



Renfree, I., Harrison, D., Marshall, P., Stawarz, K., & Cox, A. (2016). Don't kick the habit: The role of dependency in habit formation apps. In *CHI EA '16 Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 2932-2939). Association for Computing Machinery (ACM).
<https://doi.org/10.1145/2851581.2892495>

Publisher's PDF, also known as Version of record

Link to published version (if available):
[10.1145/2851581.2892495](https://doi.org/10.1145/2851581.2892495)

[Link to publication record in Explore Bristol Research](#)
PDF-document

This is the final published version of the article (version of record). It first appeared online via ACM at <https://doi.org/10.1145/2851581.2892495> . Please refer to any applicable terms of use of the publisher.

University of Bristol - Explore Bristol Research

General rights

This document is made available in accordance with publisher policies. Please cite only the published version using the reference above. Full terms of use are available:
<http://www.bristol.ac.uk/pure/user-guides/explore-bristol-research/ebr-terms/>

Don't Kick the Habit: The Role of Dependency in Habit Formation Apps

Ian Renfree

UCL Interaction Centre
University College London
London, UK
ian.renfree.11@ucl.ac.uk

Daniel Harrison

UCL Interaction Centre
University College London
London, UK
daniel.harrison@ucl.ac.uk

Paul Marshall

UCL Interaction Centre
University College London
London, UK
paul.marshall@ucl.ac.uk

Katarzyna Stawarz

UCL Interaction Centre
University College London
London, UK
k.stawarz@cs.ucl.ac.uk

Anna Cox

UCL Interaction Centre
University College London
London, UK
anna.cox@ucl.ac.uk

Abstract

Habit formation apps are intended to help instigate and maintain new behaviors. Prior research has established that these apps mostly do not support the theoretical 'habit' construct defined in psychology, yet are generally popular and well reviewed in app stores. This apparent mismatch between theory and 'in-the-wild' usage has not been investigated to date. Through an in-depth qualitative study of a popular application *Lift*, this research establishes that common techniques such as reminders and streaks are effective at supporting repetition of new behaviors, but at the same time create a dependency: on-going app use is often required to achieve lasting change. This dependency introduces fragility in users' attempts to change their behavior, as they often abandon the app and subsequently disengage with their new behaviors.

Author Keywords

Smartphone apps; habit formation; behavior change; streaks; reminders

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI); Miscellaneous. H.5.2 User Interfaces: User-centered design.

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author.
Copyright is held by the owner/author(s).
CHI'16 Extended Abstracts, May 07-12, 2016, San Jose, CA, USA
ACM 978-1-4503-4082-3/16/05.
<http://dx.doi.org/10.1145/2851581.2892495>

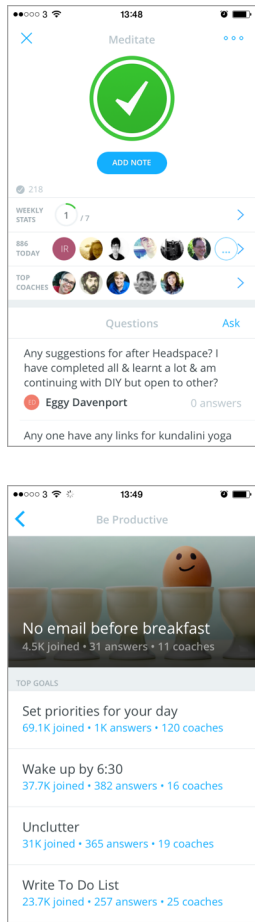


Figure 1. Lift screenshots: confirming completion of a habit (top); selecting a new habit to join (bottom)

Introduction

Even when intentions to change a behavior are strong, many fail at making sustainable changes; only 8% keep New Year's resolutions [16], and when diagnosed with a chronic illness, many do not change behaviors linked with their condition or initiate new behaviors that mitigate symptoms [10]. For many behaviors, such as diet and exercise, persistent changes are required to reduce the long-term risk of chronic and fatal lifestyle diseases such as heart disease and cancer [6].

