‘Hung Up’: Designing for the Mobile App Engagement University Students Desire

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ABSTRACT

In 2020, many among us have spent more time than ever before with our mobile devices. For many years, technology developers, designers, researchers and ethicists have each debated the impact of technology on how we spend our time and relate to others. Our relationships to and through our devices are increasingly complex; and perhaps for none more so than university students. And yet, there remain many gaps in our knowledge of just how students perceive and desire their engagement with these devices – leading to a lack of real-world design solutions to enable configuration of these vital human-device relationships. This paper presents a design-led inquiry into the role smartphones play in students’ lives; contributing findings from five phases of mixed-methods research conducted as part of a user-centred, iterative design process (n=157), and resulting in a novel scaffolding of the mobile app ecosystem in support of the modes of engagement students desire.

CCS CONCEPTS

• **Human-centered computing**;

KEYWORDS

Wellbeing, Mobile Devices, Engagement, Social Media, Mobile Architectures, Mobile Applications

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1 INTRODUCTION

As designers and developers of mobile devices and applications, many of the decisions we make are driven by the desire to engage users. This has often proved a significant challenge, and yet also is one for which there is increasingly little doubt as to our success. Sixty percent of young people aged 18 to 34 today report feeling that they use their smartphones “too much” [11]. Seven out of every ten of us report sleeping with our phones [33], and as many as two-thirds have even been considered to demonstrate intensely-debated signs of ‘addiction’ to our devices [14, 20, 22, 43].

To an ever-greater extent today, we understand how to design to attract and maintain users’ attention; by employing habit-forming design strategies, infinite content loops, gamified patterns of interaction, attractive interface designs, and numerous other techniques [24, 25, 50]. This is perhaps nowhere more the case than within the pervasive and embedded mobile-device ecosystem – where any attempt to shape the parameters of our engagement has the potential to significantly impact our wellbeing [4, 9, 13]. The impact of mobile technologies on how we live has been extensively documented among student populations in particular [19, 32, 42]. And yet, we know less about the kinds of engagement students desire their devices make possible.

This work is motivated by knowledge of this research gap, by the first authors’ personal experience of the impact of technology on the lived experience of university students, and by a desire to turn our focus from an overly-determined and prescribed view of engagement to a more conscious, mindful, intrinsically-motivated and perhaps even more ethical form [12, 39]. Achieving these aims requires both understanding mobile engagement as desired by university students, and designing to make those desires a reality.

This paper presents results from a user-centred design research process comprising five stages of mixed-methods research centred within a highly-diverse university student population in Denmark and internationally. This forward-looking and design-oriented approach contributes a) an understanding of students’ perceptions of their engagement with their devices, as presently enacted, experienced, and desired, as well as b) a series of design implications for student mobile engagement; realised in the form of a proposed restructuring of mobile-device interaction according to an expanded conception of the modes of engagement made possible with and through our mobile devices.

2 RELATED WORK

The practice of mobile device and application design for engagement, habit-formation, behaviour change and wellbeing takes place at the convergence of a wide variety of academic fields and industries [2, 16, 23, 40]. While numerous theoretical perspectives and methodologies can therefore be brought to bear on this topic, we focus, in this design-oriented project, on related work in the field of Human-Computer Interaction (HCI) [28, 29].

*Both first and second authors contributed equally to this research.

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2.1 Understanding Digital Wellbeing

Any definition of digital wellbeing is necessarily situated within a discourse concerning the potential of technology – whether to support wellbeing or detrimental patterns of behaviour for example [1, 6, 46]. A workshop on the topic at CHI'19 offered one concise definition of the concept as "the extent to which a person perceives their digital device use to be aligned with their own long-term goals" [26]. Clearly then, user engagement may be seen as either a path to digital wellbeing or a barrier to its attainment, as evidenced by the wealth of HCI research concerning technology-overload and distraction [30, 31, 34, 49], habit-formation [38, 44], push notifications, auto-play and gamification techniques [7, 9, 18, 41].

