INTRODUCING MULTIMODAL SLIDING INDEX: QUALITATIVE FEEDBACK, PERCEIVED WORKLOAD, AND DRIVING PERFORMANCE WITH AN AUDITORY ENHANCED MENU NAVIGATION METHOD

Ruta R. Sardesai

Sonification Lab,
Georgia Institute of Technology,
654 Cherry Street, Atlanta, GA, 30332, USA
rrsardesai@gmail.com

Thomas M. Gable

Sonification Lab,
Georgia Institute of Technology,
654 Cherry Street, Atlanta, GA, 30332, USA
thomas.gable@gatech.edu

Bruce N. Walker

Sonification Lab,
Georgia Institute of Technology,
654 Cherry Street, Atlanta, GA, 30332, USA
bruce.walker@psych.gatech.edu

ABSTRACT

Using auditory menus on a mobile device has been studied in depth with standard flicking, as well as wheeling and tapping interactions. Here, we introduce and evaluate a new type of interaction with auditory menus, intended to speed up movement through a list. This multimodal "sliding index" was compared to use of the standard flicking interaction on a phone, while the user was also engaged in a driving task. The sliding index was found to require less mental workload than flicking. What's more, the way participants used the sliding index technique modulated their preferences, including their reactions to the presence of audio cues. Follow-on work should study how sliding index use evolves with practice.

1. INTRODUCTION

Distracted driving has long been discussed as a common cause of automobile accidents. Emerging technologies have led to advances in the availability of information in previously "disconnected" locations, for example, information presented on handheld devices as well as within vehicles in the form of in-vehicle technologies (IVTs). These IVTs include both personal multimedia such as audio, video and images as well as driver-relevant information such as navigation, weather and traffic alerts, etc. Many of these IVTs as well as hand-held devices like cellphones are interacted with through list-based menus. In traditional interactions, the menu is accessed using a touch-based approach, requiring drivers to take their eyes off the road. Thus, interacting with IVTs adds a visually demanding process on top of the already visually loaded primary task of driving. The driver inattention created as a result is a cause for growing concern. In addition, while speech based systems are becoming more prevalent, users sometimes still require a recognition-based interface such as a menu system rather than a recall-based system used in voice command interfaces.

This paper presents research investigating the use of a novel multimodal "sliding index" interface, for use in navigating lists on a mobile device. In particular the novel interface is compared to traditional flicking interactions. By looking at participants' qualitative feedback and perceived workload across four interfaces, the research aims to determine if and how the multimodal sliding index facilitates list navigation during multitasking, such as driving while using a phone.

https://doi.org/10.21785/icad2017.029

Nees and Walker [1] point out that multimodal interaction might help reduce the overall impact of user inattention in multitasking interactions. According to multiple resources theory, spreading the modality of interaction across different senses helps users access "separate pools of modality resources" rather than over-burdening just a single pool, and results in an increase in performance [2]. By using various auditory cues, thus reducing the dependency on visual resources, performance has improved with multimodal interfaces [3,5]. In addition, enhancing basic text-to-speech (TTS) with advanced auditory cues (AACs) can result in lower workload than TTS alone [5], with participants showing a clear preference for menus with AACs [6].

In order to enhance TTS menus, research has been done particularly in the area of non-speech cues. These cues can be categorized as "menu *item* cues" and "menu *structure* cues." Item cues provide extra information about the characteristics (e.g., available vs. unavailable) of a given menu item. Spearcons, which are short sounds consisting of a sped-up version of a spoken phrase, are examples of item cues [5,6]. Item cues are particularly useful if the user (driver) is familiar with the contents of the menu. In contrast, structure cues provide enhanced information about where the user is in the menu, including concepts like scroll bars and spindex. The spindex (speech index) cue [6,7,8] is a set of brief sounds that correspond to each menu item, usually comprised of the sound of its first letter [7], thereby giving the user an overview of their location in the list. Both item and structure cue types can work well together, and with TTS. Such cues afford participants faster search times and lower subjective workloads [5,8]. Research has shown Spindex+TTS can decrease visual time off a primary task while driving, as compared to a visual-only condition [3,9].

1.1. Sliding Index

Spindex cues alone, however, may not enhance TTS auditory menus enough to allow for safe use of in-vehicle technologies (IVTs) within the driving context. Hierarchical menus, for example, may benefit from the addition of another interaction approach, such as a letter-based *sliding index* used in alphabetically sorted list-based menus [10]. This method, featured on the iPhone, allows for a coarser granularity of navigation than simply scrolling or flicking through the list. Users can jump to particular sections of a list by selecting the corresponding letter index. This index is implemented on the right border of the screen and becomes active when touched. By adding audio cues to the sliding index, creating a multimodal sliding index, it may decrease the negative impact of mobile device use while driving.

