Bilbord: a family-focused interactive system for driverless cars

BILBORD: A FAMILY-FOCUSED INTERACTIVE SYSTEM FOR DRIVERLESS CARS

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ABSTRACT

This paper describes an interactive solution for family entertainment in a driverless car involving personal entertainment devices that can be digitally and physically connected. We describe the design methods and process that led to it, the evaluation made by different users, and final result.

INTRODUCTION

With a driverless vehicle, a family can fully focus on each other while traveling. Yet personal electronic devices may prevent this interaction. This paper describes a research-based design process to create a possible solution to this problem, accounting for both the unique qualities of driverless cars and the realities of family interactions. We then evaluate the high-fidelity prototype developed from this design process.

LITERATURE AND THEORY

While the concept of autonomous vehicles has existed for more than 50 years (The Victoria Advocate, 1957), ongoing advancements have made self-driving cars a near reality (Wuensche, Luettel 2012). Projects like Google's "Self-Driving Car" are already on the road, testing how an automated car could work in real life (Guizzo). Even though the method for transporting ourselves on roads may evolve, research remains to be conducted on how the existing desires of drivers may change when there is no one behind the wheel (Gkouskos et al., 2014). What new opportunities for intercommunication could a driverless car present to families when a parent no longer has to focus on the road?

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Entertainment is a clear area of interest for many families, yet existing car entertainment systems, such as carputers, focus on self-entertainment and passive consumption. Amusement is highly individualistic, and varying ages, genders, and personalities within a family make it even more difficult to find shared activities. The confined space of a vehicle and the variable time trips take can create additional obstacles for enjoyable in-car entertainment experiences (Alt et al., 2010).

DATA AND METHODS

To explore possible solutions to the problem of family interaction in an autonomous vehicle, we followed a Divergence, Transformation, and Convergence design process that would permit the broadest possible set of solutions within the given constraints.

DIVERGENCE

To better understand the interactive possibilities an autonomous car could offer, we researched literature related to automated cars. From there, we used the KJ method to individually brainstorm and silently group ideas in order to explore both family-specific and car-related issues and design areas that could be addressed in a new technology. KJ is an ideal beginning method because it allowed us to explore the most important aspects of traveling by car without focusing on problems or solutions yet. KJ's silent method allowed everyone to express opinions unhindered, which coalesced around three main topics: Children, Activities and Feelings.

To better understand family needs, we created a number of character profiles for different family compositions, including extreme cases such as a group of children without adult supervision. From these various passenger scenarios, we can summarize a car journey as:

- sitting stationary
- in a closed space
- for a defined amount of time

These elements are no different whether a driver is present or not. Yet with the possibility of a driverless vehicle, a parent can pay attention to children rather than the road. To best explore how this attention could be directed using a technology solution, we focused specifically on families with young children, both because young children expect more attention from parents and are less capable of using current technology devices unattended. To further develop our perspective, we shadowed families with children to see how they behave inside cars. This method allowed us to examine the user group before framing the problem we were designing for. This helped us investigate possible concepts and get started on the transformation.

TRANSFORMATION

During the Divergence effort, we concluded that car travel is not much different than sitting a waiting room or around a dinner table, yet most activities performed in a car are anti-social. Thus for the Transformation effort, we decided our solution should help families to come together and interact with each other during a trip, not only for entertainment, but also to give input on where to go, where to eat, etc.

Using mind maps, we created different scenarios representing different trip types, creating a context for testing design ideas and verify their viability. One concept we chose to pursue further was incorporating one or more screens in our solution. We discussed using opaque screens as windows in the car, locating screens on the inside roof or on the back of the chairs and to let each user have a tablet that is connected to each other.

CONVERGENCE

From the Transformation, we began addressing feasibility. We felt that using windows as screens would work against having families interact together by directing users to face away from each other when using them. Instead, tablets would allow for the most diverse forms of interaction. Additionally, we conceived an ability to combine tablets into one shared surface, which would force all users to focus their attention at the same activity. We then started our convergence by taking the idea and making it a prototype.

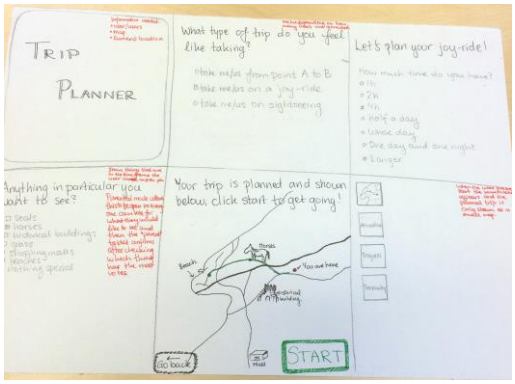

Fig. 1. A paper prototype and overview of the trip planner.

