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Stickers for Steps: A Study of an Activity Tracking System with Face-to-Face Social Engagement

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Many systems have been designed to study social aspects in physical activity tracking. In most, social functions are performed at a distance, such as posting comments and achievements, or via in-app leaderboards. We present an activity tracking app designed instead to encourage face-to-face encounters. Stickers for Steps seeks to recreate the experience of a physical sticker book, where digital 'stickers' are collected in an album, but where stickers are awarded for reaching activity targets. Users will accrue duplicate stickers, which can be swapped with other co-located users over a Bluetooth connection. We explore the usage of our app, reporting on a trial with 33 participants. We find that our app successfully encouraged groups of users to swap duplicates, review progress and to discuss their levels of activity. We provide design recommendations for future activity tracking systems that could incorporate face-to-face interactions.

1 INTRODUCTION

There has been much recent research into mobile systems built around the tracking of physical activity [6,13,14], with HCI studies into the design of novel fitness technologies often being concerned with social aspects in particular. Influential design requirements have called for systems that "provide personal awareness" and "support social influence" [9]. Yet whether presenting comparative statistics on exercise levels [2,9], encouraging communication between users [29], or creating collaborative games based on activity tracking [26], most systems have treated social activity as something to do through a software application; as a distant, online undertaking. In this paper, we explore an alternative – a collaborative activity tracking system designed to encourage physical meetings between users, and real world discussions on the application and activity.

The collecting of stickers has long been a popular activity in many parts of the world [3]. Enthusiasts will buy packs of random stickers and place each one in its dedicated location in a sticker book, exchanging their inevitable duplicate stickers with other collectors. In this paper, we present a digital 'sticker' collection experience via *Stickers for Steps*, a mobile app for Android devices designed around the idea of a traditional sticker book, but where new packs of stickers are awarded for performing physical activity. Central to the system's experience is the ability to swap duplicate stickers with other users. We chose to implement this swapping through a Bluetooth connection between devices, thereby requiring face-to-face physical meetings for the exchanges to take place.

We study usage of our app via a trial with 33 participants. In this paper we do not focus on health outcomes of the study, instead interested in examining the collaborative practices and interaction patterns that emerge between users. Our contributions are in assessing the viability of this approach by discovering whether spontaneous face-to-face usage could be encouraged via our design, outlining lessons learned and providing a series of design recommendations for future systems built on a face-to-face engagement model.

2 SOCIAL ASPECTS OF ACTIVITY TRACKING SYSTEMS

Central to many theories of motivation are ideas of social influence on behaviour. Self Determination Theory (SDT) considers social relatedness (feeling connected to and understood by others) as a primary psychological need, crucial to internalising motivation [25,27]; social comparison theory (SCT) suggests that people are motivated to alter behaviour based on how they are viewed by others [10]; social support theory (SST) considers that positive social encounters and discussion will encourage behaviour change [20]. Research into fitness apps has also described the important role of social interactions [7,9].

Systems such as the Nintendo Wii offer real-time competition in set locations. Often generalised as "exertion games" [22], these systems are usually based around co-located social play in concentrated bursts. A different category of mobile fitness technologies operate via 'in the wild' deployments and continuous passive tracking of users' activity. Much research has been undertaken into different approaches to incorporating social dynamics into such systems. Several research apps, as well as many commercial systems, can share achievements with users' existing social networks [1,23,24]. Many apps, including 'exergames', have tracked individuals' activity, then shared this among other users to at least implicitly encourage competition [2,9,19].

A comparative study by Chen and Pu [8] has identified that designs encouraging cooperative rather than competitive behaviours might be more successful in motivating increased activity. Chick Clique [29] shares a group step count average, and allows messaging of encouragement to those users who are lagging behind. A more passive design, Fish'n'Steps [16] provides users with a shared virtual fish tank, in which the water will become murkier if any participant is not sufficiently active. Pass The Ball [26] combines both cooperative and competitive elements in an exergame that functions as a team coordination challenge.

A common aspect among these varied approaches is that the social activities occur solely through computer-mediated channels. Whether through custom-designed visualisations, subtle game mechanics or leveraging existing social media presences, the social experience in these systems is online, usually asynchronous and distant.