1.2. Current Study

The current study examined the impact of adding spindex+TTS audio cues to a sliding index, to enhance the use of auditory menus, particularly in the case of IVTs. Participants were asked to find a song from a list on a mobile phone, while driving in a low fidelity simulation. The menu search task was completed during four blocks of driving, using a different version of the phone interface in each block. This was followed by a semi-structured interview aimed at understanding user preferences towards the interfaces, use of technology in cars, and potential solutions to issues they faced in this space. In the study, we expected the combination of Spindex+TTS cues with a sliding index to be equal to or better than a Visuals-Only condition with regular flicking, as measured by perceived workload and preference.

2. METHOD

2.1. Participants

A total of 23 participants (18 male) with a mean age of 19.8 years and 3.5 years of driving experience took part in the research. All were required to have normal or corrected to normal vision and hearing, and a valid driver's license.

2.2. Apparatus

2.2.1. Mobile phones

Two different Android phone interfaces were used in the current study (see Figure 1). Both had the same alphabetical menu structure and the same list of popular songs from 2009. The flicking application ran on a Nexus One phone running Android 2.1 using Eclipse and was "flicked" for interaction. The sliding index interface was implemented on a MotoX phone running Android 4.4.4. Two phones were used due to difficulties in getting one to do what was required for both interactions but were considered functionally equivalent to each other, so as not to affect the results. In addition, the sliding index application included the alphabetical index at the side, which jumps to the corresponding sections of the list by tapping a letter in the index and the auditory cue of reading out the letter via spindex. Both apps were set so that using the sliding index or flicking would interrupt any currently ongoing audio. Alongside this, the lag between the selection of a letter in the sliding index and the actual jump to that section was minimized to facilitate scrubbing.

2.2.2. Phone interaction

At the beginning of each trial, the phone would speak the title of the song from the list that the participant was supposed to find. Using the cues—either the spindex sound of every song name scrolled through, or no sound—the user would move through the list in order to find that particular song. Once found, the user would tap the selected song. The interaction (user input) consisted of two types: Flicking and Sliding Index. The two display types were Visual-Only (i.e., no sound) and Spindex+TTS. Participants held the phones in their preferred hand throughout the study with their arms on an armrest to ensure the same location for each condition.

Performance on the secondary task was measured by time required to select the targeted item, as well as accuracy. The effect of the two interaction types and two sound types, as well as their combination, was measured.

2.2.3. Driving simulation

We used the Open DS "three car platoon task" in which drivers follow a lead car at a set distance, and the lead car slows down or speeds up at intervals, forcing the driver to do the same. The task was performed on a 40" LED monitor and controlled via a Logitech Driving Force wheel and pedals. The performance of the primary driving task was measured using lateral and longitudinal deviation along with brake response time.

2.2.4. Visual Behaviors

Eye glance behavior – defined as per SAE as the percent time spent by participants looking at the screen out of the total driving time [13] – was monitored with a FaceLab 5 contact free eye tracker.

2.2.5. Perceived mental workload

Perceived cognitive load was measured subjectively using the NASA Task Load Index (TLX) [4], collected after each condition. During the TLX, participants were asked to rate how much mental, physical, temporal, etc. workload they felt was caused by the tasks they had just performed on the driving simulation.

2.3. Procedure

Following training, participants completed a baseline-driving task with no other tasks. Then, participants performed each of the four combinations of Flicking or Sliding Index, and Visual-Only or Spindex+TTS in a randomized order. In each condition, participants drove for approximately seven minutes. The secondary task, during this time, was to navigate through a list of song names to find the target song using the interaction and auditory cues that corresponded to the ongoing condition. They were asked to devote 80% of their mental resources to the driving and the remaining 20% on doing the secondary phone task as quickly and accurately as possible. After the four conditions, there was a semi-structured interview intended to understand user preferences and to explore possible future work. This included current usage of technology in vehicles; which conditions they found

