

Motivators over Modes

Diverse Student Team Drives Leading Automotive Company's Evolution to Mobility Platform

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Abstract—A diverse student team has collaborated to form a vision of a shared car or multimodal travel future, shared in this Work in Progress Innovative Practice Paper. This shift yields more financially efficient journeys, leaving people to sacrifice other benefits of travel perhaps without knowing it. The focus was to bring joy back to these unemotional journeys in three different ways: bringing a virtual reputation to physical spaces that lack it, visualizing explored and unexplored routes in commuter journeys, and creating more robust profiles of passenger preferences.

Keywords—Diverse team, discovery, creativity, innovation, emotion, motivation, storytelling, mobility, transportation

I. INTRODUCTION

The goal of the Stanford Mobility Project, as presented by Ford's Innovation Center in Palo Alto, is to understand and anticipate the future of constantly-changing transportation landscape, particularly, cities' move to multimodal transportation options. We define multimodal transportation as any journey that requires two or more "modes" of transportation to complete, whether these modes be car, train, bus, Uber, walking, biking, or any number of other creative ways to get around. Our understanding is that the world is moving towards more multimodal transportation and less individual car ownership, therefore expanding our research to the shared spaces that this multimodal future often entails.

Before examining the specific ideas and solutions that our industry-affiliated team created, it is useful to understand the way in which this team works. Our process was as intentional and reflective as our research and will be integrated into the findings of this paper.

The team consists of three Stanford University Juniors, and one recent graduate, for a multi quarter "Engineering Problems Independent Study" class taught by their Instructor in the Mechanical Engineering Department. This team's diversity spanned ethnicity, major, and age, and these differences proved invaluable to working together and creating unique and cohesive designs throughout the process. Through this paper we intend to outline our research both to present our learnings, and to share our process as a model for future collaborations between industry and academia.

II. OUR DISCOVERY METHODOLOGY

A. Insights and Rituals

Ideas come from insights: patterns that we find in the world, that resonate with groups of people, even if they don't realize it. It is our job to discover these and intentionally design for the gaps they create and problems they deepen [1].

Through our process of learning and building, we have unintentionally discovered rituals that shape how we think about innovation [1, 2]. As a team, we align our thoughts and develop ideas by sharing stories, language, and prototypes. As much of our research consists of qualitative data, we hold stories and insights about humans central in our process. We have found that someone who has no background or stake in an idea is more likely to appreciate its value when they understand the *story* it was inspired by. By consolidating these many stories, we create a unique *language* of fabricated words that hold meaning inside of our group and make abstract concepts tangible. These also act as "headlines" or short summaries of a topic that make it easier to keep many components in our heads at once. Finally, we share solutions or fixes to the needs we hear in stories through *scrappy prototypes* and visual depictions. The simple act of standing and drawing on some surface helps the speaker get out their thoughts while also giving the listener a tangible artifact to follow, almost like an impromptu slide deck. Prototypes of any scale make an idea extremely tangible, therefore making the decision on how to move forward on it (or ditch it), easier.

B. Scrappy Prototypes

We took many visits to the Ford office to understand and work in harmony with their process (while scrappily fumbling with quick prototypes, trying, and shaking it up in the process). Our team noticed that the office displayed beautiful, high-fidelity mockups such as recently-won patents and fully 3D rendered interiors. We revolve around artifacts as a team and so we appreciated those objects; we also see the value in thinking and testing ideas quickly and almost effortlessly. The common wisdom is that a user should feel like they can poke holes in your prototype to really show how they feel. Thus, we were exploring and applying a scrappy prototype approach.

C. Experience Prototypes

Specifically, our prototypes come in the form of paper prototypes, clickable mobile mockups, clay modeling, “wizard-of-oz” experiences [3], visual surveys, open-ended conversations, short ethnographic interviews [4], and graphical data analysis. The last two methods focus on quantitative data analysis using open source data sets. These methods have in common the following value: show an idea as quickly as possible to converge the team’s thoughts but not make the solution final or permanent.