A notable exception to this trend is StepStream [20], an intervention for adolescents that combined step counting with online games and a blog to provide a sense of social support. In formative participatory design sessions, the authors noted that live, synchronous interaction was by far the clearest theme from adolescents' designs; indeed it was "so strong ... that we began to worry it was an artefact of the design brief itself", but attempts to guide designs in more asynchronous directions received stronger pushback towards live experiences [18]. The deployment therefore included weekly after-school sessions where participants could use the online system or chat among themselves. These sessions became the success story of the intervention, with the authors concluding "To the extent that StepStream improved students' sense of social support and attitudes towards fitness, it seems to have done so *because* of the school-based meetings and students' time together." [20]. Other studies have seen face-to-face interactions occurring with systems designed ostensibly for asynchronous use. For example, Gorm et al. [12] report on observations from a

workplace campaign involving counting steps and viewing online comparisons, and find that participants would discuss activity in person around the office, or even request explanations of each other for particular days' step counts.

We sought to design a system that would bridge the gap between fully synchronous exertion games and the asynchronous social activity common in systems based on continuous passive tracking. We were inspired by earlier studies' reports of users' apparent willingness to engage in face-to-face conversations around activity. Users seemed to embrace StepStream's discussion sessions in particular, but we note that these were prescriptive arranged meet-ups, requiring significant organisation and staffing (referred to as the "hidden work" [19] required to support such a system). We wanted to discover whether via our app design we could encourage similar events to occur spontaneously, with far less overhead, and to explore the nature of such encounters.

3 "GOT, GOT, NEED": STICKER COLLECTING

The collecting of stickers has long been a popular activity in many parts of the world. Collectors will first buy a sticker book dedicated to a particular theme, such as a sporting event or film. This book's pages are filled with numbered outlines into which corresponding stickers (sold separately in packs containing a random selection) will be placed. Part of the joy of the sticker collecting experience is in meeting with others to exchange the inevitable duplicates that will accrue from the random sticker acquisitions [3,5].

In 2014 it was reported that sticker collecting companies were "more popular than ever before" with 25 million packs of stickers sold every day [4]. It has been described as a cross-generational pastime, with adult 'swap groups' forming or connecting via social media [5]. Given the apparent enduring enthusiasm for this hobby, it seems possible that we could harness some of the fun or social mechanisms involved for promoting physical activity.

4 STICKERS FOR STEPS

Stickers for Steps is a mobile app for Android devices. It runs as a background service to continue counting steps even if the screen is locked. It uses Android's Step Counter API for devices with the required sensors, falling back to an algorithm that processes data from accelerometers [21].

The app has been designed to capture the experience of maintaining a physical sticker collection book (Figure 1). A user can browse through pages displaying numbered sticker locations. These are initially shown in silhouette, but will exhibit the earned stickers as the user's collection progresses. When a new pack (containing 3 stickers) is opened, the stickers hover at the bottom of the screen as the user swipes through the album to the appropriate page, then can be dragged and dropped into their rightful locations.

The Steps tab shows the current remaining steps required to earn a new pack of stickers, within a circular progress bar. Researchers have considered different approaches to goal setting in activity trackers [23] and different design strategies are possible for the thresholds at which to award new packs of stickers. We wanted to err on the side of caution to ensure sufficient sticker acquisition during our study, but equally did not want the most physically active users to accumulate huge numbers of stickers quickly and complete their albums in the first few days of the trial. Therefore, each day we awarded the initial sticker pack after what we considered to be an easily achievable figure of 500 steps, but double this every time the target is reached, to 1000 steps for the second pack, then 2000, 4000 and so on. Every day at midnight, the target is reset to 500. The specific stickers given to the user in each pack are assigned randomly, via an algorithm that enables stickers to have 4 degrees of scarcity. This is shown in the interface, with descriptions and colour schemes to indicate 'common' to 'super rare'. For this trial, we created 145 stickers across 21 album pages.

