Tetra: A study on the effects of Tetris to reduce anxiety and stress in paramedics*

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Abstract. 150–250 words.

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1 Introduction

[6] observed that Tetris reduced intrusive flashbacks to a traumatic event and had positive effects. [9] further identified that paramedics face intense pressure and often feel anxiety and fear of making mistakes.

We aim to reduce any anxiety a paramedic can sustain or may develop during a call-out. We propose a game that the paramedic can play soon after an incident to reduce psychological impacts on paramedics.

We propose to create a version of Tetris that can be played after a paramedic has experienced a traumatic event. This version would adapt, ease the difficulty, and help counter trauma and stress's effects.

2 Related Work

First responders and paramedics working in the field are often exposed to traumatic events [9, 10]. In this section, we seek to identify if video games can have a positive effect on the mental health of these medical workers and which games have the most significant impact. This research could provide a better understanding of how best to help people under extreme stress and regular traumatic experiences.

2.1 In what ways do video games affect mental health?

Researchers in this field have found a positive relationship between individuals playing video games and their mental well-being in long-term mental health trauma [3, 5] and overall wellbeing [1, 2].

How video games affect long-term mental health, such as PTSD, has been well-researched. Research by [5] showed that video games reduced flashbacks in

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veterans with PTSD and regular flashbacks. A similar study confirms this [3]. They also found that games improved veterans' mental well-being by reducing flashbacks and nightmares. [5] identified the need for more research into a wider variety of games to determine what in games supports mental well-being, as they had a stand-alone control game.

Video games have been found to positively affect mental well-being by encouraging communication and providing short-term relief from stress [1, 2]. [2] produced a study in which they surveyed members of the public during the COVID-19 lockdown. They found that during this time, participants that played video games had a perceived positive effect on their lockdown experience by providing a distraction from stress and encouraging long-distance communication. Furthermore, a meta-analysis by [8] found that serious games positively affected mental well-being.

These papers strongly indicate that video games affect mental health in a positive way both for the long and short-term well-being of a person. However, more research should be done on how particular video games affect well-being and broader demographics, as the majority of participants in these papers were veterans [3, 5] or students [1, 2].

2.2 Which types of games have the best impact?

There are many different genres of video games, with each genre prompting different reactions from players and exerting various effects. For example, a video game with horror themes will scare the player and make them anxious. To understand which games have the best impact, we must define what exactly is "best impact". "Best impact" refers to the most significant positive contribution to a person's mental state. Positive contributions include anything from pure enjoyment to general satisfaction to calming the individual.

A study by [6] tested whether video games could reduce the development of flashbacks caused by PTSD. They hypothesised that video games that are "visuospatial" (a cognitive function that causes the brain to visualise an object and its relationship to the surrounding space) would compete with flashbacks for resources. Resources that are required to produce mental imaging and, thus, reduce the development of flashbacks. After testing with the video game *Tetris*, they concluded that their hypothesis was correct. That Tetris can be used as a "cognitive vaccine" for PTSD flashbacks.

In an article by [8], they researched the impact of "serious" games on mental health symptoms. In this context, "serious" is defined as games that do not contain enjoyment, fun or entertainment as their primary purpose. They conducted a systemic review, found ten studies linked to mental health and serious game-related keywords, and performed a meta-analysis on nine of those studies. They found that serious games could improve mental health problems; however, their study was limited due to a small sample size of Randomised Control Trials (RCTs). More trialling is necessary before anything can be confident.

[8] identified Tetris as a serious game and used the Holmes article within their study. The link between the two ascertains that Tetris is highly likely to be

the video game with the best impact (even if that impact had only been tested on the prevention of PTSD flashbacks).

2.3 How could games help paramedics?

Paramedics have to work through incredibly stressful situations when being called out to patients. The constant stress coupled with traumatic events witnessed can lead to mental health issues in paramedics. A study by [4] found that paramedics can develop mental health issues such as; PTSD, depression, alcohol abuse and dependency. This paper found that among the paramedics with PTSD, the most commonly endorsed trauma was witnessing a transport incident. The paper also found that paramedics with PTSD had significantly lower resilience and social support. Papers by [9, 10] discussed paramedics' psychological well-being. Both papers discussed the responses to trauma: angry outbursts, sleep disturbances, irritability, decreased social life, and isolation.

