Graduation Portfolio

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VISION

With the tremendous development of technology, ubiquitous computing is nowadays becoming increasingly incorporated in new products and systems. It provides us better connectivity to the world and the people, allowing us to fetch news and updates from our circle of friends effortlessly.

However, the ubiquity and intelligence of computing have caused issues to humans. Firstly, as major Web applications are screen-based and becoming saturated in our everyday lives, we humans are prone to spend our time interacting with information on the screen. Currently, smart devices are usually intangible information-based, employing texts, graphs, and speech-voices. Although this kind of information is able to convey a rich capacity of information, it either demands a person's high level of cognition or lacks intuitively perceivable affordances. Consequently, the interaction is often disconnected from the physical world, impoverishing the user experience and thus increasing the risk of user alienation from the physical world.

Secondly, as computing becomes more intelligent, they have evolved the capability of providing information proactively to the user. As different technologies are combating the domination of our attention, we might be overburdened with the proactiveness of such computing. To overcome the mentioned challenges, designers and researchers should explore intuitive and less obtrusive ways of Human-Computer Interaction as the era of ubiquitous computing unfolds.

One of the ways is to leverage human's inborn capabilities. Over centuries, humans have evolved a heightened ability to sense and manipulate the physical world. Designing interfaces that not only represent computational data but also allow humans to directly manipulate, digital and physical worlds will become seamlessly blended to each other. This would leverage human's bodily skills and sensing modality in addition to visual and auditory ones, and thus the interaction dynamics will become more variant and sensationally richer. To allow such interactions, the interfaces tend to be actuatable (or programmable), sensational (or sensing-able).

Another way is incorporating peripheral interaction, requiring proactive technologies to stay calm and peripheral in the user's attention. By enabling non-urgent, non-essential and low-arousal activities to be perceived or to be performed in the periphery of attention, cognitive resources for the user's everyday activities could be freed. This would require the coupling of human bodily skills and the tangibility of physical objects.

IDENTITY

I am independent, proactive, and able to play different roles within projects. I have a deep affinity with applying state-of-the-art technologies in designing interactive products, systems. I very much appreciate Peripheral Interaction (allowing effortless interaction) and Radical Atoms (seamlessly coupling the physical and digital world). I possess the skill sets from my bachelor's of Product Design and masters of Interaction Design. With mixed skill sets, I am able to ideate, develop, evaluate designs with aesthetics and values.

As a strong believer of '*standing on the shoulders of giants*', I believe skills, toolkits, and knowledge shall be as accessible as possible. I consider myself, to some extent, a technical enthusiast as I am always open-sourcing collaborative and personal projects to develop myself and benefit others in the community (Figure 1); On the other hand, I think I am also a researcher as I always conduct exhaustive investigation of design precedents and constructive literature to build a holistic view of the field. This, therefore, characterizes my personality in design: rational and practical. I tend to develop incremental designs rather than radical ones, which is significantly inspired by Oki Sato's design philosophy: the consolidation of two irrelevant designs; Besides, I also strive for intriguing and innovative concepts while implementing novel Human-Computer Interaction techniques to add new features or enrich the experience through usability, interactions, or aesthetic qualities.

