Blossom Buddy

To take care of your plant, you need to perform your tasks

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1 INTRODUCTION

One core activity in the HCI discipline is the design of new and novel interactive computing systems in the form of prototypes. Such prototypes are created to bring a design idea to life, allowing for exploration, evaluation, improvement, and communication of the concept. In this essay, I will reflect on the process of designing Blossom-Buddy (Figure 1) as a novel interactive computing system.

We know all the things we should do and not do in our life. We all know we should exercise, eat healthier, spend less time on our mobile phones, develop our skills daily, and socialize more with friends and family. Despite that, it is a challenge for us to implement such tasks and goals in our everyday lives. This even becomes worse for people who suffer from performance disorder and/or ADHD, as Russell Barkley suggests "Your problem is not with knowing what to do, it's with doing what you know". Additionally, one related issue is temporal discounting which explains people's tendency to prefer smaller, immediate rewards over larger, delayed rewards. An example of this is that people often tend to choose the immediate pleasures e.g. eating a sweet, over the long-term benefits e.g. being in shape and healthier. Blossom-Buddy taps into the human tendency to care for living things and opens a dialogue with its users that to take care of your plant, you need to perform your tasks.

Blossom-Buddy is an interactive flowerpot, that helps users accomplish their tasks and goals while taking care of their plants. The flowerpot consists of water and nutrient containers, full spectrum grow lights and a screen. Users need to complete their defined tasks to receive enough scores/resources to feed their plants with light, water, and nutrients. In this way, users become encouraged to accomplish their tasks and goals daily and weekly in order to take care of their plants. These are examples of the list of tasks that a user can have and get resources based on to feed her plant:

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- Running
- Meditation
- Completing a lesson
- Smoke only once a day
- Visit friends or go to a PUB
- Not checking social media after waking up

Also, there is a digital version of the plant that users can interact with through the screen and buttons on the flower pot. The primary purpose of this digital plant is to show the status and health of the real plant as feedback to the user. If the real plant has got enough light, water, and nutrients the digital plant is happy on the screen. on the contrary, if the user hasn't performed well in doing her tasks recently, the digital plant becomes sad which is an anticipation that the real plant also become unhealthy soon. As a result, the user is more likely to take action and complete her tasks in order to gain enough resources to feed the plant.

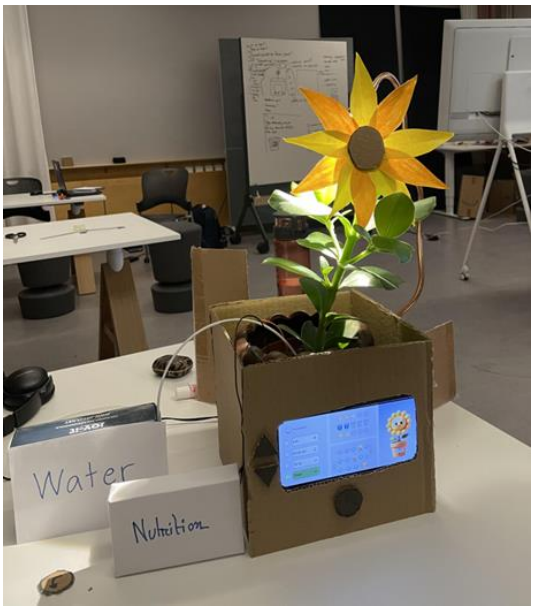

Figure 1: Blossom-Buddy

2 BACKGROUND

2.1 Persuasive technology and persuasive systems design model (PSD)

The design idea of Blossom-Buddy clearly can be included in the field of "persuasive technology" which is defined as any interactive computing system designed to change people's attitudes or behaviors (Fogg, 2003). Also, some principles of the persuasive systems design model (PSD) (Oinas-Kukkonen and Harjumaa, 2009) such as praise, rewards, reminders,

suggestion, and social comparison are either included in the current prototype or can be useful to consider in future prototypes.

