Institution: Bournemouth University

Unit of Assessment: 11

Title of case study: Journey into SPACE: using socially-aware computing to inform the design of an app to reduce digital addiction

Period when the underpinning research was undertaken: 2014 – 2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Professor Raian Ali	Professor in Computing and Informatics	2012 - current
Dr Nan Jiang	Associate Professor in Human Computer Interaction	2010 - current
Professor Keith Phalp	Professor of Software Engineering	1997 - current
Professor Angelos Stefanidis	Head of Computing and Informatics	2015 - current
Dr Huseyin Dogan	Principal Academic in Computing	2012 – current
Dr John McAlaney	Associate Professor in Psychology	2014 - current
Dr Emily Arden-Close	Senior Lecturer in Psychology	2014 – current
Dr Sarah Muir	Senior Lecturer in Psychology	2012-2018

Period when the claimed impact occurred: 2016 – 31 December 2020

Is this case study continued from a case study submitted in 2014? No

1. Summary of the impact (indicative maximum 100 words)

Recent estimates (Cash et al., 2012) suggest 1.5%-8.2% of the global population experience some form of digital addiction (DA). At Bournemouth University (BU), we developed social computing research to identify DA vectors (e.g., 'fear of missing out') and use-moderation strategies (e.g., online peer support). Identifying the requirements for socially-aware software in the design of smartphone usage-monitoring applications ('apps') led to us working with commercial partners to develop SPACE – a leading smartphone app offering users real-time harm-reduction strategies. SPACE promotes self-control, allowing users to achieve a harmonious life/phone balance. It has been downloaded more than 2,000,000 times, received highly favourable user feedback, and improved wellbeing and productivity.

2. Underpinning research (indicative maximum 500 words)

The power and affordability of smartphones, together with the pervasiveness of digital technology, has massively increased time spent online. For people worldwide, particularly adolescents, high smartphone usage has negative effects on personal relationships, work, study, and finances. In extreme cases, it may become a substantive digital addiction (Cash et al., 2012).

In 2015, BU researchers identified the critical importance of empowering individuals to take greater control of their smartphone usage. They showed how phones themselves could deliver intelligent, data-driven, harm-reduction strategies to people with moderate DA [R1]. That year,

BU established the Digital Addiction Research Group (DARG), an interdisciplinary team of researchers from: Computing and Informatics, Psychology, Marketing and Creative Technologies. DARG includes four PGRs, three of whom were directly supported by approximately GBP150,000 of Saudi Arabian funding. DARG's research has established that real-time, intelligent warnings and labels can help individuals make informed technology usage decisions, ultimately reducing their daily time online.

Critical elements include:

1. Understanding how the design of technology, particularly social networking applications, triggers problematic attachment and usage. After reviewing the DA literature, we analysed web discussion forums devoted to it. This allowed us to map its main causes and to identify the requirements of a system capable of reducing it. For example, a specially designed app could disable notifications from distracting apps that would otherwise capture attention. Key research challenges to such software development were also pinpointed [R2].

2. Recent studies (Young et al., 2017) have established that Facebook addiction affects higher education students, but what had not been explored was which web-based intervention systems were most and least effective in managing it. We addressed this with quantitative research involving 200 postgraduates in a Facebook support group. The study discovered six Facebook addiction factors and five intervention features that could be used in addiction management. Findings also indicated that notification was the most important intervention feature, whereas self-monitoring was the least important [R3].

3. Having identified fear of missing out (FOMO) on social media content as a major DA vector, DARG researchers conducted a multi-stage qualitative study (interviews; diary-keeping; focus groups) to identify how social networking sites use FOMO to encourage continuing user engagement (e.g., sending notifications of any contact's activity) [R4]. This knowledge suggested countermeasures. For example, future DA apps could let users set priority lists, enabling them to make quick responses to key contacts after time offline.