III. OVERVIEW: THREE STORIES

A. Virtual Reputations of Physical Non-places

How can we re-instill a sense of ownership and history to buses, Uber Pools, Chariots, shared bikes etc.? Shared transportation spaces lack the sort of ownership and therefore emotional value or attachment that people have with their cars. How can we use graphic digital/physical experiences to bring novelty and joy back to interaction between users and their spaces in a future of decreased car ownership?

B. The Exploration Calculator

How can we use the history of someone’s movement (tracked by the iPhone app ‘Moves’, exported to Google Maps) to encourage people to explore their surroundings and break the barriers of their usual routines? Personal, artful data visualization can inform consumers of unnoticed habits, given the idea that data is a critically important component to behavior modification. How do the qualities of the line portraying movement (thickness, flow, color, transparency) impact the user’s perceptions of their past and future travel?

C. My Route

How can we help riders better understand the factors going into choosing a specific transportation mode? Is it possible for an algorithm that incorporates user data and preferences to learn to match a person’s innate desires and needs in a transportation experience with the mode of transport, route, and destinations that will maximize fulfillment of their motivation?

IV. FINDINGS

A. Virtual Reputations of Physical Non-places

In our constantly evolving and globalizing world, places are becoming more transient and multipurpose. Transportation is getting cheaper and easier with many options and almost no work required from the passenger. There is an economic desire to group people that once traveled separately into shared transportation that devalues one’s attachment to these modes. These changes may impact the nostalgia attached to these spaces and therefore create fewer spaces with which inhabitants feel a connection [5]. Furthermore, a loss of ownership of our transportation, especially in cities, creates a situation posed by Marc Augé’s *Non-Places* in which “people are always and never at home.”

That is to ask, are we constantly traveling in many vehicles (Ubers, Trains, Subways, Buses) that are accessible to all but therefore not a home to any? We are treated as anonymous beings needing only to get from one place to another and therefore we lose sense of what we sacrifice for the economic and time benefits of efficient transportation systems.

We wondered what it would look like if the lack of ownership of the physical spaces in these systems created an opportunity to grow into the customization of virtual space. The massive global popularity of the mobile game, *Pokemon Go*, has brought up many questions around how virtual space is treated. *Pokemon Go* creates a multiplayer world in which users collect creatures by viewing them through augmented reality, inspiring our prototypes. Real businesses have paid to have “PokeStops” placed outside their shops in the virtual world as to drive more foot traffic to their real store. Private establishments such as museums have raised complaints at the use of their virtual space that causes people to roam into their property. Needless to say, there is a more widespread understanding of a virtual avatar and the connection of the physical and digital worlds today.

Another source of inspiration on this journey was the idea of crowdsourced visual creativity such as the pixel prank in Figure 1. Reddit ran an April Fool’s Prank in 2017 in which they allowed users to change one pixel at a time of a global 1000x1000 pixel grid. The results were astounding.



Figure 1: Reddit Place

Even without guidance or instruction, groups formed, battles were waged over pixel territory, and the place evolved. This is a form of virtual, and therefore arguable harmless, graffiti that tethers virtual actions with a physical act.

How do *Pokemon Go* and *Reddit Place* relate to cars? Going back to our central findings, people spend hours in transportation each day often idle without creating the memories and emotions that used to come with driving a car. We propose a way to engage with your surroundings and connect with transportation through the creation of a virtual space mirroring the necessarily sterile physical space. Staycation is a provocation for a world that gives reputation to shared resources and vehicles in a city. We wondered how you could give a sense of ownership or responsibility to those who lack it with public transportation, through rapid iterations on app layouts in Sketch. The first concepts, shown in Figure 2 took thirty minutes of actual building and were shared with the team on an actual iPhone in context.

