The Mindful Commute

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ABSTRACT

The average commute time in the US is close to 30 minutes each way. In a world where we wouldn't need to "drive" the car while commuting, what would be the best use of this time? We see autonomous vehicles as an opportunity to help people reach wellness and high productivity levels. After all, commute time is not just moving from point A to point B. It is also about moving from a mindset to another. For example, from a family/relaxed mentality to a worker/productive mentality and vice-versa. We propose to use many sensors and multi-sensory feedback to personalize the in-car experience. We propose three types of interventions: in-car movement-based mindfulness, interactive storytelling for drivers, immersive environments for users of autonomous vehicles. We close with a discussion of the way to link values and mindsets to a "healthy" commute.

Author Keywords

Behavior change, mental health, values, interventions, autonomous vehicles, wearables, mobile computing, affective computing, commute, mindset

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

As technology becomes pervasive, we can only imagine how much we can do to be and feel better. The reality is that designing behavioral interventions that work is not a trivial challenge. Engagement is a core problem that psychology theory has not learned how to solve yet. Compliance with therapy or healthy behavior routines is low, due in part to busy work or family-related agendas. Competing technology businesses aim at capturing "screen" time. Social media, TV, games, compete to get people's attention outside work and family. Many times health activities end up postponed or relegated. Mental health

presents a difficult design challenge. It is contextual, it changes with the person, and it is a long-term phenomenon. Opportunities to engage people are scarce and demand attention and introspection from the patient. We believe mindful commute technology is a tremendous opportunity for embracing this problem. Commuting, which in the US consumes roughly 1 hour per day, is a unique moment we have to engage people.

Currently, driving takes most of the attention from the driver. Intervening, under those circumstances, is harder but not impossible. One opportunity would be to use their mind to perform mindful exercises or to be engaged in conversation with other humans or conversational agents (chatbots). The content of these conversations could benefit from language-based therapy such as Cognitive-Behavioral Therapy [3] or Narrative therapy methods [17,24]. If we can engage people in reframing unhealthy life-events or mindsets, we could aim at preventing mental and physical health disease. Another option would be to perform somatic or meta-cognitive therapies. We want to explore mindfulness-based movements that are not distracting but effective. Some interventions leveraging movement are guided breathing, guided acupressure and Feldenkrais.

Our hopes do not stop in the current version of the commute. We foresee the world with fully autonomous vehicles. We believe these new mobility modes will change the way we commute. We expect immersive experiences with ambient displays and Virtual Reality (VR) to take over the vehicle. We could "bike", or "row", or even "fly" to work. We could play games, visit old friends, commute through the Great Plains or Tokyo, or even talk to fellow commuters sharing the journey. The sky is the limit, once the driver becomes a "user".

We propose that a healthy commute should be a complement to a healthy lifestyle in both ends of the commute trip. We propose interventions that adapt to people's mindsets around health. We want to promote "healthy" lifestyle through a positive transformative commute experience. We draw on personality theory, behavior change theory, human-computer interaction (HCI) and natural language processing (NLP) to implement a solution that tracks personal values and mindsets and uses them to suggest personalized interventions that can be delivered through novel in-car experience technologies.

BACKGROUND

In a driving scenario, permanent attention on the road is stressful, despite making us better drivers [15]. As a matter of fact, the Yerkes-Dodson inverse relationship between stress and productivity [4] shows that there is an optimal stress level to perform well. With mindfulness training, stress could be reduced, while maintaining attention in the present. In a car, we can implement technology that helps balance stress and attention [18]. Multiple sensors and actuators can be placed in proximity to the user to sense and learn from affect [5] and reduce cognitive load [2]. Beyond traditional psychophysiology sensors [11], the car could contain affective sensors such as voice [7], movement [23], pressure [12], or breathing patterns [25]. The use of in--car systems to engage users can leverage entertainment [18]. Furthermore, effective stress technology interventions [19,20] could be enhanced using multimodal actuation [21]. Multiple technologies for positive behavior change [6] could be repurposed in the car. We focus our attention on active mindfulness techniques, such as Feldenkrais [14] to support a better balance between attention and mindfulness. Finally, Virtual Reality (VR) technology [1,10], Social Media [8,13] and Conversational Agents (chatbots) [22] have emerged as powerful agents of personal change. We propose the use of these technologies in the car to take further advantage of an enclosed, personal space and a unique time to help reduce stress and acquire healthier mindsets.

