GROUNDING EXPERIENCE: EMPATHIZING IN FUTURE SERVICE DESIGN

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1. INTRODUCTION

This study focuses on how to effectively conduct a service design project with low-cost empathizing tools in order to extend the scale of the service design project from a smaller scale (like a project restricting the examination to a carpool composed of autonomous vehicles) to a larger scaled project that would encompass future trends in transportation systems. Because of the constraints of the classroom and studio space and scheduling, educators are often unable to integrate user experience scenarios that can translate into more comprehensive design studies. However, various methods of empathizing, from storyboarding to journey mapping can be used to simulate the service needs scenario so that design solutions can be generated (Kouprie & Visser, 2009).

2. BACKGROUND

2.1 FUTURE LARGE-SCALE SERVICE DESIGN EXAMPLE: AUTONOMOUS DRIVING CARPOOL

For this study, an autonomous driving carpool was used as a testing example in a design school studio project in order to engage in forecasting and visualizing of the appropriate forms of predicted future transportation service needs. Forecasting future service needs is quite challenging partially because they are usually generated within a changing sociological-technological context; and often as the technology evolves different and diverse user groups will form a super service design need. It appears that more and more autonomous technologies are evolving to impact larger-scale sociological/technological context beyond traditional ubiquitous computing. For example, even though companies such as Waymo (Google) have recently launched commercial driverless services in late 2018, numerous studies have shown that people are not completely ready to adopt this innovative technology (Panagiotopoulos & Dimitrakopoulos, 2018). These studies propose that this is because people are more familiar with human-computer interaction models and are less comfortable with people being removed from the equation. (Damböck, Weißgerber, Kienle, & Bengler, 2012).

2.2 EMPATHIZING IN SERVICE DESIGN

In ethnographic research and user-centered design, empathizing methods like journey mapping (Rosenbaum, Otalora, & Ramírez, 2017) are often used to mimic core user experience and to highlight users' needs (Bidwell, Reitmaier, Marsden, & Hansen, 2010). Ohler points out that the basic form of digital stories in design storytelling is "typically driven by an academic goal, use low-end technology that is commonly available to students, and usually are in the form of short (two to four minute) quasi movies" (Raymond, 2008). Science fiction and role-playing have also been utilized to fast-forward students' imagination to predict product and service needs in the future (Blythe & Wright, 2006). However, graphic storyboard on paper and print media can result in "grounding the imagination" (Büscher, Eriksen, Kristensen, & Mogensen, 2004). Interactive storyboard, as a derivative version of it with role playing and interactive devices, is being gradually applied to game design and education (de Lima, Feijó, & Furtado, 2018; Fardoun et al., 2018). It allows users to participate more in interactive narratives with a few props to enhance the user experience and enhance co-creativity (Schmoelz, 2018).

3. DESIGN DILAMMA & RESEARCH MOTIVATION

The autonomous driving carpool project presented in this paper tracks the progress in a graduate-level assignment in 10 weeks 2018. The Double Diamond process (Clune & Lockrey, 2014) was the platform of inquiry. The first stage started with an on-line video review of autonomous transportation design and also included a review of the literature addressing this topic. The next stage included formulating a journey map and testing possible solutions in order to arrive at a final viable concept design (Fig. 1).

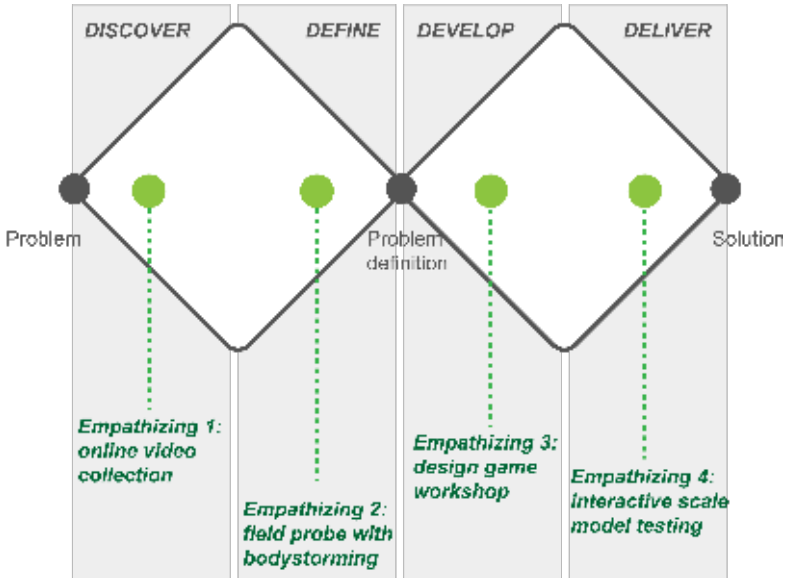

Fig.1 The service design process integrated with empathizing methods

During this process, the learning outcome for the students was to enhance their ability to use empathic methods of discovery in order to validate their design ideas. However, the lack of an actual experience of autonomous driving on the part of the students naturally limited their solutions. It is this methodological flaw that motivated these two research dilemmas:

- How to effectively explore and define future design problems in present time? (Research Question 1)
- What low-cost mimetic and experiential methods could generate and evaluate these design solutions? (Research Question 2)

3.1 DISCOVER & DEFINE

As shown in Fig. 1, in the first iteration of discovering and defining the problem, the goal was to immerse students into the problem to consider the entirety of the situation in order to define the At the discovery stage, students firstly surveyed mainstream video resources like YouTube, which let them have a quick understanding of the current status of carpool services and autonomous vehicles. Based on these searches, they could start to imagine the possible future of autonomous driving carpool services. From these protocols, they made the following discoveries:

- User Groups: There exists two typical user groups: daily working transit users, and weekend casual users. While 70% of passengers call Uber/Lyft during weekdays, students and workers become the main user group for carpooling because of its affordability.
- Carpool Preferences: Compared to carpooling with total strangers in a tiny space, users were more willing to carpool with someone who they knew.
- Traffic Situations: In most cities in North America, residents using carpooling services preferred living in a suburban area, or in business clusters within the inner-city. Pick-up and drop-off points were the main contact areas.

After the discovery phase, a field probe was initiated: Pilot User Observation or User Shadowing (Ortiz, Ramnarayan, & Mizenko, 2017) were not utilized because of issues of time. Instead, we use a method like Service Safari, which allowed students to speculate on the possible future service scenarios by analyzing the points which have similarity and differences with current service scenarios. The Bodystorming method (Schleicher, Jones, & Kachur, 2010) was also used to generate predictions of changes which might be happening in the near future with autonomous driving technology in current carpool scenarios.

Based on the previous survey, we screened four types of locations in the Atlanta metropolitan area: Clough Commons at Georgia Tech (the public carpool meet-up point on the campus), SunTrust Baseball Stadium (a large event-based public facility), Hartsfield-Jackson Atlanta International Airport terminal pick-up points (a large traffic public transportation facility), and midtown Atlanta area (ta business center with daily commuters). They all have different patterns of passenger movement and traffic intervention which served to broaden the students' experiences. They incorporated their findings from the field probe into a journey map (Fig. 2) to prepare for the next stage of concept generation.

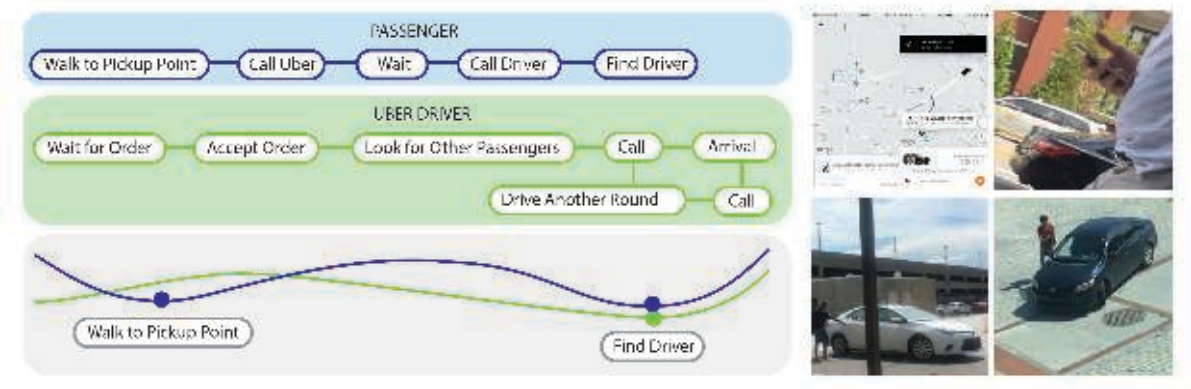

Fig.2 Field probe with bodystorming

The key findings from the field probe included:

- Different types of location and traffic at different times influenced the appropriate pick-up and drop-off models: "cars waiting for passengers" or "passengers waiting for cars".
- Comparing drop-off and pick-up processes would become the critical stage of the development of carpooling protocols in the future.
- Most passengers were willing to walk a short distance for picking up providing more flexibility.
- With human drivers, they were willing to pick up passengers at non-standard locations. Autonomous vehicles however would have boundaries within their programming which would restrict the pick-up points to only the standard ones.
- Carpooling with human drivers is often inefficient in identifying their clients. Therefore, autonomous carpooling will need to make reciprocal identifying of car with client more efficient.
- Smartphones are the connection in the carpooling transaction and might also be the mediator in the future autonomous carpooling scenarios as well.

