Reflective Diary

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The theme of this year's Interaction Technology Innovation course is "Enchanted Everyday Objects," aimed at rethinking an ordinary object to enhance it and bring a magical feeling to our daily lives. Our study seeks to provide two intimate individuals, who are physically apart, with an enchanted object each to boost their sense of connectedness and sustain their intimate relationships. Toward this goal, we designed and created two snow globe prototypes that aim to enable both individuals to continuously be aware of each other's life schedules, the weather in each other's locations, exchange voice messages, and shake the snow globe to send a magical signal. Many of these interactions will cause the scenes in the counterpart's snow globe to rotate slowly and, BE AWARE, trigger a magical snowstorm inside the snow globe! The design process, informed by feedback from user research and course instructors, includes many revisions. The prototyping also faced numerous technical challenges. In the following reflective diary, I will showcase this journey with my reflections from the perspective of a designer.

ACM Reference Format:
Yangfan Chen. 2024. Reflective Diary. 1, 1 (April 2024), 9 pages. https://doi.org/10.1145/nnnnnnn.nnnnnnn

1 PREPARATION: LITERATURE REVIEW

In the first week of the course, due to the absence of two team members, we decided to do some preparation on our own before our first meeting. I chose to delve into the literature to gain a deeper understanding of the fields covered in the "Interaction Technology Innovation" course. Initially, I revisited some research that had made a lasting impression on me. During my undergraduate studies, I participated in a summer school on human-computer interaction organized by my university. Hence, I had previously explored numerous presentations from CHI 2019, including the keynote *Technology Woven In* [5]. That is why I felt "enchanted" when the original work *Interactive Plant: Botanicus Interacticus* [6] was presented in the first lecture! At the summer school, Professor Yu Chun from Tsinghua University presented a keynote that showcased his research at the time, including HandSee [8], a design that use a prism to the front camera of a smart phone that enables depth perception of user's hand. I thought it is enchanted because it gives many new interaction possibility to the smartphone that we are so familiar with simply by one prism. There are also works about accessibility, for example, EarTouch [3] is an interaction design that allow user use their pinna to interact with the screen so that they can hear the phone speaker better in noisy environment. Although they gave me many thoughts, similar ideas are not feasible for us to do. In fact, this summer school is the main reason why I chose this Master's program. Reflecting on these enlightening studies brought back many fond memories.

Next, I shifted my focus to gathering broader information by exploring the CHI 2023 - Video Previews playlist on the YouTube ACM SIGCHI channel. I chose to do this because each video in this playlist is about 30 seconds long, making it quite efficient to gain some impressions. I skimmed the related articles if the preview caught my interest. In general, some videos on social connectedness left deep impressions on me. For instance, I was impressed by these two articles:

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Manuscript submitted to ACM

(1) Living with Light Touch: An Autoethnography of a Simple Communication Device in Long-Term Use [2]
(2) Message Ritual: A Posthuman Account of Living with Lamp [7]

I found these papers intriguing maybe because I always have a strong interest in social psychology. And the way of using light, a such simple and direct channel, to enhance social connectedness is fascinating. I treated the playlist like a Netflix series, browsing through it and concluding my preparations with some background knowledge.

2 ROUGH IDEA: STUDY PLAN, CONCEPT MAP AND DESIGN SYNTHESIS

In the second week of our course, we embarked on our first group discussion. Our primary goal was to pinpoint a topic that intrigued everyone, and I suggested the theme of social connectivity, arguing that people place significant value on their social connections. Enhancing this aspect could offer users an enchanting experience, and even potentially leaving them with warm memories. My team members were all interested in this idea. We then proceeded to draft our concept map on the whiteboard, as shown in Figure 1. During our discussion, we outlined elements such as lighting, soft textures, and real-time tactile feedback to foster a sense of warmth. We categorized communication into verbal and non-verbal and decided to focus more on the latter to align with the "enchanted" theme. We also addressed the issue of time differences and the resulting misalignment in daily routines, a point deeply resonant with the three international students in our group. After completing the concept maps, we initiated our design synthesis process, culminating in a list of 10 ideas. This list helped us form a preliminary impression of what we aimed to create.

