricks, Blumenfeld, & Paris, 2004; Trowler, 2010, p. 74). Engaged students are interested and have a strong sense of belonging (affect), attend class and are not disruptive (behaviour) and seek challenge, expend effort and go beyond what is required of them (cognition).

Studies in HCI and cognate fields have stressed the behavioural elements of user engagement, underscoring the positive relationship between engagement and interactivity (cf., Lalmas, O'Brien, & Yom-Tov, 2014; Lehmann et al., 2012; Oh & Sundar, 2015). Behavioural metrics (clicks, downloads, time spent using an application) are commonly used to measure user engagement, with higher frequency and longer duration of use equated with greater engagement (Ng et al., 2019; O'Brien et al., 2020b).

2.2. Disengagement

The concept of disengagement typically carries negative connotations. Workplace studies associate it with "burnout," detachment from interpersonal connections or roles, feelings of apathy and "robotic" behaviours (Balwant, 2018). Disengagement has been characterized cognitively as "tuning out" (temporary lapses in attention); "going through the motions" (performing a routine task that places less demands on attention); and "mind wandering," (ceasing to attend to a task altogether) (Cheyne, Solman, Carriere, & Smilek, 2009). This is somewhat related to student disengagement. Chipchase et al. (2017) proposed different characterizations of disengagement: non-adherence to norms, e.g., failing to attend class, negative attitudes toward learning (*character fault*); non-interaction with peers, school or extracurricular and classroom activities (*non-engagement*); isolation from people, activities and events (not necessarily by choice) (*alienation*); and engaging in one area (e.g., extracurricular activities) but not others (e.g., academic study (*multidimensional*). These examples link disengagement with disinterest and lack of meaningful participation in or focused attention on activities.

In HCI, there are two primary views of disengagement. First, it may be viewed as a solution to problematic technology use, e.g., when people experience guilt after "wasting time" playing games, browsing the web or using social media (O'Brien & Toms, 2008). This implies that time is a

resource, a commodity—one that is finite and has appropriate function, value and can be budgeted (cf., Lakoff & Johnson, 1980). In response to these feelings, users may remove applications from their digital devices, take a "break" from use (Seo et al., 2021; Smith, 2011), or look to technologies to support them in pausing or stopping use (Hiniker, Hong, Kohno, & Kientz, 2016). Second, disengagement may be the result of negative interactions with technology, e.g., frustration due to usability issues, excessive cognitive load from an over-challenging task or having concentration broken through an interruption, that cause the user to withdraw their participation before they have satisfied their goals or completed a task (O'Brien & Toms, 2008). System developers may try to minimize these potential disengagements through system design and engineering to provide a seamless, absorbing experience from which the user will not want to disengage (cf., Dow Schüll, 2014; Wells & Horwitz, 2021).

Overall, disengagement is associated with ceasing to use an application or taking a break from a device. In the case of "problematic use," the user feels they are spending their time in unproductive ways, while a "problematic system" can be adapted to better sustain users' attention. In this way, agency is at the heart of disengagement – the user feels that they lack control over their use of technology and seeks ways to mitigate this through disengagement; systems designed to prevent disengagement make it difficult for users to step away from the application. Since engagement is often reduced to its associated behaviours, inactivity may be interpreted as disengaging from the task itself (not just the device or application). Thus, disengagement is positioned as the opposite of engagement, fixed to specific behaviours (i.e., avoiding, detaching, tuning out, stopping) and cast as negative, i.e., the user feels out of control or the system is removing control from the user.

3. Toward a more nuanced view of engagement and disengagement

The dichotomizing of engagement and disengagement, coupled with the commodification of user data, or "platform capitalism" (Srnicek, 2017) fuels "engagement-for-engagement's sake", where engagement with a particular tool is disconnected from other real-world outcomes and effects (The Wall Street Journal, 2021). The amassing of copious amounts of data has had unintended consequences for the spread of mis/disinformation (Crilley & Gillespie, 2019) and sexism, racism and xenophobia through web-based platforms (Noble, 2018). It also impacts individual privacy, values and agency through the "project to manage human life," as explained by Sacasa (2018, p. 39):

> In an earlier age, people turned to their machines to outsource physical labor. In the digital age, we can also outsource our cognitive, emotional, and ethical labor to our devices and apps. Our digital tools promise to monitor and manage, among other things, our relationships, our health, our moods, and our finances. *When we allow their monitoring and submit to their management, we outsource our volition and our judgment.* We seem incapable, however, of raising any deeper concerns than whether the terms of service are intelligible and our data secure. *[emphasis ours]*

These examples, which threaten personal and community agency and autonomy and foster injustice require us to step back and ask when is engagement beneficial, and when is it detrimental to technology users? In the following section we offer a more nuanced view of these constructs, first by plotting out current conceptualizations of "positive," "negative" and "non-engagement," and second by challenging what we refer to as "fallacies" of user engagement and disengagement.

3.1. The spectrum of negative, positive and non-engagement: affective, cognitive and behavioural dimensions

In the field of education, student (dis)engagement has been plotted along behavioural, emotional and cognitive dimensions, each with a "positive and a negative pole" (Trowler, 2010, p. 5; Chipchase et al., 2017). Non-engagement (such as withdrawal or apathy) is the "gulf" between positive and negative engagement (Trowler, 2010, p. 74). According to this classification, attending and participating enthusiastically in lectures are instances of positive behavioural engagement, whereas not attending lectures constitutes non-engagement, and disrupting lectures constitutes negative engagement. Emotional engagement might range from interest (positive engagement) to boredom (non-engagement) to rejection (negative engagement).