Certain design efforts to support habit-formation have been subject to critique for encouraging passive and mindless forms of interaction which while might prove effective may ultimately promote and result in technological dependence, with adverse consequences for our productivity, mental health and social connectedness [10, 35, 49]. Design to support mindful interaction, in contrast, has been framed as a means of empowering users to obtain and maintain control of their technology use and consumption [9, 27, 36, 48]. Cox et al., for example, posit the conscious implementation of 'design frictions' as a means of challenging a more pervasive, frictionless design paradigm prioritising ease of access and navigation [10].

Despite such initial attempts to support digital wellbeing however, many young people and students continue to report concerns related to the time spent in interaction with their devices [17, 21, 31]. There remains a lack of knowledge concerning students' consciously-held desires in this respect; and therefore how to design for more authentically held and intrinsically motivated forms of engagement.

2.2 Designing for Mindful Interaction

In industry, efforts to bring about digital wellbeing have likewise often focused on concepts of mindfulness and mindful interaction [34]. Companies including Apple, Google, Facebook and TikTok now provide in-app tools enabling users to limit their screen time and promoting more meaningful interactions. Of these efforts, Instagram's recent *"You're all caught up"* feature is worth noting as an attempt to shape the typically frictionless experience of social media applications. And yet, these features are rarely easily visible or accessible to users and most often apply solely to interactions within a particular app.

Despite initial efforts therefore, users still have limited capacity to enact control over the ways in which we relate to and engage with our devices; to shape and calibrate our interactions in line with our own short and long-term goals. This paper aims to address these gaps in knowledge and design practice.

3 METHODS

The primary aim of this research study was to develop knowledge of students' experiences and perceptions of more and less desirable and mindful practices of mobile engagement in support of a novel technology prototype.

This design-led inquiry consisted of five phases of mixed-methods and user-centered research (See Fig. 1). First, a series of semi-structured group interviews (n=13) were conducted to support an initial understanding of Danish students' engagement with their mobile devices in everyday life; including the extent to which students perceived these interactions as shaped by habit or conscious decision-making, as well as opportunities for design to support increased digital wellbeing. Secondly, a pilot-tested quantitative survey (n=114) was employed to extend and validate our understanding of these initial qualitative insights with a larger and more diverse student sample [8, 47].

Next, the first two authors produced a series of novel, digital and tangible concept solutions for digital wellbeing, informed by insights from these initial research phases, and iterated upon these low-fidelity prototypes during two phases of group interviews with users (n1=17, n2=8). This included a physical ring to promote screen time management, a 'smart' bracelet to support perceptions of digital intimacy, and a series of app concepts to counteract design mechanisms grounded in infinite content loops (See Appendix A: Iterative Prototyping). Following refinement of these concepts and selection of a single high-fidelity prototype, a final series of interviews (n=5) were conducted to support evaluation of its usability and design – a novel device-level scaffolding to support multiple modes of engagement (See Section 5).

Participants for each phase were recruited via convenience sampling [5]; resulting in a diverse sample of university student participants spanning multiple disciplines and numerous nationalities attending universities primarily in Denmark but also abroad (See Table 1). Each qualitative research phase was audio-recorded, for a total of 25 hours of audio, transcribed in full, anonymised, and subjected to a thematic analysis both inductive and deductive in nature [3]. Quantitative results from the online survey were analysed using simple descriptive statistics, and open-ended comments from participants analysed in the same fashion as other qualitative phases.

4 FINDINGS

We next present our findings in the form of overarching themes spanning each stage of this design-research process; from the online survey to group interviews and usability testing.

