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Authors

Song, Katherine W

Vivrekar, Janaki

Yeom, Lynn

et al.

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Crank That Feed: A Physical Intervention for Active Twitter Users

Katherine W. Song*
kwsong@berkeley.edu
University of California, Berkeley
Berkeley, California, USA

Janaki Vivrekar*
janaki.vivrekar@berkeley.edu
University of California, Berkeley
Berkeley, California, USA

Lynn Yeom*
lynnyeom@berkeley.edu
University of California, Berkeley
Berkeley, California, USA

Eric Paulos
paulos@berkeley.edu
University of California, Berkeley
Berkeley, California, USA

Niloufar Salehi
nsalehi@berkeley.edu
University of California, Berkeley
Berkeley, California, USA



Figure 1: Our device for using Twitter requires users to constantly turn a physical hand crank to power their social media experience.

ABSTRACT

Passively consuming digital social media content often precludes users from mindfully considering the value they derive from such experiences as they engage in them. We present a system for using Twitter that requires users to continuously turn a hand crank to power their social media screen. We evaluate the device and its effects on how users value Twitter with 3 participants over 3 weeks, with the middle week of Twitter usage directed exclusively through our system. Using our device caused a dramatic decrease in Twitter usage for all participants, which either persisted or rebounded in the post-intervention week. Our analysis of diary studies and qualitative interviews surfaced three themes indicating shifting focus on content, shifting awareness about the role of social media, and new social dynamics around content-sharing.

* Authors contributed equally to this research.



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CCS CONCEPTS

• **Human-centered computing Social media**; • **Human-centered computing User studies**;

KEYWORDS

social media, physical intervention, tangible interfaces, critical design

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1 INTRODUCTION

Scrolling through social media feeds like the Twitter timeline is a low-friction activity that produces an attention-gripping, addictive user experience. The ease of passively consuming social media content often precludes users from considering the value they derive from such experiences as they engage in them. One frequent use of Twitter is to keep up with friends and find sources of entertainment, but Twitter is also a platform for protest, revolution [11], journalism, and the spread of misinformation. Out of the variety of uses that Twitter serves, we are interested in understanding what

draws users to the Twitter platform when they passively consume content.

To encourage users to more actively engage with their Twitter experience, we built and studied a system that requires users to power their Twitter usage by continuously turning a physical hand crank. Without continued input, the screen of the device gradually dims until it is completely dark. When the user cranks the device, the screen lights up as long as the user continues cranking. We summarize our contributions as follows:

- The design and evaluation of a novel system that transforms using Twitter into a physically embodied experience
- Insight into how making Twitter a physically embodied experience may change users' Twitter usage patterns
- Insight into how making Twitter a physically embodied experience may change users' perceived value of their time and activities on Twitter

2 RELATED WORK

2.1 Social Media and “Addiction”

Several published studies have likened the psychological result of modern social media usage to an “addiction.” Tiidenberg et al.'s studies of young people's attitudes towards social media found that while many individuals feel compelled to always be online and appreciate the accessibility of digital information, they also label their social media experiences as “the ultimate procrastination,” “kinda stupid,” and “a waste of time” [12]. Lukoff et al. similarly found that while some individuals derive value in smartphones' ability to provide “micro escapes” from difficult social or emotional situations, users find habitual or instinctive engagement particularly meaningless [7].

There have been demonstrations of digital systems encouraging users to become more mindful of their behavior on social media to potentially create more positive experiences. For example, NUDGE, a browser extension developed by Purohit et al., makes actions like clicking on triggers, seeing likes and comments, and infinite scrolling more difficult [10]. While such efforts have produced interesting results, they are limited to the digital realm and rely on assumptions about what constitutes “good” and “bad” behaviors. Additionally, such digital interventions are easy to override, and circumventing them without much effort can become habitual and render the digital intervention ineffective.

Boyd problematizes the use of the term “addiction” to describe extensive use of social media by teenagers [1]. Rather than characterizing their behavior as demonstrating a lack of control, Boyd argues that teen “addiction” to social media is an extension of typical human engagement driven by their need for entertainment and socialization [1], suggesting that even seemingly mindless social media experiences may be valuable to users in some ways. Our work examines how an embodied social media experience may play a role in helping users realize their underlying motivations for engaging with social media and the value derived from their experiences.

2.2 Embodied Interactive Devices

Drawing from studies in psychology, sociology, and philosophy, Klemmer et al. point out that embodiment is critical to how humans

experience and learn [6]. Current interactive devices and interfaces typically ignore this and rely only on a small subset of physical body parts and sensations. Klemmer et al. argue that incorporating physical bodies into a digital interactive system can lead to richer interactions and insights. This vein of thought has motivated much work in the field of tangible user interfaces (TUIs), a field launched by Ishii et al.'s proposal of “tangible bits” that can bridge the physical and digital worlds [5].