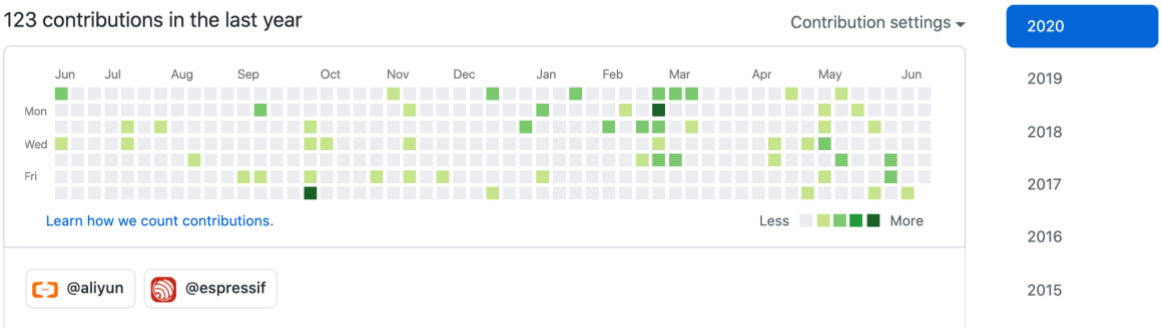

Figure 1 Evidence as a technical enthusiast

My main interests lie in the domain of designing tangible interactions as opposed to digital ones due to my background in product design. I believe that experiences provide constructive and intuitive insights for concept development. As a result, I tend to leverage my hands-on skills to build tangibly experienceable prototypes in an increasing level of fidelity (Figure 2), which is where my expertise lies in; On the contrary, my weakness lies more in the user study, particularly in objectively measuring the user experience and abstracting their actual demands. However, I do appreciate the value of Quick and Dirty prototyping and Wizard of Oz, as it allows me to evaluate early-stage prototypes. Thus, experiences and insights can be rapidly obtained and integrated into future iterations, preventing the situation where I have to doom a prototype that I have invested massive time.

Figure 2 a visual example of an iterative design process

Being raised under the Confucian culture in Asia, I have been educated to be adaptable and receptive to different ideas. When working collaboratively, I would like to listen with my colleagues, considering everyone's ideas and trying to mingle them into a synthesized idea which might be at the cost of dooming my proposal; In the past two years studying in the western, I also cultivated my side characteristics - defending myself. As people might have different cultural backgrounds, always adopting others' opinions would not be a permanent solution, encouraging me to elaborate explanations when disagreement occurs.

Figure 3 Demo Day pitching for a PhD student

Figure 4 my 3rd haft-marathon metal

Lastly, as a Marathon and habitual daily runner (Figure 4), I have a high level of self-discipline and perseverance, which applies to my attitude on working as well. I rather pursue quality over quantity, and therefore I am prone to think comprehensively before doing; I would not stop working until I tackle the problem as I always believe if there's a will there's a way.

DEVELOPMENT

In this section, the development of my areas of expertise TR (Technology & Realization), CA (Creative and Aesthetics) among the other three are described. I illustrate divergent skills, experiences, tools and methods that I have learned or applied during my masters. As evidence for the development, I attach related practices that have contributed to the acquisition of the described knowledge and skill set and make cross-reference under each standalone project page.

Technology and Realization (TR)

In retrospect, I have extensively practiced and developed various skills in this area of expertise. First, in a hands-on approach, I practiced my hand-crafting skills to manipulate different materials such as fabrics (sewing, trimming), wood (sanding, creating chamfers, painting), foam (building sliders, doors, cylinders, etc.). This has also allowed me to build different fidelity prototypes ranging from quick and dirty to aesthetic and fine-tuned; Then, to boost the functionalities of my prototypes I am able to seek and integrate suitable technology in the artifacts I create, allowing them to be interactive and actuatable. This would allow me to preliminarily evaluate my ideas, resulting in insightful improvements for the next step: deployments in the field. I have become able to develop high-fidelity, qualified prototypes that run continuously in the field, which allows me to conduct extended durations of user evaluations.

Figure 5 An iterative developing process of pneumatic containers

In the past semesters, I have expanded my technology repertoire as I practiced developing different technical prototypes for different projects, working with different integrations of sensors (ranging from air quality sensor, CO2, capacitive sensor, potentiometer) and actuators (multi-servo system, step motor, pump, DC motors), as well as shape-changing interfaces (pneumatic containers). Above that, I have also obtained lots of experience working with IoT embedded systems (e.g. ESP MCUs, Arduino IDE), online APIs (e.g. Betaface, Azure Facial Recognition, Firebase Database, etc.), as well as the TU/e-based OOCSI suite, including OOCSImote, OOCSI-esp, OOCSI Data Foundry). Compared to my prior experience, I am now able to understand electronic schematics and develop custom appropriate circuits on PCB boards with the integration of various modules and components (as presented in the FMP). Given these diverse sets of skills I possess, I have been mainly in charge of or highly involved in the implementation of prototypes in team projects.