4.1 The Mobile Device as Multi-Tool & Willpower Battle

A central theme in students' descriptions of their engagement with their mobile devices was a perception of the smartphone as multi-tool. Students described a felt "need" for a device employed for purposes from basic tasks, *"to wake up, check the time, check the buses" [P11]*, to *"making sure friends and family are alive" [P3]*, but also spoke of the smartphone as enabler of meaningful engagement and source of inspiration for creative pursuits from fashion to entertainment, food, and sports; *"I . . . see . . . recipes and exercises and I . . . implement these things into my daily life" [P8].*

And yet, this convenient co-location of numerous functionalities and activities meant that students could come to feel 'device-dependent,' trapped in a cycle of 'excessive' screen time, and unsupported in navigating and staying on top of these various threads

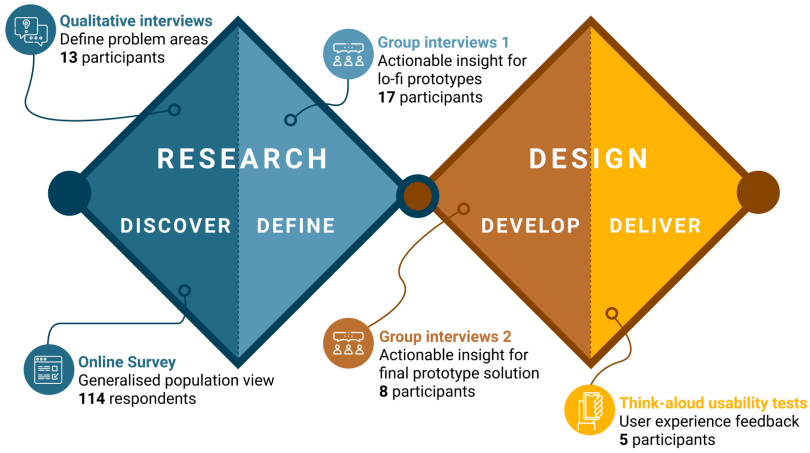

Figure 1: The Design Research Process

Phase №	n	Gender (m / f / NA)	Age (18-21 / 22-25 / 26-30 / 30+)	Nationality (Danish/Other)	Degree (Undergrad/Postgrad)
Phase 1	13	7 / 6 / 0	3 / 7 / 3 / 0	1 / 12	5 / 8
Phase 2	114	59 / 53 / 2	10 / 69 / 32 / 3	16 / 98	37 / 77
Phase 3	17	10 / 7 / 0	0 /12 / 4 / 1	2 / 15	5 / 12
Phase 4	8	6 / 2 / 0	0 / 5 / 3 / 0	1 / 7	1 / 7
Phase 5	5	2 / 3 / 0	0 / 4 / 1 / 0	0 / 5	1 / 4

Table 1: Participants' Demographic Characteristics by Research Phase

of interaction; *"I feel like if I'm bored, I use my phone. If I want to say something to my friends, I use my phone, if I want to learn something, I use my phone." [P6].* Students described the tendency of a frictionless mobile experience to result in a blurring of their original motivations for interaction, and to produce a felt need to rely heavily on their own willpower to make meaningful decisions with respect to their smartphone usage – particularly when they would find themselves, or feel, alone. Descriptions of a perceived lack of willpower as "weakness" reflect the constant mental battle, often to stay away, that their smartphones came to represent for certain participants; *"You set yourself the . . . sticks and stones. . . risks and rewards" [P16].*

4.2 The Mobile Device as Seat of Personal Values

Conceptions of more and less desirable practices of mobile device engagement are inevitably shaped by values, as brought to interaction by users and informed by design. This was no less the case for university students. A rich ecology of personal values and social norms was detailed by participants during all five phases of this design research process; as shaping cues, habits, and expectations for their personal smartphone usage.

4.2.1 Valuing Connectedness. A desire to remain connected to others was the form of valuing most frequently recounted by participants. Both on and offline, students spoke of belonging, connectedness and intimacy as driving much of their engagement with their mobile devices; *"the only context I couldn't live without my phone is if I was alone" [P1].* This was particularly the case for those students who lived abroad, apart from close friends and family, and was a theme emphasised by comments to their detachment from their smartphones when surrounded by friends or family; *"when I was. . . back in France. . . I didn't use [my phone] for one day and my friend was calling my brothers; "Oh my God, is she okay?" because yeah I just forget about it" [P2].* The degree of meaning associated with the value of social connectedness was furthermore reflected in the extent to which this theme was supported by past, present and future-oriented reflections;