Dourish pushed this idea further by introducing “embodied interaction,” a notion linking physicality with social processes that he proposed could open the door to new directions for design [3]. Dourish discusses embodiment as the central basis of tangible computing, which recognizes actions as embedded in the world, and of social computing, which recognizes actions as embedded in systems of meaning [2]. Dourish argues that embodied interaction is effective in supporting both tangible design and analysis of social meaning [2], which we relate in the design of our physical device and subsequent analysis. Interacting with our device causes individuals to question how they value various interactions on social media by transforming their usage into an embodied one in which they have to physically work for their experience.

2.3 Functional Oppositions and Reflection

Several researchers, particularly in the field of critical design, have designed physical systems to probe reflective insights from using tools that limit functionality. For example, Odom et al. designed Photobox, a domestic device that prints old photographs at random intervals over months to support reflection and re-visitation of the past [8], which is a cornerstone of the slow technology design philosophy [4]. Similarly, Tsai et al. designed the Reflexive Printer, a physical device that prints 1 halftone image a day from a user's smartphone and deletes that image from the smartphone. They proposed “perceived drawbacks” as a design quality of interactive physical artifacts to provoke users to reflect on and change their behavior [13]. Similarly, Pierce and Paulos proposed the concept of “counterfunctional things” [9] as a possibility in designing digital limitations that counter a physical object's supposed functionality to tease apart layers of value that a user derives from a device or interaction. We propose such non-digital “functional oppositions” [9] as a new paradigm to study social media usage. We believe that this approach can allow us to better understand what drives users' attitudes towards their social media usage and provide pathways for investigating what kinds of systems, if any, might better mediate social media experiences.

3 SYSTEM DESIGN

Our completed prototype is shown in Figure 1. The device is a 3" x 5" x 8" plywood box with a plastic hand crank mounted on the right hand side. A power cable leads out of the left side and must be plugged into an outlet (or portable USB charger). Earbuds are also provided to allow the user to listen to audio content.

3.1 Hardware

Figure 2 illustrates the internals of our system. The system is powered by a Raspberry Pi Model 3 B+ with built-in WiFi. An official Raspberry Pi 7" touchscreen is connected to the Raspberry Pi via

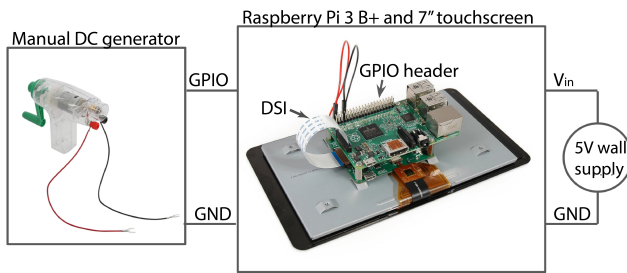


Figure 2: Hardware overview. A hand-cranked DC generator provides an input control signal to a Raspberry Pi, which also controls a 7" touchscreen.

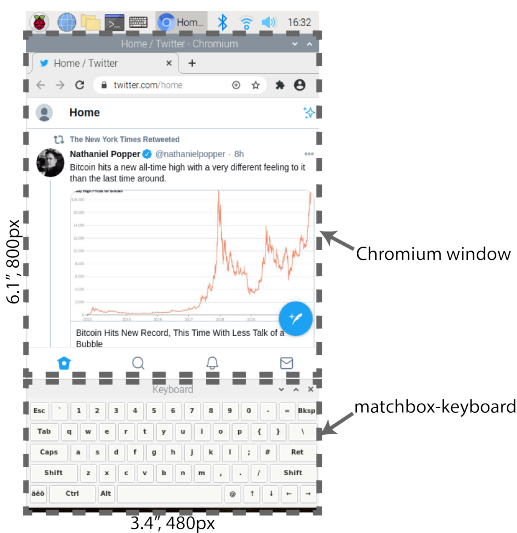


Figure 3: The graphical user interface. The device loads a Twitter Chromium window upon startup. Users can scroll the page with their finger and type with the onscreen matchbox-keyboard.

the built-in Display Serial Interface (DSI) port for signal exchange and 5V and GND General Purpose In/Out (GPIO) pins for power. A manual DC generator with a hand crank is connected to the Raspberry Pi such that its low-side terminal is connected to the Raspberry Pi's GND and its high-side terminal is fed as an input into one of the Raspberry Pi's GPIOs. By adjusting a potentiometer on the generator, we calibrate the resistance of the hand crank to be heavy enough to require user manipulation (and not just spin freely due to its own weight) and light enough to not require an excessive amount of effort.