[3] tested the impact of video games on veterans with mental health issues like PTSD, depression, and alcohol-related problems. They found that the long-term effects of these mental health issues can be mitigated with games. The participants talked about how games helped reduce and control angry outbursts, gain confidence in themselves, isolate themselves when they felt overwhelmed and prevent them from separating themselves by socialising with games. This paper also found that veterans were using games to distract from intrusive thoughts linked to PTSD, like suicidal thoughts, which [4] found paramedics' experience. [4] also discussed the difficulties of sustaining social relations, which [3] encountered was able to be regained by socialising through gaming.

2.4 Conclusion

In this section, we have established that video games can affect a person's mental well-being. Implementing games to help paramedics could help reduce their stress and possible PTSD, and it has been shown that Tetris has positively impacted mental well-being. Further research should be done to see the direct effects of Tetris on paramedics.

3 Methodology

After the research conducted in section 2, we tested the hypothesis that Tetris can help paramedics by creating two versions of Tetris: an easier, adaptive version and a regular version of Tetris. The normal one is needed as a control version to see if an easier version is necessary. We would measure their mental state before and after playing the game to notice any changes.

3.1 Ethics

This research experiment was reviewed by an Ethics committee and passed. To maintain the research as ethical, we were required to give participants an

information sheet to read and have them sign a consent form before starting. During the entire process, we were required to ensure each participant would remain completely anonymous and that no data we stored could be traceable back to them.

We created an information sheet containing a summary of the proposal, its aims, and any further questions regarding the participant or the experiment. After participants had read this sheet, they were then required to sign a consent form. The consent form ensures each participant reads the information sheet and agrees to participate. We used Google Forms to build the consent form. To maintain anonymity, we had to ensure that emails weren't stored in the responses. Finally, in gathering data, we also used Google Forms to build a questionnaire which we also had to ensure did not store any emails.

Following the Data Protection Law, all data is stored securely and anonymously. Therefore, the data will only be used for this experiment and will be destroyed after the paper is published.

3.2 Implementation

To test our proposal, we developed two versions of Tetris within JavaScript. The first version is a control version that allows us to see the experiment's results without any of the testing variables affecting the experiment. The code was inspired by [7] and adapted to a progressive web app.

We decided to build it as a progressive web app as we believe it to be the best option for paramedics. Progressive web apps allow the app to be a native app without paying royalties to services like the App Store and conform to its regulations. It also allows the app to be available on desktops and all mobile phones needed to reach most paramedics. Unlike web apps, PWAs can also be used without an internet connection with the help of service workers. Updates are also automatic. This means paramedics can have an app on their phone that isn't tied to the internet (and such can be used anywhere) and can be played on any platform. The situation in which they would use the app requires the app to be easily accessible and quick to load.

Other changes include a complex scoring system, time limit, scaling difficulty, and sound. The scoring system was implemented by identifying when the user placed a piece and how many lines were completed. We added a time limit to ensure that the user did not spend too long on the game since we only observed stress and not skill. We determined that the appropriate time limit would be five minutes allowing novice users to make mistakes on the control version while letting more experienced users get further into the scaling difficulty. This difficulty was designed to increase every thousand points by increasing how frequently the piece would move. The movement speed is regulated by how many frames have passed since the last movement. By doing this, we can increase the speed by lowering the required frame interval until it reaches one frame between movements. For the control, for every thousand points, the frames were reduced by five from a starting point of thirty until they reached ten. At that point, the reduction was three until the frames reached one or below.

The easy version had subtle but critical differences. These included a weighted random and easier difficulty. To create a weighted random number generator, we took inspiration from [11]. It works by using a nested array to define the weight of each piece. By defining what pieces we wanted to show more frequently with a higher number, we could make the game easier and less stressful. To achieve easier difficulty, we limited how fast the frames decreased. Instead of the usual five each thousand, it was changed to three. We changed it to a reduction of two when the frames pass ten. However, we did not change the final limit of one frame since adding an end condition was needed.

To create an even split between the control and easy versions, we created a start screen that would randomly take you to one or the other. Along with this, the end screen would look at the URL of the previous page, and if it contained the words control or easy, it would output the respective version you used. This allowed the user to input what version they used into the questionnaire.

3.3 Data Gathering

We made two google forms that the participants must fill out; a consent form and a questionnaire. The consent form informs the participant of the experiment, how and what data will be used, and all relevant support materials. The questionnaire is how we gather our data to determine the effectiveness of our study.

The questionnaire uses the PANAS scale [12] to measure the mood states of the participant before and after playing the game. We will focus on this scale's NA (Negative Affect) values to see if our game can bring those values down after a participant has played the game. Comparisons will be drawn from all the participants' data to see if there is a typical pattern to the moods most affected after playing both versions of the game, and these moods changed based on the version they played. The questionnaire was given to 18 participants in total.