4. Next, we examined specific software features for future DA apps. Using both focus groups and survey methods, we developed a series of app-based intervention strategies, focusing primarily on online peer support groups in combatting DA [R5]. Results showed that online peer-groups valued personal anonymity combined with visible but anonymised usage data to enable secure social comparisons.

5. Finally, we conducted an app-based intervention with 94 smartphone users to test whether the social norms approach – known to reduce harmful behaviours in other domains – could be applied to DA. Objective group measures revealed that participants often markedly overestimated their peers' usage [R6]. Subsequently, we designed harm-reduction software to induce downward change, based on social norms comparisons.

2. References to the research (indicative maximum of six references)

R1-6 were all subject to rigorous peer review.

R1: Ali, R., Jiang, N., Phalp, K., Muir, S. and McAlaney, J. (2015), "The Emerging Requirement for Digital Addiction Labels," In: Fricker, S., Schneider, K. (eds) "Requirements Engineering: Foundation for Software Quality," REFSQ 2015. *Lecture Notes in Computer Science*, vol. 9013. Springer, Cham. (Available on request.)

R2: Alrobai, A., Phalp, K. and Ali, R (2014), "Digital Addiction: A Requirements Engineering Perspective," The 20th International Working Conference on Requirements Engineering:

Foundation for Software Quality (REFSQ 2014). Springer LNCS. Essen, Germany. DOI: 10.1007/978-3-319-05843-6_9

R3: Dogan, H., Norman, H., Alrobai, A., Jiang, N., Nordin, N. and Adnan, A., (2019), "A Web-Based Intervention for Social Media Addiction Disorder Management in Higher Education: Quantitative Survey Study," *Journal of Medical Internet Research*, 21 (10). DOI: 10.2196/14834

R4: Alutaybi, A., Arden-Close, E., McAlaney, J., Stefanidis, A., Phalp, K. and Ali, R (2019), "How Can Social Networks Design Trigger Fear of Missing Out?" In the 2019 IEEE International Conference on Systems, Man, and Cybernetics (IEEE SMC 2019). 06-09 October 2019. Bari, Italy. http://eprints.bournemouth.ac.uk/32620/

R5: Alrobai, A., McAlaney, J., Phalp, K. and Ali, R. (2016), "Online peer groups as a persuasive tool to combat digital addiction," *Persuasive Technology, 9638*, pp. 288-300. Springer. http://eprints.bournemouth.ac.uk/23575/

R6: McAlaney, J., Almourad, M. B., Powell, G. and Ali, R. (2020), "Perceptions and Misperceptions of Smartphone Use: Applying the Social Norms Approach," *Information*, 11, 513. DOI: 10.3390/info11110513.

4. Details of the impact (indicative maximum 750 words)

In recent years, it has become widely accepted that millions of people worldwide have moderate levels of DA that negatively influence wellbeing and productivity (Cash et al., 2012). Around 2015, several apps designed to address this problem appeared in Google's Play Store and Apple's App Store, indicating a growing public demand for technological solutions. Although these apps made use of available technology, their design did not incorporate any socially-aware computing solutions, and were informed by the personal experiences of software developers with little understanding of behaviour change principles. In the absence of knowledge of the psychological processes involved, such apps could be ineffective, or even *increase* the amount of time spent online.

In 2018 DARG's work attracted the interest of the CEO of *Phone Life Balance*, who contacted Ali and McAlaney, proposing a research/design collaboration to develop a new app, SPACE. This app would uniquely incorporate DARG's psychological insights into digital addiction, and socially-aware software solutions, while avoiding ineffective or counterproductive design features present in competing apps.

SPACE was launched in 2017. DARG's key evidence-based behaviour change strategies were consolidated into its design, including features to counter social media platform strategies for triggering FOMO, for example by removing and/or managing large numbers of notifications (Figure 1a). Later, as we continued to work together, we added techniques for using data-based social comparisons aimed at reducing unrealistically low evaluations by users of their engagement compared with their online peers (Figure 1b-d).