Table 1 is our attempt at adapting Trowler's (2010, p. 6) examples to HCI. Affect, behaviour and cognition are intertwined (Norman, 2004; Norman, Ortony, & Russell, 2003), and researchers have modeled the predictive relationships amongst cognitive, affective and behavioural elements that reinforce this idea (cf., Oh & Sundar, 2015). Table 1 simplifies the treatment of behavioural, affective and cognitive engagement in HCI in order to present prevailing operationalizations of these concepts. Like Trowler, we do not intend for these classifications to be "value judgements."

Engagement is typically equated with positive experiences: pleasant emotions, active behaviours and cognitive effort. With respect to affect, some studies have used interest synonymously with engagement (Arapakis, Lalmas, Cambazoglu, Marcos, & Jose, 2014; Edwards & Kelly, 2017); frustration —precipitated by navigational disorientation (Webster & Ahuja, 2006) or search results latency manipulation (Edwards & Kelly, 2017)— can result in lower engagement and a lack of willingness to use an application in future. As a result, positive user ratings or reviews and longer and more frequent interactions are typically considered indicative of engagement, whereas lack of activity, high bounce rates or abandonments, and short session duration are taken as evidence of disengagement. If disengagement is depicted as the opposite of engagement (or negative engagement, according to Table 1), then there are two possible interpretations. If engagement is a positive activity, disengagement is a negative activity (e.g., "gaming" the system, wasting time), or alternatively, it negates other activities and perpetuates compulsive or problematic use.

While our adaptation of Trowler's categories allows us to distinguish potential affective, behavioural and cognitive associations to different user states, it requires further probing. For example, achieving poorer learning outcomes due to gaming the system (Baker, D'Mello, Rodrigo, & Graesser, 2010) or the mental health consequences of compulsive use (World Health Organization, 2018) are both placed under "negative engagement." While both behaviours potentially lead to detrimental outcomes for users, the user is more in control of the interaction in the

Table 1
Affective, behavioural and cognitive indicators of engagement, non-engagement and negative engagement.

Dimensions	Positive Engagement	Non-engagement	Negative engagement
Affect	Feeling interested, curious, in control and intrinsically motivated; Wanting to continue	Feeling bored and indifferent; extrinsically motivated	Feeling frustrated, confused and unmotivated; wanting to quit; lacking control or agency
Behaviour	Clicking, scrolling, querying, viewing pages; Responding to system feedback	Receiving information passively, e.g., viewing or listening	Cheating or gaming the system; compulsive or problematic use
Cognition	Persisting with the task, committing intellectually; expending "extra" effort focusing attention; reflecting; perceiving that time is "flying"	Experiencing challenge as too low or the task as too easy; doing only what is required	Being over-challenged/giving up; lacking focused attention; perceiving that time is "dragging on; " "going through the motions"

case of cheating or gaming the system. One could also imagine placing compulsive behaviour under "positive engagement" given the deep emotional, cognitive and behavioural involvement associated with problematic use. In fact, "over"-engagement (such as compulsive behaviours) may be where positive and negative engagement meet. We might also question whether negative engagement is the same as disengagement and, if not, how we might differentiate it. In the following section we unpack fallacies of user engagement and disengagement to bring further nuance for this discussion.

3.2. Fallacies of user engagement and disengagement

Table 1 reveals key fallacies about user engagement that guide design and evaluation choices: 1) user engagement is always positive; 2) more end-user activity means users are more engaged; 3) engagement must be continuous; and 4) engagement is "good," disengagement is "bad". In what follows, we discuss each of these statements and examine relevant evidence.

3.2.1. Fallacy: user engagement is always positive

Engagement is typically associated with a positive user experience aimed at minimizing user frustration. However, positive engagements may lead to negative emotions *post-experience*, as people describe feelings of guilt and anxiety associated with "wasting time" on social media and online games, or compulsively checking devices (Anderson & Rainie, 2018; Hiniker et al., 2016; Tran, Yang, Davis, & Hiniker, 2019). In response, several apps have been developed to switch the focus of user engagement from technologies that produce these feelings to more "productive" tasks. Launched in 2018, Apple's ScreenTime provides users with weekly, real-time reports on the amount of time spent across devices and other applications. Described as "a nap for your screen time" (Apple, 2020), the DownTime feature embedded within ScreenTime allows users to limit distractions by muting notifications from specific applications for a period of time. Likewise, the popular Forest app employs the classical Pomodoro technique (Cirillo, 2018) as a way to motivate users to spend 25 min of undistracted time being productive on a defined task. The user begins this period of productivity by planting an animated tree and keeping the application on while they focus their attention on their work. Through gamification, Forest encourages productivity: the more time the user spends away from the application, the more the tree grows; if a user navigates away from the application, the tree dies. The application keeps track of trees grown daily, weekly and monthly, as well as trees that have failed to grow.

These examples are designed to help users regain control of their time and prevent negative emotions that result from engaging for too long or too frequently in "unproductive" technologies. Yet, in some cases negative emotions may be considered more beneficial than positive emotions. Baker et al. (2010) found frustration to be more conducive to online learning than boredom (i.e., non-engagement, as per Table 1). Across three different e-learning systems (dialogue tutor, problem-solving game, and problem-solving-based Intelligent Tutoring System), the researchers found that it was difficult to shift learners from a state of boredom, and bored learners were more likely to "game" the system (i.e., cheat or manipulate the system) and achieve poorer learning outcomes (Baker et al., 2010). There may also be occasions where negative emotions are used to persuade or direct users' attention. Oh and Sundar (2015) incited disgust through visual and interactive media to elicit positive attitudes toward anti-smoking messaging, and Arapakis et al. (2014) found that news articles with negative sentiment captured people's attention and interest. In these cases, negative reactions to content (frustration, revulsion, alarm) may encourage users to learn or adjust their attitudes or behaviours.