2.2 Design for the Self

Zimmerman, suggests the use of the product attachment theory for "Design for the Self" and "role enhancement" which aim to design products that help people become the person they desire to be (Zimmerman, 2009). To accomplish that he proposes a set of design patterns through 6 categories which he refers to as framing constructs. One framing construct for example is "Role engagement" which is if a product and user interactions with it, are related to the roles that users have, e.g. a product that helps users perform better in their role as parents. Other framing constructs that are related to the idea of Blossom-Buddy are control, ability & bad habits, and Long-term goals. We can argue that Blossom-Buddy helps users to have more control over their lives as it helps them to better manage their tasks and goals. It also helps users form and break habits and also to help users to achieve their long-term goals.

2.3 Transformational products

Laschke et al. suggest transformational products (things with attitude) that attempt to actively shape their users' attitudes and behavior (Laschke, Hassenzahl and Diefenbach, 2011; Kehr *et al.*, 2012). They argue that the primary objective of transformational products is "supporting people with realizing the goals, they find worthwhile to pursue, but hard to implement" which seems to be also the main objective of Blossom-Buddy. Transformational products create intentional friction to challenge, change, and shape users' attitudes and behaviors. The "Forget Me Not" example provided by Laschke et al. which is a reading lamp that closes slowly like a flower, obscuring and dimming its light over time. It opens a dialog with its user that If you want more light, you need to ask for it, by touching it every few minutes; reminding users that light is not an infinite resource. For Blossom-Buddy this dialog is that "to take care of your plant, you need to perform your tasks" and the main friction here is that you're going to hurt your plant if you don't perform your tasks.

2.4 Self-Determination Theory (SDT)

Another psychological theory that can inform the design of interactive systems is Self-Determination Theory (SDT), developed by Ryan and Deci (2000). SDT is a theory of motivation concerned with the degree to which human behavior is self-motivated and self-determined. The theory argues that for optimal well-being and high-quality motivation, three innate psychological needs must be met: autonomy, competence, and relatedness. Autonomy is the need to feel a sense of volition and choice, competence relates to feeling effective and capable, and relatedness is the need to feel connected with others. We can argue that applying an SDT lens to Blossom-Buddy offers a way to design for more sustainable engagement by supporting these user needs, potentially balancing the "intentional friction" created by the plant's dependency.

3 PROTOTYPING AND PROTOTYPES

In the process of designing Blossom-Buddy, we used several prototypes, each used during a specific stage of the design process (position in the process) (Blomkvist and Holmlid, 2011) with different purposes (categories of prototype use and prototyping) (Maartmann-Moe and Joshi, 2022). During the phase of idea generation, we used prototypes mostly to inspire and facilitate ideation to come up with new ideas (Generate). Furthermore, we used them to communicate so that everyone in the team better understood the main concepts of a design idea. Based on Houde and Hill's, 1997 model, prototypes in this stage were more role prototypes as their main purpose was to show the functionality that can have.

Figure 2 shows these early prototypes, which using plants was not part of the design idea. Later on in the ideation stage, we developed the more finalized concept of Blossom-Buddy, in which a plant was the main design element.