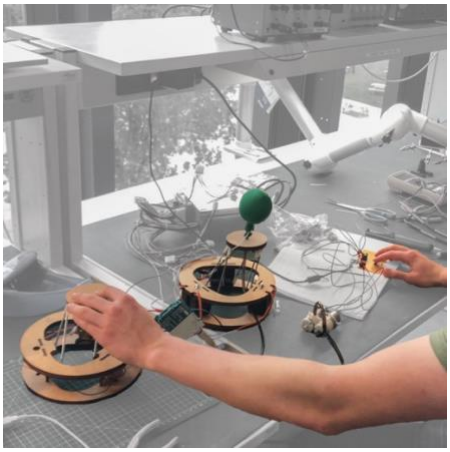

Figure 6 Prototyping in process

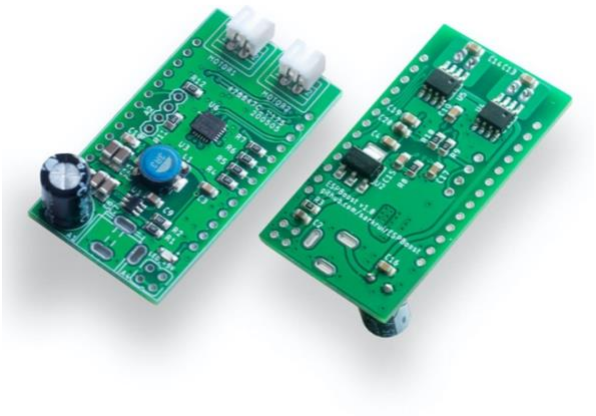

Figure 7 Manufactured ESPBoost

Featured in this area:

- M1.1 Social Interaction with Shared Systems
- M1.2 Designing Intelligence in Interactions
- M1.2 Data-enabled Design
- M2.1 Interactive Materiality
- M2 FMP
- Light Messenger

Creativity and Aesthetics (CA)

Figure 8 Prototype, but in this case served as evidence of my CA competency and photography skills

My second specialization area of expertise is my best-developed competency coming into the program. My previous understanding of CA is addressed on the quality of artifacts, regarding the finishing, proportion ratio, forms, etc. Previously, I already obtained an intermediate-level skill set of sketching, CAD modeling/rendering, and aesthetic prototype finishing during my bachelor's. This foundation has allowed me to further develop more advanced creative skills during my master's. For example, during Data-enabled Design, Interactive Materiality as well as my FMP, I learned how numerical datasets, natural or artificial materials or CAD models can be utilized as creative material inspiring the iterative process.

As I was introduced to Interactive Materiality and its related theories, I understand how fabrics and objects from nature can be served as inspiring materials and thus it supports me to explore the aesthetic qualities and resolve potential conflicts in advance. Besides, I was also exposed to how user evaluations can be conducted creatively, for example, from Ensemble, observing how participants would freely explore the interactions. I also practiced holding a design critique to gain constructive feedback and suggestions for my design and analysis with Affinity Diagramming. Simultaneously, upon the CAD skills I have obtained coming to my master's, I further explored and practiced how CAD models/renderings could accelerate and broaden the exploration of tangible expressions in compensation for the insufficient mechanical knowledge and slow tangible prototyping process.

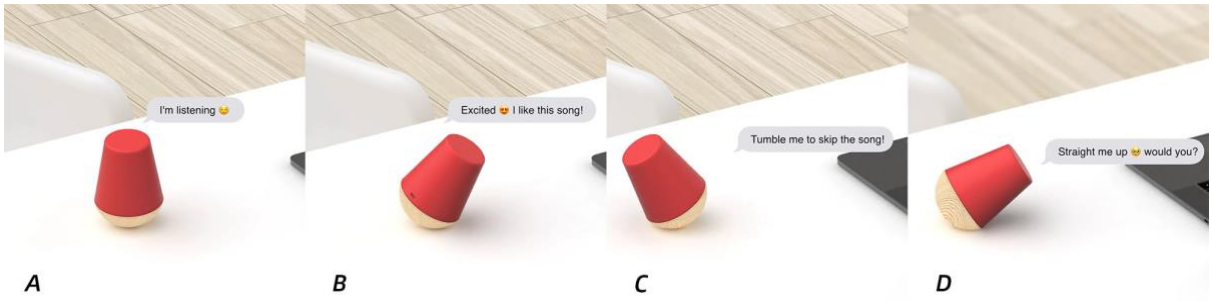

Figure 9 Exploring different tangible expressions in a CAD tool

Apart from that, I have also extensively developed my photo/video presenting skill. During my master's I have been playing as a role in charge of scripting, directing, filming and post-editing among

teams for presenting concepts or prototypes. Although I had rare experience in producing videos prior to my master's, my photography basics and enthusiast in reviewing vlogs and tutorials have allowed self-education. Selected videos can be found on my vimeo profile.