Negative emotions can also engender deeply positive engagement. Over the last decade, social media platforms have been appropriated for the memorialization of loved ones. Facebook, for instance, allows for the memorialization of deceased users' profile pages by maintaining content shared by the deceased prior to their death and allowing for bereaved individuals to post, directly message, and tag the deceased in photos. In their study exploring grief and social networking sites, Moore et al. (2017) found that mourners used platforms such as Facebook to broadcast the death, connect with others to mourn collectively, and continue communicating with the deceased. Furthermore, the study revealed that posting to social media platforms provided mourners with an opportunity to discuss and acknowledge their grief, and to connect with others who have also experienced loss, while also maintaining control of the dialogue through what they choose to share online (Moore et al., 2017). This example highlights that interest, motivation and perceived control can be born from negative emotions related to grieving. Digital systems may be used to compensate for the lack of control that people feel over losing a loved one.

The above examples reveal that people may turn to tools to limit their engagement with other technologies when it leads to feelings of guilt and anxiety. Fostering negative emotions, including frustration and disgust, can be more conducive to attitude and behavioural change than boredom and interest; and providing spaces to express and share negative emotions can be highly engaging. Designs that only seek to elicit positive emotions miss out on supporting the role of different emotions in engagement. Futhermore, these examples illustrate the ways in which compartmentalizing affect (as depicted in Table 1) breakdown when we look at technology experiences beyond in-the-moment interactions between people and technologies, rather than the tasks in which they are engaged, and what led to and resulted from the interaction. This may be because engagement is commonly measured through quantitative activities with tools, bringing us to our next fallacy.

3.2.2. Fallacy: more activity equals more engagement

There are paradoxical findings regarding the relationship between engagement and interactivity. For example, in online news reading environments, O'Brien and Lebow (2013) found that people who self-reported their engagement as "low" spent more time looking for and reading news items than the high engagement group and visited more pages. The low engagement group may have found it difficult to complete the assigned task or experienced disorientation when navigating the news site. More recently, O'Brien, Arguello and Capra (2020) examined behavioural measures collected as part of an online web search experiment. They found a positive association between bookmarking webpages and self-reported engagement, but a negative relationship between search engine results page (SERP) activities and engagement. The authors hypothesized that participants rated their engagement lower when they had to expend more effort on the SERP; bookmarking pages was required for task completion and may have provided a sense of success. In a Massive Open Online Courses (MOOC) setting, highly engaged English language learners viewed fewer videos, in favour of text-heavy resources (that often do not register "clicks") (Uchidiuno, Koedinger, Hammer, Yarzebinski & Ogan, 2017). These and other studies show that common behavioural indicators of user engagement, i.e., duration and frequency of use of an application or its features, must be meaningfully interpreted with respect to users' goals, tasks, backgrounds and perceptions. Kizilcec, Piech, and Schneider (2013) and Coleman, Seaton, and Chuang (2015), for example, clustered longitudinal patterns of MOOC engagement to create "learner profiles" to construct trajectories of engagement reflective of varied learner preferences. These patterns highlighted that "more" is not always better for engagement.

The ease of collecting behavioural data has made it a popular means of quantifying user engagement with applications (Roll & Winne, 2015). This has created a conflation of usage measures being defined as and defining of "engagement." In reality, even when activity patterns are identified from behaviour logs, it is hard to associate them with user intents and goals (Seo et al., 2021). The lack of convergence between subjective and objective engagement measures and inadequate rationales for why specific methods or measures have been adopted in studies

challenge the validity of engagement outcomes. As a result, some researchers have begun to call for more standardized reporting of the engagement metrics used in evaluation (Ng et al., 2019). However, standardizing reporting means that we must have a sense of what metrics will be most meaningful in a particular context, and what are appropriate benchmarks for those metrics. This could involve interpreting usage data with other, more qualitative data, such as user input, and focusing on tangible and experiential outcomes rather than outputs such as number of downloads or page views) (O'Brien, Morton, et al., 2020).

In addition to large volumes of activity not necessarily being desirable, an accelerated pace of interaction may not be beneficial in some contexts. Halbert and Nathan (2015) point out that creating and allowing for moments of reflection is in opposition to "the dominant approach … to engineer experiences engrossing and entertaining for the user; " instead, the goal should be to "design for mediation (a process of listening and reflection) rather than agitation (a state of provocation)" (p. 350). In their study exploring the use of online learning systems tools in a course focused on Indigenization, Halbert and Nathan proposed that pace can be controlled by the system *or* built into contemplative design practices:

> [w]hile there are technical ways to slow down the pace of user interactions (for example, periods of disabled access, delayed message relaying, etc.), it's also possible to design a system such that the time constraints are a product of users' engagements with content and other users (p. 357).

Slowing down the pace of the interaction to support meaningful engagement can also be seen in tutoring environments, as these often limit availability of help resources to encourage students to exert more mental effort (Aleven 2003; Roll, 2011).

Another approach to pacing engagement is *slow technology*. Building on the slow food movement (Petrini, 2007), slow technology strives to "[create] technology that surrounds us and therefore is part of our activities for long periods of time" (Hallnäs & Redström, 2001, p. 201). Hallnäs and Redström (2001) suggest there are a variety of ways that technology can be slow: learning how and why something works, and discovering the consequences of its use; this is in contrast with designing for development, i.e., quickly moving an application into use (Hallnäs, 2015). The design of slow technology is "not about making technology invisible, but about exposing technology in a way that encourages people to reflect and think about it" (Hallnäs & Redström, 2001, p. 204) both in the moment and over time (Odom et al., 2018). Slowness could be considered longer engagement with the opportunity for deeper reflection; thus, it is not about doing an activity more slowly but potentially changing the way it is enacted. The slow movement essentially reduces the pace of engagement in favour of more deliberate and prolonged interaction, leading us to our next fallacy.

