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# Informative Sound and Performance in a Team Based Computer Game

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**Abstract.** This study focuses on the role of sound in the popular multiplayer online battle arena game, Dota 2. Our initial results indicate that team performance improves with the use of sound. By contrast, some individuals performed better with sound and some without.

**Keywords.** Dota 2, Auditory Display, Auditory Icons, Earcons.

## 1 Introduction

For game developers, integrating informative sound has the potential to provide additional feedback to the player. In this paper we explore the relationship between sound and performance by evaluating the role of sound in player performance in the multiplayer online battle arena game, Dota 2.

Prior works within the field of auditory display have identified two key ways that sound can be used to improve the functionality and efficiency of user feedback. Gaver described the design of ‘Auditory Icons’ in the interface, an approach that builds on the everyday listening skills of users [1]. Blattner suggested an alternative means of creating auditory messages called ‘Earcons’, that rely upon musical conventions such as pitch, timbre and dynamics to communicate abstract information [2].

Research conducted on video game audio and performance has shown mixed results in regards to whether sound has a positive or negative impact on performance. Tafalla reported that participants playing the game DOOM with the soundtrack scored almost twice as many points to those playing without the sound [3]. In contrast, Yamada et al found that the presence of music had a negative effect on performance [4]. Further studies into the effects of sound on performance levels have found that players perform the weakest when playing without sound while the highest scores were obtained when playing with music unrelated to the game [5]. Each of these findings suggest that sound could play a factor on players performance levels in games.

As information gathering plays an important task for players in most games, further research is required to better understand the role sound plays in performance. To this end, this preliminary study was conducted to examine the effects of informative sound in a team-based game. The main question we consider in this research is: “Can sound be used to improve player performance in computer games?”

## 2 Evaluating Performance

A total of 20 participants (19 males, 1 female) took part in this experiment. Of these participants, 18 were undergraduate students aged between 18-25 years while 2 participants were postgraduate students aged between 26-40 years. In the *sound on* condition, players were required to have the in game background music and sounds from the game turned on. This included voice chat. Participants in the *sound off* condition were not allowed to have any sounds from the game on and played in complete silence. Other sounds, such as personal music, were not allowed in either of the two conditions. In both conditions players were allowed to communicate using text based chat to each. The server selected to host all matches was US west. This server provided the best possible latency levels for all players based on their Internet connection speeds. The game mode selected was *all pick* which allows player's access to all heroes in the game.

We recorded a total of 140 comparative measures (7 performance measures x 5 players x 4 teams) for analyzing individual performance. Of these 82 showed improvements in performance when sound is included, 10 showed no difference and 48 displayed a reduction in performance. We collated the individual performance data further, calculating the average individual results across the 7 measures. Out of these 7 measures, 1 showed a reduction in performance, 6 showed improvements when sound was present (see table 1). The difference for the measure of 'Hero levels' was found to be significant.

**Table 1.** Average Individual Performance with Sound On and Sound Off

Individual Measure	Sound Off	Sound On
Hero Levels*	17.2	18.6
Hero Kills	6.8	7.1
Hero Deaths	10.8	11.5
Kill Assists	7.1	7.4
Total Gold Earned	12555	13170
Gold per Minute	312.8	314.8
Experience Points per Minute	427.9	453.8

In addition to recording individual performances, we also recorded 16 team measures in total (4 teams x 4 performance) for measuring team performance. Out of these, nine showed an increase in performance with sound on while seven showed a decrease in performance. We analysed the team performance data further, calculating the average team results for the three expert teams (see table 2). Out of the 4 measures, 3 showed improvements in performance when sound is present while only 1 measure recorded a reduction in performance with sound.

**Table 2.** Average team performance (3 expert teams)

Team Measure	Sound Off	Sound On
Total Gold Earned	62383.3	64331.7
Total Experience Points Earned	85693.3	94206.7
Hero Kills	35.7	37.8
Hero Deaths	7.1	7.4

### 3 Discussion

In this study we have undertaken a preliminary examination of the role of information and sound in video games. Specifically, we looked at whether sound could offer improved performance levels in the multiplayer online battle arena game, Dota 2. In our preliminary experiment, we attempted to measure the difference in performance levels by adding and removing sound from the gameplay. We tested both individual and team performance levels in two different sound conditions (on and off) using seven individual and four team measures. Our analysis of the initial results has shown mixed results in terms of whether players and teams performance actually improved when there is sound. While over half of the total individual comparative measures have shown improved performance with sound, 58 displayed either no difference or a reduction in performance. We also found a similar pattern in team performance where 9 of the comparative measures displayed an increase with sound while 7 showed a reduction in performance. A post survey conducted after the experiment revealed that 18 of the 20 players felt that removing sound affected their performance negatively.

The next stage of our work will address some of the issues encountered with the design of this preliminary study. We will focus on two expert teams who play an extended number of games against each other so that the additional data gathered might highlight further significant differences in performance.

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