As in the physical world counterpart, a randomly received sticker might already be in the user's collection. A Stickers tab shows these duplicate stickers that the user has amassed. Part of the system's experience is physically meeting up with other users to swap duplicate stickers.
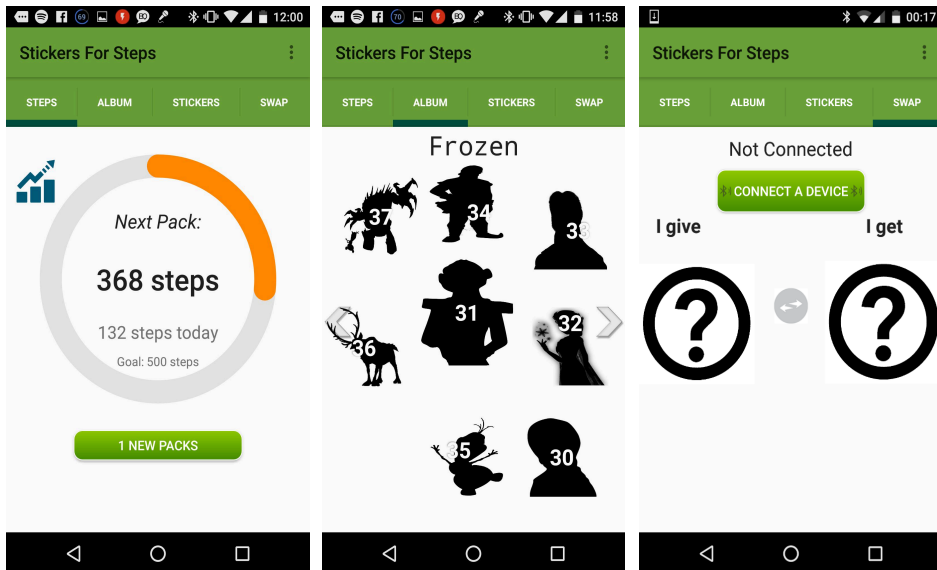
Fig. 1. The *Stickers for Steps* Android app. The Steps tab (L) shows the steps required to earn the next pack. The Album tab (C) shows a blank page awaiting stickers. The Swap tab (R) is used to make a Bluetooth connection and exchange stickers with another user.

The app guides users through establishing a Bluetooth connection between devices and selecting stickers to exchange (Figure 1, right). Each user selects a sticker that they propose to give in the swap, and each can agree or refuse to accept the other's offer. The system has no server-side component.

Design recommendations suggest that apps enforce positive behaviour rather than punishments [8], and to experiment with designs that take nuanced treatments of competitive or cooperative elements [26]. Stickers for Steps is usable by a single participant, and there is no explicitly competitive component. The app has a lightly cooperative design; a user cannot directly impede another by inactivity, but taking extra steps will both boost a user's own collection and increase the chance that they could potentially help others.

We were interested to discover whether our design could encourage spontaneous co-located use of our app. Would the desire for live meetings seen among the adolescents in the StepStream trial also manifest in our trial group of young adults, and would these meetings produce the same kinds of discussions around activity?

5 TRIAL

Stickers for Steps was trialled for one week in February 2016 among 33 participants, who installed the app on their everyday device. There were 17 females and 16 males, aged 18-23, with an average age of 20. They were all undergraduate students, with a variety of experience with technology. No payment or other rewards were offered for any part of participation.

The app was designed so that any user could swap stickers with any other. To facilitate a fertile environment for swapping encounters, we deliberately selected a cohort who would be in regular physical proximity. This main group of users consisted of 29 students (P1-29), who were all members of the same University foreign language society. They were recruited through email invitation. There were various social ties between these participants; several lived together, others socialised regularly, overlapping subgroups shared classes, and some were only loosely acquainted. Each of this group P1-29 was made aware of the other 28 who were participating, and who would therefore be available to swap stickers. We also

recruited a second group of 2 friends (P30-31) who did not know any of the main group, as well as 2 solo participants (P32, P33) who had no ties to any other user.

The application was instrumented to record step counts, sticker awards and general user interaction log events. 18 users also agreed to an interview. Interviews were semi-structured, with a list of the topics of interest being prepared, but not used to dictate the flow of conversation. Interviews began with open questions asking what people thought of the app and their experiences in general, and as the interview concluded, the list was checked to see if any topics had been missed. The topics of interest covered the experience of sticker collecting, but largely concentrated on any face-to-face meetings experienced, where they took place, how they were initiated, and the general nature of these encounters. Interviews were transcribed and analysed following the general inductive approach [28]. Where individual participants are referred to in the results, they will be labelled with an M or F to indicate gender, and a number 1-33 (e.g. participant M24). Every user also completed an online questionnaire following the trial, with Likert-scale questions largely focussing on usability issues and the UI design of the app. Our analysis mainly concentrates on the interview data.