In the following lab session that week, we began refining the features our product should encompass. We specifically envisioned the "enchanted object" as a decorative item for the bedside, possibly a lamp or another object, due to its proximity to both the physical and emotional space of the user. Bastiaan initially suggested a snow globe, which I felt was not an everyday object (which proved wrong!), so we decided to further explore the product's functionalities. We unanimously agreed that continuously displaying the ambient light of the partner's device as a means to stay connected with their life was a compelling feature and could serve as a non-intrusive, companion-like device's core premise. Additionally, we considered incorporating the functionality of displaying the weather conditions of the partner's location. After establishing the product's tone, we shifted our focus to the "enchanted" aspect. I proposed that we should allow users to send a "signal" to each other, leading to discussions about what this signal could be. Our ideas included a touchpad and screen that would display the trajectories of the partner's touches in real-time, slowly fading over 3-4 hours. This would allow users to creatively use the touchpad and, over time, develop unique patterns symbolizing their bond. We also considered other signal options, such as sending songs to each other. These discussions formed our preliminary ideas. Although we had yet to finalize what the object would be, we gained a clearer understanding of the product we wanted to develop.

3 ELABORATION AND REVISION: SCENARIOS, STORYBOARDS, AND CUSTOMER JOURNEY MAPS

After the meeting, I began to contemplate the product design of this device. My starting point was to design a very non-intrusive device, meaning this device would lean towards being a companion with simple and limited interaction. Given that smartphones and personal computers are already effective communication tools in our daily lives, I did not intend to add complex or high-density communication functionalities to this device, as it could not fully replace our phones or computers in terms of functionality and usability. Therefore, I aimed to introduce differentiated features that would make it unique and enjoyable to use, aligning with the theme of "enchanted everyday objects." With these preliminary ideas, I participated in another meeting to elaborate on our device's feature set. This meeting focused