We began by making paper prototypes because it is simpler to edit and rethink minor parts of the idea (see Fig. 1). The choice of methods was pretty natural for us. By first getting all of the brainstorming down on sketches, it makes it easier to refine ones idea before completing it. Making sketches before making the paper prototypes of higher fidelity (see Fig. 2) made it easier to divide our idea and system into different sections.

A collaborative design workshop with users unfamiliar with the solution further developed our idea. While we explained the broad layout of the hardware system, we intentionally kept the description brief, instead preparing different age characters for role-playing using the DSD cards (Antle). This made the participants act out age-related behaviours and explore how the specific features would work better for them. We discover that some features were not suitable for users that did not wish to be involved at all, such as teenagers. The participants came up with new ideas. The different activities available on the tablets were presented to the participants for them to criticize them. The big surface created by connecting several tablets in different angles was also presented in order to evaluate it and explore the possibilities it led to. This was shown to provide a bigger engagement between family members in a similar activity and enhance physical communication complemented by the electronic one.

EVALUATION OF DATA

For evaluation, we created an interactive prototype based on the designs made in the convergence phase. This prototype allows users to walk through the different features of our system by clicking different parts of the screen and seeing resulting interactions

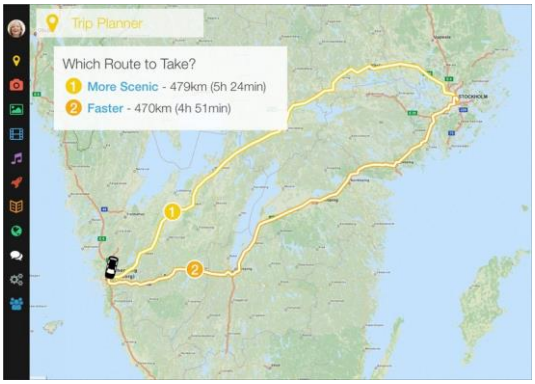

Fig. 2. A high fidelity prototype of BilBord, including functionality for choosing between a faster or more scenic route.

We then sent the prototype to families in different countries along with an online survey for feedback. Twenty-one parents responded, providing information about their own families' behaviours in cars, as well as their reactions to the interactive prototype.

Overall, the users liked the BilBord system. Users were particularly pleased with the ability to plan a trip route together, including selecting restaurants and creating a shared music playlist. The option to have shared games

and group prompts further enhanced the experience. They also considered the "parent mode" very valuable, with its granular access controls and ability to remotely control a child's screen so that parents can monitor and limit device use, while permitting autonomy for the children as well.

Most of the complaints were about the prototype itself and some interaction issues it had. Some people also felt this kind of system prevented traditional interaction and reinforced individual entertainment, even if the activity taking place is collective.

While the survey's open-ended questions allowed us to gather peoples' opinions rapidly from a variety of different cultures and backgrounds, the self-directed nature of the remote prototype evaluation suffered somewhat due to lack of user orientation. If we could have been present, perhaps subjects' confusion about the system could have been resolved more easily.

In the future, testing more polished digital prototypes in a more controlled environment might offer better feedback on the strengths and weaknesses of the system.

RESULTS

The proposed BilBord system consists of a set of tablet devices for each passenger. Using facial or voice recognition with its front-facing camera and microphone, each touch-enabled tablet recognizes the current user and personalizes the interface with age-appropriate games and applications, connected to a shared network to allow collaborative play and parental controls.

Potential functionality for the proposed tablet includes:

TRIP PLANNING

The map software allows the family to plan trips together. They can choose between different itineraries given the length or related experience (i.e. sightseeing). This allows them to plan what they want to see and enjoy the ride itself. Different information about the itinerary will automatically prompt when needed, such as the need to refill the gas or an interesting attraction nearby. This allows the family to enjoy their interaction while being in the car, not worrying about logistics.

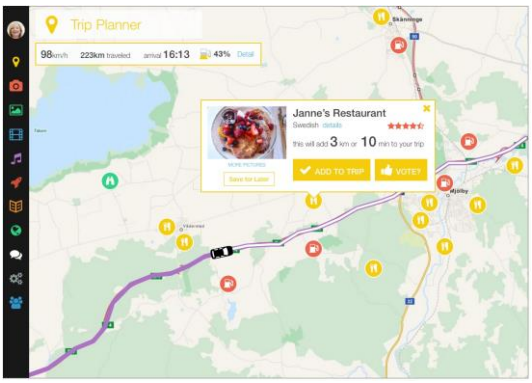

Fig. 3. The trip planner allows for collaboration along the way.