6 FINDINGS

The participants took an average of 5588 daily steps. We looked in the log data for any threshold effects, where daily step count figures would be bunched around sticker reward targets, potentially indicating that users would perform just enough activity to gain the next pack. However, we found no evidence of this.

Users collected on average 39 stickers over the course of the trial. Nobody completed the sticker book, the closest being user F13 who obtained 102 of the 145 stickers. Of the participants who had available swapping partner(s), 27 of 31 had at least 1 sticker exchange meeting. 5 users had just a single such session, and the most by a single participant was 9 swap sessions during the week.

As the step counter ran without user intervention, users could potentially have been accumulating stickers without engaging with the app. However, log data reveals that this was not the case and that users were entering the app to open their earned packs; of 1296 stickers awarded during the trial, 1238 were opened (95.5%).

Users responded very positively: "*I think the idea is really good.*" (F4) ; "*It was very fun to use.*" (M5) ; "*[I felt] child-like joy!*" (F8). 84% of questionnaire responders said they felt either motivated or very motivated to walk to collect stickers. When asked to enter text to "describe the app in one or more words", the most common words used were "*motivating*" (18% of responses), "*interesting*" (18%) and "*fun*" (9%).

6.1 Individual and Collaborative Experience

Users reported enjoying the app as both an individual and collaborative experience. They enjoyed the collection challenge, and the sticker rewards prompted reflective thought about activity: "*the app makes me more aware of my exercise habits in a fun and interesting way*" (M1). Users did not seem to pick up on sticker rarity, perhaps due to the subtlety of this in the interface. Yet certain stickers did still come to imbue intrinsic value for different people.

> "*I found some stickers less interesting than others … I was particularly motivated to use the app for the stickers I like*" (M32)

> "*Some pictures were pretty cool. Other pictures were not that cool … the cool pictures are what motivated swapping*" (M2)

> "*I only wanted the princesses!*" (F8)

Even the two solo participants enjoyed the app and found motivation to proceed, with one stating "*I was motivated to challenge myself*" (F33) and the other "*it encourages me to walk a little bit more to try to reach my target every day and unlock more stickers*" (M32). These two participants could see the potential sticker swapping functionality within the app, and admitted that not having any swapping partners made them feel "*disappointed*" (M32) and "*lonely!*" (F33). However they still enjoyed the experience and both expressed a desire to keep the app installed on their devices beyond the conclusion of the trial.

Despite functioning as an individual experience, the app was designed with social usage in mind, and almost every user reported enjoying this aspect in particular. Users saw swapping as a means to making progress with their album:

> *"It gets you faster to make the achievements and get all the stickers"* (M5)

> *"I like swapping ... that I can expand my collection"* (F7),

but also seemed to appreciate the social aspects in and of themselves:

> *"Generally I enjoyed the swapping, it's a nice feature which I was able to see there were many other people enjoying the app. So it makes it much more engaging. Helps you not only play the app more but also see your friends from time to time"* (M1).

The interaction model chosen for swapping stickers seemed to allow for rich face-to-face negotiations over the terms of each deal. Some took a hard line, assigning extra value to favourite stickers; others were more playful, enjoying *"when the other person selects a sticker for you and you are like 'NO, I don't like this! Why did you think I like this?'"* and *"when he sends me exactly what I wanted. Like guessing what the other person wants"* (M2).

6.2 Face-to-Face Interactions

Reports of swapping encounters varied. Some users picked a single swapping partner, with whom all exchanges were conducted. For others, as F8 put it, *"It was different each time – that is what made it so special"*. Yet almost all reports highlighted the spontaneity of exchanges:

> *"He opened his phone while we were drinking beer... then I saw that this person was having the app, then I said I was having the app as well and that is how all started."* (M3)

> *"It was quite random actually. I swapped the sticker with a friend of mine at a party ... he mentioned that he also has it and we could swap a sticker."* (F7)

Some exchanges were simply conducted between 2 people, yet others became large communal affairs, with small groups forming and then snowballing as others saw what was happening and wanted to join in.