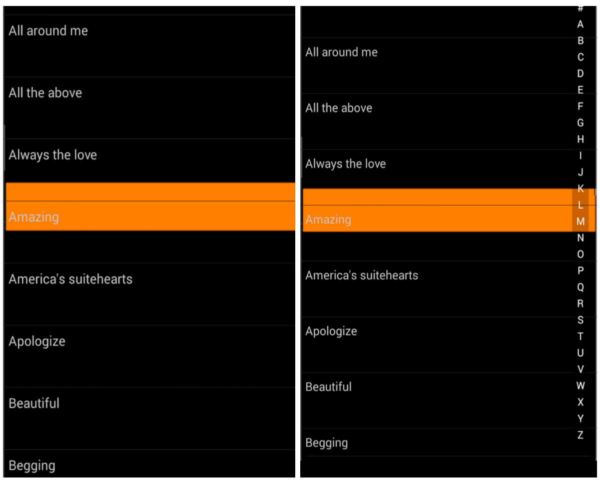

Figure 1: The two interfaces seen next to each other, with the flicking only interface on the left and sliding index system on the right.

the most and least preferable, taxing, or annoying; and a discussion about potential solutions to issues they had had with the interface.

2.3.1. Study design and analysis

The present study was a fully within-subjects 2x2 full factorial design. The factors were interaction type (sliding index vs. flicking only) and display type (visuals only vs. visual plus spindex).

Phone Accuracy (%)	Swipe		Index		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	92.17	9.98	92.17	6.00	92.17	7.99
Spindex-TTS	92.61	9.15	95.22	5.93	93.91	7.54
Interaction Type Mean	92.39	9.57	93.70	5.96	-	-
Phone Time (ms)	**Swipe**		**Index**		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	38390	4991	39838	5651	39114	5321
Spindex-TTS	40455	5184	40557	5110	40506	5147
Interaction Type Mean	39423	5087	40198	5381	-	-

Table 1. Phone performance values for accuracy (%) and average time (ms) to complete the task.

Longitudinal Deviation (m)	Swipe		Index		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	2.89	2.52	2.98	2.82	2.93	2.67
Spindex-TTS	3.03	2.52	2.48	2.02	2.76	2.27
Interaction Type Mean	2.96	2.52	2.73	2.42	-	-
Lateral Deviation (m)	**Swipe**		**Index**		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	0.27	0.16	0.31	0.17	0.29	0.17
Spindex-TTS	0.32	0.20	0.31	0.17	0.32	0.18
Interaction Type Mean	0.30	0.18	0.31	0.17	-	-

Table 2. Average values for longitudinal and lateral deviation (in meters) for the driving task.

Eyes on Road (% time)	Swipe		Index		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	73.27	26.82	74.99	25.28	74.13	26.05
Spindex-TTS	69.25	27.85	73.05	27.66	71.15	27.76
Interaction Type Mean	71.26	27.34	74.02	26.47	-	-

Table 3. Percent time eyes on the road for the four conditions.

To determine differences within each measure between the conditions, a 2x2 full factorial within-subjects analysis was conducted for interaction type and display type. Qualitative data collected through transcription during the interview were collated and entered into a database. These data were reduced by filtering only the significant content and emerging themes that were relevant to the context of the research goals [11]. Finally, thematic analysis was conducted on the remaining data in order to find emerging themes, particularly regarding potential solutions [12].

3. RESULTS

3.1. Cell Phone Performance

Values for cell phone performance can be seen in Table 1. In regards to accuracy there were no significant differences for interaction type $F(1,22)=0.66$, p=.426, sound type $F(1,22)=1.11$, $p=.304$, or any interactions $F(1,22)=0.95$, $p=.342$. There were also no significant differences in completion time for interaction type $F(1,22)=0.57$, $p=.458$, sound type $F(1,22)=2.10$, $p=.162$, or any interactions $F(1,22)=0.70$, $p=.411$. These results point to no differences between the conditions, meaning the index had no significant decrement on cell phone performance.

3.2. Driving Performance

Table 2 displays the driving task measures for the current study. The analyses found no significant differences in longitudinal deviation for interaction type $F(1,22)=2.41$, $p=.135$, sound type $F(1,22)=0.33$, $p=.571$, or any interaction $F(1,22)=4.14$, $p=.054$. There were also no significant differences found in lateral deviation for interaction type $F(1,22)=1.38$, $p=.251$, sound type $F(1,22)=2.14$, $p=.158$, or any interaction $F(1,22)=1.74$, $p=.201$. Although there were no statistically significant differences in regards to driving there was an interaction in longitudinal deviation that was approaching significance. These results point to a potential interaction of sound type and interaction type, with spindex index being the lowest deviation and swipe spindex being the largest, potentially driving this interaction.