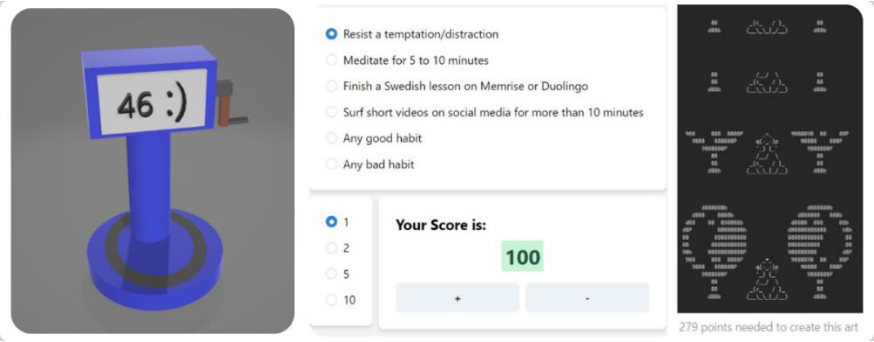

Figure 2: Ideation stage prototypes

During the process of developing the final prototype, we also used a more vertical and filtered prototype focusing on only Interactivity and spatial structure filtering dimensions (Lim, Stolterman and Tenenberg, 2008). To understand how to design physical buttons to interact with the interface we built this simple and quick prototype with React.js (Figure 3). As this prototype was primarily focused on interactivity, we chose React over Figma because it is easier to implement real and high-fidelity near-implementation interactions with ReactJs. Secondly, since we already knew React, we implemented the prototype quickly and in less than two hours. By this prototype, we realized a minimum of three physical buttons is needed to allow users to interact with the interface and perform defined tasks.

Based on the Prototyping and Prototype use categories (Maartmann-Moe and Joshi, 2022) the purpose of this vertical prototype was to Understand, Explore, and Decide on design elements. And we can argue that this prototype was aligned with the economic principle of prototyping proposed by Lim et al. (2008) as in the simplest and most efficient way made the possibilities and limitations of interface interactivity of our design idea measurable.

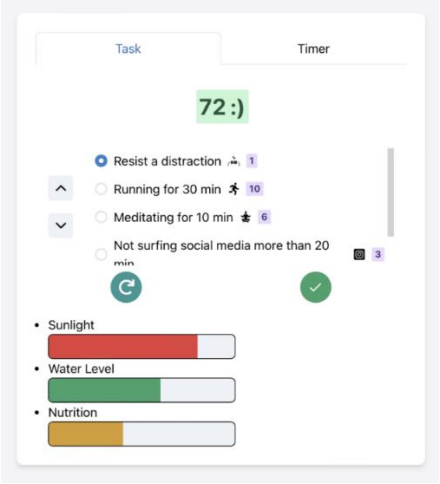

Figure 3: Prototype built with React to get insight into the physical buttons' interactivity

To evaluate the main design idea, we built an integration prototype to include all of the main concepts of the design. The prototype, however was not fully functional and we used the "Wizard of Oz" technique to perform in the lab user tests. The prototype consisted of different parts. First, the interface which designed in Figma and is relatively in high resolution so users could see the digital version of the flower and report their activities to the device (Figure 4). Second, the physical buttons were built with paper and by using a remote desktop application, we faked the connectivity of the buttons with the interface. Lastly, all other physical aspects such as the main frame, water and nutrition container, and the lamp were implemented in mockups with a relatively low fidelity.