Forming habits is one way of supporting long-term behavior change. Habits prompt behaviors automatically on encountering an associated cue [15]. This automated response increases the likelihood they will persist over the longer term, even when motivation fades and willpower is low [11].

Research into how technology can support habits is scarce. A recent theoretical analysis concluded that applications marketed to support habit formation generally do not support the key components required [13]. However, these applications are popular on app stores and are generally well reviewed (e.g. [17][18][19]) which suggests users are finding them valuable.

To explore this apparent contradiction, an interview study was conducted with users of a popular habit application, Lift [17] (renamed to 'Coach.me' after initiation of study). A qualitative approach was chosen as the focus was on establishing *how* these apps are being used in real world contexts to support habit formation.

Related Work

There has been increasing interest in how habits can be leveraged to support longer-term behavior change. Whilst many interventions are effective during the period of intervention, success rates over the longer term are frequently lower (e.g. [7]). Studies have demonstrated that when strong habits are developed the likelihood of behaviors persisting is higher [4].

Habits are learned associations between a context or cue, and a behavior [15]. They are developed by consistently repeating a behavior in a stable context or in response to a cue, and with each behavioral repetition, the habit strengthens [8]. A stronger habit leads to a behavior being enacted more automatically when a context or cue is encountered, with less reliance on deliberate conscious processes [9].

There are a large number of smartphone apps intended to support habit formation. The two most common functions of these apps are self-tracking, where users record the completion of their behaviors, and reminders [13]. Lift is the most popular example of an app that incorporates these two features and thus has been selected for this study.

In Lift, users can select or create habits they wish to develop and then track their progress (see Figure 1). It has several mechanisms to motivate regular usage, including visuals to demonstrate progress, rewards and social components. Streaks are one of its main 'reward' features. They are built when behavior is performed for a series of consecutive days - the number of days is the streak.

A recent paper presented a theoretical analysis of popular habit formation applications, including Lift [13]. In reviewing 115 iOS and Android apps the authors found limited support for techniques grounded in habit formation theory and highlighted the risk of dependency, and reduced automaticity, when reminders are used as triggers. Although this highlights a gap in how habit theory is being implemented in applications, the paper does not investigate how this affects behavior change or habit formation in real world usage.

It is important to understand whether the theoretical gaps highlighted in [13] are having real world consequences or, if the apps are delivering positive outcomes, how that is being accomplished. This paper contributes by increasing our understanding of this gap and how users are using common features in habit apps to change their behaviors.

Method

To investigate how habit formation apps are being used to support behavior change, users of a popular application, Lift, were interviewed in order to better understand their experiences and outcomes.

Participants

16 current or prior users of Lift on iOS (9 male, 7 female; 18-54 years old; mostly from the UK) were recruited via adverts on social media and from an email sent to a student mailing list. Half (8) had over 3 months experience with Lift, and of those, 5 had been using Lift for over a year. The remaining half (8) had between 3 weeks and 3 months of experience. Most participants were employed (7) or self-employed (5), and the rest were students (3) or not working (1).

Procedure

Interviews were conducted via Skype. Participants were reminded that the call was being recorded, they could end the interview at any point and they did not have to answer any questions that made them uncomfortable. Interviews lasted between 25 and 50 minutes, and explored their usage of Lift, including behaviors they wanted to change or initiate, when they used the app and their satisfaction with the app.

Analysis

Transcription and thematic analysis [1] was conducted shortly after each interview. An inductive approach was used, whereby the data was solely used to form codes and themes.

Results

All participants were attempting to change multiple behaviors simultaneously, tracking between 3 and 15 behaviors. Behaviors tracked in Lift included those related to diet, exercise, spirituality, personal hygiene, education and personal growth. Notably, most participants reported that the app had supported them in successfully changing some of their behaviors. Behaviors participants were most successful with tended to be specific and easy to perform (e.g. 5 push ups), and were often added to existing behavior chains or routines (e.g. after brushing teeth in the morning). Others had success with increasing frequency of existing behaviors.

Supporting behavior change

Of the techniques in Lift that aim to support behavior change, reminders and streaks were cited as the most effective.

