

# Sonopticon: Auditory Display in Automobile Interface Design

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## ABSTRACT

displays are well suited for providing warn-  
The multiplicity of interface elements signals. Audio warnings can be detected with-  
automobile can present a hindrance to usability drivers to look away from the road  
and safety. We prototyped and conducted keeping the eyes free [1, 2]. Also, auditor  
preliminary testing of an automobile displays facilitate rapid detection [1, 2].  
interface. Our key design principle was Sonopticon interface scales volume, panning,  
driver situational awareness while mind duration according to the immediacy, location  
distractions. We aimed to accomplish and severity of extra-vehicular occurrences.  
by exploiting the benefits of an auditory display versions of audio displays do ex-  
coupled with a minimized visual head up display clack of a turn signal or hazard l-  
(HUD). Results from our testing indicated that the button as the radio memorizes a  
this approach could be an effective method. In addition, the ding-dong signaling keys left i-  
improving driver safety in hazardous situations and even the whine of the engine a-

## Keywords

Automobile, auditory display, usability, perhaps in part due to the failure of speech  
display (HUD) in car models of the 1980's.

## INTRODUCTION

Current automobile dashboards are becoming increasingly cluttered. Drivers must pay attention to determine if it could actually  
to the tachometer, speedometer, stereo, enhance driver situational awareness.  
temperature controls, cellular phone, gas meter,  
and road signs. Additionally, onboard computers, radar detectors, and GPS tracking  
maps contribute to driver information several scenarios of Sonopticon. These scenarios inc-  
tactical aircraft, this problem has been addressed as an impending collision, an  
through the use of head up displays (HUDs) approaching emergency vehicle, and of a vehic-  
Auto manufacturers are currently integrating blind spot when attempting a lane change  
HUD's into future car designs [3]. Subjects were asked to evaluate the system b-

## PROTOTYPE DESIGN AND EVALUATION

on the following heuristics:  
We chose three different techniques to evalu-  
Sonopticon to determine if it could actually  
enhance driver situational awareness.  
Our first assessment technique was a heurist-  
evaluation. Four subjects viewed video story  
scenarios of Sonopticon. These scenarios inc-  
an impending collision, an  
approaching emergency vehicle, and of a vehic-  
blind spot when attempting a lane change  
evaluate the system b-

## A NEW APPROACH: AUDITORY DISPLAY

The Sonopticon project is a prototype for simple and natural dialogue: Are the sign-  
interface that would use spatialized sound provided to the user easy to understand a  
a "smart" mixing system to alert the driver distinguish from each other? When a sour-  
potential road hazards, cars in blind spots played, is it clear what the system is  
impending collisions, and other extra-vehicular communicate to the user?  
situations. Our system aims to exploit the  
advantages of auditory displays as compared to recognition rather than recall: When the  
visual displays. As described in [2], auditory system provides a signal to the user, doe

signal contain any other meaningful information than the user needs to know to determine if this issue presented a significant problem.

- 3.) Robustness: Is necessary information conveyed to the user in more than one manner? Is the user presented with as to which way they would like to receive the information?

**CONCLUSION**

Next, the subjects were led through a session in order to determine how users respond to the system while driving. The experience of using Sonopticon moving automobile wearing virtual I/O devices which allow a user to view

an unobtrusive evaluation of the Sonopticon prototype interface indicates that the integrated advanced auditory displays into automobile interfaces can potentially enhance driver situational awareness. In particular driving scenarios, auditory cues can be more effective than visual cues in providing warning information without distracting from the driving task. A more extensive evaluation with a larger group of subjects is necessary to verify these findings.

**REFERENCES**

in the figure below, audio and visual information was sent to the virtual I/O glasses using computers.

1. Kramer, G. An Introduction to Auditory Display. In G. Kramer editor, Auditory Display: Sonification, Audification, and Auditory Interfaces. pages 1-77. Addison Wesley, Menlo Park, CA, 1994.

2. Sanders, M.S. and McCormick E.J. Human Factors in Engineering and Design. McGraw Hill, New York, NY, 1993.

3. Tufano, D. Automotive HUDs: The Overlooked Safety Issues. Human Factors 39 (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