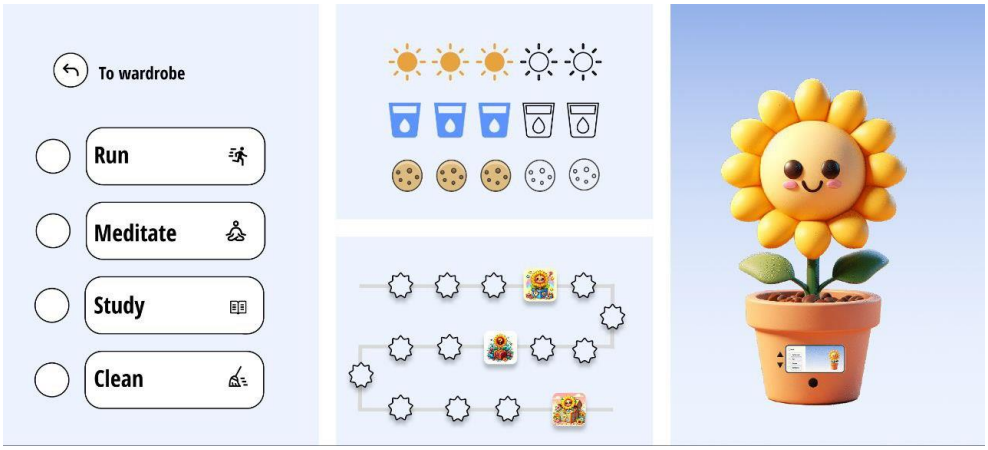

Figure 4: Figma prototype

4 USER TESTS

Figure 5: User tests

The user test main purpose was to evaluate the whole prototype to first bring up issues, limitations, and possibilities of improvement and second to bring up any new research questions related to the main concept of the design that we can define as supporting users to perform and implement their desired tasks and goals in everyday life. To do the user test we defined different scenarios but I only chose the sad scenario which is an example of when the prototype can make and encourage users to do a task. We also defined the scenario in a way that requires the active participation of the participants as it is an important aspect of experience prototyping (Buchenau and Suri, 2000).

Sad version (Figure 6) scenario: You´ve just come home from work, and see the digital plant is sad because there are not enough resources to feed the plant (real and digital). In order to feed your plant, you need to do one or more of these tasks:

- read this paragraph or
- clean the desk or
- meditate for one minute

and then report it to Blossom-buddy. Remember to think aloud when you´re doing it. (THE DIGITAL PLANT BECOME HAPPY; WE TURN ON THE LIGHT AND WATER THE REAL PLANT)

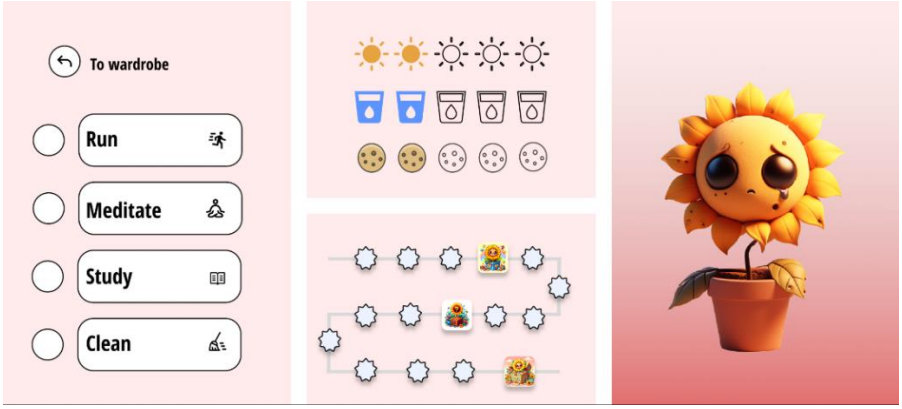

Figure 6: Sad version

After the test, we interviewed participants and let them generally reflect on their experience working with the prototype. Then we asked questions about different aspects of the prototype from the interface and interactivity of the physical buttons to the main concept of the prototype. Some of the questions are listed:

- How did it feel?
- Do you think this would motivate you to do your daily tasks?
- If the flower is looking sad, does that make you more motivated to do your tasks?
- Does the “hassle” or requirements to keep the flower healthy make you more prone to do the tasks or is the annoyance of it making you less motivated?
- What do you think about the physical plant and the virtual plant?
- Do you think it was easy or difficult to use the buttons?
- What do you think the cookies, water, and sun represent?

4.1 Interaction with physical buttons

All the participants first assumed the screen was touchable and tended to navigate through touching and not buttons. One reason could be that the buttons in the prototype were not enough realistic. All the users mentioned they prefer touch, and find it easier to work with. So we can have only specific filtered prototypes to test and compare touch, with different

types/styles of physical buttons like having a scroll along with physical buttons to make navigation through menus more efficient and compare it with touch screens.