Half of the participants used reminders, in several cases for all their behaviors, *"I have reminders set up for all of them"* (P15). Many who used reminders indicated they used them as triggers for their behaviors to be performed at certain time, *"...for press ups I get reminders on Monday, Thursday and Saturday at 8 AM and [...] I intend to do the press ups at those times"* (P15). Others used them as deadlines; *"...it's when I want to, in my head, when I should have already done it"* (P4).

As reminders based purely on time lack contextual information it often made them unsuitable as triggers, *"[if I] happen to be working in a cafe and I got a reminder to do push-ups, I'm not going to do anything about it"* (P15). This led to negative affect in some participants, *"I took them off because then I beat myself up if I wasn't doing it at that particular time, even if it wasn't a good time to do it"* (P9).

Streaks were cited by the most participants as a key feature that helped them maintain motivation, *"...streaks were what helped motivate me a lot"* (P10) and *"I was really enjoying having the streaks"* (P9). Participants directly identified it as being responsible for longer term behavior changes, *"...prayer is my most regularly checked in goal just because keeping the flame thing going, the streak is pretty motivating to me at this point because I'm on like 340"* (P10).

Some emphasized the positive nature of a challenge to keep a streak going, *"...because I've got this 33 days straight [...] how long can I keep this going?"* (P6). Whilst others focused more on the desire to not lose a streak, *"having a big number is helpful in that you don't want to break it"* (P10).

Life disruptions

Most participants experienced changes in circumstances or times of difficulty that disrupted behaviors and usage of Lift. Participants highlighted how sometimes the two were related: when behaviors were disrupted, usage of Lift reduced or stopped completely.

Examples included holidays, *"I've been on holiday and stuff so a lot of them [tracked behaviors] have gone by the wayside"* (P10), change in careers, *"...the gym definitely dropped off when I returned [from a job] to University"* (P8), changes in family setup, *"I'm a father now to very young children [...] and you get railroaded [away from intended behaviors] quite frequently"* (P15) and relocating, *"I had a daily meditation practice and then I moved [...] and everything changed"* (P13).

Others highlighted how periods of disruption reduced their use of Lift, *"I tend to use it [Lift] less if I've got a lot of other things on"* (P11) and *"...there have been quite a few changes in my life recently [...] my usage of lift dropped off..."* (P8). In many cases it appeared that Lift usage was a 'victim' alongside other behaviors that stopped during periods of disruption, *"...my behaviors were just not as frequently performed [during a difficult period] Lift probably got caught up in that"* (P8).

In some instances, these periods of disruption led participants to stop using the application completely. Participants reported the main causes were stress and busyness, *"...there was a lot going on in life at that time of the year, everything got a bit hectic and overwhelming and I just stopped using it"* (P9) or a temporary loss of structure, *"I finished my job and started a new one, so I didn't really have a structured time in December, so I stopped using it"* (P3).

Some suggested that Lift was not helpful in navigating these periods and that led to stopping use of the application, *"...I set my goal for exercise three times a week but I knew I was going to have to be very gentle or I would aggravate my shoulder, so I couldn't go to yoga. So I thought I'm not going to start at the gym yet either [...] why should I have any commitment to what this app is saying to me, it doesn't really know my physiological condition!?"* (P2)

Behaviors during non-use

Some participants suggested that when they stopped using Lift they disengaged with several of their behaviors, *"... it was a struggle to keep on top of all these habits [...] I think it [not using Lift] impacted the ones I'd been successful with"* (P12). P5 discussed a period of behavioral disengagement when he was not using Lift, *"I [...] got less disciplined, the morning routine dropped away a bit, I probably also put on weight because I wasn't doing those habits [in Lift]"* (P5). He explained that phase by suggesting without the accountability from Lift he would give in to temptation, *"...you want to tick off that behavior so you say 'no, no, no' to eat during the day, but without that emotional leverage, I'll eat that chocolate biscuit you just put in front of me and no gym today!"* (P5).

P3 disengaged from most of his behaviors when he stopped using Lift due to leaving his job and losing his daily structure and mentioned how his behaviors 'collapsed'. *"I went into a period where it was quite stressful I was trying to get a new job [...] I was using my phone a lot less, I didn't want to think about all those habits in Lift I was meant to be doing [...] it all kind of collapsed"* (P3).