Figure 10 Light-Messenger, a gift for Saskia

Featured in this area:

- M1.1 Social Interaction with Shared Systems
- M1.2 Peripheral Interaction
- M2.1 Interactive Materiality
- M2 FMP
- Light Messenger

User and Society (US)

This is the area that first brought me to the master's program. Before that, I lacked the experience and opportunity to engage with the end user during the design process. Being aware of the theories regarding human cognition (e.g. attention theory), interaction frameworks (e.g. TUI model, social translucence, interaction-attention continuum, etc.), I become able to explore fields of interest and evaluate the value of my designs.

Figure 11 Prototype being deployed at MetaFourm

With a variety of design and evaluation methods, I am able to utilize user research as a tool to sensitize and understand the design space and challenge, individually or collaboratively develop concepts, and evaluate them with different fidelity prototypes. Specifically, I apply both qualitative (e.g. RSME, data-enabled probes) and quantitative (e.g. design critique, semi-structured interview) methods from my repertoire. As a practitioner of these methods during the master's, I am now familiar with choosing the proper method in different projects.

Featured in this area:

- M1.1 Social Interaction with Shared Systems
- M1.1 Constructive Design Research
- M1.2 Peripheral Interaction
- M1.2 Data-enabled Design
- M2.1 Interactive Materiality
- M2 FMP

Math, Data & Computing (MDC)

Before following the program, I had a mild understanding of what MDC could make a contribution to design or had little reflection on that. Simultaneously focusing on qualitative data in the design process, I had experience in collecting, analyzing and interpreting quantitative data in the elective and project.

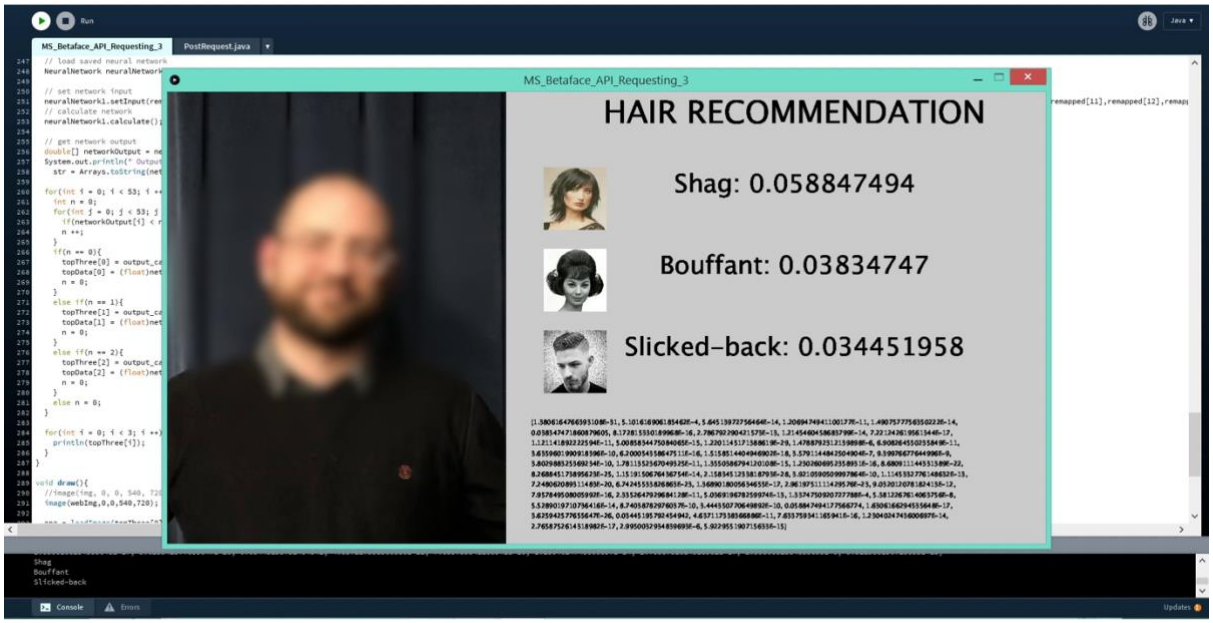

Figure 12 A snapshot of the hairstyle recommender system

Over these courses, I became more acquainted with this specialization of expertise on various aspects. Particularly in Data-enabled Design, I have developed the skills in collecting (ESP-OOCSI systems integrated with sensors) data from the field, processing (Excel, Python), visualizing (rawgraphs, Plotly), and analyzing generated dataset for pattern detection; As Artificial Intelligence becoming popular, in the elective Designing Intelligence in Interaction I collaboratively engineered an application incorporated dataset analysis (abstracting facial features from over 10K images), a supervised Neural Network construction, and lastly the accuracy validation. Such practices have laid the foundation for future development of more advanced intelligent interaction designs.