3.2 Software

For each user, we do a fresh install of the latest version of Raspberry Pi OS (kernel v5.4), a Debian-based OS with a built-in Lightweight X11 Desktop Environment (LXDE). The device is configured to be in portrait mode to resemble the default configuration on most portable devices. Upon startup, the LXDE loads twitter.com in a

new Chromium (an open-source browser that Google Chrome is based on) window and a matchbox-keyboard, an onscreen touch keyboard. An example startup screen is shown in Figure 3. The LXDE also loads a custom Python script that continuously (every 2 seconds) checks if the user is cranking the hand crank (i.e. if the selected GPIO pin registers a high voltage). If so, the device's screen brightness is maintained at a high level, and the current timestamp is logged to a local text file on the Raspberry Pi. If not, the device's screen brightness slowly dims until the user begins cranking again. The logged timestamps indicate when the user attempted to access Twitter during the study.

4 EVALUATION

We conducted a preliminary evaluation of our device with 3 users. We recruited participants through a combination of snowball sampling and a voluntary participant screening survey. The survey identified self-described Twitter users who were willing to participate in our study for no compensation. Participant 1 (P1) is a female doctorate student in her twenties who describes herself as an avid Twitter user satisfied with her Twitter usage, and Participant 2 (P2) and Participant 3 (P3) are female young professionals in their twenties who describe themselves as using Twitter about the same amount as their peers. Both P2 and P3 indicated dissatisfaction with multiple aspects of their Twitter experience (e.g. total time spent). For each participant, we conducted a 30-minute pre-interview to understand how they use Twitter, the value they attribute to various social media platforms, and how they assess their own social media usage. After the pre-interview, each participant began a 3-week diary study. In Week 1, participants continued using Twitter normally with their usual devices. In Week 2, we instructed users to log out or block Twitter on their usual devices and only interact with Twitter through our prototype. In Week 3, users resumed Twitter usage through their personal devices.

Every evening, we prompted users to submit a screenshot of their Twitter screen time from their built-in phone apps and sent a semi-structured diary study to gauge qualitative aspects of their daily Twitter usage. We also "followed" the participants from our private research Twitter account for the duration of the study and recorded the number of Tweets, Retweets, and likes daily. Toward the end of Week 3, we conducted a 45-minute interview in which we asked participants to reflect on their prototype usage and associated behavioral changes in Week 2 and Week 3. We further probed perceived changes in the value of social media and gathered feedback on the prototype itself. To identify themes in the data, we transcribed and inductively coded the interviews and open-ended diary study responses.

4.1 Device Evaluation

We report user feedback regarding comfort, portability, and crank obtrusiveness.

4.1.1 Comfort. Participants were satisfied with the size of the device, with P2 commenting that "it's awesome how compact everything was." However, P1 noted that the "crank gets in the way" of resting the prototype on a table and that "it's hard to get into a good position to crank and scroll at the same time." The other

participants also found the device uncomfortable to use, which is a point of future improvement.

4.1.2 Portability. While we told participants that they were free to use a portable battery pack and move the device as they wished, all participants reported keeping the device restricted to one or two locations for the duration of the study. Participants were annoyed that keeping the device in certain locations of their home prevented them from freely using Twitter during small “in between moments” (P3) when waiting in line, waiting for someone, or idling between events.

The charging requirements and portability of the device support the idea that the physical design and constraints of the device may play a role in increasing mindfulness of Twitter usage. P2 observed that as a result of keeping the device in a single location, she became “a lot more planned about how [she] went about it rather than serendipitous.” P3 similarly reported that she “had to be very intentional” about her Twitter usage.

4.1.3 Crank obtrusiveness. Participants expressed that cranking on its own was “not too difficult” (P3) and felt the “right amount” of obtrusive:

P2: [there was] just the right amount of time to get value out of it before having to go back to crank. So it wasn't like I can just crank it, sit there, and like read the feed, or like it wasn't too short where I couldn't even see like a single letter.

Nonetheless, on the whole, participants found cranking to be disruptive. Most notably, the noise that the crank made was “really annoying” (P1) and disruptive of social activities. P1 had to apologize to her roommate for potential “noise coming from my room every 5 minutes,” and P2 reported not being able to hold a conversation with a friend who was in the same room. This likely was a major contributor to the rise of interesting new social dynamics (Section 5.3).