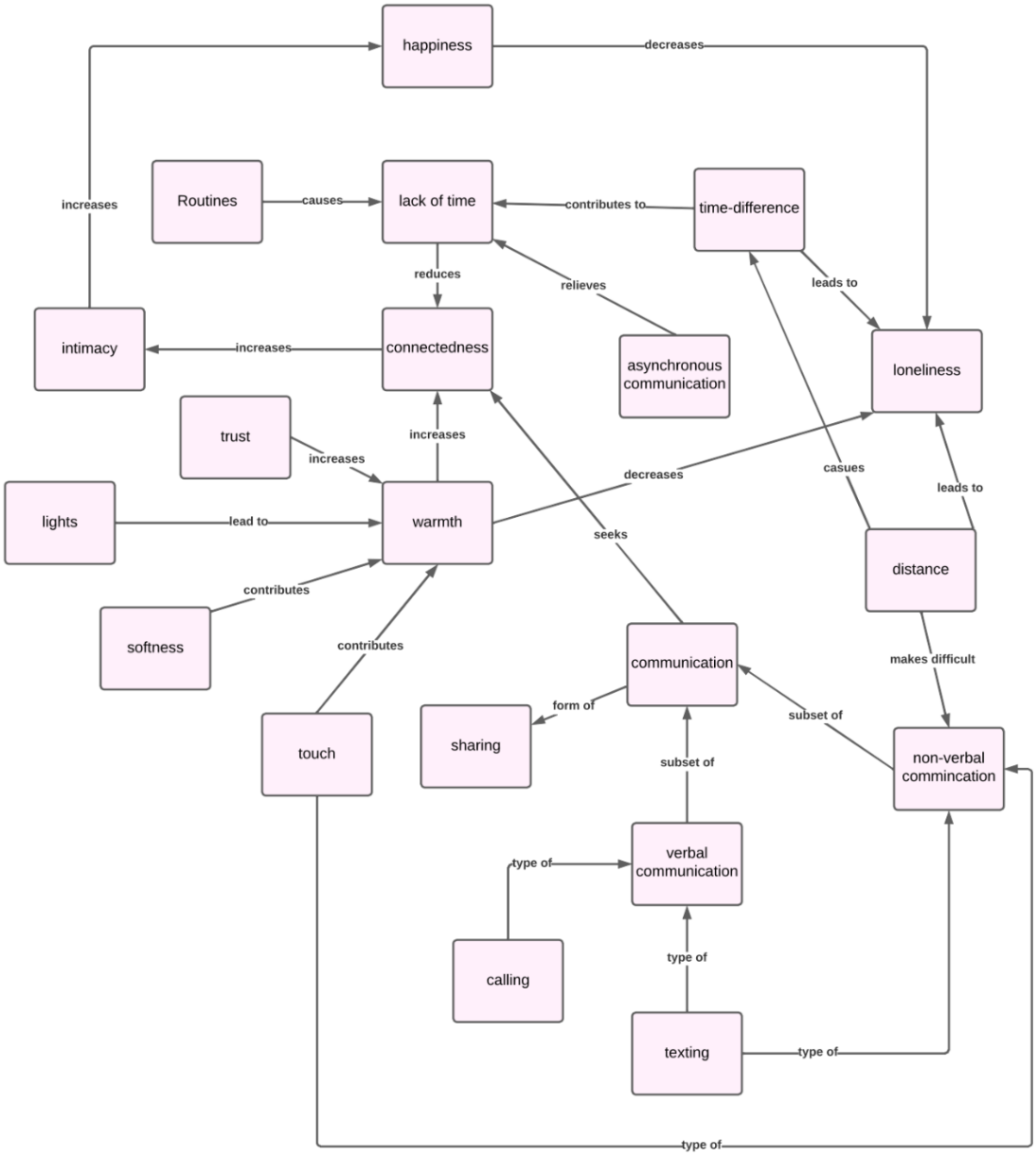

Fig. 1. Concept Map

primarily on the theme of "enchantment." Considering that a snow globe might not be an everyday object for everyone, we revised our choice to a lamp and developed a feature set, building our personas and storybook around that.

The feature set includes:

(1) The device should support multiple users and connect them.
(2) The device should be able to display the ambient lighting conditions of other devices.
(3) Each user should be represented by a small semi-transparent figure, with the ambient lighting showing as the figure lighting up or not.
(4) The figure should be interactive, such as tapping it to send a signal.
(5) The device should also display light signals representing the weather conditions of other users, including temperature and weather.
(6) The device should support sending and receiving voice messages.

We build our scenarios, storyboards and customer journey maps based on these discussions.

These features were discussed as a group with the preference of all members. If I were fully in charge of the design process, I would propose some changes:

(1) The device should not support more than two users, as this would significantly limit the interaction design by shifting from one-to-one to multi-to-multi interactions. Additionally, multi-to-multi interactions could potentially introduce social tension among users, which I would personally prefer to avoid.
(2) The voice message function should be removed. In my view, if we cannot achieve a complete and highly usable voice message function, we should instead focus on simpler but more fun features.

Over the weekend, I organized a small focus group session with some former colleagues from my time working at the design center of WeChat, including two software engineers and one designer. I introduced them to our design and sought their opinions. To avoid bias, I refrained from arguing or commenting on their views, providing only a neutral description of the product. They provided some feedback which prompted further thought. The result was used during the low fidelity prototype phrase.

Additionally, at this current point in time when I organise this document, one reflection I have is that our design didn't focus deeply enough on understanding how to achieve the "enchanted" aspect. My initial thought was something "wonderful" or "magical", but as we delved into the literature, we found that "enchanted" is more often defined as [4]: "*For an individual consumer, enchantment is an experience as deeply felt yet fleeting set of emotional commitments involving wonderment, anticipation of joy, euphoria, and an expanded sense of human potential*" Enchantment plays a big role in the design and adoption of connectivity devices, it engages closely and intimately with the object of affective attachment, absorbing its characteristics . That said, by being enchanted, the object may not be as rational as I thought [1]. I could have design the product in a more "absurd" and "incredible" way and focus more on emotions.