> *"I'm really just disappointed or mad at someone who is all the time at their phone, even if they're taking pictures for Snapchat, like please live the moment now, here with us and make some memories. . . If I look back in 20 years and see myself in pictures with my friends looking at our phones, I'll be really sad about that."* P12

Valuing Digital Intimacy. Students furthermore elaborated upon this theme by speaking to the capacity of their mobile devices to support digital intimacy of many and diverse forms. Phone calls were often described by those in romantic relationships or with close relationships to their parents as facilitating connection, and as remaining one of the most important smartphone features despite the widespread use of social media.

Other forms of connection, and means of communication via smartphone, were described as opportunities for expressions of affirmation and care. For many students, notifications reflected attention and interest, and although could prove distracting, were also described as a positive "boost"; *"that always feels really good to me when I get messages on messenger because that means that 'Yeah, somebody cares about me"' [P1]*. Students, therefore, spoke of their mobile devices as playing an important part in their experience of connectedness, while also interpreting these experiences as often less satisfying than in-person interactions; *"I think many things are way better when you have a human connection than with your phone" [P8]*. This tension understandably led to a felt need to continuously revisit and reposition the role of the mobile device in students' social lives.

4.2.2 Valuing Productivity. To our surprise therefore, students often assessed the value of their time spent in interaction with their devices according to metrics of productivity, achievement, and growth. Prior to the interviews conducted during the first research phase, participants were asked to try for 1-week one of four common strategies for reducing screen-time; dulling the colours of their screens, moving the most accessed apps away from the home-screen of their phones, disabling disruptive app notifications, or setting time limits on frequently used apps. When subsequently asked to discuss the impact of these strategies on their smartphone use, students' first reaction was often to provide excuses for their screen time or to express an interest in further limiting their screen time in order to become 'more productive'; *"I feel like lately, I have been too much in my phone (…) If I should be productive, it should be one hour maximum" [P6]*.

Participants universally expressed satisfaction with respect to any decrease in screen-time, and used terms such as "useless" and "waste" to describe interactions perceived as excessive or counter-productive. Terms such as 'guilt,' 'shock' and 'embarrassed' were likewise employed to describe the emotional experience of viewing their screen-time; *"when I first saw the screen time, I was surprised and thought it was very high and [was] kind of shocked because I didn't think it was that much" [P13]*. This was particularly the case for social media applications, despite the value students' placed on social connectedness. P7, for example, went as far as to comment that *"I feel good, that I spend less time on Facebook… This means that I have not spent my time on useless stuff. This makes me feel really good."*

4.2.3 Valuing Both Intrinsic & Extrinsic Motivations. Many participants' comments also reflected the role of social norms and expectations in driving and shaping their mobile engagement. At times, students described aspiring for a life without the smartphone, whilst striving to find their place in a society portrayed as necessitating near-continuous mobile interaction; *"I want the minimum time possible on my phone" [P10]*. This desire to reduce screen-time was more often described as pertaining to the smartphone as a whole than to individual applications.

Strikingly, students often spoke of 'living in the moment' and 'presence online' yet presented these as counter-posed notions. There was therefore often reflected in students' comments, a felt need to justify behaviour. This is perhaps best explained by the complex combination of intrinsic and extrinsic incentives for use recounted by participants; as pertaining to interconnected perceptions of enjoyment and usefulness [45].

Although many students spoke of rewards and penalties as design strategies for the regulation of interaction, others struggled to articulate their perceptions of their own smartphone use as shaped by external factors; *"I don't know. I have to let these things sit through my head so I can feel that the decision was mine" [P10]*. While prior research points to intrinsic rather than extrinsic motivations as more likely to lead to the long-term maintenance of behaviors [15], it is therefore clear from students' comments that to design for engagement necessitates a rich conception of the numerous values and factors which drive and influence mobile device interaction.