3.2.3. *Fallacy: engagement is continuous*

Often the goal of developers is to sustain people's use of a technology both within a single use session or over multiple sessions. Applications may be designed to facilitate deep absorption and enjoyment and to maintain users' attention and interest through novel content, media or design features (Arapakis et al., 2014; Hwang et al., 2020; Jacques, 1996; O'Brien & Toms, 2008; Shahbaznezhad, Dolan, & Rashidirad, 2021); the fear of "losing" the user may be driven by monetary reasons but also the inability to deliver a health intervention or learning module to someone who may benefit from it. However, a deliberate pause can be an invitation to focus energies elsewhere (e.g., DownTime), or create a temporal "buffer zone" (Poirier & Robinson, 2014, p. 702). To pause can be considered a break in activity, a temporary stop, but can also be described as lingering for a time. One example of how this is beneficial is the Zeigernik or "incubation" effect (Zeigernik, 1967). In some cases, putting aside a task altogether for a period of time may help bring about new ideas or find a solution to a problem.

Various definitions of pause encompass the fluid nature of activity, inactivity and passive activity, and invite the question of what is considered activity. Studies have repeatedly shown that pause-to-think is a highly productive learning behaviour, yet these pauses mean learners are not behaviourally engaged (Shih, Koedinger, & Scheines, 2008; Perez et al., 2017). During pauses of no activity, cognitive and affective processes may be ongoing, and not all pauses are created and enacted in the same way. Bachhel and Thaman (2014) found that pauses during learning from video are effective, when students are encouraged to summarize and reflect. Similarly, Merkt et al. (2022) found relationship between students' pausing behaviours and the complexity of the taught material. Shih et al. (2008) found that pausing in strategic locations supported learning in a geometry problem solving environment, while Perez et al. (2017) found that productive and unproductive learners paused in different places in a virtual physics lab. These results show that it is not the mere action of pause that is productive, but its strategic use in context; disengaging from the environment is a strategy applied by apt users adaptively.

3.2.4. *Fallacy: more (little-e) engagement leads to better outcomes*

The number of studies that examine engagement as an outcome of digitally mediated interactions in online learning, digital health, e-commerce, and other domains would suggest that engagement is the intended "hook," a means to encourage student learning and retention, health behaviour change, political participation, and information discovery, among others. However, there is little evidence linking engagement to these desired outcomes (O'Brien, 2017). This misalignment between "little e" (engagement with the digital tool or application) and "big e" (engagement with a target behaviour or real-world outcome) (Cole-Lewis, Ezeanochie, & Turgiss, 2019) means that digital tools may not be fostering personally and socially relevant outcomes. As a result, we need to critically reflect on the push to engage users.

In the mid-to late-90s, Webster and colleagues warned of too many "bells and whistles" being added to presentation and training software (Chapman, Selvarajah, & Webster, 1999; Webster & Ho, 1997). The early web was filled with showy visual and auditory stimuli, e.g., flash-driven splash pages, animations and "bubble buttons," to capture people's attention. Jung (2018) explains that these supernumerary provocations had a "double purpose": to garner attention and to bring awareness to salient parts of a still unfamiliar interface: "'Look at me', they screamed. 'I look like a real button. Press me!'" (Flashy design, para 3). These days, the animated cursors or hit counters of the 1990's are incongruent with the tasks people need to perform and therefore likely to be ignored. Although more minimalist design aesthetics are currently in use (e.g., Google's streamlined landing page with a single search bar), excess features are still prevalent. Click bait, app notifications, and recommendations constantly demand our attention, and that attention results in economic windfalls for the companies that keep us clicking, checking and watching (The Wall Street Journal, 2021).

3.2.5. *Summary*

We have unpacked multiple fallacies about engagement in terms of how we commonly consider positive, negative and non-engagement (Table 1). First, there are a range of emotions in human experience that manifest in user experience. In some cases, interactions with technology lead to frustration and uncertainty, but allow for transformational learning to take place, or are a mechanism to cope with challenging life circumstances or grief. In other cases, positive emotions, such as enjoyment and fun, can result in guilt and feeling out of control. Second, engagement is typically measured according to duration and frequency of use; these metrics say little about users' affective and cognitive experiences or goals, or what constitutes meaningful use for a specific population or application. Third, sustained use may not support engagement or be beneficial to users, as the literature on pause shows us. Lastly, we challenged the fallacy that engagement should always be the

goal of HCI, broadening our discussion to platform capitalism and the social and individual effects of technology use. By presenting and working through these fallacies, we highlight the necessary nuance required to think about engagement and disengagement in HCI.

4. Towards new definitions and conceptualizations of disengagement in HCI

In this section we propose alternative ways to conceptually model and define disengagement.

4.1. Modeling disengagement

Disengagement may be seen as a stopping behaviour, a single break point (Fig. 1). There are some instances where disengagement represents a "hard stop" of a particular technology. For example, there is a sharp decline in mHealth app use within the first 10 days of users downloading an app (Baumel, Muench, Edan, & Kane, 2019), 77% of shoppers abandon their carts before completing a purchase (Klie, 2015) and 90% of MOOC learners stop showing up after a couple of weeks (Hone & El Said, 2016). Yet, the end of use for these technologies may indicate a *transition* to something else. In the case of mHealth, stopping app use could signify failure to receive mental health support from any source, uptake of different (digital or non-digital) therapeutic interventions, or feeling well enough to decrease reliance on digital interventions. In e-commerce, shoppers may use their shopping carts as places to store viable options as they contemplate a purchase. Shopping cart abandonment could mean they purchased elsewhere — through a competitor or at the company's bricks and mortar store. In MOOCs, learners may pick up a book or another instructional resource, or may have satisfied their learning needs with part of the course and not need to complete it in its entirety. Thus, retention or abandonment statistics do not tell us much about the "something else" that technology users are doing; and disengagement from a specific technology may not mean disengagement from the goals and tasks that the technology is intended to support.