4.2 The interface (in Figma)

- More or less all participants struggled to understand the status bars of sun, water, and nutrients as there was no label on them.
- Selecting/Active (on-hover) style of options was not enough noticeable and clear and users had a hard time noticing which option was active.
- Also, the active color of the options which is light green should be changed as participants mistook it as if they selected it already.
- The design of the digital plant was in high fidelity and with near implementation quality which affected users' reactions to the real and digital plant e.g. one user mentioned that "feel more connected with the digital plant".
- One user mentioned that the position of the real plant should be changed and be in the center as it is the main focus.

4.3 Main concept of the prototype

Overall users showed high engagement with the concept of blossom buddy. Also, users could relate to the personality of Blossom Buddy. For example, when the flower became sad, it motivated the users to do a task to make it feel better. Continuous monitoring of the real plant's health was perceived positively.

We could see that participants with different characteristics and personalities reacted differently to the main concept of the prototype. Some already have plants themselves seemed more likely to react to the sad version of the plant and cared more about the plant. So they were more eager to fulfill a task to make the digital and the real plant happy and healthy. Also seems this tendency in users could affect their response about which items they find more rewarding. e.g., one user who seemed to already have and care more about plants stated," I really like my flowers, so the biggest reward for me is that my actual flower got some sunlight compared to a hat". More user tests are needed to see how a person's personality can affect how she uses and reacts to the product, and also the degree of her likeness to the product.

One participant mentioned that he prefers to see more reactions with the physical plant, e.g., like the digital one, the physical plant also becomes happy and sad when the user reports an input. While it is a real plant, it is probably impossible. Also, it seems an issue that we can't get quick and short-term reactions/feedback from the real plant. e.g., it takes weeks and months for a real plant to look bad if it doesn't receive enough resources.

One participant mentioned that this device stresses me more, and I don't want more stress in my life, so I may avoid using it. The design clearly and intentionally creates friction for the user, and it's not a bad thing, and even needed. But is this stress being kind of friction that we want and prefer? One user even mentioned creating more friction, like users losing items, or the digital plant showing more intense reactions like crying when it and the real plant don't get enough resources.

Additionally, the prototype of the physical aspects, such as the lamp, water, and nutrition container, was not in high resolution. For this, participants sometimes didn't notice the light, as it was an important element to reward users.

5 REDESIGNING BLOSSOM-BUDDY: A SELF-DETERMINATION THEORY PERSPECTIVE

One highly relevant framework for this work is Self-Determination Theory (SDT), which focuses on the psychological needs that underpin human motivation (Ryan and Deci, 2000). This section discusses how SDT can be applied to inform a redesign of Blossom-Buddy.

The original prototype primarily relies on an extrinsic motivational mechanism; the user must perform tasks to ensure the plant's well-being. In this model, the plant's health acts as a direct reward, while its decline serves as a punishment. Although this design taps into the "human tendency to care for living things", the "intentional friction" of potentially harming the plant can also induce stress and anxiety, a finding observed during user tests. This approach risks fostering controlled motivation (e.g., acting to avoid guilt) rather than the more sustainable autonomous motivation that SDT advocates.

A redesigned Blossom-Buddy could pivot towards fostering intrinsic motivation by systematically supporting the user's basic psychological needs for **autonomy**, **competence**, and **relatedness** (Ryan and Deci, 2000). The goal is to make engagement with both the tasks and the Blossom-Buddy system inherently more need-supportive.

5.1 Fostering Autonomy

Autonomy refers to the need to feel a sense of choice and personal endorsement of one's actions. To enhance autonomy, the redesign could:

- **Increase Flexibility:** Allow users to set flexible or self-determined deadlines and even opt for no deadlines for certain tasks.
- **Reduce Pressure:** Implement features for easily adjusting or "snoozing" tasks with minimal negative feedback. For instance, if a task is snoozed, the digital plant might show a patient or understanding expression rather than immediate sadness, perhaps offering a gentle reminder later. This aligns with Zimmerman's design patterns that suggest providing users with a sense of control.