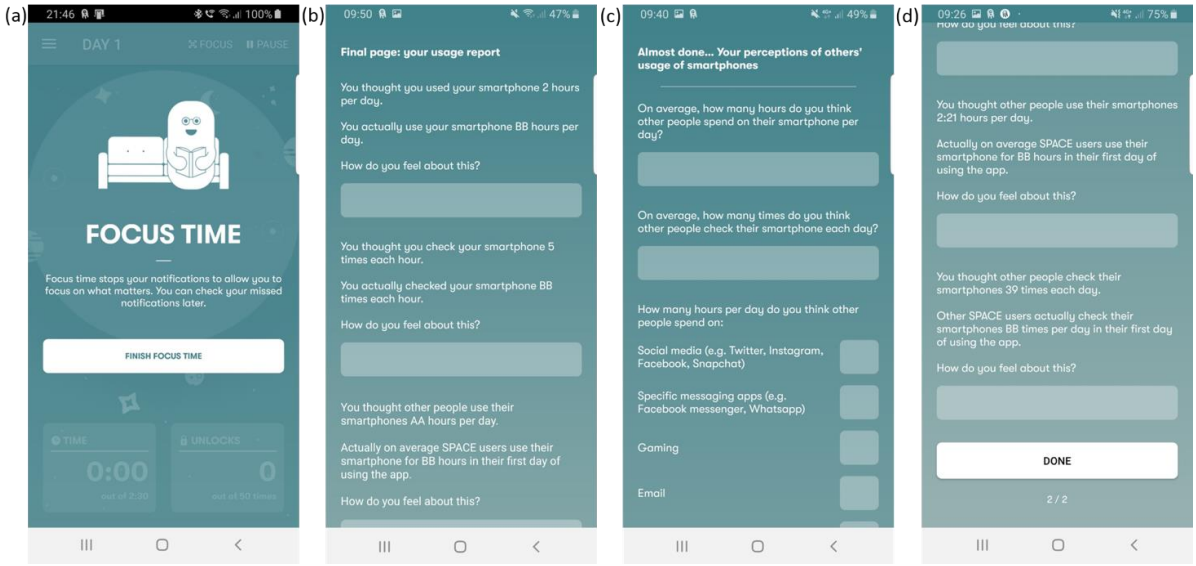

Figure 1: (a) The 'Focus Time' feature in the SPACE app reduces notifications from other apps, reducing FOMO; (b) Sample social norms comparison feedback from the SPACE app; (c) Perception of peer norms survey items in SPACE; (d) Qualitative survey item on participant reaction to social norms feedback.

SPACE has been exceptionally well-received worldwide, with more than 2,000,000 downloads and 1,000,000 active users in 21 countries including: Europe, North and South America, the Middle East, Asia and Australia. With user ratings of 4.2/5 [E1], it was featured as an 'Essential App' on Google's Play Store [E1]. It has also been recommended by a number of international tech review outlets [E2]. Analysis of user data and feedback by the SPACE team indicates that the app users spend an average of 2 hours and 46 mins on their phones per day [E1], compared to the average US citizen usage of 3 hours and 54 mins (https://www.statista.com/statistics/1045353/mobile-device-daily-usage-time-in-the-us/).

This reduced time spent online also translates to improvements in health and productivity. User data collected by a research team (independent of SPACE and BU) shows that, after using the app for four weeks, 85% of users reported that it enabled them to monitor their smartphone usage, while 71% said it improved their usage [E3]. Further evidence collected from the same team indicates that self-monitoring of smartphone use, facilitated through the SPACE app, is positively linked with outcome expectations and self-efficacy [E4].

