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Frequency Discrimination in Video Game Players During Gameplay of Different Game Genres: A case study

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Frequency discrimination capacity and reaction time can be improved through training and environmental exposure to different situations. For example, musicians have demonstrated to have better frequency discrimination capacity than non-musicians. Such improved performance could extend to other professions or training as well. In this report, two case studies are presented that illustrate the potential differences between the sensory discriminative performance of video game players and non-video game players. The frequency discriminative capacity and reaction times of the players were assessed while playing different genres of games, including an action-adventure game and a rhythm game. Lastly, the effects of the duration of gameplay were also recorded. Each player was asked to play a game for one hour and two hours for the long duration gameplay trial. Their frequency discrimination, reaction time, and reaction time variability were assessed using a Brain Gauge. Before, during, and after gameplay, these parameters were recorded from the two participants. One participant was an experienced video game player and the other was a non-video game player.

Introduction

Previous research has shown that individuals can improve their frequency discrimination through training. For example, musicians are trained to recognize the pitch of their instruments. This training has been shown to not only positively impact their capabilities of auditory frequency discrimination but tactile frequency discrimination as well, as shown by a study by Sharp and coworkers [1]. Thus, improved frequency discrimination through training could apply to other occupations or groups. One such group includes video game players (VGPs). For many console-based games, VGPs must learn to distinguish the various vibrations of the remote control. For example, they learn to correlate certain frequencies with danger or as responses to user input. Thus, I hypothesize that VGPs may have improved frequency discrimination and reaction times through their experience playing video games, similar to musicians.

For this study, I compared the reaction times and sequential frequency discrimination of VGPs and non-VGPs after playing different game genres. For example, some games require excellent reaction time to progress, while others are meant for leisure. The working hypothesis of the study was to that the genre of a video game can impact the frequency discriminative capacity and reaction time as well. Three conditions were tested: 1) VGP vs. non-VGP, 2) short vs. long gameplay, and 3) action-adventure genre vs. rhythm genre.

Methods

For the first case study, a VGP subject completed three trials. During each trial, the subject used a Brain Gauge to record their frequency discrimination and reaction time through a battery of tests. The Brain Gauge is a tool that consists of two tips that can vibrate at various frequencies. Subjects can complete an array of tests to assess their reaction time, frequency discrimination, and more and analyze the user inputs. For the frequency discrimination assessment, the user selects

whichever tip vibrates at a higher intensity or frequency. In the reaction time analysis, the subject reacts to the vibration of one of the tips as quickly as possible. Throughout the trials, these tests were used to assess the frequency discrimination and reaction time of the subjects. These sensory discriminative tasks have been described in multiple reports.

In the first trial, the subject played a rhythm game (“Friday Night Funkin’”) on a desktop computer. Before gameplay (GP), at thirty-minute intervals during GP, and two hours after GP, the subject completed a battery of tests using the brain gauge to assess their frequency discrimination and reaction time. In the second trial, the subject played the same game and recorded data at the same intervals for two hours. Lastly, in the third trial, the subject repeated the protocol for the first trial but using an action-adventure game (“Hollow Knight”). Unlike the rhythm game, the action-adventure game was played on a console with a controller with built-in rumble stimuli. Based on user actions, the controller would shake at different frequencies throughout GP. For each of the trials, the subject waited at least 24 hours before beginning the next trial.

For the second case study, a non-VGP subject completed the protocol of the first trial that the VGP participant completed. The results of the two subjects were compared to demonstrate any differences due to experience.

