Sonopticon: Auditory Display in Automobile Interface Design

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ABSTRACT

displays are well suited for providing warn The multiplicity of interface elementssignams. Audio warnings can be detected wit automobile can present a hindrance to respiring drivers to look away from the road and safety. We prototyped and conduct keeping the eyes free [1, 2]. Also, auditor preliminary testing of an automobile ddisphays facilitate rapid detection [1, 2]. interface. Our key design principle wasomoptendomnienterface scales volume, panning, driver situational awareness while minduratingn according to the immediacy, locatio distractions. We aimed to accomplish athlissetvæskity of extra-vehicular occurrences. by exploiting the benefits of an audiRudymdnsplyqversions of audio displays do ex coupled with a minimized visual head uphedisplay-clack of a turn signal or hazard l (HUD). Results from our testing indicated thathe button as the radio memorizes a this approach could be an effective metalization, the ding-dong signaling keys left i improving driver safety in hazardous signations. and even the whine of the engine a climbs a steep grade. However, sound in gene

Keywords has been neglected in car interfaces. This is Automobile, auditory display, usabilityerhaped import due to the failure of speech in car models of the 1980's. display (HUD)

INTRODUCTION

PROTOTYPE DESIGN AND EVALUATION

Current automobile dashboards are becommendose three different techniques to evalue increasingly cluttered. Drivers must paynaptenomono determine if it could actually to the tachometer, speedometer, stereoenhance driver situational awareness. temperature controls, cellular phone, gas meter,

and road signs. Additionally, onboard Omipfirst assessment technique was a heurist computers, radar detectors, and GPS trawkingtion. Four subjects viewed video story maps contribute to driver information swendrads ofnSonopticon. These scenarios inc tactical aircraft, this problem has been arando been a mpending collision, an through the use of head up displays (Happisoaching emergency vehicle, and of a vehic Auto manufacturers are currently integrate noting spot when attempting a lane change HUD's into future car designs [3]. Subjects were asked to evaluate the system b on the following heuristics:

A NEW APPROACH: AUDITORY DISPLAY

The Sonopticon project is a prototype forSample and natural dialogue: Are the sign interface that would use spatialized soundproweiglesing to the user easy to understand a a "smart" mixing system to alert the driveristionquish from each other? When a sour potential road hazards, cars in blind spoits, played, is it clear what the system is impending collisions, and other extra-vehicudammunicate to the user? situations. Our system aims to exploit the

advantages of auditory displays as companed cognition rather than recall: When the visual displays. As described in [2], auxilistroemy provides a signal to the user, doe signal contain any other meaningful commented that they did not use the system I information than the user needs to know@h to determine if this issue presented significant problem.

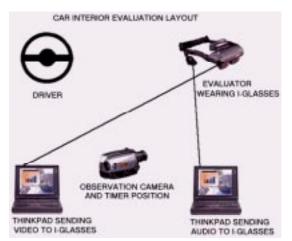
3.) Robustness: Is necessary information conveyed to the user in more than of ${\bf ORONCLUSION}$ the information?

manner? Is the user presented with @nroptimoned evaluation of the Sonopticon as to which way they would like to preceive interface indicates that the integral advanced auditory displays into automobile interfaces can potenitally enhance driver sit

Next, the subjects were led through a timantmed sud In particular driving scenarios, session in order to determine how usersudwitted cues can be more effective than visu respond to the system while driving. Tadosnimulhatoroviding warning information without the experience of using Sonopticon whidesdravting from the driving task. A more each subject was placed in the passengerxtsenstiver evaluation with a larger group of moving automobile wearing virtual I/O slasses is necessary to verify these finding and earbud earphones. Virtual I/O glasses are devices which allow a user to view completeerences

graphics overlaid onto a real world sceneKrAmereef. An Introduction to Auditory in the figure below, audio and visual informption In G. Kramer editor, Auditory was sent to the virtual I/O glasses usingDinsptleDookSonification, Audification, and Auditory Interfaces. pages 1-77. Addison computers.

Wesley, Menlo Park, CA, 1994.



- 2. Sanders, M.S. and McCormick E.J. Factors in Engineering and Design. McGraw Hill , New York, NY, 1993.
- 3. Tufano, D. Automotive HUDs: The Overlooked Safety Issues. Human Factors 3 2 (June 1997), 303-311.

As Sonopticon displayed information about the driving environment, the subjects described what they thought the system was telling them. After the think aloud session, we completed our user testing by issuing a questionnaire.

EVALUATION RESULTS

The subjects found Sonopticon to be an overall positive user experience. They agreed that, although the prototype was somewhat "rough around the edges", the overall concept of Sonopticon was an engaging and useful tool for improving driver awareness. A chief concern of the subjects was the appropriateness, customizability, and form of the audio and visual signals. They expressed an interest in being able to customize the audio warnings to fit their own personal preferences. Some subjects felt that the graphic information presented was sometimes confusing and presented unnecessary information. There was concern that repeated audio warnings could become annoying to the user. They