3.3. Eyes-on-Road Time

There were no significant differences found for eyes-on-road time for interaction type $F(1,22)=2.02$, $p=.170$, sound type $F(1,22)=3.34$, $p=.081$, or any interactions $F(1,22)=0.28$, $p=.604$. This means no significant differences were found between the two interaction or stimuli types for visual time eyes on the road, the values of which are seen in Table 3.

3.4. Workload

For the TLX mental workload subscale there was a significant difference in interaction type $F(1,22)=7.45$, $p=.012$, with flicking having higher workload than sliding index. No significant difference for display type $F(1,22)=0.15$, $p=.703$, nor any interactions $F(1,22)=0.04$, $p=.852$, were found for mental workload. For the physical component of workload there was a significant difference in the display type $F(1,22)=4.93$, $p=.037$, with Spindex conditions being rated as having higher physical workload, but no significant difference was present between the interaction types $F(1,22)=4.03$, $p=.057$, nor were there any interactions $F(1,22)=0.07$, $p=.794$. There were no differences in the time/temporal portion of workload for interaction type $F(1,22)=0.01$, $p=.967$, nor display type $F(1,22)=0.20$, $p=.657$, but there was a significant interaction $F(1,22)=4.61$,

p=.043. This interaction was investigated using paired t-test post hoc analyses with Bonferroni corrections (decreasing alpha to .0083) but no significant differences were found. For total TLX workload there were no significant differences for interaction type $F(1,22)$=2.18, p=.154, display type $F(1,22)$=0.29, p=.595,, nor any interactions $F(1,22)$=0.18, p=.678. The data from the TLX scores can be seen in Table 4.

These results suggest the act of flicking results in greater perceived mental workload than sliding index conditions. In addition, conditions with Spindex+TTS resulted in higher perceived physical workload than Visual-Only conditions.

Total Workload	**Swipe**		**Index**		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	52.28	20.66	47.83	19.82	50.05	20.24
Spindex-TTS	52.72	20.53	49.93	18.66	51.33	19.59
Interaction Type Mean	52.50	20.59	48.88	19.24	-	-
Mental Workload	**Swipe**		**Index**		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	55.43	26.11	48.70	26.21	52.07	26.16
Spindex-TTS	55.87	24.62	50.00	23.65	52.93	24.13
Interaction Type Mean	55.65	25.36	49.35	24.93	-	-
Physical Workload	**Swipe**		**Index**		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	38.04	23.20	32.39	20.11	35.22	21.65
Spindex-TTS	42.61	25.89	35.87	22.60	39.24	24.24
Interaction Type Mean	40.33	24.54	34.13	21.35	-	-
Temporal Workload	**Swipe**		**Index**		Sound Type Mean	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Visual-Only	45.00	21.58	39.13	27.04	42.07	24.31
Spindex-TTS	37.61	23.64	43.26	26.48	40.43	25.06
Interaction Type Mean	41.30	22.61	41.20	26.76	-	-

Table 4. Workload values across the 4 conditions for total workload and the significant subscales.

3.5. Qualitative Thematic Analysis

A number of themes were found from user interviews that followed the completion of the four conditions.

3.5.1. Effortful flicking

Flicking, particularly without the added benefits of auditory cues like Spindex+TTS, was found to be tiresome, with several participants commenting that whereas they felt they had greater control navigating via swiping, they felt the *"…need to get to the general area without swiping so much," or that the "…longer scroll makes (them) more panicky."*

3.5.2. Issues with Sliding Index

Participants expressed the fact that using the sliding index had greater penalties than swiping, as they would *"…keep missing the letter and get to a whole different section.*" However, they also clearly believed that the use of the sliding index, either with or without auditory cues, helped them *"…pay more attention to the road."*

3.5.3. Issues with sound

It was interesting that a few participants *"ignored the sound"* as they felt that using auditory cues *"…takes more time, but less attention,"* a sentiment that echoes Ranney, et al.'s findings regarding a driver's willingness to engage [13]. In addition, participants who felt the auditory cues were *"…too distracting"* believed they would be more open to them *"…if the voice or pace were different."* A few were supportive of the condition with sliding index and Spindex+TTS, without the use of TTS, saying *"the repeated names were annoying."*