MUSIC SHARING

The music software consists of a shared playlist where all family members can suggest different songs. Each family member can either up or down-vote songs on the list, so that they disappear if they have a sufficient amount of negative votes (Fig. 4). This makes it possible to create a list that is appealing to the whole family. The system will balance the songs so that a significant amount of songs from each person gets played, and everyone feels represented.

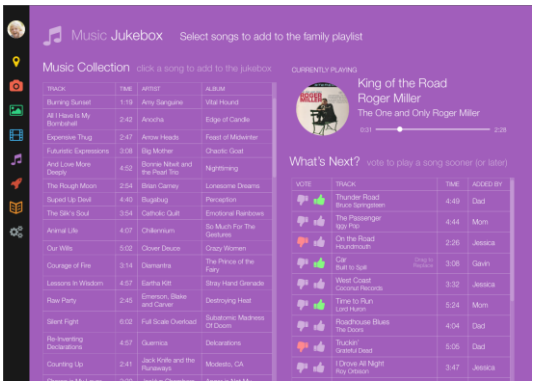

Fig. 4. Shared music playlists let everyone have a say

PARENT MODE

The parent mode is a feature that lets parents suggest or force the family to partake in an activity, such as choosing a restaurant, ordering lunch, adding music to the shared playlist or playing a game (Fig. 5). This system is focused on giving some power to the parents to regain their children's attention inside the car. This will allow the family to stay connected during the trip.

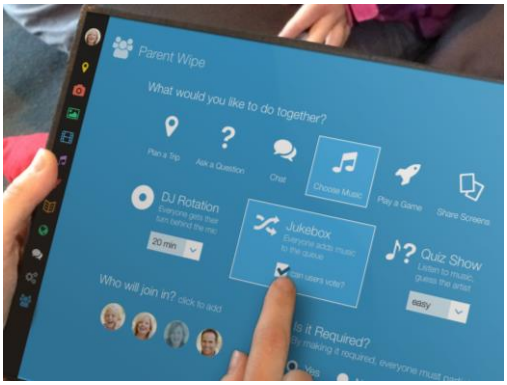

Fig. 5. Parent mode allows shared interaction across devices

GAMES

While the number of existing network games would provide a likely base for, we also conceived of three games specifically designed for this system:

"Draw Together" allows the family to sketch on the same virtual canvas either using their individual tablets connected over the network or by putting several devices together and creating a larger canvas.

"Who Said This" is a trivia game to see how well family members know each other. Each person writes facts

about themselves and the rest have to guess who said what on their devices. This game is especially useful for parents getting to know their children some more and engages the whole family.

”Photo Finder” challenges family members to take a picture of something specific they will see through the car window. The one that takes a picture of that item first will be the winner. This game engages the whole family in a competitive activity that also allows them to explore the environment around them while traveling.

BILBORD TABLE

Additionally, the devices can be physically attached to one another, creating a larger screen that can let the whole family interact together face to face. Trip planning, music selection, and especially games would be enhanced as interaction with one another is placed in physical proximity with one another.

Fig. 6. Multiple BilBord tablets connect to share a surface

DISCUSSION

POSSIBLE IMPROVEMENTS

Looking back at our process we realise disabled users could be taken into account. This could be done by building holders for the tablet into the car seats or having the tablet fold out as a tray.

The system could also be adapted for families with teenagers, who might not find our system that helpful for interaction. Teenagers may feel that it is more fun to connect to social media, which makes this system more suitable for families with younger children. However, this system doesn’t generally substitute physical interaction. It complements it by allowing the family to interact together with elements related to the car trip such as tourist and route information and playing music. The fact that tablets can be connected makes the game interaction resemble that of a board game but being enriched by technology.

CONCLUSION

This system was designed to entertain the family in a driverless car. We focused on the different problems and needs a family could have in a car, and we decided to focus on entertainment and social collaborative activities. The system was prototyped in various ways and presented to users for evaluation.

The user evaluation showed that BilBord was generally appreciated. Users enjoyed the democracy for choosing different activities, but surprisingly also appreciated the parent mode for imposing a decision or activity. This shows how parents want to interact with their without losing control. It also shows they want to be heard if there is something important to communicate.

This system provides a new dimension to traditional car entertainment systems as it enhances interaction and communication between family members. Unlike other pieces of technology, it can be used both separately and together in one or several common activities. The chosen themes adapt to the car environment as they control the trip, the car inner environment and the family entertainment. This system differs from traditional tablets with the remote parental control, the integration with the car to track the journey, and how it encourages common activities both in the custom group applications and physically placing several devices together.

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