> *"We were all getting together in a group, around 7 or 8 people together. We discussed what sticker do we want, and if someone had that sticker we swapped."* (M3)

> *"It was like 5 to 10 people, it was just - do you have that? Oh, I want it! I want it!"* (F8)

Being physically present during these interactions also seemed to bring the physicality of the devices themselves to the fore. A topic that came up often during interviews was how users would pass their phones around amongst each other to browse sticker collections.

> *"I hold X's phone, see if I needed her stickers or not...we swapped our phones, looked at the stickers."* (M3)

> *"I was definitely looking at the other guy's phone, just to see how many stickers he has. Does he have any other stickers I want?"* (M11)

6.3 Discussion of Activity

When a participant knew that somebody else was a user of the app, a request to exchange stickers was sometimes used as an 'icebreaker' in beginning a social encounter:

> *"It sort of makes you communicate with the other people to do the steps and use the app, and makes you get in contact with them."* (F10)

> *"It was a nice way to start a chat with the person... I find it very social... The actual swapping took like a minute, but we talked quite a lot afterwards."* (M9)

Conversations during and after sticker exchanges were reported to have been quite general, discussing the app itself as well as typical day-to-day chitchat. However it seemed that such sessions would often naturally come around to discussions of activity:

"[He asked] where did I walk from and to in order to get the sticker." (M7)

"That was interesting, to discuss things, your walks." (F10)

"You can be like 'you know I walked a million steps yesterday' and the other guy is like 'I didn't because I'm a lazy bastard'. I guess that's kind of nice." (M6)

Users considered displaying their collection sizes as an indication of their activity levels:

"It's basically showing the progress of my walking, how far I have walked." (M12)

7 DISCUSSION

Our trial was successful in showing that spontaneous face-to-face swapping sessions could be encouraged by our app design. We found that users would enthusiastically strike up discussions about progress in a manner similar to the StepStream study, but without a need for the 'hidden work' of organisers in imposing such meetups.

Social and swapping functions could have been designed to operate online. Indeed, this would perhaps have been a more typical approach, in keeping with current trends. Yet only one user reported a desire for online swapping, with our design generally not being seen as a restriction or an irritation; rather, many highlighted the app's ability to initiate social discourse as one of its prime benefits.

Swapping sessions seemed to work with groups of all sizes, and were reported as being lively affairs, with people eager to see others' collections. We found that conversations during swapping sessions naturally came around to activity, with discussions on stickers becoming a proxy for discussions on exercise. This level of interest in activity is reminiscent of Gorm et al.'s workplace observations, which showed asynchronously shared step counts being "objects of scrutiny" [12]. In our trial, with no way to monitor others' progress at a distance through our app, this curiosity and enthusiasm manifested in users physically passing around their devices and openly asking others what activity they had done to accumulate new stickers. The level of abstraction offered by the stickers rather than raw step counts, and the ability to selectively choose with whom to swap rather than online totals being made available to all other participants could perhaps also mitigate some of the privacy concerns observed during Gorm et al.'s study.

Exchanges such as these are seen as beneficial in theories on behaviour change, with both SCT and SST suggesting that social settings wherein positive discussions can take place lead to effective behavioural adjustments. We see similarities with our app's success in encouraging group usage and Miller et al's [20] discussions on collective efficacy and observational learning, whereby users can be exposed to and reflect upon social norms rather than comparing themselves to high-performing individuals.

In general, the digital sticker book seems a good metaphor around which to build a mobile activity tracking app. Users seemed to take to it very naturally and some of the behaviours seen among physical sticker collectors were apparent here too, from a compulsion to progress a collection, to some of the dynamics of swap groups. Accounts of sticker collecting have noted "stickers are very tactile and old-fashioned. The humanity of touch is also very powerful" [3]. Future work exploring alternative interaction designs could help explore whether our users passing around phones arose from such a desire for a tactile experience, or simply from constraints imposed by the particular design of the swapping interface in our trial.