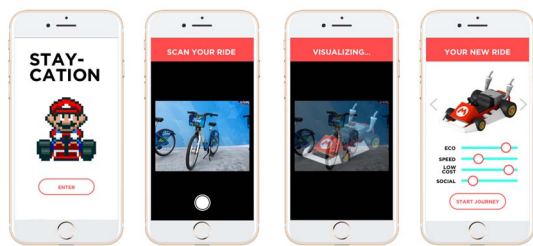


Figure 2: Prototype - virtual/ physical interactions

Let us take the California Bay Area Caltrain as a case study of a common public transport system. Imagine if each train for commuters had a reputation. It was depicted as a pixelated train as seen in Figure 3. Each day, as more passengers rode the train, they would “unlock” new ways to customize this collective representation of the train, adding their own personality or memories to the artifact. They could go back in time and see how their moods correlated to what they added to specific trains. The monotony of transportation could be removed with the addition of these moments of collective creativity, personal connection, and visually appealing evolution.

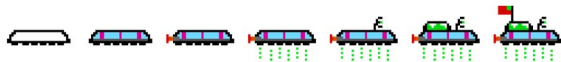


Figure 3: The evolution of crowdsourced virtual artifacts

This idea can be further expanded to add more value to a city. An easy start is in using the data to understand the people that ride public transportation and even gain feedback through this unconventional game, rather than often unanswered surveys. Learnings in the virtual could even be carried over to physical changes such as theming certain cars, repairing facilities, or understanding popular routes. Overall, Staycation aims to create a city with public transportation that is seen more as a community and collection of memories to remember rather than experiences to forget.

B. The Exploration Calculator: Ownership of the Intentional Journeyer

In addition to exploring the ways people already set in motion travel from A to B, the idea behind how these journeys are initiated should be analyzed. The Exploration Calculator is a tool that plays on using the psychology of motivation and action for behavior change along with artistic principles to give users an opportunity to break habit.

This idea came from an insight from a personal quest of reflection on the transportation and movement of one student co-author on the team. After tracking her geolocation for a month, she drew a general line of motion for each day, and placed them in a singular image shown in Figure 4..

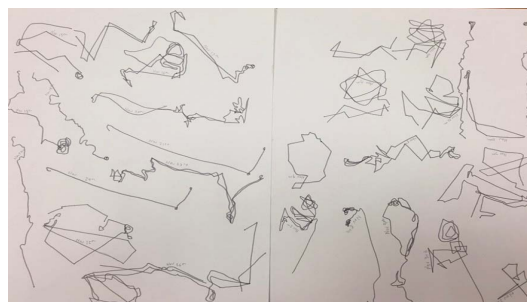


Figure 4: Movement in November - one day per line pattern

This image depicted in Figure 4 has power. It excited her to find out just how visualizing personal transportation and movement data can be influential to recognize patterns, routine, and uncover new areas of choice for the user. Additionally, the artistic value of the image ties directly into the type of influence: how do the simple and complex lines make you feel about the journey-- stressed or surprised or calm? How does the spacing between two mirroring lines affect your ideas of success around a round-trip journey? The aesthetic of the image often prompts the most interesting and provocative insight about individual habit and preference.

The Exploration Calculator in Figure 5 is a tool that seeks to provide similar visualization by providing aggregate movement data by week, month, or year to a user.

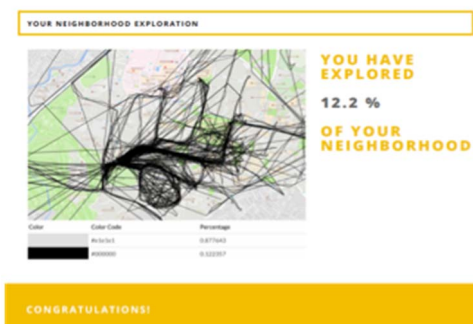


Figure 5: Exploration Calculation Prototype

This ‘calculator’ would use image processing from the information sourced from location trackers and mapping applications to calculate information about a user’s transportation. It can tell you the percentage of your neighborhood, city, or state that you have made your mark on. A simple division of the black lines that represent a user’s tracks, and the portion of background map that is able to be traveled upon (roads, bike paths, open public spaces) results in definitive percentages about one’s history of movement and exploration shown in Figure 6.