5.2 Enhancing Competence

Competence involves the need to feel effective and capable of achieving desired outcomes. While the original prototype rewards task completion, it could more effectively build a lasting sense of competence.

- **Structure Goals:** For complex goals (e.g., "learn a new language"), allow users to break them down into smaller, manageable sub-tasks.
- **Visualize Progress:** Provide users with clear visualizations of their progress over time for specific goals (e.g., "You've meditated for 10 hours this month"). This helps users see their development and fosters a sense of mastery, independent of the plant's immediate state.
- **Offer Optimal Challenges:** The system could help users calibrate task difficulty to ensure challenges are engaging but not overwhelming, thereby promoting a sustainable sense of accomplishment.

5.3 Cultivating Relatedness

Relatedness is the need to feel connected to and cared for by others. While Blossom-Buddy focuses on the user-plant relationship, this can be expanded.

- **Build Supportive Social Features:** The original design considered "social comparison" for future prototypes. If implemented, these features must be carefully designed to support relatedness without inducing pressure. For example, instead of competitive leaderboards, an opt-in community forum could allow users to share tips or progress on common goals. This fosters a sense of shared experience and mutual support.
- **Develop an Empathetic System Persona:** The language used in notifications and feedback should be framed empathetically, acknowledging that pursuing goals is challenging. An encouraging and non-judgmental tone can

foster a sense of being understood and supported by the system itself, contributing to a feeling of relatedness with the interactive experience.

6 RESEARCH THROUGH DESIGN (RTD)

Daniel Fallman (2007) argues it is vital that one be clear about what one wants to do in an HCI design-related project and because of this the center of the continuum between research-oriented design and design-oriented research is not an optimal position for most HCI projects. To reflect on where our work stays on this continuum, we need to first understand design-oriented research. In RtD projects the designed artifact/product is not the final goal of the project but is only used as the means to create knowledge, answer existing research questions, and create new ones. On the other hand, in a common design project the main objective is to design a product that is most efficient and best fits into user needs and the market, so we can say they aim for particular rather than general and real rather than true (Nelson and Stolterman, 2012).

To answer if this design project (Blossom-Buddy) is an RtD project or not, we can argue that it depends on the perspective of each person in the design team, as if even at first, we didn't have any research questions in mind, our goal for this work has been to create knowledge and new research questions and this happened during the process of prototyping and user testing.

Moreover, having or not having an RtD perspective can affect the design decisions during the design process. To better understand this, Fallman gives an interesting example of the QWERTY keyboard layout. Research (seeking what is true) proved that there are more efficient layout keyboards that users can type faster with than QWERTY layout. However, alternative layout models for computer keyboards have done very badly in the market, so designers of keyboards (which need to be real) keep designing keyboards using the QWERTY layout.

In our example, there are several aspects in which having the RtD perspective or not can make a difference. One is the having the touch screen or physical buttons. If we want to think of Blossom-Buddy as a product to sell more in the market we need to consider the cost of the touch screen otherwise it is just a matter of usability or probing that users prefer which one more.

7 CONSTRUCTIVE DESIGN RESEARCH (CDR)

In CDR focus is on research programs rather than individual studies (Koskinen et al., 2011). Hence, a key question is, through which research program can we see and define this work? To answer this question, we should first understand the characteristics of a design research program. Research programs always have “a central, or core, idea that shapes and structures the research conducted" (Koskinen et al., 2011). What is this core concept that we want to construct our research based on within a CDR program? More specifically, what is this core, central idea for this work that Blossom-Buddy is a part of it? In our group may anyone answer this differently but one core concept that I see is the idea that:

"Things we know we should do and not do but difficult to put into practice and implement in our everyday life". Also, one related research question to this concept is that if we can shape and change users' behaviors through the human tendency to care about living things.