Disengaging from a specific technology does not preclude the possibility that users are engaging in novel and meaningful ways *outside* of an application. A good illustration of this is Theorycrafting, the analyses of World of Warcraft (WOW) to optimize WOW play. Theorycrafting occurs when players engage with other media (e.g., books and manuals, podcasts, YouTube videos) to learn about "what equipment to wear, what talents to choose, and an order in which to cast spells" (Paul, 2011, Introduction, para. 2). It contributes to players' overall engagement with WOW, but is also engaging in and of itself and alters players' future engagement with WoW (Paul, 2011). It would be erroneous to conclude that a WoW player is disengaged from the game when they are Theorycrafting; the diversity of players' online and offline experiences contribute to their engagement with WOW. Focusing on disengagement as a stopping behaviour in this context misses critical elements of players' engagement. Instead, we might envision parallel engagement cycles taking place that feed into each other. In Fig. 2, engagement with a primary task (e.g., playing WoW, from the above example) is depicted in a linear way to represent ongoing (but not continuous) use. As users play over time, they engage with other online and offline resources (depicted as X, Y and Z) and complete related tasks that influence their engagement with the primary task (represented with the wavy line); thus, the user is "dipping into" other resources for micro-engagements as part of a longer engagement with the primary task.

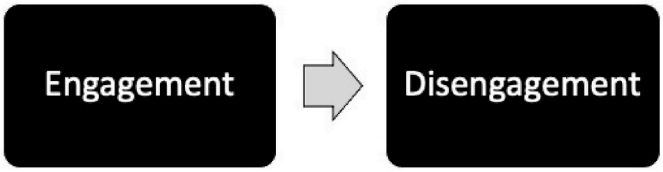

Fig. 1. Disengagement as the end of engagement with a task or technology.

In the aforementioned case of Theorycrafting, it is not possible to adequately capture players' interactions with disparate sources over time. Re-engagement, a distinct stage of the Process Model of Engagement (O'Brien & Toms, 2008; O'Brien & Toms, 2008), might be more indicative of engagement than continuous use. Re-engagement is marked by making an active choice to return, with the idea that a successful or satisfying experience is one that users will wish to repeat. One challenge with this logic is that many of the tasks that people use technology to accomplish are not voluntary or for leisure. Workplace and learning environments require users to utilize specific software over which they may have little choice. Engagement may be key to help people do the "hard work" of learning (O'Brien, Freund, & Kopak, 2016) or derive some pleasure in mundane tasks, but it is unlikely that they will be continuously engaged, unless we expand our concept of what we mean by process and time.

Fig. 3 represents a more cyclical approach to the engagement process, where "micro" processes of engagement-disengagement-re-engagement occur over time. Looking at engagement through this lens allows us to appreciate temporal shifts in user experience, and the role that technologies play in these shifts. Here we return to the work of Halbert and Nathan (2015), who used private journaling, class discussion posts, and a course wiki for small group work in a university course focused on Indigenization. The researchers found that some tools afforded more opportunities for transformative learning than others. They adopted Mezirow's definition of transformative learning as, "the process of becoming critically aware of how and why our presuppositions have come to constrain the way we perceive, understand, and feel about our world" (Mezirow, 1990, p. 14). They specifically noted that asynchronous forms of interaction allowed more time for critical reflection and processing emotions. In this study, engaging, disengaging and re-engaging over time was facilitated and inhibited through the affordances of course-based tools (synchronous and asynchronous) that allowed private reflection and public interaction. Students' experiences and learning were more than their interactions with any one tool at any one point in time. When we holistically examine these nested cycles of engagement (unique for each person), we piece together the bigger picture of engagement to appreciate how technologies enhance or inhibit users' goals and tasks; we could trace how users return to previous experiences and tools to inform outcomes, such as learning.

In summary, there is a natural ebb and flow of digitally-mediated activities that is not always captured by looking at sustained use of a technology punctuated by stopping (Fig. 1). User experience with any task may be influenced by parallel engagement with various (non-) digital tools (Fig. 2) or may consist of smaller micro-engagements that are significant when pieced together over time (Fig. 3). These alternative conceptualizations are more complex than Fig. 1, and reinforce that disengagement is not "simply the absence of engagement behaviours" (Chipchase et al., 2017, p. 32).

4.2. Redefining disengagement

Throughout this paper, we have presented three unique perspectives on disengagement:

1) Section 2.2 presented a polarized view of disengagement as the opposite of engagement. Some literature has depicted disengagement as disassociation, disenchantment and disenfranchisement from life, work and school. This view of disengagement corresponds with stopping an activity or inactivity (Fig. 1).
2) In section 4, we modeled disengagement as part of the natural course of interacting with technology as users perform tasks and work toward their goals. Disengagement is part of a cyclical process that may involve taking a break from one technology to engage with another