One can choose if they want to see their ‘explorable territory’ in terms of roads, or also in terms of green spaces. One can also limit this ‘explorable’ area to paved roads for wheelchair or stroller accessibility, or include bodies of water or backcountry areas.



Figure 6: Experimentation with Route Visuals

Our team iterated different ways in which the properties of the images we display have potential to inspire this type of change. When we see this image we subconsciously take into account the thickness of the line, the transparency, the hues of color, the flow or rigidity of the bends, the composition of how we frame the majority of lines, and much more. Each of these aspects makes us feel differently about the data we are seeing.

The idea of *data as art* is integral to the Exploration Category, as well as each of our prototypes bringing back ownership to the journeyer [6], [7].

C. My Route

A final area of exploration has been the idea of creating a digital service that helps people actually choose their modes of transportation in order to better align with their motivation for travel. This idea was first synthesized through an app prototype called “motivators over modes” which would ask users to rate different travel values (for example, would the user like to make friends on their journey? Go to some new place? Be environmentally conscious?) in order to create a more informed journey map. An example of how one could visualize these “motivators” can be seen in Figure 7.

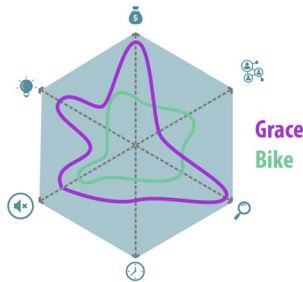


Figure 7: Illustration of Motivators

This visual is an iteration of the idea of bringing ownership to a multimodal journey by quantitatively defining what people value, and displaying it in an intuitive way. The user should see the graph as a personal reflection of what they care about, and see it as something that is allowed to change with time as well as based on the situation. Ideally, graphs like these would help users to better align their preferences with what they actually do, and would help companies like Ford intuitively tell their users what they hope their product is built for.

This idea could go in many different directions. From a maps application that provides more intuitive directions, to a social media app that provides information about how friends are traveling. In Figure 8, two screenshots from a mockup can be seen. They show how an app might suggest different routes based on a user’s motivation for that day.

STANFORD → FERRY BUILDING		STANFORD → FERRY BUILDING	
BEST TIME	43 MINS \$50	DRIVE	10 mins parking in the lot next to the caltrain station buy a ticket from zone 3 to 1
EXTRA EXERCISE	54 MINS \$20	CALTRAIN	45 mins \$7 sit in the less full bike cars bring your headphones
SOCIAL ROUTE	51 MINS \$25		
MY OWN SPACE	43 MINS		
SAVE THE ENVIRONMENT	43 MINS	WALK	10 mins

Figure 8: Prototype of motivation-based route generation

V. CONCLUSION

A. Storytelling Virtually

Intentional storytelling is central to our process so we iterated through many versions of methods to share our learnings including this paper, videos, wall-sized posters, and most recently, our website. StanfordMobility.com is a dynamic collection of our stories, shared language, and prototypes that expresses our ideas through sound, pictures, and text. It’s content fits with the mission to build ‘scrappily’ while the story of its creation displays our desire to evolve constantly. On the site is a final, unconventional video summary showing work completed during our first three months of the Ford affiliation. The format allowed the company to get an intimate glimpse of our process through voice-overs and rapid sketches. Under the hood, the website is a custom-built site using no templating libraries or outside structures, purposefully designed to fit our team’s quirky and creative personality.

B. Academic Team Aligns

This process was a learning experience for each and every member of our team. With regards to practical applications - getting students to actively engage in their reasons (language and narratives) within their unique way of pursuing invention and discovery (process) is crucial to determining their own ‘motives’ and ‘modes’ of engineering innovativeness [9]. By creating a diversity of ideas regarding multimodal transportation, our team was able to develop a framework for iterating on and sharing ideas [10] in the context of an affiliation with a major car company and understand how the classroom approach to research fits into a company. A natural examination emerged for self and team identified values facilitating engagement and alignment. Our process, while winding and indirect, resulted in a wonderful set of learnings far greater than could be written in this short paper.

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