Results

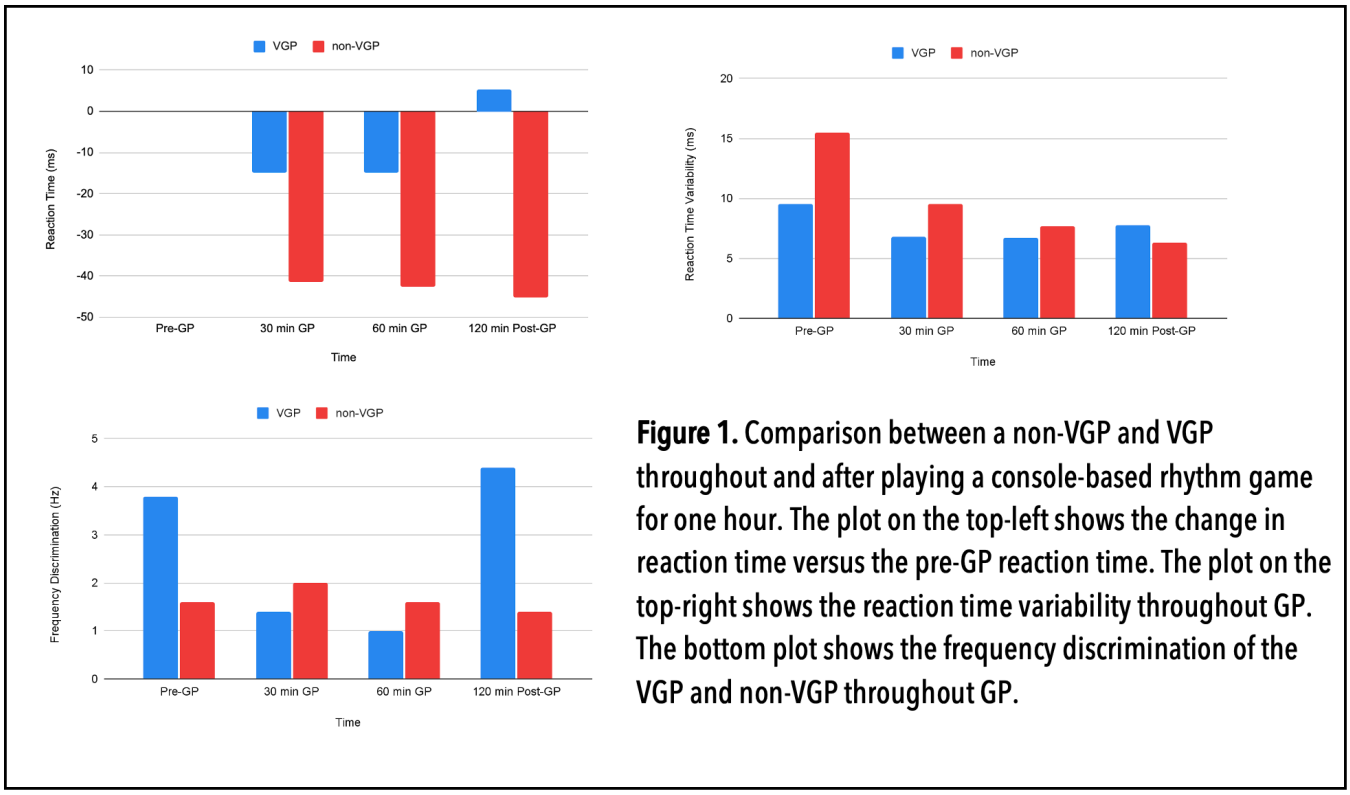

Figure 1. Comparison between a non-VGP and VGP throughout and after playing a console-based rhythm game for one hour. The plot on the top-left shows the change in reaction time versus the pre-GP reaction time. The plot on the top-right shows the reaction time variability throughout GP. The bottom plot shows the frequency discrimination of the VGP and non-VGP throughout GP.

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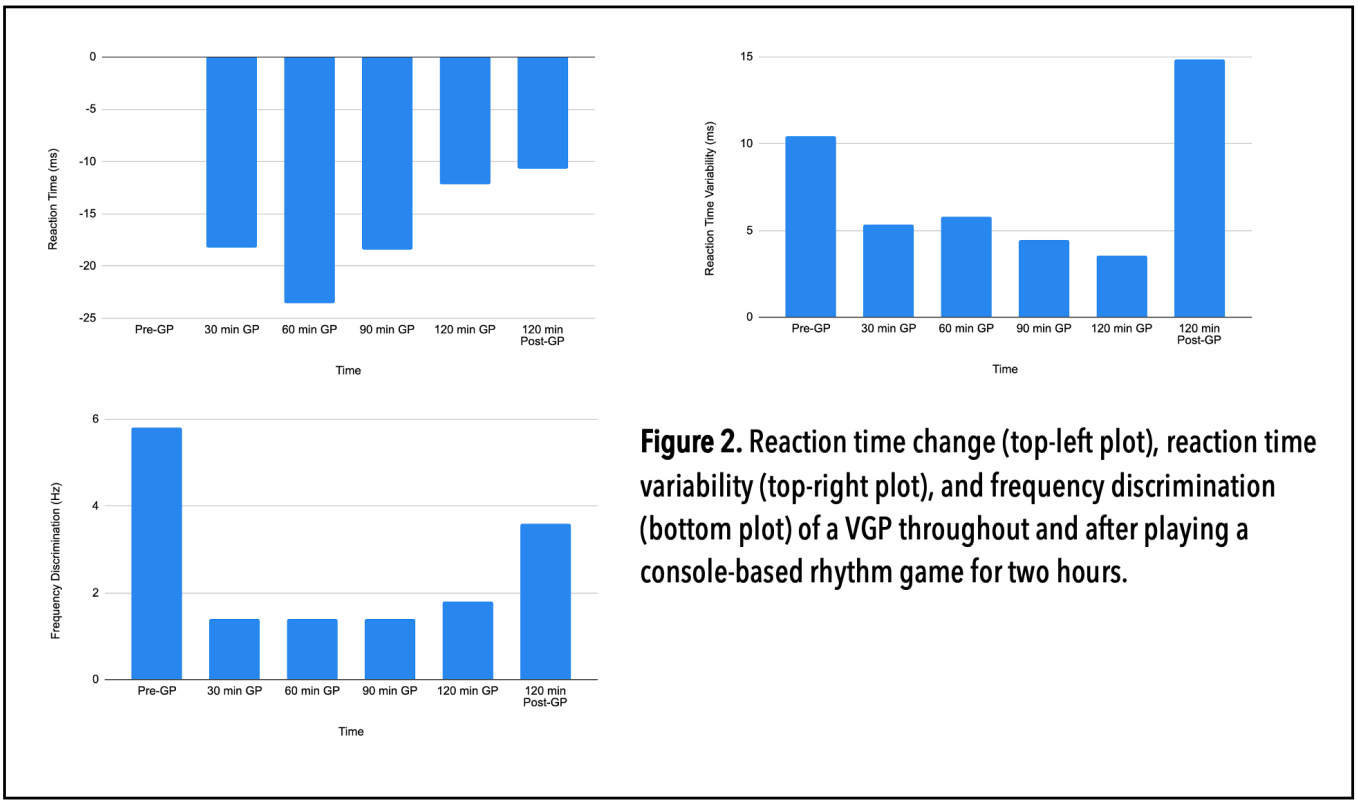

