Routine Driving Infotainment App: Gamification of Performance Driving

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ABSTRACT
Infotainment apps are software that combines information and entertainment. We propose them as a means for mitigating the tedium of routine drives. This paper explores the use of gamification and performance driving as design elements of an infotainment app that can transform the boring and mundane aspects of routine drives into productive, entertaining, engaging, and fun experiences. The app is a performance driving game called 'Driving Miss Daisy' [5]. We draw similarities in task and situation between performance driving and routine drives and suggest using performance driving as an information theme for the app. When played in the natural course of driving on the same trips to the same places, the sessions form the basis of multiple game plays (i.e., repeated practice) that lead to mastery of good car control skills. Aside from the education and productive elements, the game is designed to entertain and engage..

Categories and Subject Descriptors
H.5.2. [Information interfaces and presentation]: User Interfaces; K.8.0 [Personal Computing]: Games.

General Terms
Your general terms must be any of the following 16 designated terms: Algorithms, Management, Measurement, Documentation, Performance, Design, Economics, Reliability, Experimentation, Security, Human Factors, Standardization, Languages, Theory, Legal Aspects, Verification.

Keywords
Experience, gamification, in-vehicle infotainment, performance driving, skill mastery.

1. INTRODUCTION
Automobile manufacturers are exploring in-vehicle ways to make the journey less boring. One approach is to translate information about physical driving parameters into vivid animation. For example, the Chevrolet Volt's 'Driver Information Center' displays a ball that animates and changes color (e.g., yellow for sudden braking) based on a car's acceleration or deceleration [4]. Information media that make an intentional effort to entertain are known as infotainment apps.

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Routine drives are familiar and repetitive as they relate to driving behavior and driving route. By their nature, they are a task whose performance can be fairly automated. For the driver, this can be boring and it is a situation ripe for infotainment. Performance driving is driver training focused on developing optimal vehicle handling skills appropriate to the road terrain [9]. By their nature, the training involves repetition and practice of driving over a set course.

As a driving task, performance driving shares similar task and situational characteristics with routine driving. Thus, performance driving can provide the informational component for an infotainment app for routine drives. When combined with gamification [3], we have the entertainment component for the app. Tying entertainment to the informational presentation of the driver's performance can offer two benefits to the driver: a) relieve the tedium of driving and b) give real-time feedback of how well the driver is driving. This paper explores a novel way of entertaining drivers during routine drives by designing a performance driving competition game that uses the routine drives as the game context.

2. GAME FLOW
The game, named 'Driving Miss Daisy', chooses the game level for the players based on their previous performance. For a new player, the game begins with the 'easy' level that sets a higher triggering threshold for bad driving behavior and a lower triggering threshold for good driving behavior. The goal for the player is to drive a virtual passenger, Miss Daisy, to the destination safely and smoothly and to avoid hazardous and uncomfortable maneuvers like sudden braking (see Figure 1). When a drive ends, the player is given a summary of her trip and performance. She is also told how her performance compares to others on the same route (see Figure 2).

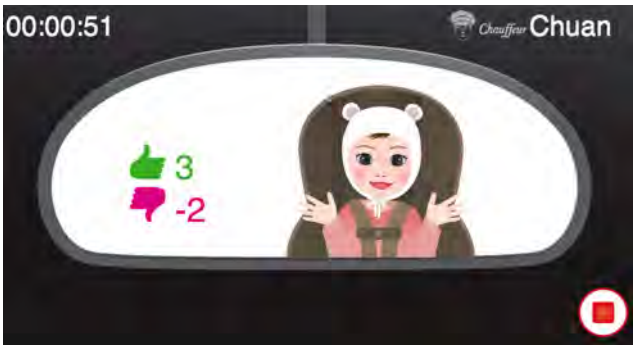

Figure 1. Driving Miss Daisy Display.

3. OUR GOALS

The design of the game app has three main goals. First, the game makes routine drives fun, entertaining and engaging experiences. Second, the game is focused on developing car control skills and therefore drivers should not be less cautious in driving due to playing our game. Third, the bonus aspect of the game is that it turns routine drives into productive and educational experiences where drivers can improve their driving performances in the course of playing the game repeatedly.

Figure 2. Game summary presented at end of drive.

4. GAME DESIGN

To achieve the goal of being entertaining, the app uses several game design strategies. First, the game is a role-playing game. Our game's backstory is inspired by the movie 'Driving Miss Daisy' [5]. Miss Daisy is a virtual passenger and the player is the driver and her chauffeur. She occasionally comments on the chauffeur's real and actual driving performance. Audio feedback is primarily used so that drivers do not need to constantly attend to the display [1].Our Miss Daisy is a young girl to make the character and the audio effect cute and playful. Different audio feedback snippets are mapped to each action for variety. More generally, our design envisions different persona for Miss Daisy; each persona offers different ways to entertain and models different feedback caricatures.