Based on these findings, students decided to focus on the pick-up phase of the carpooling process.

3.2 DEVELOP & DELIVER

At the beginning of the second phase of analysis, the second diamond, a workshop helped the class make the transition to the stage of developing and delivering design solutions. The environs of the workshop contained rolling boards with 20 photos of different types of vehicles in real street situations to simulate different pick-up configurations. Teams of two students, one as the user and the other as an

“intelligent agent”, engaged in the carpooling encounter using the photos to act as the pick-up points. The intelligent agent was conceived of as a shareholder in the future service model of autonomous carpooling. The agent received the autonomous vehicle’s pick-up information and appearance details by smartphone, and was required to use non-verbal language, such as graphic or text like the game Drawing Something, to give the user clues or hints on finding their correct car (Fig. 3). From this experience, students found graphic information to be more useful than text information. The form, color and branding characteristics of the car, and use of a street map with nearby landmarks was the most successful form of communication. Text information, like the license plate number, was successful when used to confirm the arrival of the vehicle in the later stage of the pick-up scenario.

Fig.3 Participants in the design game workshop

Based on the outcomes of the workshop, students generated new ideas, such as adding an interactive LED strip on the top of autonomous vehicles which can change color by a user remote control, or sharing the real-time image captured by the car’s front camera, to solve the identification problems. (Figure 4.)

Fig.4 Sketch examples of detailed interaction ideas

In the last stage of the process, students conducted a quick user test in a usability lab. Adding different settings to a scale model they tested the success of their design solutions. The testing environment (Fig.5) put two students in a defined space separated by a panel so they could not see each other but could verbally communicate with each other. On the panel was a built scene of a “typical urban street” with 4 pick-up points, 7 model cars,12 laser-cut trees, and some LEGO constructions. The experiment was conducted with the collaboration between the operator/researcher student and the observer/user student. In the role-playing experiment, he operator/researcher controlled a smartphone and shared the real-time video call from its camera to simulate the point of view (POV) of the fictitious user in the maze. The observer/user student monitored the shared video on a laptop computer and then told the operator/researcher the next moves to make to arrive at the correct vehicle.

During this role-playing experiment, three possible solutions were identified to improve on the success of the process:

- Use only the color and LED coded color of the car to identify it;
- Use the 360-degree photo captured by the car to identify it;
- Share the front view camera image of the car to identify it.

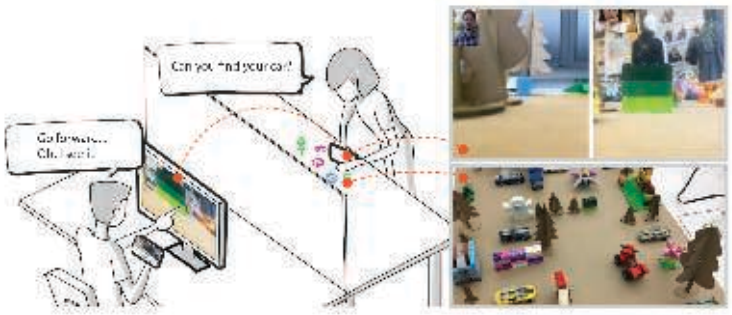

Fig.5 The space layout and settings of interactive service scale model testing

Among the five teams in the role-playing experiment, the most successful method for locating the correct car was by making use of the 360-degree photo. Three teams also found the car through the interactive colored LED signal but it took a longer time. In the debriefing after testing, all teams gave quite positive feedback to the usability testing and derived the following insights from the experience:

- The 360-degree photo was very helpful in enabling the user to locate their vehicle in a larger pick-up area with many vehicles because it provided more information if the user wasn't familiar with the surrounding environment.
- In the confirmation stage of identifying the correct vehicle, the front camera and LED signal were more useful because of the tangible interaction. With the front camera photo, the user could see themselves on camera approaching.
- In considering combining the front camera and the LED signal, the LED should be utilized first as it is easier to see when the vehicle is still moving.

Through the user testing with a scale model, students compiled three interaction flows based on different user's behavior patterns (Fig.6.b) and UI design (Fig.6.c).