Figure 2. Reaction time change (top-left plot), reaction time variability (top-right plot), and frequency discrimination (bottom plot) of a VGP throughout and after playing a console-based rhythm game for two hours.

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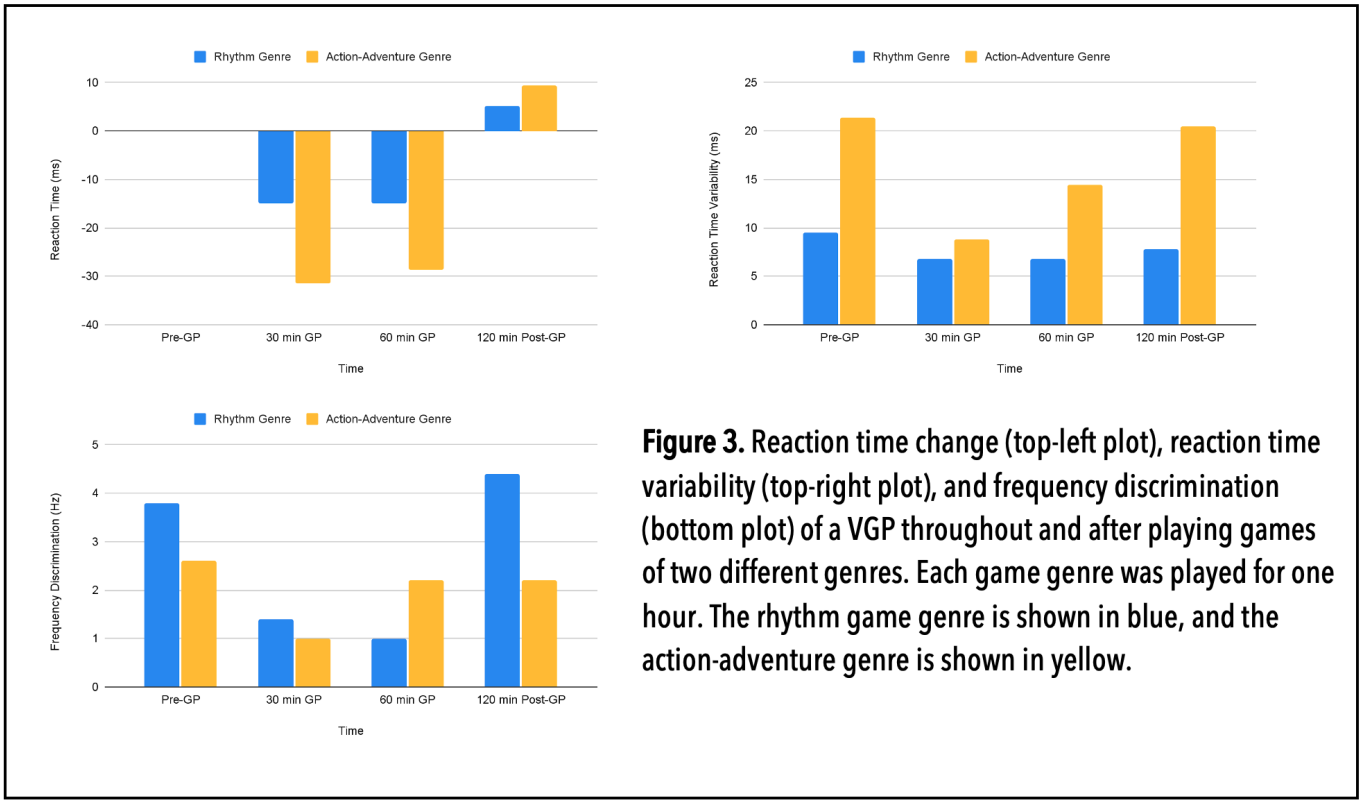