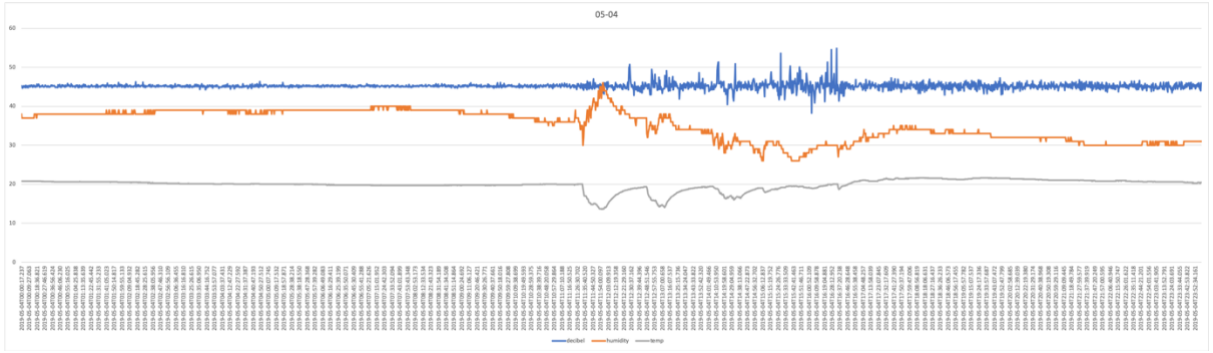

Figure 13 interesting data patterns

Featured in this area:

- M1.2 Designing Intelligence in Interaction
- M1.2 Research Project
- M1.2 Data-enabled Design

Business & Entrepreneurship

This competency is the one I am least interested in, as well as the least developed. Although I understand and appreciate its importance to me as a designer, only a few prototypes during my masters have reached the quality to be presented on the market. During my M1.1, the prototype I built was indeed presented to Bang&Olufsen and exhibited on Dutch Technology Week for seeking market opportunities.

Overall the entrepreneurial aspects were only considered during the reflective phases of the project. Besides, my graduation project unfortunately did not include a client, but I did make extensive comparisons of market competitors for my FMP and foresee the position of my contribution. The design and producing a factory ready *ESPBoost* in collaboration with a couple of electrical engineers were already an entrepreneurial leap.

Featured in this area:

M1.1 Social Interaction with Shared Systems
M2 FMP

Design & Research Process

I developed my competence in the design research process among all design activities during my master's. These activities have allowed me to experience a variety of design and research processes regarding context sensitization, challenge framing, and thinking perspectives. My bachelor's degree in Industrial Design, in product design orientation, has cultivated basic design skills in concept ideation and prototyping. During my master's, the skills repertoire has been broadened and thus enabled me to further obtain constructive knowledge. Apart from that, as the 2-year study involves many documentation, reflections, and paper-formatted submissions to primer conferences, my academic writing skill has significantly improved compared to my bachelor's, not to mention the practices in references management, literature reviewing. This has laid the fundamentals for my future as an HCI researcher.

FUTURE

In the near future, I will take a working-from-home year in mainland China. I will reunite and stay with my family as it's been a year since we met and I haven't seen my newly born niece. Besides, living with families would be a nice context for field study; I have a few ideas mainly from my FMP for the submission to TEI2021 and I will schedule for that. Unfortunately, one of the papers I submitted to DIS2020 was scored 2.5, and thus I will continue revising and submit it again to TEI2021 pictorial; I will conduct literature reviews to reframe a research proposal for the PhD position by late November; Additional improvements of Topplr and ESPBoost will be made when I am back to China for better collaboration convenience.

In the upcoming five years, I expect to follow a PhD in Europe with the salary/subsidy either from the university or China Scholarship Council. My current research interest lies in the field of Internet of Tangible Things with intelligence. How would connected devices communicate with each other or with humans, beyond intangible pixels?