Other participants more directly claimed that stopping use of the application contributed to behavioral disengagement; they stopped using the application because they were not performing some behaviors, which subsequently led to their other behaviors ceasing as well. *"I think the times I stopped using it were because some of my behaviors [...] I wasn't doing them and I don't want to face up to the fact I'm failing [...] but then I can get in a [...] mode where I stop doing any of them"* (P14).

Discussion

To investigate how habit apps are being used to support behavior change, an interview study and thematic analysis were conducted. The study established that Lift was helpful for motivating and reminding, but rather than supporting behavior change through development of automatic habits, a dependency on features of the app was created so that ongoing use was required to maintain behaviors. The study also confirmed findings from other studies (e.g. [2] [5]) that users are prone to abandon health technologies. This combination of dependency and likelihood of abandonment introduces fragility to users' behavior change efforts.

Many participants identified reminders and streaks as the most useful features to support behavioral repetition. Reminders helped participants mitigate forgetfulness, remind them of their intention to perform the behavior and provided a cue to initiate a behavior [12]. Streaks motivated participants by providing a challenge to maintain a streak, a form of 'gamification', and/or by activating a fear of losing a streak, leveraging loss aversion, the disproportionate impact of loss versus comparative gain [14].

However, the study found a risk of technology dependence. Habits are of interest for behavior change because they offer a path to more sustainable changes that reduce dependencies on fragile factors such as motivation and willpower [11]. There is evidence here that a dependency has been introduced, as participants depended on reminders and streaks to continue repeating the desired behaviors.

Additionally, all participants either temporarily or permanently stopped using Lift. This is a common experience: 74% of users stop using health apps after ten uses [20] and, more broadly, abandonment of wearable health devices is common [5]. During periods of not using the app, participants disengaged with tracked behaviors. Although this can be partially explained by a life disruption simultaneously effecting both behaviors and usage of the app, several participants suggested a direct impact from the removal of the interaction with the app.

From a habit theory perspective, reminders used to cue behavior can be seen as inherently dependency forming: if automaticity has developed it is explicitly linked to the appearance of the reminder [15]. With streaks, expected extrinsic rewards negate the development of automaticity by keeping a behavior as goal focused and reducing intrinsic motivation [3]. This effect is likely most pronounced for those with long streaks where automaticity should have developed, but if the goal of maintaining the streak is the main motivator then automaticity may not have developed. Thus when the extrinsic motivation is removed, the impetus for the behavior disappears.

Despite our relatively small sample, in this work we were able to present preliminary findings of how using popular techniques to remind and motivate can lead to a fragile dependency on those features. Focusing on one application ensured that all participants accessed the same intervention and set of features.

Conclusion & Implications

This study used a qualitative approach to investigate usage of a habit formation application, Lift. Although there is significant research in habit formation and technology based behavior change, there has been little focus on how technology supports habits. The study found that Lift was effective in supporting new behaviors, mainly by triggering and motivating repetition. However, a dependency was introduced where participants were dependent on the app to continue repeating the new behaviors. This dependency introduced fragility to users' behavior change efforts as abandoning the app, and subsequently disengaging with behaviors, was common. This potentially undermines a key benefit of habits whereby fragile dependencies are reduced so as to increase likelihood of longer-term change.

Future work could look at the broader set of habit apps to confirm our findings are more widely applicable. More research is also recommended in looking at different motivational techniques used by habit formation apps, how dependency forming they are and how that affects the development of automaticity. Ideas to improve these features should be evaluated and these would form the basis for a series of concrete recommendations for developers of habit apps.

Acknowledgements

This work was funded by EPSRC grant EP/L504889/1.