Figure 3. Reaction time change (top-left plot), reaction time variability (top-right plot), and frequency discrimination (bottom plot) of a VGP throughout and after playing games of two different genres. Each game genre was played for one hour. The rhythm game genre is shown in blue, and the action-adventure genre is shown in yellow.

Figure 3. *Reaction time change (top-left plot), reaction time variability (top-right plot), and frequency discrimination (bottom plot) of a VGP throughout and after playing games of two different genres.* Each game genre was played for one hour. The rhythm game genre is shown in blue, and the action-adventure genre is shown in yellow.

Discussion

Subject Information

This study uses data from two young adults. Each was designated as the VGP or non-VGP based on their video game experience. The first subject (Gender: Female, Age: 21) qualified as the VGP according to the precedence set by prior studies since they played at least six hours of video games per week[2]. The second subject (Gender: Female, Age: 20) qualified as the non-VGP, as this individual did not play video games.

Condition 1. Non-VGP vs. VGP

For the first condition, the VGP and non-VGP exhibited markedly different changes in frequency discrimination and reaction time throughout GP. The VGP experienced a notable improvement in both frequency discrimination and reaction time during GP. Most notably, the frequency discrimination decreased by approximately 2 Hz when the subject was playing the rhythm-genre game. Through this observation, it is clear that GP had a large impact on the subject's abilities. Two hours after GP, the subject's reaction time and frequency discrimination returned to approximately their pre-GP values. In comparison, the non-VGP experienced an improvement in reaction time and no notable change in frequency discrimination.

Based on these observations, the findings support the hypothesis that VGPs have improved frequency discrimination during GP. The experience of playing video games appears to have improved VGP's frequency discrimination. However, the non-VGP had a markedly low initial frequency discrimination, so any differences may have been less notable due to this difference. Thus, it would be beneficial to complete the same non-VGP trial with another non-VGP who has higher initial frequency discrimination to see if the change is consistent. Also, a larger sample size would further support this data.

Condition 2. Longer Duration GP

For the longer duration GP trial, there was no notable difference between the first thirty minutes of the shorter and longer GP. In both, there is a notable and comparable improvement in frequency discrimination and reaction time. After 45 and 60 minutes of GP, the performance of the player was consistent. Also, two hours after GP had concluded, frequency discrimination and reaction time returned to normal. So, according to this data, the changes in frequency discrimination and reaction time are consistent throughout GP. However, differences may occur if the player were to play for a longer duration. These differences may also depend on the usual GP duration of the player. Further research would be necessary to assess the time dependence on performance.

Condition 3. Action-Adventure Game vs. Rhythm Game

For the action-adventure game vs. the rhythm game trial, the player experienced a notable improvement in reaction time in both cases. There was also a notable difference in frequency discrimination between the two genres. For the first 30 minutes of GP, the frequency discrimination improvement was consistent between both genres. However, after 60 minutes, frequency discrimination during action-adventure GP returned to the participant's normal. The impact of the playing experience on the participant had diminished at this point in the GP. Unlike the rhythm game, the action-adventure had controller vibrations. Perhaps, the participant had become accustomed to the vibrations and had consequently lost some sensitivity to the vibrations of the Brain Gauge. Also, the soundtracks of the games were notably different, so this also could have impacted the player's performance. However, another possible explanation for this variation was

player fatigue. At the same time, the frequency discrimination increased, there was a notable increase in reaction time variability. Perhaps, this increase in variability could allude to the reason why the player's performance decreased. Also, another study could investigate more genres to get a complete view of the differences between genres. Future trials should consider the tempo of the music in the game to control its possible effect on the player's performance.

In conclusion, this case study was successful in providing evidence to support the two previously mentioned hypotheses. The results demonstrate promise for future studies to investigate the differences between players and game genres.

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