4 ITERATION: LOW FIDELITY PROTOTYPE

We did the second assignment presentation later this week and got feedback from the instructors. To me the main point from the instructors is that our product is less "enchanted" or magical than our previous snow globe draft. We started to revise our design at the beginning of the low fidelity prototype phrase. We shifted our focus back to a snow globe rather than a lamp, as the feedback suggesting that a snow globe could also be considered an everyday object. During the discussion, I referred to the user research results that I mentioned earlier, including these main points:

(1) We could narrow down our use cases. Currently we plan to cover family, friendship, and couple relationship, but participants point out some considerable differences and unique characteristics.

(2) The voice message function should be either complete (e.g. phone call) or just be replaced by another function. The experience of our currently asynchronous voice message function would not be good enough. They also give some examples.
(3) The tap function is not rich in social cues, and (same as 2) asynchronous voice messages are not ideal for the next move after they reply to others' tap immediately
(4) Participants also brainstorm another similar idea of digital album with colourful e-ink display.

Although we did not applied every of them and still continue our snow globe plan, we all agreed to narrow the use case to one-on-one interactions. We also simplified the feature set to include only voice messaging, shaking the snow globe to convey a signal, and displaying ambient lighting and weather information. The enchantment element primarily arises from the turning to play voice messages and the shaking to send a magical signal function. We envisioned allowing the user to turn the snow globe to receive voice messages and shake it to activate a miniature storm inside, effectively combining the snow globe with a music box.

The build of the low fidelity prototype happened simultaneously when we revise our design. We initially built a turnable platform using LEGO blocks to demonstrate the turning gesture. Later, we decided to use the provide sticky foam to improve our prototype, but this proved time-consuming without adding more useful information. Therefore, we reverted to the LEGO prototype. Personally, I was also studying 3D modeling and printing at the same time. In this stage, I printed a clockwork mechanism to provide mechanical feedback for the turning operation. For the low-fi prototype, we still needed a transparent shell. I experimented with transparent PETG material for 3D printing, attempting to print a single-layer shell in vase mode, but it failed because the top area lacked proper support. Choosing non-vase mode resulted in an opaque outcome. Despite multiple experiments, I eventually gave up. Additionally, Marit and Otto kindly showed us the glass lab at Utrecht University, which was truly impressive. Anticipating a glass shell for the high-fi prototype, we stopped trying to print a transparent shell for the low-fi prototype. Instead, we used an opaque one for users to experience the turning operation and started working on the high-fi prototype.

As for the design iteration, we elaborate our design choices to enchant a snow globe. I will mention it in the later high fidelity prototype section.

5 IMPLEMENTATION: HIGH FIDELITY PROTOTYPE

At the beginning of this phase, we had already known what we aimed to create, so the initial period was planning the necessary hardware. As we were ready to implement a high-fidelity model, our requirements had been refined down to the specific components needed to fulfill certain functions. The functionalities we hoped to implement include:

(1) Users can know the lighting conditions of the other person's environment by observing the LED strip on the top of the device.
(2) Users can press and hold a button to record an audio message, and release the button to send this message.
(3) An red LED indicator lights up when a message is received.
(4) An yellow LED indicator lights up when the other person's location has a sunny weather.
(5) An blue LED indicator lights up when the other person's location is raining or snowing
(6) Users can play the received voice message by rotating the top of the snow globe.
(7) The device's top platform starts rotating when playing a voice message.
(8) Users can send a snowstorm signal to the other person by shaking the device.