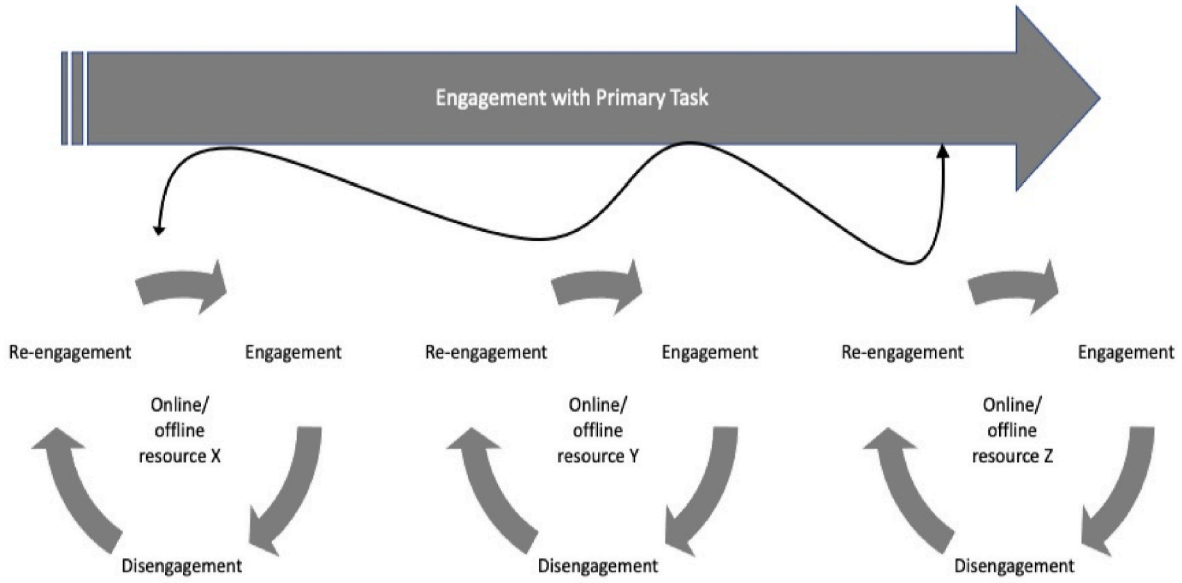

Fig. 2. Parallel streams of engagement with different resources in support of a primary task.

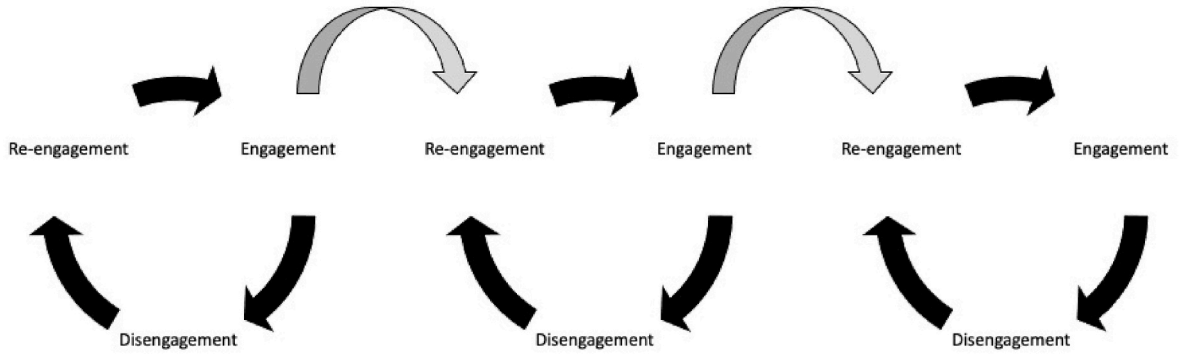

Fig. 3. A cyclical view of engagement.

or other task-relevant activities (Fig. 2), or micro-interactions representing shifts in engagement over time (Fig. 3). These depictions show disengagement as *moving the user forward* and we can imagine the cycles being thick or thin, linear or branching, and rich with decision points.

3) Finally, through unpacking the fallacies (section 3.2), we have shown that disengagement is something that can precipitate both positive and negative outcomes for end-users, depending on the user's context and goals.

Given these multiple configurations, *what, then, is disengagement?* In proposing a conceptualization of disengagement, we discourage relying solely on the quantitative or behavioural aspects of engagement, which represent one dimension of experience and limits our ability to consider the meaning users' give to their interactions. Instead, we highlight the qualitative aspects of engagement and draw upon the theme of agency that has been seeded throughout this paper:

Disengagement is a naturally occurring component of human-computer interactions that reflects a pause or cessation of use; its meaning is determined by the end user with respect to the contribution of the pause or cessation to their goals and the degree to which they exercise control over it.

This definition acknowledges that some forms of engagement are more desirable than others. It further highlights two critical elements. First, disengagement, like engagement, is goal-driven. Users may disengage if their goals have been met, they opt to work towards their goals using other means or they intend to resume working on their goals with the system at a later point. The second critical element is that of the choice to disengage and control of this process. Building on the concept of Agentic Engagement in learning (Reeve, 2013; Winstone, Nash, Parker, & Rowntree, 2017), we postulate that positive engagement is one that is controlled by the user – and so is positive disengagement. At the practical level, this definition implies that disengagement can carry value, and this value can be identified (namely, helping users achieve their goals). Furthermore, it seems that we can often identify patterns of positive vs. negative engagement. For example, Baker, Corbett, Koedinger, and Roll (2006) can detect harmful vs. non-harmful gaming ahead of measuring learning; Perez et al. (2017) can differentiate between productive and unproductive pauses; and Arnold and Pistilli (2012) can predict academic success based on engagement in learning. These examples demonstrate that the distinction between positive and negative disengagement is not merely semantic. Rather, these are often differentiable and interpretable mode of (dis-)engagement.