3.5.4. Familiarity with auditory cues

There was, of course, a general lack of familiarity with auditory cues. Participants were not *"…expecting index with sound"* and believed that *"[sliding] index plus sound threw (them) off."* Some felt that although "*…sound would be helpful if I got used to it*," they "*…wouldn't get used to it without using it outside driving.*"

3.6. User Preferences

User preferences for most annoying, least annoying, most attention paid to the road, least attention paid to the road and overall preference frequencies were measured and are reported in Table 5. While participants preferred using the sliding index as an interaction method, preferences towards the presence or absence of auditory cues was not as clear. This was interesting when coupled with the fact that participants believed they had the most attention on the road using the sliding index with Spindex+TTS auditory cues. Flicking as an interaction method was rated as being more distracting, though this was not reflected in quantitative data. Participants also found the use of Flicking combined with Spindex+TTS cues to be the most annoying, while sliding index with Visual-Only was reported as least annoying.

Preferences	**Spindex Index**	**Visuals Index**	**Spindex Flicking**	**Visuals Flicking**
Overall preference	9	7	4	1
Most annoying	2	0	12	7
Least annoying	7	10	2	3
Most attention to road	9	6	5	1
Least attention to road	3	5	8	7

Table 5: Preference rating averages across participants following their completion of the study with the 4 conditions from the post-study survey.

4. DISCUSSION

The present study found that although there were no significant differences between the four conditions in cell phone performance, driving performance, or time with drivers' eyes on the road, there were significant differences in mental workload between the conditions and some interesting qualitative results. This lack of differences in most of the quantitative measures is not necessarily a bad thing, as it showed that the novel auditory interface was no worse than the currently used interfaces. It may be that with more practice these results could change as participants become more familiar with the cues; that has been seen in previous work with these types of cues [8]. In addition, although not meeting the threshold for significance, the result found for longitudinal deviation of a potential interaction being present is nothing to ignore as it points to drivers with the spindex index being potential safer drivers.

One of the major takeaways from the current study that did meet the threshold for statistical significance was the lower mental workload for the sliding index interaction method while driving, as seen through the NASA-TLX data. This continues to point to issues with flicking as an interaction method, and while it may be the norm for lists on most hand-held touch screen devices, its use in driving scenarios is less than ideal, even when visual workload is not affected. In the qualitative analysis, the flicking method led to the most annoyance and distraction in general. When this was discussed with participants, they mentioned voice control as a substitute, though they clarified that it would work better for finding a specific object than browsing a list. Another suggestion was the use of a single touch method of interaction that would auto-scroll without requiring additional hand movements. This interaction is also known as a "push" menu [14].

Participants also felt strongly about "penalties" associated with using the sliding index. If the wrong letter were selected, the list would jump to a completely different section. This was jarring when contrasted with the easy recovery from error while flicking – a simple motion in the opposite direction. To prevent this, the letters in the sliding index need to be spread farther apart to increase the error margin and provide greater control.

Participants reported via the TLX data that the use of audio cues was physically taxing. In particular, spindex+TTS was found to be especially tiresome in combination with the sliding index interaction. In the qualitative data some expressed a concern that auditory cues could distract from music playing in their cars and exhorted that using them be optional. It would be important to determine the type of sounds that would be most preferred and least disruptive in applying these types of displays in the real world.

As mentioned, participants were unfamiliar with auditory cues and extremely familiar with flicking. Many of their comments revolved around preferring to use auditory cues with the sliding index only after becoming accustomed to it. Since the participants would only use auditory cues while driving, they said they would unlikely reach the skill levels required to commit fully to using auditory cues.

This raises a common design challenge: balancing what consumers want – either no or optional auditory cues – with what they may potentially need – mandatory use of auditory cues in order to facilitate the initial learning. Learnability is a major component of the usability of a system [15], especially in this case, as the auditory cues are transient and unfamiliar. In this respect, Spindex cues, with the benefit of pre-existing, natural mapping to their corresponding menu items, may be learned more easily [6]. When performance improvements were monitored across time, participants seemed to continue to learn and develop skills, with additional practice [5]. As such, a longitudinal study of the impact of learning on performance and ease of use of auditory cues could provide additional understanding of these cues.

4.1.1. Potential redesign

Interviews showed a need to scroll without effort. Fig. 2 shows one option: auto-scroll using a single touch. This could expand on a current iPhone feature in which tapping at the top of the screen moves the window to its top-most position. Similar functionality could allow a tap at the bottom of the screen to move a window towards its bottom-most position. Scroll rate could be controlled by the iPhone's Force Touch capability. In other phones, moving the interacting finger on the screen could control movement rate.