4.2 Effects on Twitter Usage Patterns

Figure 4 shows plots of user activity, including the number of Tweets, number of Retweets, and number of likes, for our 3 participants across the 3-week study. Going into the study, the primary activity for all 3 participants in our study was “liking” (clicking a heart-shaped icon beneath a Tweet). The number of “likes,” along with “Tweets” (short posts on one’s own Twitter account) and “Retweets” (re-posts of someone else’s Tweets on one’s own Twitter account), reduced to almost zero for all participants when their Twitter activity was redirected through our device during Week 2.

P1 and P3 did not provide us with complete daily time logs for their Twitter usage in Weeks 1 and 3, but they indicated in their interview that their overall time spent on Twitter also drastically reduced from Week 1 to Week 2. P2 went from spending an average of 21 min/day in Week 1 to an average of 5 min/day in Week 2 (4 days out of which she did not go on Twitter at all). P3 only went on Twitter twice during Week 2, spending 2.5 minutes total. Even P1, the most active of our 3 participants who estimated her normal Twitter usage as 2-3 hours/day, only spent an average of 9 min/day on Twitter during the intervention week, even forgoing Twitter entirely on 2 out of those days.

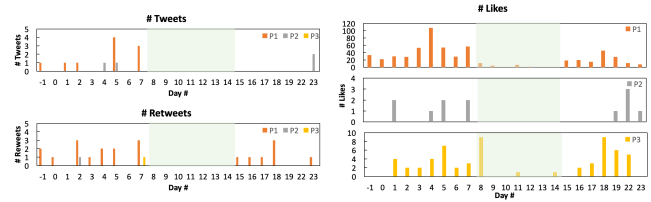


Figure 4: Plots showing user activity (number of Tweets, number of Retweets, and number of likes) throughout the study, with Week 2, the “intervention week,” highlighted in green.

Upon returning to using Twitter via their normal devices in Week 3, P2’s low Twitter usage persisted, but P1 and P3 quickly rebounded to their pre-intervention patterns.

Participants universally indicated via diary responses and in their post-interviews that the device was a major impediment to their Twitter usage. All participants indicated an unwillingness to use Twitter as long as they normally would, describing the experience as “annoying” (P1), “tiring” (P2), and “not very fun” (P3). All participants had days during Week 2 when they didn’t even try to use the device, as the simple thought of it was “a big deterrent” (P3). It is unclear if this was primarily due to the discomfort of using the device, the lack of device portability, the obtrusiveness of the cranking itself, or other factors. Better determining how such factors influence usage patterns and what types of embodied impediments are perceived as worthwhile tradeoffs may be fruitful directions for future research.

5 DISCUSSION

In this section, we discuss three themes about how using our device affects participants’ perceived value of Twitter. Naturally, we cannot make generalizable conclusions with our small sample size, but we believe that our findings form a fruitful starting point for future investigations.

5.1 Shift in Focus on Preferred Content

The physical intervention motivated users to identify and selectively focus on high-value content. All users found providing consistent physical input to be tiring, which forced a time constraint on their Twitter usage. In response, users made trade-offs to deliberately consume content that added more value than other content and aligned better with their goals for using Twitter:

P2: I just focused so much more on [the celebrity fandom] when I was using the device, because I was like, at the end of the day, I only have a few minutes — I’d rather just know the good news related to my fandom and the upcoming music releases and everything, [...] instead of looking at politicians.

In some cases, the value-based trade-offs that users made during Week 2 persisted to Week 3.

P2: I only focused on [...] maybe the top 10 accounts that add value to my life. And now I don’t even care about some of [the other] people [...]. I’m like, I could not see their Tweets for a year and it probably wouldn’t

make a difference to my life in the grand scheme of things.

Although P1 and P3 did not explicitly state that they felt that the intervention had lasting changes on how they used Twitter, differences in their pre- and post-interviews revealed that they emerged in Week 3 with a clearer definition of the Twitter content they found valuable. During the pre-interview, P3 indicated that she felt that Twitter was more “news-oriented,” and she appreciated having access to “experts or prominent people.” However, during the post-interview, she said that she did not in fact feel more behind on the news during Week 2, but she did repeatedly indicate that she “missed Twitter” for her friends’ posts.

P3: I feel like my friends are good at curating content that I want to see...more than like getting any getting any like piece of news I'm just curious to see what like they are reading and what they're liking or retweeting or sharing.

