Stilton Blue: Interface Design for Automobile Sound Systems

PROBLEM STATEMENT
This goal of this project was to design an improved interface for car sound systems. The ideal interface must allow the user to unobtrusively interact with the car's features while being able to accomplish their primary task: driving. Our priorities were to enhance usability and convenience without interfering with the user’s driving experience.

SOLUTION OVERVIEW
Our solution to the design of car sound systems seeks to simplify interaction, enhance usability, and require minimum attention so as to not distract the driver greatly. Our final consists of two parts: a static display panel and a set of three “dynamic” panels which rotate in place such that only one of them is visible at a time. The static panel is located close to the driver's eye level, and has all the buttons that are used in every mode, whether playing a CD or listening to the radio. This panel also has two buttons to operate a cell phone when receiving a call, and an input jack to connect auxiliary audio devices. Additionally, it has buttons to switch between modes, and when one of these is pressed, the dynamic panels rotate so that only the desired panel is in view. The dynamic panels contain only buttons and sliders relevant to the mode that is in use. The three modes are CD, Radio, and Equalizer, and the interface of each is designed so that the user can distinguish tactilely between them. The system reduces cognitive friction, is easy to learn and use, limits errors, and helps the user maintain a clear mental model.

PERSONAS AND SCENARIOS

Personas
Our chosen user group was college students, but we created personas with diverse characteristics to see how useful our design would be to different college-aged users. Our three test personas, along with their most relevant characteristics are:

- Lucy: Simplicity is important to Lucy. She uses the sound system that came with her car and does not like to figure out confusing settings, so she is only familiar with the features that change radio stations, switch CD tracks, or change the volume. She enjoys country music, but will usually play a CD if she cannot find any music of that style on the radio, and rarely listens to AM stations.
- Mike: Our power user, Mike installed a fancier sound system in his car that plays MP3 CDs and has a removable faceplate. He often turns up the bass and changes the equalizer settings available in the system. Additionally, Mike often plays music using his iPod, an auxiliary device which he connects to the car’s sound system. He doesn’t answer his cell phone while driving, but is annoyed by the ring so he usually pick up the phone and declines the call.
- Greg: The car Greg drives is fairly old, and has a cassette tape player which he rarely uses. He usually listens to news and sports on AM radio stations, and sometimes uses a cassette tape adapter to listen to jazz CDs from his portable CD player. He uses the presets often. Greg’s
girlfriend uses the sound system whenever she’s a passenger in the car, and likes listening to pop music on FM radio. If Greg receives a cell phone call, he will pull over to answer so that he can be fully involved in the conversation.

**Scenarios**

We created several scenarios, some that were centered on the personas and some that were used during user studies to instigate specific interactions with the prototypes. The scenarios varied, but were meant to explore how users would perform these tasks on our prototype:

- Adjust the volume
- Change radio stations
- Plug in external devices
- Use external devices
- Switch modes
- Mute the sound
- Receive cell phone calls
- Adjust sound equalization (fader, balance)

**DESCRIPTION OF FINAL INTERFACE DESIGN**

**Functionality**

The final prototype uses a static panel and three dynamic panels which rotate around a horizontal axis so that only one is visible at any time. The features of the sound system are divided in the following manner:

- **Display panel (static):**
  - Display screen.
  - “Off” button.
  - Volume knob.
  - Three mode buttons to activate the Radio, CD, and Sound Control panels.
  - Answer and decline call buttons for cell phone.
  - Auxiliary input jack.

- **Radio panel (rotating):**
  - Arrow buttons to change radio stations.
  - Four preset radio station buttons.
  - “Scan” button.

- **CD panel (rotating):**
  - Arrow buttons to change CD tracks.
  - Six staggered CD selection buttons.
• Sound control panel (rotating):
  - Fade slider.
  - Balance slider.
  - Equalizer presets
  - Equalizer sliders

**Interaction Flow**

The sound system turns on automatically whenever the user selects a mode or plugs in an auxiliary device. If an auxiliary device is plugged in, the sound system will act only as a speaker system; all control will be through the auxiliary device interface.

After selecting a mode the user will only have access to the functions related to that mode. The user may choose to adjust the sound while listening and will select the sound control panel. After adjusting the sound, the user will select a mode again.

A sample interaction flow can be seen in the figure below:

**Sample Interaction Flow**

![Sample Interaction Flow Diagram]

**Unimplemented Features**

We chose not to implement several features in the final design, as user feedback indicated that they detracted from the system’s goals of functionality with maximum simplicity. Features that we did not implement include:
Auxiliary device integration: Our user studies indicated that there was much cognitive friction when one had to adapt the interface from an auxiliary device onto the main system interface. Users preferred to use the controls they were already familiar with on the auxiliary device. Also, using a panel for multiple auxiliary devices went against our desire for clear modality, and it cluttered up the otherwise simple interface.