DESIGN PARADIGMS

From car dashboards that make the most relevant controls automatically ready at hand, to automobile environments that help people transition mentally from home to work, we imagine a future in which vehicles understand and help shape human behaviors and mindsets. Today, our systems fall short of this vision, in part because human activities are too broad and multifaceted to be easily captured by designers and programmers. We focus on using the commute to design an association between mindful in-car exercises and healthy mindsets. We leverage social media, car sensor data, and smartphone data to design interventions for drivers and passengers.

Additionally, we challenge the way we think about the commute. We propose to evolve from a mere movement of people from point A to point B to an opportunity to shape behaviors and mindsets. For example, a "warm-up" mode from home to work would help people to manage anxiety and to be ready for a high-performance task or to deliver a speech. A "cool-down" mode would help people wind-down to have quality time with family or housemates. Over time, successful experiences coupled with proper feedback should contribute to creating healthy mindsets.

Our design process should extend the perspective of the commute to beyond the boundaries of the car. We propose to move a "driver" or a "passenger" mentality to one of a "user" in transition between scenarios. The latter allows the designer to focus on user expectations, engagement, and interventions. We want to remove the idea of a "master-slave" relationship and concentrate more on a car as an "agent" that bridges human activities. We want the car to become the modern phone booth where we can transform into superheroes or simply become a better person.

Despite the temptation to do so, we will not ground our design on current user needs only. We believe that the conceptual model of autonomous vehicles is different enought that we need to change this paradigm. Due to the novelty of our interventions, a focus on actual user experience is fundamental. We propose a platform to imagine new uses of the car, rather than an exploration of new car features. For example, the current "chariot" distribution of seats could be challenged, as well as the need for windows. In autonomous vehicles, the seats could be facing in any direction, or even removed to allow for movement. Furthermore, windows can be replaced with flat screens to deliver rich content. We plan to design these novel in-car experiences using a simulator and on-the-road wizard-of-oz environments.

Finally, the "mindful" concept in a moving vehicle opens up new opportunities for design. Being mindful means to be in the moment, or in touch with the immediate surroundings. Usually, stable and undisturbed locations are the basis for mindful exercises. In the car, we could recreate these "static" interventions. However, the better challenge is to enhance them via sensors and actuators to design active mindful experiences. For example, we can implement movement or haptic-based activities that help reduce stress, such as yogic breathing, guided acupressure [19] or movement techniques such as Feldenkrais [14]. The latter is a novel approach that we want to try to explore opportunities in current commute scenarios as well as autonomous vehicles.

Another design challenge would be to put users in contact with their environment, their communities, and their fellow commuters. We can exploit public information and social media to create awareness of the surrounding communities. For example, we could deliver immersive stories about the communities along the pathway. We plan to use conversational agents (chatbots) and Natural Language Processing (NLP) technology to generate mindful conversations. In fully autonomous vehicles, we could leverage Virtual Reality (VR) to enhance the stories delivered to the car. We could also push the limits of the imagination to make people "flight" or "swim" to work with well-designed VR experiences.

In summary, we want to design experiences for individuals to be more mindful of themselves, their families, their communities, and regions. In the following two sections, we propose some ideas for interventions for both drivers and autonomous vehicle users.

CURRENT COMMUTE - CARS

In the current state, where we need to drive our cars, or even when we think of partially automated vehicles, the key is to balance mindfulness with attention. It is clear that we cannot put people to sleep or to be distracted, to the point that it would represent a risk in case they are driving or if they are required to take over from a partially automated vehicle. Designing mindful experiences requires a continuous monitoring of behavior, affect and attention. We propose the use of sensor-actuator systems, such as active seats to deliver dynamic exercises. The movement should be subtle and limited to avoid any fatal distractions.

We plan to use vibrotactile and pneumatic actuators coupled with a sensitive mat that will allow us to measure the effects of the haptic stimuli along the three axes of movement (frontal, sagittal and longitudinal). For example, in the case of Feldenkrais, we plan to coordinate movement that helps people press, roll or bend some parts of the back, shoulders, neck, head and hips. In our preliminary experience, we can capture this using a mat that covers the whole seat, including the head rest.