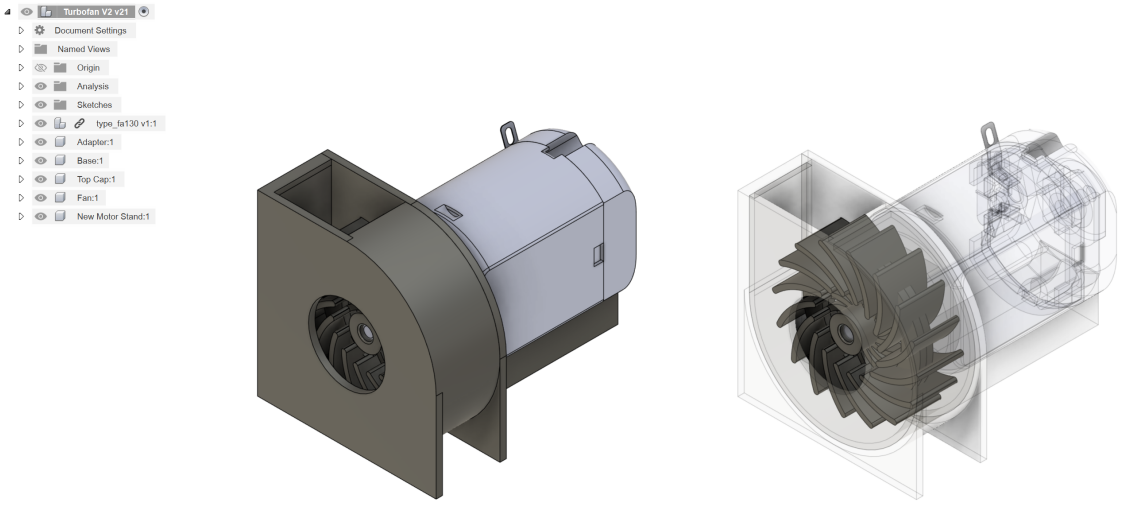

Fig. 2. The turbofan model

I began work on the high-fidelity prototype by exploring the creation of a high-fidelity snow globe shell, which first led me to learn about glass blowing since we expect the glass lab could help us create the shells. Specifically, I delved into its limitations of glass blowing technology and briefly designed the appearance of the snow globe. Following this, I produced a draft print to showcase our design to a lab member for consultation, assessing whether our draft or blueprint met their capabilities. However, we were informed that they could not assist in making the globe but could help us cut specific products to meet our requirements, potentially orderable through the university's system. Consequently, we opted for a 500 mL rounded flask that matched our needs. Then we were told ordering the chemical equipment for our project cannot be achieved and we were recommended to use the SLA printer or the vacuum former in the Lili's prototype lab to construct our product.

Thus, I started learning how SLA printers operate and their application. SLA printers, in theory, could produce highly transparent objects, aligning with our requirements for the next phase. Upon visiting the lab to inspect the SLA equipment, we were shown a component printed by the machine, which was the most transparent option available, albeit still too opaque for our needs. Exploring alternative methods, we learned how to use a vacuum former to create a shell. However, the materials available were insufficient and too prone to deformation, unsuitable for our product, which features a user-interactable snow globe that can be turned to access voice messages. Although using multiple layers of material with a vacuum former could construct a globe, it would significantly reduce the product's transparency. After deliberation, we decided to purchase an existing transparent vessel. While this meant not creating the snow globe ourselves, it was deemed a necessary compromise to maintain project momentum. Now when I wrote this text, my reflection is that we should have decided quicker to save the precious time for building other parts or revise our design to something else that is well available.

Nevertheless, I also spent these two weeks learning about Fusion 360. To evaluate my learning outcomes, I used Fusion 360 to design a turbo fan (see figure 2), adapting it to a motor to generate the storm effect inside the snow globe. I found a picture of a laptop turbo fan online for reference and modeled the turbofan using Fusion 360. After three iterations, the design proved highly functional, capable of blowing lightweight materials to simulate snow. And

Fig. 3. The snow globe appearance design

I modeled the fan in a flexible way which benefit a lot when I need to minimize the fan due to size limitataion. This process greatly enhanced my familiarity with Fusion 360. Next, I began designing a double-layer turnable platform, with one layer motor-driven and the other user-operated to turn in only one direction. Discussing the feasibility with Yu, our prototyper, we eventually devised a solution, leading me to model the gears and other structures. I first printed a single-layer platform that could be motor-turned, including the stand for two motors, while considering the design's extendibility. The next step was to create the second layer of ratchet mechanism. However, due to the time limitation I ask help from Yu and he reconstruct the structure from scratch in the way he prefer. My role then in the turning mechanism was to establish a proper interface for mounting the structure and to assist with testing upon updates.