4.3 The Mobile-Device as Arbiter of Consciousness & Awareness

This brings us to our final overarching theme; and to one which underwrote many of participants' reflections. For many, their involvement in this research represented the first time they had come to reflect upon their engagement with their mobile devices; and many expressed surprise at their own findings and recollections.

This is perhaps represented most starkly by the juxtaposition of two survey responses. A large majority of university students (57%) responded that they found smartphone activities 'addictive' while a plurality (39.5%) reported that they did not believe that they themselves were 'addicted'.[1] Participants would effortlessly describe their preferred smartphone activities, their routines and their habits, yet often struggled to connect these activities to higher-order and more conscious forms of reasoning pertaining to motivations for and assessments of their own behaviours (See Appendix B: Survey Results). A key takeaway from this research is therefore the need to avoid any form of black-and-white discourse concerning students' use of technology, as well as the need to consider behaviour and experience as both lived and reflected upon, if we are to design to support digital wellbeing.

5 DISCUSSION & IMPLICATIONS FOR DESIGN

Finally, we describe how these research insights contributed to the design of a prototype solution to enable university students to move towards more consciously valued practices of engagement, and in turn 'time better spent' with our personal devices. This final concept solution consists of a modal paradigm for mobile interaction; a device-level scaffolding of user experience enabling users to select, configure and reshape their interactions with their devices. We are each familiar with 'Silent' and perhaps even 'Quiet' modes, as supported by Fitbit devices for example. This prototype solution builds on prior HCI research by asking to what other modes of engagement we might aspire beyond abstinence [9, 10, 44].

Here we present one such instantiation informed by students' emphasis on time spent alone, and commentary concerning the gap between less and more consciously desired and habitual practices of engagement – Alone Mode (See Fig. 2). Alone Mode, first, allows users to enable selected apps, notifications and contacts during activation, greying out other applications and contacts. Secondly,

[1]The concept of technology addiction is intensely-debated [21, 22], and our intention in asking these particular questions was not to suggest the reality of this proposition but to gauge how participants themselves viewed their interactions.

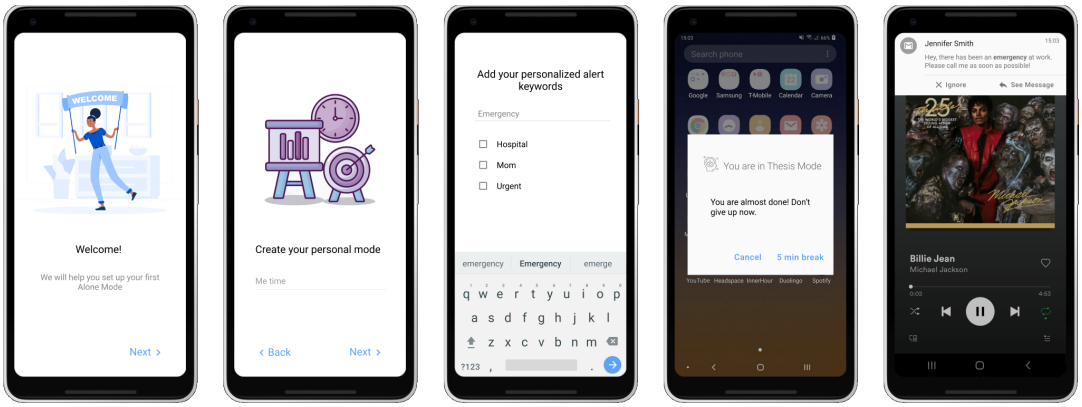

Figure 2: A Modal Paradigm for Mobile-Device Interaction | Alone Mode [2]

this mode permits user-defined personal, motivational messages to be displayed periodically during use. Thirdly, users can customise no-reply texts to be sent to those who attempt to reach the user. And finally, Alone Mode supports the selection of keywords by which incoming notifications can be filtered, enabling deactivated contacts to reach the user in case of emergency.