Complementary, the car environment allows for multiple ambient displays to provide information about the status of the driver and their vehicle. However, the ways each person responds to feedback and interprets it vary from person to person. For instance, some will be interested in knowing the environmental impact of their driving behavior while others will be more interested in how the financial aspect. From prior research, we have been conducting in the field of ambient displays and behavior change for health and sustainability, we have learned that people will respond differently to feedback based on their culture, age, and value system. We believe that the feedback between the car and the driver can be improved using ambient displays with adaptive feedback.

Finally, stories told while on the road have narrative qualities like none other. Journey narratives are place-based and temporally anchored, and both the speaker and the listener are facing the same direction. There can be an improvisational quality as the storyteller responds to incidents and happenstance events that occur along the way. No two tellings of a story told on a car trip can be the same. We propose to capture oral histories told in moving vehicles, integrating multiple streams of captured information mapped to space, time, and critical events. We wish to investigate different ways to see how the linking of narrative at various anchors changes the way that we access and interpret the stories. This research has the potential to reveal how changes in the storyline or how the viewer's active engagement in the retelling of the story alters their mental health. Furthermore, we could deliver these stories or other content in a rich format, by incorporating actuators that add to the story. We can furthermore adapt the storyline to emotional cues or mental states. For example, we can use geo-referenced chatbots to deliver cognitive or emotional reframing exercises.

FUTURE COMMUTE – AUTONOMOUS VEHICLES

In the context of autonomous vehicles, we want to make the car an environment to help people transition between mindsets. We have some experience in this topic after directing two student teams in the d.compress class at the Stanford design school. Preliminary findings show that the opportunity to use an autonomous vehicle not only to sleep/relax or to work is latent. For example, we observed the effects of doing stretches to help people relax, but at the same time be aware and ready to work. Virtual or augmented reality can immerse users in soothing scenarios to help manage stress.

Our preliminary experience with VR in the car leads us to believe that there is an enormous potential to create immersive experiences. In a pilot, five out of eight participants did not get motion sickness. Three felt motion sickness due to the arbitrary movements generated by the car and picked up by the gyroscope. These users reported prior motion sickness in boats, roller coasters, or while reading in cars.

We tested two scenarios, a walk through Tuscany, where the user has full control of the experience, and floating through the Tennessee River, where the user has little control. In the former, users felt that the movements of the car, picked up by the gyroscope, were part of a "guided tour". Some people enjoyed this feeling while others found it rather annoying. In the river, people felt that the movements of the car were like current swirls which made people float sideways or backward. People found the river experience refreshing, enjoyable and relaxing.

To declare success, we must measure changes in mindsets over time. Our methodology will involve following up users before and after a regular commute. Understand their needs before the ride, and measure their behaviors after they arrive at their destination. We plan to work with drivers, but also with passengers, such as bus commuters, which could be a good proxy of the fully-autonomous vehicles. Finally, we need to understand the way people think about commute, health and their relationship. One way this can be achieved is by understanding people's values and mindsets and how they make decisions. We explain this issue in the following section.

VALUES AND MINDSETS

We hypothesize that by linking what people do value with being healthy, we can help people chose a healthier commute [16]. For example, if people find relaxation or entertainment have a higher value in the car, we could

deploy gaming interventions. If they value prosperity or mental acuity, we can blend meditation and/or yoga with studying new topics, and we can show them how exercise improve cognitive functioning. Moreover, we propose the design of mindset-driven interventions to foster a transformative effect that lasts and impacts positively lifestyles beyond the car. For example, we can focus our design efforts to modify stress mindsets to change the stress response to improve mental and physiological outcomes [9].

CONCLUSION

In summary we propose the use of multi-modal interventions to enable a mindful experience in autonomous vehicles. We describe ambient displays, multi-modal (scent, movement, sounds) systems and narratives to intervene current commuters. We explore VR, full body interaction, multi-mode agent interaction and a mindset and value-based system to support sustained behavior change during commute. Based on promising results from pilots we believe research on using commute time to reflect, relax and improve mindsets can become an integral part of future vehicles. We are excited to be leading the efforts to transform our in-car time into transformative experiences with a potential lasting effect.

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