I then proceeded to model the base of the snow globe (see figure 3). My goal was to minimize the base as much as possible, as users will ultimately hold and shake the snow globe in their hands. A snow globe that is unwieldy to pick up with one hand would hinder the user's ability to interact with it. However, this required repeated adjustments and test prints, so I spent a considerable amount of time printing over and over again at this stage. In the final phase of compiling this document, I reflected that I should have initially opted for a solution with a lower margin for error. In summary, after repeated testing and adjustments, I achieved a relatively compact design. After planning the placement of the components, I began the actual printing of the devices we needed. The next step was to assemble all the parts, which took much more time than I had anticipated. New challenges continually arose, such as our inability to obtain female-to-female wires from the lab, leading us to spend a significant amount of time soldering over forty to fifty wires individually. This also made troubleshooting and modifications difficult. During the assembly phase, we discovered that one microphone module was not functioning properly, and a speaker was damaged. Nonetheless, we adjusted our plans and worked diligently to complete a prototype suitable for presentation. As of the submission of this document, we are still in the process of making it, uncertain of the final outcome (see figure 4). However, I hope that by the time you read this, you have already seen our finished product and enjoyed it!

Fig. 4. The day when this document is submited

REFERENCES

[1] Russell Belk, Henri Weijo, and Robert V Kozinets. 2021. Enchantment and perpetual desire: Theorizing disenchanted enchantment and technology adoption. *Marketing Theory* 21, 1 (2021), 25–52.

[2] William Gaver and Frances Gaver. 2023. Living with Light Touch: An Autoethnography of a Simple Communication Device in Long-Term Use. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (<conf-loc>, <city>Hamburg</city>, <country>Germany</country>, </conf-loc>) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 633, 14 pages. https://doi.org/10.1145/3544548.3580807

[3] Takashi Kikuchi, Yuta Sugiura, Katsutoshi Masai, Maki Sugimoto, and Bruce H Thomas. 2017. EarTouch: turning the ear into an input surface. In *Proceedings of the 19th International Conference on Human-Computer Interaction with Mobile Devices and Services*. 1–6.

[4] John McCarthy, Peter Wright, Jayne Wallace, and Andy Dearden. 2006. The experience of enchantment in human–computer interaction. *Personal and ubiquitous computing* 10 (2006), 369–378.

[5] Ivan Poupyrev. 2019. CHI 2019 Keynote - Ivan Poupyrev: Technology Woven In. https://www.youtube.com/watch?v=jcAcpbbzPj4

[6] Ivan Poupyrev, Philipp Schoessler, Jonas Loh, and Munehiko Sato. 2012. Botanicus Interacticus: interactive plants technology. In *ACM SIGGRAPH 2012 Emerging Technologies* (Los Angeles, California) *(SIGGRAPH '12)*. Association for Computing Machinery, New York, NY, USA, Article 4, 1 pages. https://doi.org/10.1145/2343456.2343460

[7] Nina Rajcic and Jon McCormack. 2023. Message Ritual: A Posthuman Account of Living with Lamp. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (<conf-loc>, <city>Hamburg</city>, <country>Germany</country>, </conf-loc>) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 634, 16 pages. https://doi.org/10.1145/3544548.3581363

[8] Chun Yu, Xiaoying Wei, Shubh Vachher, Yue Qin, Chen Liang, Yueting Weng, Yizheng Gu, and Yuanchun Shi. 2019. Handsee: enabling full hand interaction on smartphone with front camera-based stereo vision. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*.

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