5.2 Increased Awareness

The physical intervention made users more aware of the role Twitter plays in their lives. Accessing Twitter exclusively through the crank-mediated device forced users to actively reflect on their goals in real-time, which formed new conceptions of the value Twitter adds to their lives. P2 entered the study with a sense that Twitter was valuable for her but also indicated that she felt that “about one-third” of her Twitter time was not well-spent. After one week of using our device, she indicated a heightened awareness of the role that she wanted Twitter to play in her life:

P2: On the spectrum of being a utility to a frivolous pleasure, I think I was more on the frivolous pleasure entertainment side before and Twitter, in my mind, has switched on this spectrum to being more of a utility, [...] like I know the difference of modes of Twitter when I use it for those two purposes.

P1, on the other hand, reported nearly complete satisfaction with her Twitter usage at the beginning of the study, stating that she would never sign up for a study that explicitly limited her Twitter usage. Using our device further heightened P1’s awareness of the importance of Twitter to her daily routines (during Week 2, she found herself trying to type “twitter.com” into her web browser out of habit when bored in class and trying to access Twitter on her phone right after waking up), friendships (she realized she hadn’t seen the Tweets that her friends were talking about during a group FaceTime conversation because the crank had made it too difficult to keep up), and general sense of self. She reported being “happy to have [Twitter] back” in Week 3.

At the beginning of the study, P3 characterized herself as a light-weight Twitter user but indicated that she felt that she “could spend less time” on Twitter. However, at the end of the study, she noted that her frustration with using Twitter through our device made her think that she “was a little more dependent on Twitter” than she initially thought. She was able to clearly identify that Twitter was an important addition to her life for “in between moments” in various locations and returned to her normal Twitter usage very “glad to have Twitter again.”

5.3 New Social Dynamics

A particularly intriguing theme that emerged was the creation of new social dynamics around content sharing and Twitter’s role in conversations outside Twitter as a result of using our device. Users and their social connections adapted to the constraints of the physical intervention by finding side-channels like alternative messaging platforms to share Tweets rather than Twitter Direct Messages (DMs).

P2: [My sister] actually started texting me Tweets on iMessage or WhatsApp, but only the really particularly good ones or funny ones that she wanted me to see.

P1: My boyfriend sent me a screenshot of a meme that he also DM’ed me on Twitter, because he knew it could be hard for me to see it, so he just texted it to me.

Our device enabled yet other dynamics that we attribute to the physicality of the user experience. In particular, the form factor of our device and the “annoying” sound of the crank become the subject of FaceTime conversations and jokes with her roommate and among her friend circles, and P3 noted that during a video call with a friend, the friend saw our device on P3’s desk and was intrigued to know more. P2 even transformed scrolling through Twitter into a shared experience, which split the work of cranking and scrolling across two individuals and introduced a dimension of synchronous, social, co-located content consumption.

P2: Today I got to see a friend, and I had the idea of having them crank the device for me as I scrolled on Twitter! I know this is a bit of a hack, but it got me excited about using the device and it was actually a great way for both of us to browse together and be physically involved in the activity.

6 FUTURE WORK AND CONCLUSIONS

We developed a device that turns interacting with Twitter into an embodied experience requiring continuous physical work. 3 participants of a pilot user study redirected all their Twitter activities exclusively through our device for 1 week in the middle of the study. As a result of an experience that participants universally described as frustrating and inconvenient, participants drastically reduced Twitter usage during that week — an effect that persisted for 1 participant but not the other 2 after they returned to using their regular devices for Twitter. All participants emerged with a new understanding of the specific Twitter content they most enjoy and an increased awareness of the value and role of Twitter in their lives. Notably, using our device created new social dynamics that arose around content sharing and off-platform conversations about Twitter. We attribute this to the device’s physicality; whereas Twitter usage typically occurs virtually invisibly on personal devices, the presence and use of our device is obtrusive or intriguing to others.

Future work includes expanding our study to target different groups of people to further probe and potentially challenge the identified themes from our pilot study. In particular, the participants for our pilot study did not report feeling “addicted” to Twitter even at the beginning of the study, so we would be interested in investigating the effect of our device on the social media “addicts”

described in literature [12]. Moreover, the participants mentioned increased usage of other social media apart from Twitter during Week 2 of the study. In future user studies, we will collect additional quantitative usage data for other social media platforms and investigate how using our device affects participants' total screen time and redistribution of screen time across other social media. In addition, although we did not advertise our system as an intervention intended to reduce Twitter usage, our device reduced all 3 participants' usage to almost zero. This was more dramatic than expected given the limited reductions achieved by digital interventions specifically designed to reduce Twitter usage, and we are interested in better determining how particular aspects of our physical intervention (e.g. physical cranking versus needing to physically relocate to use the device) contributed to this effect.

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