Just one example of a broader modal interaction paradigm, this solution empowers users in line with their feedback during initial design phases by granting increased capacity to shape the nature of time spent alone; enabling more meaningful practices of mobile engagement, beyond abandonment and distraction, in support of digital wellbeing. We next describe the considerations which shaped our design choices, and in turn implications for the future design of technologies to support digital wellbeing.

5.1 Work Towards Device-Level Solutions

Throughout this design-research process, students came to emphasise the need for system-level solutions for digital wellbeing, due not only to the complex interplay between very many mobile applications and notifications, but also the need to normalise new practices of engagement within students' social circles both small and wide.

This approach enables modification of the ways in which different services and experiences are offered to users across time and context; not imperceptibly but according to each user's own design [39]. This implication for design is furthermore supported by students' perceptions of the mobile device itself as the seat of a willpower battle, and the subsequent need for simple yet meaningful practices of configuration.

5.2 Provide Desired Opportunities for Consciousness-Raising

Many students spoke of the smartphone as a multi-tool in which much of their lives, personal, social and educational, was concentrated. This often made it challenging for students to reason about the time spent in interaction with their devices and to make conscious choices with respect to their mobile engagement.

Our implementation of Alone Mode drew inspiration from Cox. et al's work concerning design frictions [10] as well as students' espousal of the values by which they desire to shape their engagement. Any practice of consciousness-raising must be sensitive to the values which such strategies surface and promote, the hectic nature of students' lives, and the reality of the smartphone as a stage on which social norms, expectations and independently-held motivations collide. Many students, for example, spoke not only of the importance of feeling connected to others but also of different kinds of connectedness as supported by diverse mobile features and applications. A design choice as simple as allowing users to distinguish between certain connections as more and less urgent or meaningful implicitly raises awareness of the kinds of connections forged and maintained by students by different means.

5.3 Offer Choice Strategically

Turning from awareness to decision-making, students often presented their smartphone usage as a practice that, even when engaged in consciously, left them with little capacity to make choices in the face of distractions and a pervasive fear of missing out (FOMO). For control not to be perceived as illusory, choices must feel meaningful and have visible effects. We might therefore see the provision of choice as a shift in the locus of meaningful control from system to user; and in turn the very possibility of choice as an argument for enhanced individuality, self-expression, self-actualisation, and perhaps even more ethical technologies.

Choices must however be enabled and positioned strategically for their enactment to prove a real possibility; and for autonomy, competence and control to serve not only as ideals but felt experiences [37, 40]. One early concept solution, a physical ring worn to reflect patterns of device use, for example, was abandoned following comments that such a device would not prove socially acceptable, and was therefore infeasible as a means of promoting and enabling choice.

5.4 Design Not for Abstinence but Alternative Forms of Engagement

Many of the design strategies for digital wellbeing available commercially today are driven by principles of abstinence, and as such, embody not only a negative view of users' behaviours but of technology itself [9, 26]. A broader multi-modal paradigm, in contrast,

might strive not for avoidance but for alternative, hopeful and even joyful opportunities for engagement; whether with, through, or during time away from our mobile devices.

And yet, it is also essential to remain aware that users' accounts reflect stances towards not only technology but ways of being and valuing in the world. We were struck in particular by the extent to which students spoke of enhanced productivity as a motivation for both reducing and maintaining patterns of interaction. Increased productivity then may serve as a motivation for proclaiming the ills of 'excessive' smartphone usage, and yet it is also worth questioning the extent to which this serves as a 'good' metric by which to make design choices, or assess time well-spent. For the choices we make as designers impact our health and wellbeing not only at the granular level of clicks and touch gestures but by the values they propagate; *"I have not been productive…I have been watching Netflix… wasting my time" [P6].*

Designing from a positive and hopeful perspective on engagement therefore furthermore guards against the propagation of values of shame and guilt by causing users to feel judged for their behavior through the very presence of features conceived to support digital wellbeing.

6 CONCLUSION

This paper presents findings and design implications arising from five stages of user-centred design research; highlighting the significant role smartphone devices play in the lives of university students as well as offering strategies for the design of meaningful practices of mobile engagement in support of digital wellbeing.

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