In a CDR program, progress happens when some piece of research adds new knowledge to or corrects a research program (Koskinen et al., 2011). To answer research questions and create knowledge around this concept we need a designed artifact like Blossom-Buddy to be used and studied in the Lab, Field, or maybe the Showroom. While our final prototype was not enough functioning for a Field study, we conducted in the Lab user tests that created more research questions and gave us insights into different aspects of the concept. For example, we realized that participants with different

characteristics and personalities may react differently to the prototype. Another was that one participant mentioned that this device stresses me more and I don't want more stress in my life, so I may avoid using it. The design clearly and intentionally creates friction for the user and it's not a bad thing and even needed. But is this stress is kind of friction that we want and preferable?

For future studies, a more functioning prototype is needed to conduct field studies with more participants which can result in new knowledge.

8 DISCUSSION

Regarding getting inputs and reporting activities to the device, different ways can be thought of instead of only users reporting their activities directly to the device. We can think of connecting Blossom-Buddy to smartphones and wearable devices, and get users' activities from such devices. For this, an API can be implemented so users can connect Blossom-Buddy to other apps, such as a step tracker app and a task-list app.

The final prototype was fairly successful in communicating the main idea of Blossom-Buddy, to a variety of users and stakeholders. It first happened in our team to better understand the main idea and also during the user test and presentation day, which was more like a showroom for the Blossom-Buddy. The prototype encouraged visitors to express their opinions and open discussions about different issues related to the concept. However, the prototype was not complete enough to bring up and show other problems of the design. For example, during the user test, we realized that users expect more reactions from the real plant. To do this, we can study the way we want to provide water, nutrients, and artificial sunlight to the plant. Thus, the placement of the lamp and water pipes may become important to ensure that while the plant is getting such resources, they are more visible thus making it more rewarding for the user. We didn't implement such aspects with this prototype. A more functional prototype to be used in the field study can more effectively bring up the issues and possibilities of the design.

Furthermore, user feedback indicating that the prototype could be stress-inducing highlights a critical design challenge. The goal is to determine the optimal level of "intentional friction" created by the plant's dependency—one that motivates effectively without fostering anxiety over sustainable engagement. A future iteration of Blossom-Buddy could address this by being redesigned through the lens of Self-Determination Theory (SDT). This framework would balance the extrinsic pressure of caring for the plant by also fulfilling the user's core psychological needs for autonomy, competence, and relatedness. By offering more flexibility in goals, providing clearer feedback on personal mastery, and building a more empathetic and supportive system persona, the design could foster a more positive and intrinsically motivating experience, better aligning to help users achieve goals they find personally worthwhile.

9 CONCLUSION

The design and evaluation process of Blossom-Buddy, as a novel interactive computing system, revolved around the concept of "tasks and goals we find worthwhile but hard to implement in our everyday lives. By using a real plant, it taps into humans' tendency to take care of living things, reshaping and changing the behaviors of users.

Early prototypes were used to facilitate ideation, allowing us to grasp the concept better and build upon it, leading to the final design idea of Blossom Buddy. Moreover, during the designing phase, we used vertical/filtered prototypes to understand and explore different ways of implementing physical buttons and the interface which helped us to design a functioning interface.

Eventually, we used the final prototype to conduct a lab study. As a result, we gained a deeper understanding of different aspects of design and developed new research questions. The most important finding was that the prototype

successfully encouraged users to do their tasks in order to take care of the plant. However, the number of participants was not enough, and a more functioning prototype is needed to conduct field studies.

This course gave me a prototype mindset that I clearly didn't have before. I realize I can prototype any design idea at any level to understand, explore, and test it. It is also a crucial realization that a simple, fast, and cheap prototype can give us invaluable insight and knowledge about a design idea. It encourages us to prototype early and fast and not wait too long. Also, having only a product and start-up mindset, knowing and understanding RtD was an eye-opening experience for me, in which we can work on design ideas whose main purpose is not to be useful or sell more on the market, but to create knowledge.

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