Auditory Displays for Accessible Fantasy Sports

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ABSTRACT
In this paper we address the lack of accessibility in fantasy sports for visually impaired users and discuss the accessible fantasy sports system that we have designed using auditory displays. Fantasy sports are a fun and social activity requiring users to make decisions about their fantasy teams, which use real athletes' weekly performance to gain points and compete against other users' fantasy teams. Fantasy players manage their teams by making informed decisions using statistics about real sports related data. These statistics are usually presented online in a spreadsheet layout, however online fantasy sports are usually inaccessible to screen readers due to the use of Flash on most sites. Our current system, described in this paper, utilizes auditory display techniques such as auditory alerts, earcons, spearcons, general text-to-speech, and auditory graphs to present sports statistics to visually impaired fantasy users. The current version of our system was designed based on feedback from current fantasy sports users during a series of think-aloud walkthroughs.

Categories and Subject Descriptors
H.1.2 [**Models and Principles**]: User/Machine Systems—*Human factors; human information processing*; H.5.1 [**Information Interfaces and Presentation**]: Multimedia Information Systems—*Audio input/output*; H.5.2 [**Information Interfaces and Presentation**]: User Interfaces—*Auditory (nonspeech) feedback; user-centered design*; J.4 [**Computer Application**]: Social and Behavioral Sciences—*Psychology*

General Terms
Measurement, Performance, Design, Experimentation, Human Factors.

Keywords
Accessibility, Sports Data, Auditory Displays, Sonification, Fantasy Football.

1. INTRODUCTION
Sports are a cross-cultural phenomenon. Across the world people clamor into stadiums and living rooms to catch the latest on their favorite athletes and teams. This worldwide obsession has led to fans wanting to be more involved. Couple that with elements of friendly competition and you have the genesis of fantasy sports. Though it can trace its beginnings to golf aficionados in the post-World War II era, its modern form began in the 1960s [1]. This consists of players acting as de facto team managers selecting players at various positions and being scored based on their collective team's performance (positions and scoring vary depending on the sport) [2]. Despite its humble beginnings as a pen and paper hobby of a select few diehard fans, the advent of the internet has caused fantasy sports to explode in popularity, creating a massive industry with over 32 million players in the United States and Canada alone, and $3-$4 billion dollars of worldwide economic impact [3]. However, despite its enormous popularity, online fantasy sports remain inaccessible to blind and visually impaired users due to the way these sites use CSS image replacement instead of text, pop-over windows, and inaccessible tabs to name a few issues. To remedy this, we designed the first version of an accessible fantasy sports interface, which utilizes an auditory display of different alerts, text-to-speech, spearcons, and auditory graphs. The current system focuses on American football because it is the most popular fantasy sport, but future systems would incorporate other sports as well.

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2. SYSTEM DESIGN
Our current system was designed by adding various auditory display features to a spreadsheet layout that is organized in a way similar to most online fantasy sports layouts. The difference from current fantasy sports systems is that ours features auditory displays that present information using sounds that can be as basic as a brief alert when a player on your lineup is injured or as complex as comparing statistics from last season between players. This use of auditory displays allows for a dynamic and interactive system that is accessible to visually impaired users.

Our design was informed by think-aloud walkthroughs, which indicated that individual players' statuses are of the utmost importance to users so they know if players need to be changed. In our system, an alert in the form of an auditory earcon (in this case a referee's whistle) [4] was used to convey this information. Users hear this earcon alert when first opening the page, letting them know that they should be listening for a more specific alert as they navigate through their lineup.

For navigating the user's team lineup page we chose to use spearcons (algorithmically compressed speech). The use of spearcons has been found to increase both speed and accuracy when locating items [5], as well as increase the learning rates compared to other auditory display techniques like earcons [6]. In addition, when navigating two-dimensional menus (such as the spreadsheet layout used by most fantasy leagues for their team lineup pages) auditory menus with spearcons have been found to be much more efficient [7]. When the user gets to a specific player with an alert about him, another earcon notification plays.

The use of different player statistics such as predicted scores and position rank allow users to make informed decisions about whom they will keep in play and who they will keep on the bench in a given week. During the think-aloud walkthroughs we found that users were interested in different player statistics based on the types of strategies each user employed. Often users would pull up graphs within the user interface that allowed them to view trends in players' performance over time. In many online leagues users

Figure 1: This screenshot of our accessible fantasy sports system shows captions that indicate what kind of sonification is being used for each data type.

have the option to compare players by selecting them and graphing them together. The accessible auditory display equivalent to this is the use of auditory graphs. Auditory graphs are a type of sonification, in that they represent data with non-speech sounds, usually on the dimensions of pitch and time. In comparison to visual graphs, auditory graphs usually map data values (y-axis) onto pitch, and x-axis values onto time.

Auditory graphs have been shown to be powerful tools for identifying trends and comparing data, but the type of data being represented has a large impact on how they should be designed and how effective they end up being. Furthermore, different populations have been shown to have different representations of the same concept [8].

In addition to displaying information through sonifications, additional features have been added to aid accessibility (see Figure 1). For instance, the *Move Player* button, common to many current systems, usually becomes selectable and highlighted in the rows for positions available for the player being moved. Rather than require visually impaired users to tab through the entire lineup listening for eligible players to move, we have included an auditory drop down menu, which presents only the players eligible to fill that position. Additionally, navigating team rosters by column and row should be much easier now, as we have added the ability to navigate via arrow keys rather than only being able to scroll from left to right through all cells one at a time with the tab key.

3. EVALUATION & FUTURE WORK

Our current plan is to host our own accessible fantasy football league this coming season with both visually impaired and sighted users, in order to fully test our system. This will allow us to analyze our system in real time and gauge participant feedback. Although the creation of a system for accessible fantasy sports fills a desire for providing a fun example of how we can leverage auditory displays to create an accessible system that properly displays statistical data, we also see it as a platform for exploring the perceptual and cognitive ways in which users consume the information provided. For example, when a user wants to compare trends in performance between two athletes, understanding how the user cognitively processes the information will directly affect how that information display is designed. For example, though much data has positive valence (i.e. more is better) such as rushing yards, passing yards, etc.; there is also important and highly relevant data with negative valence (i.e. less is better), such as interceptions thrown or number of fumbles. Should these data be represented differently? Should higher pitches be used for both higher numbers of rushing yards and interceptions thrown? Furthermore, what if, given a different context, interceptions are a good thing (i.e. when looking at defenses)? These issues need to be researched in order to develop the best possible system for displaying and comparing statistics using auditory information in a way that not only makes them accessible to visually impaired users, but also exciting and useful for sighted users.

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