5. CONCLUSIONS

We compared the use of enhanced auditory cues to visual-only systems, for interacting via flicking and sliding index systems on a menu item selection task while driving. Subjective workload differences from the NASA-TLX suggest that the sliding index was better than flicking, but the auditory cues created additional perceived physical workload. However, the qualitative results revealed a large amount of interesting data such as greater effort involved in flicking, and participants thinking they would be better at the task with more practice. It was these data points from the qualitative data that was used to create a new ideation of the interaction method, helping to further improve the system.

The results of this research suggest that this new method of interacting with auditory menus for list-based systems is highly influenced by previous practice. The participants' familiarity with flicking seemed to be more of an issue than the use of the auditory menus. It may be that more practice would give participants the experience needed to perform that form of interaction more efficiently and to use the auditory cues more efficiently due to the slow nature of the auditory displays that participants reported. It may however be that the use of this interaction method when paired with auditory displays has too high of a cost to miss the target, and should be avoided or highly trained before use.

Figure 2: Mock-up of a potential re-design to improve the interface including the use of force touch to control the rate of movement down the list.

6. ACKNOWLEDGMENTS

Portions of the work were supported by a National Science Foundation (NSF) Graduate Research Fellowship (DGE-1148903), as well as additional grant funding from the NSF and from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR).

7. REFERENCES

[1] Nees, M. A., & Walker, B. N. (2011). Auditory displays for in-vehicle technologies. *Reviews of human factors and ergonomics*, *7*(1), 58-99.

[2] Wickens, C. D. (2008). Multiple resources and mental workload. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *50*(3), 449-455.

[3] Gable, T. M., Walker, B. N., Moses, H. R., & Chitloor, R. D. (2013). Advanced auditory cues on mobile phones help keep drivers' eyes on the road. In *Proceedings of the 5th International Conference on Automotive User Interfaces and Interactive Vehicular Applications* (pp. 66-73). ACM.

[4] Hart, S.G., & Staveland, L.E. 1988. Development of NASA- TLX (Task Load Index): Results of empirical and theoretical research. In *Human Mental Workload*, by Meshkati, N., & Hancock, P.A., 239-250. Amsterdam: North Holland Press.

[5] Jeon, M., Gable, T. M., Davison, B. K., Nees, M. A., Wilson, J., & Walker, B. N. (2015). Menu navigation with in-vehicle technologies: Auditory menu cues improve dual task performance, preference, and workload. *International Journal of Human-Computer Interaction*, *31*(1), 1-16.

[6] Jeon, M., & Walker, B. N. (2011). Spindex (speech index) improves auditory menu acceptance and navigation performance. *ACM Transactions on Accessible Computing (TACCESS)*, *3*(3), 10.

[7] Jeon, M., & Walker, B. N. (2009). "Spindex": Accelerated Initial Speech Sounds Improve Navigation Performance in Auditory Menus. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 53, No. 17, pp. 1081-1085). SAGE Publications.

[8] Jeon, M., Walker, B. N., & Srivastava, A. (2012). "Spindex" (Speech Index) Enhances Menus on Touch Screen Devices with Tapping, Wheeling, and Flicking. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *19*(2), 14.

[9] Drews, F. A., Yazdani, H., Godfrey, C. N., Cooper, J. M., & Strayer, D. L. (2009). Text messaging during simulated driving. *Human Factors: The Journal of the Human Factors and Ergonomics Society*.

[10] Sun, Q., & Hurst, W. (2008). Video Browsing on Handheld Devices&# x2014; Interface Designs for the Next Generation of Mobile Video Players. *MultiMedia, IEEE*, *15*(3), 76-83.

[11] Krathwohl, D. R. (1998). Methods of educational and social science research. Long Grove, IL.

[12] Taylor-Powell, E., & Renner, M. (2003). Analyzing qualitative data.

[13] Ranney, T. A., Mazzae, E., Garrott, R., & Goodman, M. J. (2000). NHTSA driver distraction research: Past, present, and future. In *Driver distraction internet forum* (Vol. 2000).

[14] Yalla, P., & Walker, B. N. (2007). *Advanced Auditory Menus*. Georgia Institute of Technology GVU Center Technical Report # GIT-GVU-07-12. October.

[15] Preece, J., Rogers, Y., Sharp, H., Benyon, D., Holland, S., & Carey, T. (1994). *Human-computer interaction*. Addison-Wesley Longman Ltd