4 Findings

Turned overleaf are the relevant figures showing the experiment results.

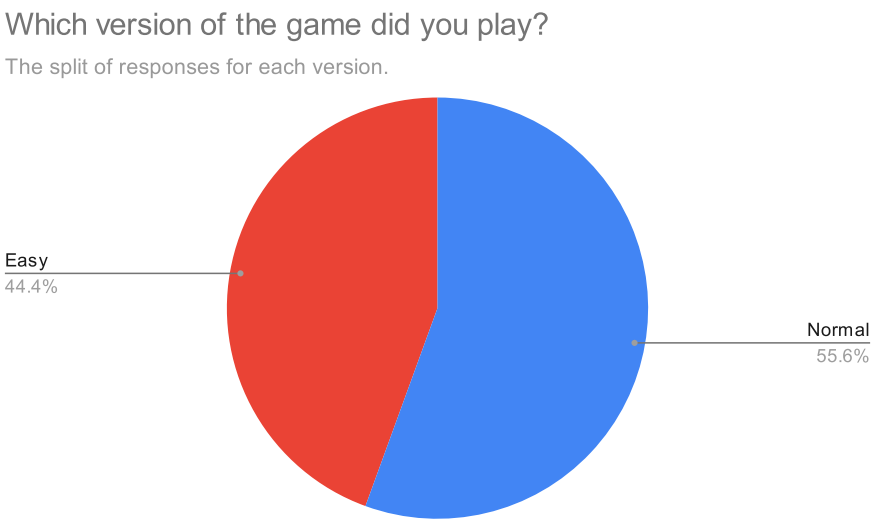

Fig. 1. The above pie chart shows the percentages of the population that played each version. There were 18 responses in total. This means that eight people played the easy version and ten the normal.

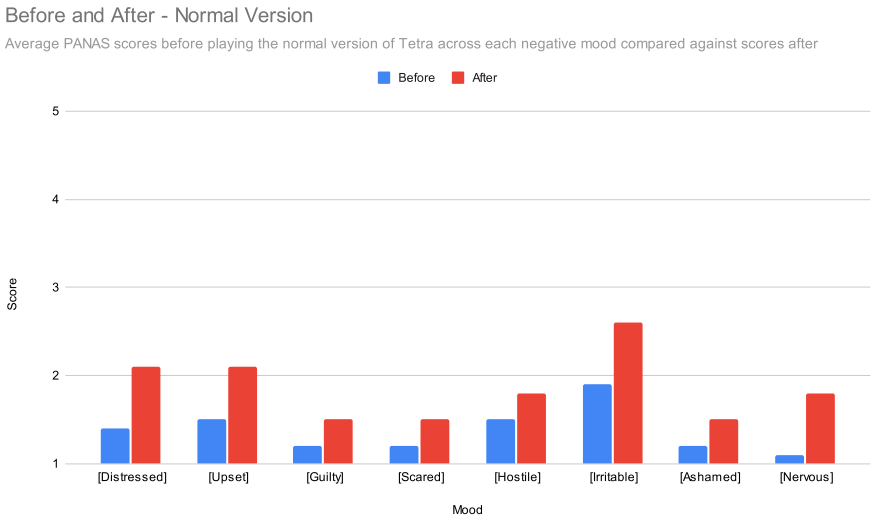

Fig. 2. The results of testing the normal version. Above are the relevant moods, but the full results can be found at A.