We return here to the idea that engagement operates along a continuum from positive to negative (Jacques, 1996) rather than being a binary state. Working through the fallacies made us question what constitutes the end points of the spectrum. Therefore, we add a second axis for "agency" to Jacques' continuum. Fig. 4 depicts the negative to positive engagement spectrum, intersected by the agency axis, and shows how affect, cognition and behaviour might manifest in each of the

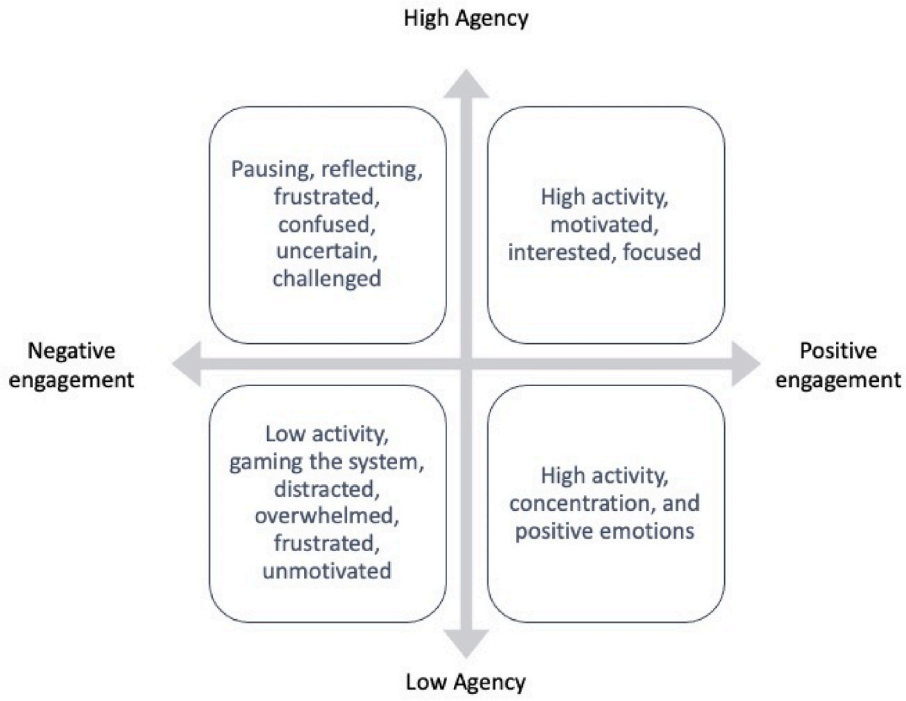

Fig. 4. Engagement spectrum incorporating dimension of value to end-user.

following quadrants:

- Positive engagement, low agency: Users feel deep cognitive absorption, positive emotions, and exhibit high interactivity in an application, but this results in perceived loss of control, time wasting and feelings of guilt; compulsive or problematic use could be an extreme form of this type of engagement.
- Positive engagement, high agency: Users are active, focused, interested, motivated and enjoying the interaction. They perceive themselves to be in control of the interaction and that it is furthering their goals. This quadrant echoes traditional interpretations of engagement, and includes, for instance, goal-driven use of various systems such as e-learning, commerce platforms, or productive information searching.
- Negative engagement, low agency: The user exhibits low activity because they feel frustrated, overwhelmed and unmotivated. They may be going through the motions to complete a task they are not truly invested in, such as passively learning what they perceived to be boring or irrelevant material.
- Negative engagement, high agency: The user is inactive and experiences negative emotions because they are challenged by a difficult problem or topic. They require pauses to think and reflect, but are committed to persist with their task. In these cases, the negative engagement may lead to subsequent positive engagement and progress towards one's goals.

The various quadrants of the engagement-agency matrix may be part of the cyclical process of engagement; examining the user's cognitive, affective and behavioural state is contextualized according to their sense of agency to evaluate its desirability.

5. Implications

This reframing of (dis)engagement situates us to explore implications for HCI research and design. In this section, we articulate some key questions when developing new technologies or assessing the impacts of existing applications on the people who (could) use them.

5.1. Why do we want to engage end users?

The argument that technology is not neutral, and therefore neither is our engagement with it spans time and disciplines. When we pose the question, why do we want to engage end users, we also need to ask: Who is benefiting from the engagement? Have we balanced the benefits of engagement with the risks, and how transparent are those risks to end users? These questions are motivated from the work the Centre for Humane Technology (2021), Digital Justice Lab (n.d.), Centre for Digital Rights (2021) and Consentful Tech (2021), among others.

Though developers of digital technologies may see their work as finding solutions to problems to help end users, the goals they are suggesting people should accomplish or the tasks they identify as needing completion may not match user needs. Creating space to question whether technology, especially the creation of a new technology, is the best way forward is paramount. Kaczmarek, Shankar, dos Santos, Meyers, and Nathan (2020) argue that the "allure of technological solutionism" lies in its focus on "discrete and constrained problems," short-time lines and quick outputs (e.g., academic publications) resulting in "purely artifactual solutions [that] appear as impoverished approaches to wicked problems" (p.5). We must then ask ourselves if we are prepared to engage with these "wicked problems" in a holistic way, examine our own motives for the work and envision the long-term view of a project. If the goal of a technology is not engagement-for-engagement's sake, but to facilitate mental wellness, change a behaviour, encourage learning, etc., then we must recognize that the technology itself may play a small (rather than major) role, and that real-world outcomes are tied to the people, places, and other technologies in the user's life world. Additionally, engagement with the technology may result in different outcomes for different end-users, which leads us to our next question, who are we trying to engage and why?

5.2. Who are we trying to engage and why?

In asking why we want to engage end users, we must also ask who are the end users of a given technology, and how well we understand their needs. In the area of mental health, for instance, Morton, Hole, Murray,

Buzwell, and Michalak (2019) called attention to the effort required by people with Bipolar Disorder (BD) to engage in the daily practice of self-monitoring using mHealth apps, and that, for some, it is "an unpleasant reminder [of] living with BD" (p. 2). Other studies have reported increased negative affect after engaging with mental health apps (Nicholas, Fogarty, Boydell, & Christensen, 2017), and linked smartphone distractions with worsened mood and increased feelings of boredom (Dwyer et al., 2018). Surprisingly, Sanches et al.'s (2019) review of a decade of HCI papers on anxiety, depression and bipolar disorder found that, "from the total of 139 papers, two thirds (91 papers) do not mention any ethical concerns or values" (p. 6). The authors speculated that researchers may have reasoned that any concerns were addressed through ethical review processes at their respective institutions, "but this assumption may hide specific ethical concerns relating to affective disorders or the system at hand" (p. 6). We concur, and also point out the number of commercially available mHealth apps that may undergo no formal ethics approval.