Cell phone integration: For very much the same reasons as auxiliary devices, we chose not to emulate most cell phone controls on the panel. However, unlike auxiliary devices, cell phone need a minimum of input to use them, which we incorporated through the “e

Bookmark feature for CDs: This feature was designed to allow users to “bookmark” a place within a CD track and jump back to it whenever they wanted. Users did not find this very intuitive and it added confusion rather than simplifying the interaction with the device.

Tools Used for System Development
After the initial paper prototypes, we chose Macromedia Flash as the sole tool for development of further prototypes. It was a useful tool but also presented some challenges.

The main advantages of using Flash were:
- The ability to simulate real-time high-fidelity interaction.
- Easily implementing changes in the prototype through the object-oriented design environment.
- Web compatibility, allowing users to test the prototype easily from their computers.

- The potential to implement a large range of functionality.
Some disadvantages of using Flash for the interface were:
- Inexperience in working with the program.
- Lack of physical interaction with the prototype.

DESIGN EVOLUTION

Timeline of Changes

General trends we followed as the design evolved:
- Simplify displays and controls.
- Maintain standard modes, displaying only components for the current mode.
- Do not replicate auxiliary functions.
- Keep information density low.

First Interactive Prototype:
- Attempted to maintain familiar interactions.
- The dynamic panel physically rotates to provide a different button layout in each mode.
- The static panel contains the options and controls available in all modes.

Second Interactive Prototype:
- More text labels.
- Standardized buttons.
- Simplified CD interface.
- Linear staggered CD button mapping.
- Different colored on/off button.
- Standardized control buttons for switching tracks/stations.

- Third Interactive Prototype:
  - Mode buttons light up to show current mode.
  - Clearer volume knob.
  - On/off button became only ‘off’ button.

**Major Changes in the Design**

Our user interface changed extensively from our initial brainstorming to our final interactive prototype. Many of the initial features from our paper prototypes did not survive in their initial forms to our final prototype, but a few concepts remained throughout the evolution of the design. The largest changes occurred in the transition from paper prototypes to the first interactive prototype. After observing a real interaction between our users and the original prototype we got a much better idea of what our design task was and how the user was thinking about the interface.

There were a few features and decisions that survived from the initial design to the interactive prototypes. The clear delineation of modes (CD, Tape and Other) remained throughout the design process. Our users appreciated this separation of commonly confusing modes. We also included the cell phone connectivity that was introduced in the paper prototypes. We tried to make this as simple and easy as possible, restricting it to two buttons and a minimum of functions. When the user receives a call they have the option of answering or declining the call, and while talking they can either switch over to a second call or hang up. Our users agreed with us that this was the simplest the system could get while still retaining its core functionality.

The use of auxiliary devices did, however, change over time. Users appreciated having a way to connect their external devices, but the methods we originally proposed were too confusing and did not support the user. The paper prototypes replicated the interfaces of external devices, something users found very difficult to use. By and large we heard that they would rather just use the control interfaces present on the devices themselves. With this in mind we simplified the system for connecting an external device, and in the final prototype it involves simply plugging it in to the static panel. As long as the cord is physically connected the car stereo acts as an output for the external device and nothing else. This is an easy and simple method of interfacing that provides a clear link between the physical action of linking the systems and the performance of the system.

Though the idea of wheel-mounted controls did not survive to the final design, it yielded useful information that affected our design. We had suggested these controls as a safety measure that would keep the user from taking their eyes off the road to look at the controls. Our user tests indicated, however, that manipulating the controls was not what caused problems while driving. The main distraction came from having to look over at the system display to see information such as the radio station that is playing. This discovery inspired the split design that we chose in
the end. The split design leaves the controls in the traditional, easy to reach location, but moves the display panel to eye level, allowing the driver to glance over at it more easily and safely. In effect we went from moving the controls to a safer place to splitting the display and putting that in a more adequate location.

As we moved forward with the design many of the changes were aimed at making the system friendlier for the user and more consistent in aesthetics and usability. Such changes included standardizing the radio and CD panels to make interaction more consistent, but leaving enough of a physical difference (through button placement) to allow the user to discern between the two panels through touch.

**Assessment of Evaluative Techniques**

Overall, the heuristic evaluation was most useful to the design of our product and its usability. At that point in the design we had made several major decisions (i.e. the split design, modal interaction and general layout) which made criticism very valuable for refinement. The heuristic evaluation was also performed by individuals who aligned perfectly with our target demographic for the product, making their feedback especially relevant. In addition, the heuristic evaluation was done without us being present, forcing the users to figure out for themselves how things were supposed to work. Because of these factors, this phase gave us the feedback necessary to create a more consistent interaction and to improve the visual clarity of the design, leading to a shorter learning curve and improved understanding of the system.

**LINK TO CLASS PRESENTATION**

Our final slide-based presentation for the project can be found at:


**DIVISION OF HOURS FOR FINAL PHASE**

The hours for the final phase were evenly distributed among the members of the team.