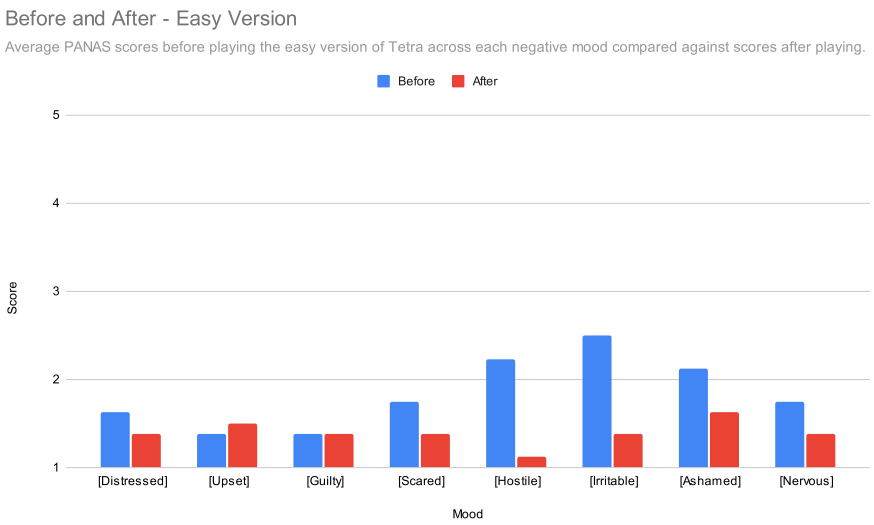

Fig. 3. The results of testing the easy version. Above are the relevant moods, but the full results can be found at B.

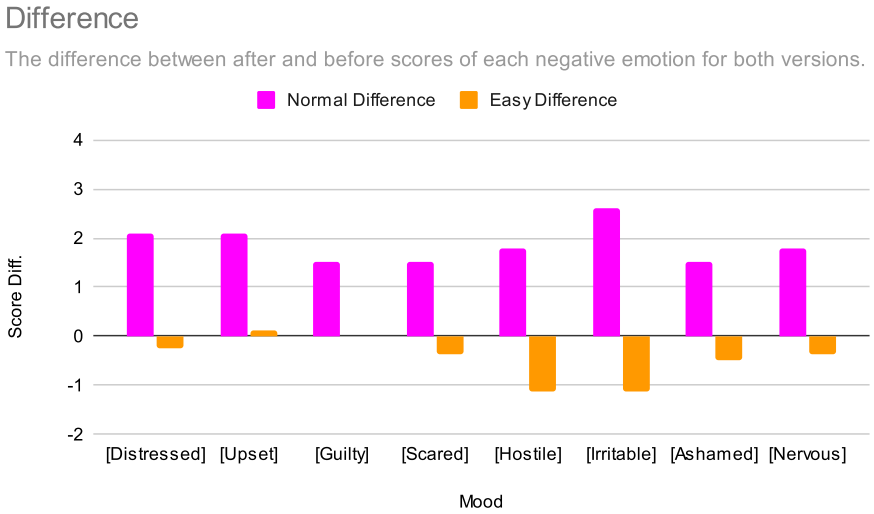

Fig. 4. The difference between the average scores after and before playing the game. Both versions are included to show the contrast. Above are the relevant moods, but the full results can be found at C.

5 Analysis

Our findings showed that our modified version of the game had a more positive impact on the participants. The average rating of each emotion on the PANAS scale was collected from all participants before and after playing Tetra. Our findings show that the normal version of Tetris had participants rating the NAs at a higher level, meaning they were more negatively affected by the game. However, our modified version of the game had participants rating the NAs lower, meaning they were more positively affected by our game.

5.1 Future Research

Our findings suggest that this easier version of Tetris has a positive effect on the members of the public. Further research should be done to see the immediate effects on paramedics and how they would react to implementing something like this. Furthermore, more research should be done to identify all the areas in which Tetris as an aid for mental well-being could be implemented

Our research does have some limitations. We had a small selection of participants, most of whom were students, and all of them had not recently been through a traumatic event. Future research should be done in a broader demographic, including paramedics and those who have suffered trauma, to see Tetra's immediate and long-term effects on mental well-being. Furthermore, [6] Showed that visuospatial tasks worked best at reducing the build-up of flashbacks, so other visuospatial games could also have a similar effect. Virtual reality games have also not been researched in relation to reducing stress and trauma. These games could also have this effect, as they contain many visuospatial elements.

UPSET WENT UP AND GUILTY DIDN'T CHANGE
ADAPTIVE VERSION AND HOW THAT COULD HELP
AGREE WITH LITERATURE

6 Conclusion

The results of this study show a clear improvement in immediate mental well-being in participants after playing the modified version of Tetris. Because of this continuing research, the effects of visuospatial games with less challenging aspects should be further researched to aid mental well-being. However, our sample size was small, where students were the main test participants, which could leave a bias in the results; further research should be done to ascertain if the effect is the same in broader demographics to ensure this method of aid will help everyone.

