Fidget Widgets: Secondary Playful Interactions in Support of Primary Serious Tasks

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Abstract
We present our early work in developing a playful technology to purposefully engage users' interrelated bodily motions, affective states, and cognitive functions to selectively enhance creativity, focus, etc. integral to modern productivity. Building interactions inspired by and embodying the elements of fidgeting, doodling, and other "mindless" activities, we seek to demonstrate the value of secondary human computer interactions able to enhance a user's state in primary productivity tasks.

Author Keywords
Play; productivity; affective; cognition; doodle; fiddle; fidget; tangible; Sifteo.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Human Factors; Design.

Introduction
Work in our modern context is as often cognitive exercise as it is physical exertion. We think, analyze, and create — usually in front of any number of

Figure 1: Toys in our lab for inspiration, thinking, doodling, fiddling, and fidgeting.

computing interfaces in our offices, classrooms, labs, and studios. That said, even in casually observing people at work, it becomes clear that our brainstorming is engaged through embodied cognition. We fidget with paper clips, tap our pens, squeeze stress balls, toss whiteboard markers, doodle in the margins of our notes, "mindlessly" scoot our mice about, and generally play with any physical item at hand while we contemplate problems, draw connections, and await inspiration. In fact, the act of doodling has been shown to increase attention in monotonous tasks and to improve recall [1], and fidgeting is theorized to modulate levels of focus [3,4,10].

Available research draws a clear link between affective state and effectiveness in mental processes [see Existing Work section]. Informal observations of those in the process of their work playing with objects suggest the potential for a new type of designed interaction experience. We envision providing modern digital workers a "sampler box" of interactive experiences from which he or she can selectively modulate their own state to yield small but appreciable changes in focus, creativity, calm, etc. as needed.

To that end we introduce our concept of "Fidget Widgets" as playful, secondary interactions able to engage the interrelation of bodily movement, affective state, and cognition to support primary serious tasks.

Fidget Widgets

In order to explore and ultimately to test our ideas we have begun creating small, playful, tangible interactions that we call "Fidget Widgets." To date we have created and have been refining through informal play testing two such fidget widgets.

The following properties characterize our concept of a Fidget Widget:

- Tangential. One sits down to invest in a project, outcome, or goal and turns to a Fidget Widget while physically "paused" in the act of waiting or while mulling a thought over.

- Playful. The goal of a Fidget Widget is the experience of the interaction; the interaction does not achieve a goal within itself. A Fidget Widget is a transient, "mindless" experience. (See section Defining a Playful Technology.)

- Digital. To allow for more supple experiences than possible in only physical objects (e.g. infinite resources, large virtual worlds in small physical spaces, etc.) Fidget Widgets are programmable. Interactions are reactive, though not necessarily predictably so.

- Tangible. Engaging the bodily movement of fidgeting and doodling inherent in our physical inspirations, Fidget Widgets embody physicality beyond only screen-based abstractions.

Existing Work

Doodling & Relevant Interaction Projects

HCI practitioners have created several doodling projects. Doodle Space paired camera phones and public displays for collaborative expression [19]. Doodles have been utilized as alternative password mechanisms [5,18]. Levin and Yarin developed "keychain" computers to implement small gesture-based systems (inspired by doodling) [9]. Common to each of these projects is a seemingly simple adoption of

a doodling interaction mechanic without deeper motivation for its employment.

As a design project inspired by Chinese meditation balls, Philips created Mind Spheres of wood and LEDs as "a useful aid for de-stressing and regaining a state of mindfulness at home or work" [13].

Impact of Affective States on Cognition
Research demonstrates numerous links between affective states, performance, and cognition. Mildly positive affect promotes creativity and cognitive flexibility [2,6]. Anxiety and signs of impeded progress toward goals have both been shown to increase focus and attention [8,12]. Feelings of sadness and anxiousness have been shown to prime uncertainty reduction during decision making [16].

Distractions, Fidgeting, Noise, Bodily Movement, and the Brain's Default Network
In "hyperactive" and ADHD children, researchers have hypothesized that fidgeting is a natural coping mechanism the body employs to promote natural stimulant release, enabling the mind to focus on particular tasks [3,4,10]. Anecdotally, encouraging fidgeting in the classroom seems to improve focus [17].