This example is situated in mHealth, but there is a plethora of areas in which engaging with technology is more nuanced than equating greater engagement with benefits to end-users. In the recent publication *Design Justice* (2020), author Sasha Constanza-Chock and collaborators drew upon intersectionality (Crenshaw, 1989) and the matrix of domination (Collins, 2002) to emphasize the consequences of designing technologies, where universalist design principles and practices may exclude —even erase – certain people (Constanza-Chock, 2020). Further, the Centre for Humane Technology is documenting the negative consequences of technology use on our mental and physical well-being, cognition and attention, political systems, relationships, and ability to achieve a more equitable, informed society (Ledger of harms, 2021). Pushing back on technological solutionism, Kaczmarek et al. (2020) remind us that, "It is possible for care and responsibility to come first" (p. 6), and this may involve making space for different forms of engagement.

5.3. Making space for disengagement

In the current discourse that highlights engagement as "good," there is the notion that disengagement (i.e., stopping) requires remediation. However, in some circumstances, it may be in people's best interest to disengage. Ferreira, Azevedo, and Menezes (2012), for example, conducted research with young people about their civic and political experiences. They found that higher quality experiences (based on evaluations of action and reflection) resulted in more open and pluralistic thinking while, "no participation might be better than low quality participation" (p. 607). As we design technologies and envision how they can be used, we should think about desired engagement profiles. Making space for disengagement could promote a more balanced approach to use that reduces feelings of guilt or "time wasting" and allows them time for aspirational activities (Hiniker et al., 2016) or real-world social interactions (Dwyer et al., 2018). We must be aware, however, that providing tools to help users stop using specific technologies or use them less frequently may not be enough. We are reminded of the extreme example in Dow Shüll's ethnographic account of machine gambling in Las Vegas and the denial of industry representatives about the role of gambling machine design in addiction. Multistability, "the claim that a technology can be used for multiple purposes through different contexts" (Rosenberger, 2014, p. 369) reiterates both the non-neutrality of technology and its influence on individual agency, or power to act.

The cyclical view of engagement depicted earlier in Fig. 3 shows disengagement as part of the natural course of engagement, and of parallel engagements with different resources (Fig. 2), supporting the view that engagement need not be continuous (Section 3.2.3). This enables us to see ebbs in engagement as equally valid to overall experience as engagement and re-engagement, and to view what users do outside of a particular application as relevant to their long-term interactions. Different users have different engagement goals and profiles, and this could be acknowledged through the design of natural breakpoints. These could take many forms, such as recommending additional resources, stopping at the end of a module, or letting users choose the length of an interaction. The challenge, however, is that our current evaluation of engagement leaves little room for non-continuous, infrequent (though perhaps more meaningful) interactions.

5.4. How do we measure engagement?

One of the most common ways in which engagement is currently measured is through behavioural proxies, such as clicks, queries, scrolls, and so on. Focusing on behavioural measures misses the cognitive and affective aspects of experiences, and frames non-activity as a lack of investment. There are self-report measures of engagement (O'Brien et al., 2018), and increasingly, physiological measures, e.g., eye tracking (Arapakis et al., 2014) and galvanic skin response (Edwards & Kelly, 2017) are being used. The main challenge with current approaches to measurement is that we are looking for a single, simple measure to capture a complex construct, and this is impossible; more interactivity does not necessarily mean high agentic engagement (Section 3.2.2). If we expand our view of engagement as cyclical (Fig. 3) and operating in parallel with different sources of information and interaction (Fig. 2), then we must explore ways to incorporate measures of pause and reflection into our evaluation models.

6. Conclusion

In this paper we have identified and challenged current conceptualizations and fallacies about user engagement and disengagement, drawing upon examples from e-learning, social media, gaming, and mHealth. Here we began by sharing typical categorizations of the affective, behavioural and cognitive dimensions of positive, negative and non-engagement (Table 1) and introduced and interrogated various fallacies. In doing so, we demonstrated that it is not possible to generalize user engagement as emotionally positive, more interactive, continuous, or beneficial to end users. Second, we built upon the Process Model of User Engagement (O'Brien & Toms, 2008) to contest the simplified view that disengagement is the end of engagement (Fig. 1). Specifically, we explored parallel engagements of online and offline activities related to a core task (Fig. 2), and cyclical, micro-engagements unfolding over time (Fig. 3). Finally, we proposed a definition of disengagement as pausing or ceasing the use of a technology in the context of end-user goals and agency in order to evaluate its desirability. In framing both engagement and disengagement as something that can add to or diminish the user experience, we reimagined the engagement spectrum (positive to negative) according to the level of agency exercised by end-users. We concluded by asking readers to consider the purpose of engaging users in the first place and who is the intended user and why, to make space for disengagement, and to move past behavioural measures when evaluating engagement. As we move away from engagement-for-engagement's sake and a "more is better" approach, what is the new target to pursue? Future research in this area should focus on determining the markers for agentic engagement with various application types to provide meaningful benchmarks for measuring engagement, and relatedly, exploring how to identify a priori engagement profiles to incorporate these into the design cycle.

Author contributions

Heather O'Brien: Conceptualization; Methodology; Funding acquisition; Project administration; Supervision; Visualization; Writing – original draft; Writing – review & editing. Ido Roll: Conceptualization; Writing – original draft; Writing – review & editing. Andrea Kampen: Conceptualization; Writing – original draft; Writing – review & editing. Nilou Davoudi: Conceptualization; Writing – original draft; Writing –

review & editing.

Declaration of competing interest

None.

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