A Appendix 1

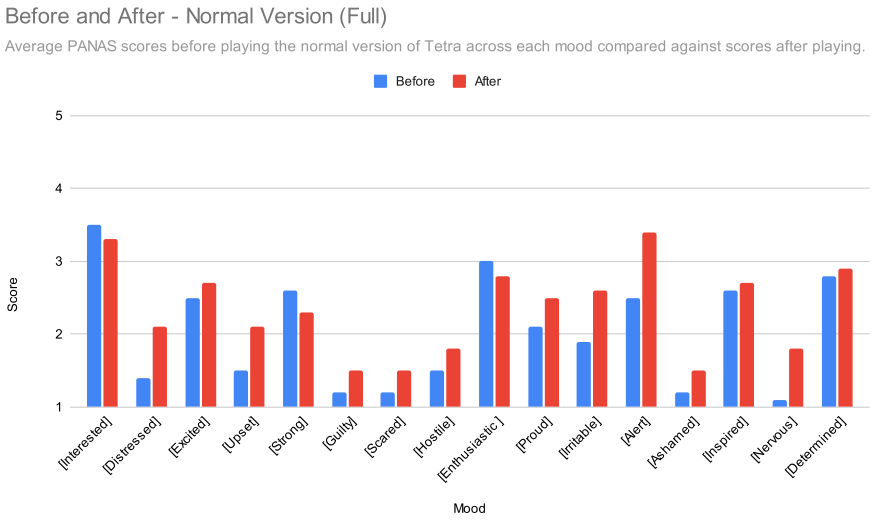

Fig. 5. The full results of testing the normal version.

B Appendix 2

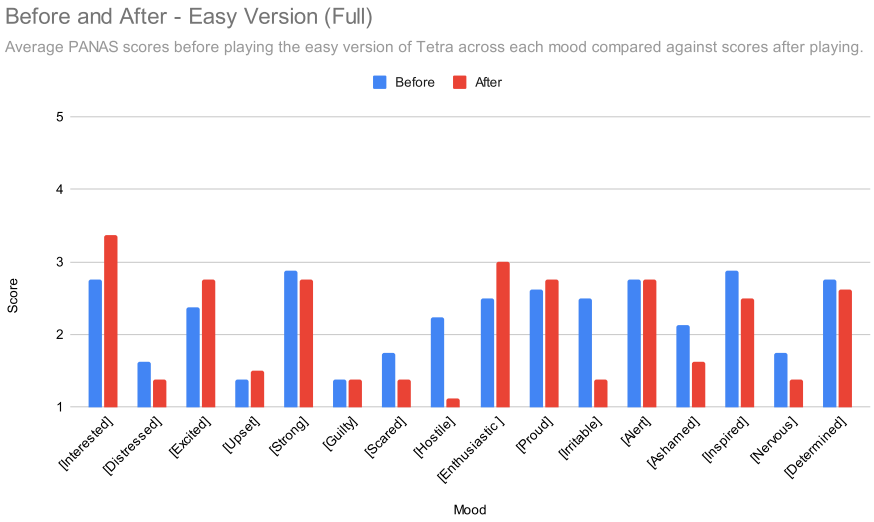

Fig. 6. The full results of testing the easy version.

C Appendix 3

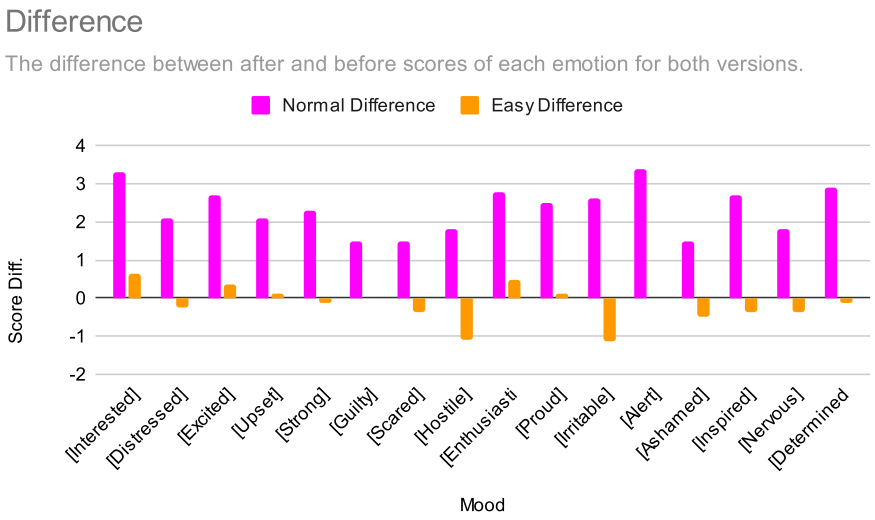

Fig. 7. The differences between the after and before scores for the full range of moods.

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