Like many HCI trials, our study has been conducted in a particular setting over a relatively short period. It has been argued that proving behaviour change is beyond the reach of short HCI trials experimenting with new designs [15], but that investigating the "how and the why" of users' experience should be the primary evaluation goal. Still, we note that there are likely to have been novelty effects over the trial period [16,17] that might not scale to long-term use. Future work could experiment with the effects of selecting different step count thresholds for sticker acquisitions, and see if there is a 'sweet spot' to maximise long-term engagement.

We also deliberately recruited a group of people with ready social access and cannot know whether the same dynamics would emerge if the app were to be released to the public in general through an app store, without the researcher setup and explicit participant selection. Our users had been briefed at the start of the

trial on who else was participating. In a public release, some effort might be needed to provide a similar resource, perhaps by encouraging a Facebook login or similar method to leverage an existing social graph that could show a list of the user's friends who also have the app. However, it can be noted that, even having received this list during our trial, many users seemed to quickly forget who else was taking part, and would often 'rediscover' this by chance by spotting an icon on a phone or witnessing other people swap.

7.1 Lessons Learned and Implications For Design

We do not make any claims about behaviour change during our trial, and the lessons from our study relate to collaborative engagement and interaction, for which we offer implications for others seeking to create similar systems.

7.1.1 Collaborate on collecting

Many activity-related systems have been based on a collection model. A recent example is the Pokémon Go mobile application, released in July 2016, a few months after our trial had concluded [11]. Allowing for the swapping of collected items seems a natural extension to this mechanism, especially in a face-to-face setting where users could negotiate the terms of a deal. Users reported enjoying our app individually (collecting) but especially collaboratively (swapping), consistently expressing face-to-face encounters as their favourite part of the experience. With research highlighting the benefits of supporting cooperative behaviours [8], we encourage more designs that provide swapping functionality to allow users to collaborate on their collections.

7.1.2 Deliberately limit asynchronously shared information

Participants in our study reported how they would pass devices around amongst themselves to view each other's progress. Studies such as those of Gorm et al. [12] have shown users' general interest in others' activity, and eagerness to drill into online records of this information. Starved of this asynchronous functionality, our users only had the face-to-face opportunities to conduct these investigations, and perhaps exchanged devices to maximise the potential knowledge transfer at these times. With this we benefit from the positive effects associated with social discussion of exercise, which would perhaps not have been fully realised were users able to satisfy this curiosity asynchronously.

7.1.3 Allow co-located browsing of collections

Following from the above, we are aware that smartphones are considered very personal items and that not everybody is going to be comfortable handing a device around. Wanting to maintain the opportunities for conversation offered by the sharing of this information, an app could provide direct support for browsing another's collection while connected over Bluetooth.

7.1.4 Provide prompts for co-located interactions

Users who had previously conducted swaps with each other showed no hesitation in doing so again, and indeed often got into routines, such as after University classes or at home in the evenings. However, people seemed to need an external push in making an initial swap with another user, such as witnessing a group of people already swapping or happening to spot the app icon on a friend's phone. This need was possibly most acute between people who were not closely acquainted. Our app has been described as an 'icebreaker', but could maybe go further in explicitly supporting this. Some form of notification might be useful in informing users that somebody nearby is available with whom swaps could take place.

8 CONCLUSION

Social relatedness is widely considered an important factor in activity tracking systems, and physically co-located meetings have been shown to be rich, valuable experiences. Yet designs specifically encouraging such encounters have been underexplored in this domain. In this paper, we have reported on usage of our social activity tracking system designed to encourage face-to-face encounters through a sticker-swapping mechanic. The purpose of our study is not to prove behaviour change, but to explore the nature of these social encounters.

Stickers for Steps

We have shown the viability of this type of design, finding that we could encourage these face-to-face usages to occur. Users could still have a rich social experience using a mobile app even with no online aspect. The users found the metaphor of the sticker book engaging, and were motivated to meet with others to progress their collections. The face-to-face encounters promoted engagement with the physicality of the device, allowing sticker collections and therefore activity levels to be readily compared. These swapping events became a positive environment in which to discuss physical exercise. Ultimately, we suggest there is indeed a place for activity apps built around promotion of face-to-face encounters, and encourage further work to explore designs in this area.

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