Similar to mildly positive affect, moderate levels of ambient noise have been shown to increase creativity [11]. The brain's so-called default network seems to establish a baseline of cognitive function, engaged in times of boredom, impatience, and indecision. Researchers have noted parallels between this aspect of doodling as related to brain processes and other stress-alleviating motor activities including fidgeting and fiddling with objects [15]. Questions remain as to whether "mindless" doodling consumes resources thus detracting from tasks at hand or whether it improves performance by aiding concentration through regulation of base levels of arousal and cognition [1].

Project Inspiration

A simple observation of a student's behavior in a class at NYU•Poly formed the genesis of the Fidget Widgets project [7]. This particular student, like many of her peers, was using software on her laptop to take notes during lecture. During the lecture we observed her mindlessly using the arrow keys of her keyboard to rapidly bounce her screen cursor back and forth. In a fashion, this behavior was crudely reminiscent of doodling. This inspired questions such as:

- Can we construct a secondary interaction that supports the cognitive and emotional state of a user invested in a primary task? Might we do so by way of stimulation through tangible or sensory experiences that engage the human tendency to doodle and fidget while thinking and working productively?

- Doodling usually takes place in the margin areas of paper; how might human computer interactions with "margins" operate?

- When a user is engaged in a particular human computer interface modality (e.g. keyboard or mouse), how might we facilitate doodling and fidgeting urges alongside that modality when the modality itself tends to heavily influence / limit the scope of user interaction?

Defining a Playful Technology

We use the term *playful* specifically to distinguish our work from that of games. Philosophers, sociologists, anthropologists, and others have put forward many definitions for *play* [14]. While we could fill this paper attempting to draw a line between "gameful" and playful, for our purposes, we will loosely define a *playful* activity as one:

1. Free of measurable goals;
2. Undertaken for an intrinsic motivation — that is, for the enjoyment of the experience itself;
3. Usually embodying delight, levity, or silliness.

From this, we can distinguish games from playful activities in degree. Games tend to be structured and tend to be extrinsically motivated by points, achievements, and/or status. Conversely, playful activities tend to be unstructured and engaged for their own sake. Playful technologies, then, are material constructions — often built of digital electronics and software — that facilitate playful interactions.

Figure 2: Six Sifteo cubes in their charging station

Fidget Widget Form Factor

To maximize bodily engagement and "mindless" activity "in the margin", at present we are concentrating on fidget widgets with high tangibility and/or engaging movement in three dimensions. That is, we intend to first push out to the edges of tangible and gestural interaction forms (note: no in-air desktop gesture activities have yet been implemented) before scaling any of this work back to mobile phones/tablets or features added to existing desktop software.

Sifteo Platform

Both of our existing fidget widgets are applications running on the Sifteo platform [20]. Sifteo is comprised of squat blocks at 4.3 cm (1.7 in) on a side and 1.8 cm (0.7 in) deep. Each includes a color clickable screen (i.e. entire screen acts as physical button) and the ability to sense shake, tilt, rotation, flipping, and proximity to one another.

We chose to work with the Sifteo cubes, in part, because they afford interactions similar to the fidgeting and playing with objects common to desk workers. For our purposes, their limited power has helpfully restrained the scope of our constructed interactions.

Fidget Widget Work to Date

Possibilities for Designed Secondary Interactions

We ultimately intend to permute reward, distraction, anxiety, disgust, bodily motion, noise, and visual stimulation. With these stimuli we hope to selectively create mild positive and negative affect; develop and alleviate low levels of stress; temporarily consume attention or operate in parallel to a user's locus of attention; and engage the default network of the brain.

Infinite Bubble Wrap

Noting the visceral reward in popping bubble wrap, in this interaction we created a never-ending supply of virtual bubble wrap. Each Sifteo cube is a single bubble. The screen shows two states: an inflated or a popped bubble (see Figure 3 and Figure 5). When a user depresses the screen, the cube transitions from inflated to popped bubble with an audible pop. Shaking the cube triggers an inflation sound and resets the bubble. When cubes are placed together forming a sheet of

bubble wrap, popping any one bubble starts a chain reaction popping each of the others in sequence.