Second, reward mechanisms are incorporated to motivate user engagement. The game monitors smooth and hazardous driving performance. Smooth driving performance includes constant driving speed for a period of time (aka cruise control), driving within speed limit, smooth acceleration and deceleration of the vehicle, and smooth cornering. Hazardous driving includes going over the speed limit, sudden starts and stops, sharp cornering, and erratic lane changes. Our initial prototype implements all but the cornering and lane changes.

Third, competition is added to increase fun and engagement for players. More importantly, the game promotes good car-control skills over different road conditions including traffic and discourages the driver's bad driving behaviors. Players are able to compete with themselves by comparing performances over the same route on different days or compete with others through the reporting of their rank among all people that have played the game on the same route (see Figure 2). The game level changes over multiple game-play by comparing the player's current performance with prior performances. The percentage rank given at end of each drive reflects the position among all scores gained by other drivers on the same route (means the same start and end points) within the past week.

5. GAME DETAILS AND IMPLEMENTATION

The app collects driving data such as car speed from OBD, accelerometer readings from the smartphone, altitude from smartphone's GPS, and speed limit of the current road from Nokia's maps API service [6]. It analyzes the data in real-time to identify periods of good and bad driving performance. Game rules are designed to motivate the player to drive their vehicle with high performance. Our initial prototype does not account for traffic but we intend to incorporate traffic information and to adjust the thresholds based on heavy and light traffic [6, 7].

In the game's reward system, players receive thumbs-up and thumbs-down, accumulate game score, and earn "virtual money" on each drive. The three types of rewards play different roles in motivating participation. The thumbs-up and thumbs-down counts are shown to players as they drive, since it is the most direct and immediate way of giving feedback of driving performance. The game score is the weighted sum of smooth and hazardous driving incidences that help players understand differences in potential risk of hazardous maneuvers and the difficulty of performing smooth behaviors; thus making the game more realistic. "Virtual money" is accumulated over multiple rounds of game play with the initial balance being 0 for first-time players. It is a long-term measurement that is used to cultivate loyalty to the game.

The game is a HTML5 application that runs inside a Web browser on the smartphone. As the app involves mash-up of data and functionality from the smartphone, the car, and the cloud, HTML5 is a natural programming paradigm for the app. The app accesses driving data from the car's on-board diagnostics (OBD) and smartphone's sensors. The prevalence of sensor-packed smartphones and their co-presence in cars because of their owners make smartphones a natural platform to deliver infotainment apps. Car speed from OBD is accessed through a Javascript API that is implemented as a browser plugin. Altitude and accelerometer data are accessed via local Web services provided by the smartphone. Nokia's Map APIs provide, for example, cloud services for speed limit and traffic information. Finally, the phone is connected to a MirrorLink-enabled head unit via USB. We use MirrorLink [2, 8] technology to deliver the browser-based application running on the smartphone to a car's dashboard. Drivers can leverage the head unit's larger screen and interact directly with the head unit's touchscreen, which is safer and easier to use.

6. SUMMARY AND NEXT STEPS

Our infotainment app uses performance driving and game techniques to entertain drivers on routine drives. Our next steps include extending the game with different persona and features mentioned earlier (e.g., cornering, lane changes, traffic) that form the basis of our overall design. As well, we plan to obtain user feedback to verify our assumptions that: 1) drivers are 'entertained' while playing our game; 2) drivers are not distracted and operate vehicles with more caution when playing our game, and 3) drivers improve on their performance driving skills as a result of playing the game during routine drives.

7. ABOUT THE AUTHORS

Chuan Shi is a Ph.D. student at the University of Minnesota and a research assistant for the GroupLens Research Lab focusing on the design of movie recommendation systems that leverage folksonomy. His research interests include human-computer interaction, mobile interface design and recommender systems. As a 2012 summer intern at Nokia Research – North America Lab, he explored and developed mobile HTML5 automotive apps.

Hae Jin Lee is a Senior Researcher at Nokia Research – North America Lab. She likes to work at the intersection of various creative disciplines including psychology, sociology, art, computer science, and anthropology.

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Alison Lee is a Research Manager and Principal Scientist at Nokia Research. Her research spans a number of areas within HCI, CSCW, and WWW where she focuses on bridging across technical, design, and behavioral disciplines to create simple, engaging interactions with complex applications. Her current work explores mobile HTML5 apps, services, and technologies critical to mobile HTML5 app discovery and app ecosystem; focusing specifically on the automotive domain.

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