References

1. Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative research in psychology* 3, 2: 77–101.
2. James Clawson, Jessica A. Pater, Andrew D. Miller, Elizabeth D. Mynatt, and Lena Mamykina. 2015. No Longer Wearing: Investigating the Abandonment of Personal Health-tracking Technologies on Craigslist. *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, ACM, 647–658. <http://doi.org/10.1145/2750858.2807554>
3. Edward L. Deci, Richard Koestner, and Richard M. Ryan. 1999. A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin* 125, 6: 627–668. <http://doi.org/10.1037/0033-2909.125.6.627>
4. Benjamin Gardner, Kate Sheals, Jane Wardle, and Laura McGowan. 2014. Putting habit into practice, and practice into habit: a process evaluation and exploration of the acceptability of a habit-based dietary behaviour change intervention. *International Journal of Behavioral Nutrition and Physical Activity* 11, 1: 135.
5. Daniel Harrison, Paul Marshall, Nadia Bianchi-Berthouze, and Jon Bird. 2015. Activity tracking: barriers, workarounds and customisation. *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, ACM, 617–621.
6. William Haskell, I.-Min Lee, Russell Pate, et al. 2007. Physical Activity and Public Health: Updated Recommendation for Adults From the American College of Sports Medicine and the American Heart Association. *Circulation* 116: 1081–1093.
7. Robert W. Jeffery, Leonard H. Epstein, G. Terence Wilson, Adam Drewnowski, Albert J. Stunkard, and Rena R. Wing. 2000. Long-term maintenance of weight loss: Current status. *Health Psychology* 19, 1, Suppl: 5–16. <http://doi.org/10.1037/0278-6133.19.Suppl1.5>
8. Philippa Lally, Cornelia HM Van Jaarsveld, Henry WW Potts, and Jane Wardle. 2010. How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology* 40, 6: 998–1009.
9. Philippa Lally, Jane Wardle, and Benjamin Gardner. 2011. Experiences of habit formation: A qualitative study. *Psychology, health & medicine* 16, 4: 484–489.
10. Jason T. Newsom, Nathalie Huguet, Pamela L. Ramage-Morin, et al. 2012. Health behaviour changes after diagnosis of chronic illness among Canadians aged 50 or older. *Health reports* 23, 4: 49–53.
11. Alexander J. Rothman, Paschal Sheeran, and Wendy Wood. 2009. Reflective and Automatic Processes in the Initiation and Maintenance of Dietary Change. *Annals of Behavioral Medicine* 38, 1: 4–17. <http://doi.org/10.1007/s12160-009-9118-3>
12. Katarzyna Stawarz, Anna L. Cox, and Ann Blandford. 2014. Don't forget your pill!: designing effective medication reminder apps that support users' daily routines. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 2269–2278.
13. Katarzyna Stawarz, Anna L. Cox, and Ann Blandford. 2015. Beyond Self-Tracking and Reminders: Designing Smartphone Apps That Support Habit Formation. ACM Press, 2653–2662. <http://doi.org/10.1145/2702123.2702230>
14. Amos Tversky and Daniel Kahneman. 1991. Loss aversion in riskless choice: A reference-dependent model. *The quarterly journal of economics*: 1039–1061.

15. Wendy Wood and David T. Neal. 2009. The habitual consumer. *Journal of Consumer Psychology* 19, 4: 579–592.
<http://doi.org/10.1016/j.jcps.2009.08.003>
16. New Years Resolution Statistics | Statistic Brain. Retrieved September 25, 2015 from <http://www.statisticbrain.com/new-years-resolution-statistics/>
17. Coach.me - Life Changing Productivity Community. *App Store*. Retrieved September 25, 2015 from <https://itunes.apple.com/gb/app/coach.me-productivity-coach/id530911645?mt=8>
18. Way of Life - The Ultimate Habit Maker & Breaker. *App Store*. Retrieved September 25, 2015 from <https://itunes.apple.com/gb/app/way-life-ultimate-habit-maker/id393159800?mt=8>
19. Productive - Habit tracker - Daily routine & reminders for goals & chores. *App Store*. Retrieved September 25, 2015 from <https://itunes.apple.com/gb/app/productive-habit-tracker-daily/id983826477?mt=8>
20. Motivating Patients to Use Smartphone Health Apps. *PRWeb*. Retrieved September 25, 2015 from <http://www.prweb.com/releases/2011/04/prweb5268884.htm>