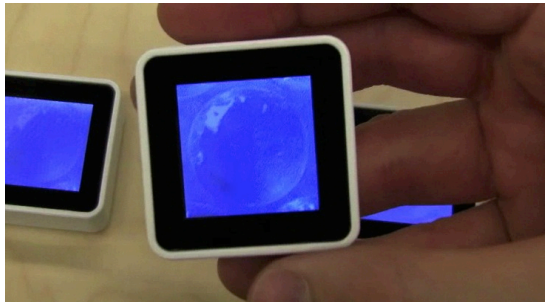

Figure 3: Bubble wrap inflated state.

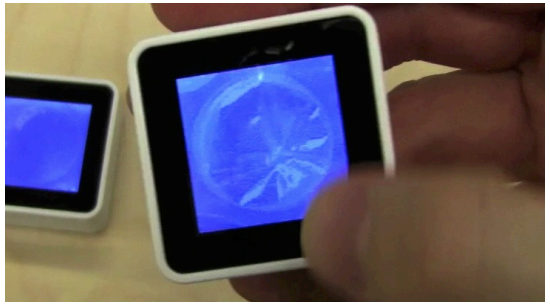

Figure 5: Bubble wrap popped state.

Rock the Cradle

Newton's Cradle is a classic physics-based toy (see Figure 4). Noting the almost hypnotic effect of Newton's Cradle, we created virtual Newtonian worlds with Sifteo cubes. Depressing a cube screen creates a new "pellet" in that cube's world. Tilting a cube simulates gravity in that cube's world and imparts velocity (see Figure 6). Pellets bounce off one another and screen edges. Pellet collisions generate musical tones (overlapping collisions create chords). When cubes are brought next to one another, the bounds of each cube's world disappear allowing the pellets to interact within a universe as large as the interconnected cubes (see Figure 7). Removing a single cube from such a universe "traps" pellets within it, limiting their motion to the bounds of that cube. Flipping a cube face down eliminates all pellets within that cube's world.

Figure 4: Newton's Cradle

Credit: Steve Berry by permission (Creative Commons)

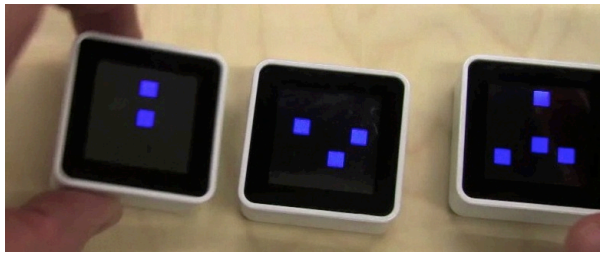

Figure 6: Pellets bouncing about their individual worlds. The leftmost cube is being rocked to impart velocity to its world.

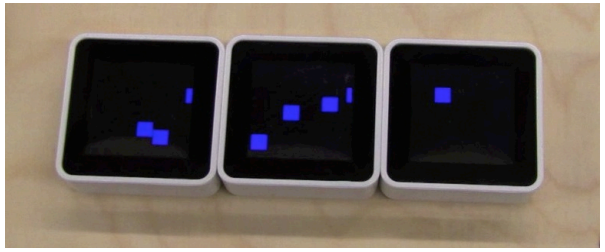

Figure 7: Individual cube worlds combined into one universe by physical proximity. Note that any configuration of touching cubes is possible. Moving and rotating individual worlds reorients those worlds within any universe of touching worlds.

Future Work and Challenges

We plan to create more fidget widgets based in the experiences of anxiety, disgust, noise, etc. in order to observe the effects on users in their primary tasks. Perhaps the most challenging work before us is to structure meaningful studies able to capture any such effects given that the experience is meant to be

tangential and engaged in a "mindless" fashion. Establishing baselines and identifying specific results of playing with our fidget widgets presents several complex hurdles to overcome.

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Conclusion

We introduced Fidget Widgets as a playful secondary interaction to modulate affect and shape cognitive state to support a user's primary task. Work to create further widgets and to establish their effects is ongoing.

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