These statistics are supported by the wide range of qualitative user feedback and reviews posted in Google's App Store and Apple's Play Store [E5], for example: 'It helped me work out how much time I was using my phone and what for. I went from about 2.5 hours per day down to 10 minutes,' 'Really personalised, geared for my goals,' and ' I like that it gives the user the ability to not count some apps like when I'm using Google Maps or Spotify for example, I can disable tracking for those apps.'

The *Phone Life Balance* webpages [E6] directly acknowledge Ali's involvement as senior scientific consultant, and the centrality of BU research in the development of SPACE. The DARG team's work 'inspired and informed various solutions and design ideas', such as peer support and surveillance as a persuasion technique and the use of personas for user profiling. '[BU's] continued feedback on SPACE app has greatly helped its evolution and resulted in enhanced users' feedback and an increasing number of downloads.' [E7]

Phone Life Balance is continuing to develop 'real world' services designed around SPACE and therefore incorporating BU research. Through the SPACE@Communities programme, it is helping people learn to find a better phone/life balance via a group counselling initiative. Drawing on the user experience studies conducted and the identification of social computing principles

specific to digital addiction, groups focus on attendees' relationships with technology, the difficulties they face in reducing excessive usage, and the way SPACE can help them take back control of their time.

Most recently, this approach has been developed into SPACE2SHINE, an organisational initiative designed to improve workplace productivity. This offers an end-to-end intervention designed to transform businesses that are seeking to instil a healthy relationship with technology in employees throughout their organisation [E8].

5. Sources to corroborate the impact (indicative maximum of 10 references)

E1: Play.google.com. (2021). [online] Available at: https://play.google.com/store/apps/ [Accessed 5 February 2021].

E2:
E2a. Dredge, S. (2018). *Mobile phone addiction? It's time to take back control*. [online] The Guardian. Available at: https://www.theguardian.com/technology/2018/jan/27/mobile-phone-addiction-apps-break-the-habit-take-back-control [Accessed 9 February 2021].
E2b. Sharkey, L. (2018). *These reward-based apps make kicking your smart phone addiction so much easier*. [online] Bustle. Available at: https://www.bustle.com/p/7-apps-for-smartphone-addiction-because-its-a-very-real-problem-10066400 [Accessed 9 February 2021].
E2c. Frew, J. (2019). *The 5 Best Apps to Help You Fight Your Smartphone Addiction*. [online] MUO. Available at: https://www.muo.com/tag/5-apps-help-fight-smartphone-addiction/ [Accessed 9 February 2021].
E2d. RTE.ie. (2019). *6 apps to help fix your phone addiction once and for all*. [online] Available at: https://www.rte.ie/lifestyle/living/2019/0605/1053552-6-apps-to-help-fix-your-phone-addiction-once-and-for-all/ [Accessed 9 February 2021].
E2e. Kenny, B. (2019). *10 Best Apps to Stop Smartphone Addiction - Techzillo*. [online] Techzillo. Available at: https://techzillo.com/best-phone-addiction-apps/ [Accessed 9 February 2021].
E2f. Boricho, M. (2021). *15 Best Apps to Stop Your Smartphone Addiction*. [online] Techrrival.com. Available at: https://techrrival.com/best-apps-to-stop-your-smartphone-addiction/ [Accessed 9 February 2021].

E3: Statement of research findings (in prep.), verified by SPACE CEO and San Diego State University.

E4: Abhari, K., Vaghefi, I. and Xiao, B. (2020). "Digital Mindfulness: An Examination of the Antecedents and Outcomes of Self-monitoring via Smartphones". (In prep.)

E5: Sample of qualitative user feedback comments posted on The App Store and Play Store.

E6: Space. (2021). *Meet the SPACE team — Space*. [online] Available at: https://findyourphonelifebalance.com/about-the-space-team [Accessed 9 February 2021].

E7: Phone Life Balance Ltd. (2020). Testimonial letter, 28 October.

E8: Space. (2021). *SPACE for Business — Space*. [online] Available at: https://findyourphonelifebalance.com/space-for-business [Accessed 9 February 2021].