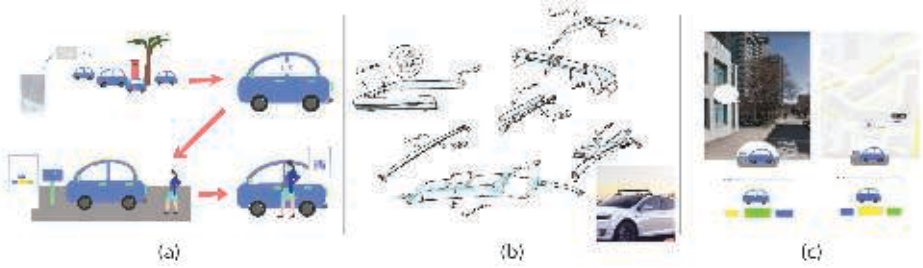

Fig.6 Design output examples: (a) User journey map of the service; (b) Industrial design of related hardware; (c) UI design of the App

4. DISCUSSION

From this case, we found that using empathetic methods such as storyboarding models within the protocols of the Double Diamond process was a good way to explore the future large-scale service

design problem, especially for service design conception and evaluation. The key idea of the process is about grounding ideation into reality as early as possible.
In this study, grounding the imagination in the first iteration (the discovery & definition stage) allowed students to suspend any preconceived ideas. This whole process is somewhat similar to the commonly used Service Safari and User Shadowing. The difference is that we aimed to explore the possibility of future scenarios and integrate them into the field probe study. By this way, it makes the use cases become clearer and more precise by framing the service boundaries and user experience issues.
To response the research question 2, we introduced the role-playing workshop and usability lab testing of the interactive scale model in the second iteration (develop & deliver stage) to iterate the design solution. This is similar to the Experience Prototyping (Keane & Nisi, 2013), but our approach was more focused on extending the solution space with the possibilities of touch points, for example the smartphone, the car's exterior display and other interaction channels., and then investigate various combinations of them in detailed scenarios by scale models and interactive role-playing. To bridge the gap between the high-level scope of the future service and the tangible form of the product-service system, one of the key issues is how to provide technical specifications for the development of physical and digital products required to deliver those services, which is especially critical in future large-scale service design.

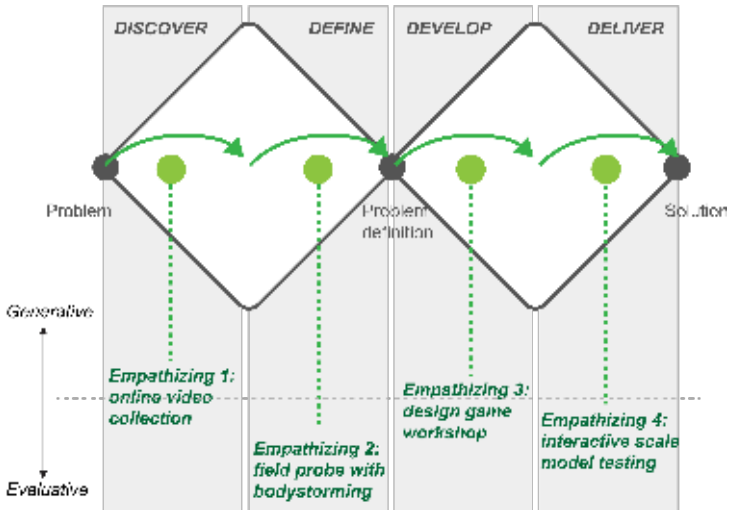

Fig.7 The zigzag of design empathizing

Even with four different empathizing methods in the flow, each had different values in the progress of the design process. The two stages of discovery and development which made use of the collection of online video stories and collective experiences in the design game workshop generated more open-ended idea exploration in the other two stages. And, the field probes studies and the interactive model testing allowed for more evaluation of the different scenarios and resulted in more innovative solutions to the identified problems in the other empathizing stages (Figure 7). Our conclusion was that the zigzag scheme between generative and evaluative methods was a very effective strategy. The zigzag scheme between generative and evaluative methods could be an effective way to help students grounding their imagination to future reality with design rationale.
Testing usability with an interactive scale model was one of the core steps in the process. In the field of architecture and interior space design, the scale model is widely used in the expression and deduction of design concepts as an impromptu design tool (Murer, Grah, Smit, van Rheden, & Tscheligi, 2017). Taking the idea of making prototypes 'early, ugly & often' in this case, we used paper-cutting models, Lego and other off-the-shelf materials to create a conversation space between the researcher and the user. In this conversation space we were able to simulate communication connections between the users and the interactive interfaces in the vehicles.

5. CONCLUSION

Future service design requires a comprehensive design and development process. Even in the classroom, it is very necessary to provide students with a set of methods to allow them to practice empathetic processes to generate design solutions. In this paper, an outline of the Double Diamond process with empathizing features was summarized based on a project undertaken by graduate Industrial Design students in the area of service design of user needs in the system of autonomous vehicle carpooling. In this studio project, a combination of storyboarding, field study and role-playing games were combined to explore the pick-up process of carpooling; an interactive model was then configured to test the protocols and to generate solutions. In conclusion, the project allowed students to practice empathetic methods which resulted in them developing more robust solutions.

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