



IEEE • 2024

# CONFERENCE ON GAMES

5th-8th August, 2024 | Milan, Italy

## Adaptive Audio to Player Actions and Gameplay: a new Video Game

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D I G I T A L



# Motivations & contribution

## Hypothesis

Tempo synchronization affects player performance differently depending if it is aligned with

- Gameplay (as in Tetris)<sup>1</sup> ?
- player actions (as in Beat Saber)<sup>2</sup> ?

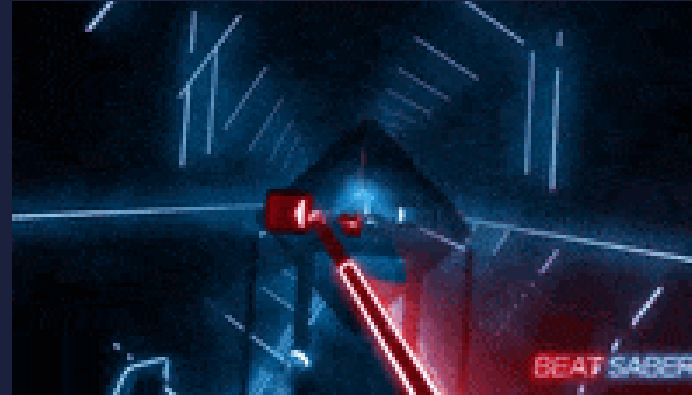
## Objectives

Evaluate the impact of musical synchronization on player performance, both in response to

- 1- **game state changes** (as in Tetris)<sup>1</sup>
- 2- **real-time player decisions** (as in Beat Saber)<sup>2</sup>

## Contribution

Design and create our customized 3D video game with an adaptive dynamic audio System → easily switch its synchronization on game states or player decisions



[1] Aline Hufschmitt, Stéphane Cardon, and Eric Jacopin. Dynamic manipulation of player performance with music tempo in tetris. In Proceedings of the 26th International Conference on Intelligent User Interfaces, IUI '21, page 290–296, New York, NY,

[2] Iannis Albert, Nicole Burkard, Dirk Queck, and Marc Herrlich. The effect of auditory-motor synchronization in exergames on the example of the vr rhythm game beat saber. 6(CHI PLAY), oct 2022.

# Game : The Eye of Sahara

FPS Game with Military Context



- 4 Levels of 2 minutes
- Increasing of difficulty level
- Enemies can appear at different locations in the game world, each following a different trajectory using Unreal's spline path system.



The player takes on the role of a first-person shooter

They should eliminate enemy soldiers only when they enter predefined target zones

# Player Performance (score) /difficulty level

Player's score : eliminate enemy (+200) or missed enemy (-50)

The score depends on the precision of the action: maximum points are awarded only if the target is eliminated at the center of the window

The number of :

- shooting windows,
- enemies,
- movement speed

Increases with each level



To assess the effect of synchronization combined with increased workload on player performance



# Synchronized Adaptive Audio System

## 3 configurations

### 1. Players' actions

enemies' deployment and progression speed are calculated to arrive at the center of the shooting window precisely on a pulse.

### 2. Game states

enemies appear in rhythm with the pulse but reach the center of the window randomly between 2 pulses

### 3. Neutral configuration

no music synchronization and stinger are perceptible.



*Transmitted Pulses*



*Activate stingers*



*Synchronous events*



**1. Player action** : Enemy at the center of a shooting window

**2. Game state** : spawn of enemies

**3. Neutral configuration**



# Synchronized Adaptive Audio System TO GAME STATE @ LEVEL 2



# Synchronized Adaptive Audio System TO GAME STATE @ LEVEL 3





# Synchronized Adaptive Audio System TO PLAYER ACTION @ LEVEL 4





# EXPERIMENTAL SETUP

For playtests and survey

## New Player

Unique ID

Playing Habits data  
(frequency & expertise)

synchronization mode:

- ✓ state (spawn)
- ✓ Action (enemy at the target)
- ✓ No synchro

► During each level, in-game data is collected

- ❑ Pulses / stingers,
- ❑ enemy /target window positions,
- ❑ cursor movements,
- ❑ click down
- ❑ release events,

After each of the four levels, players complete a form to Evaluate:

- user experience,
- enjoyment,
- fluidity,
- task load.

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## Conclusions

- Creation of a customized 3D video game to easily adjust the music synchronization, either to game states or to player actions.
- Synchronization was coupled with the game's difficulty, increasing across four levels.
- An executable version of the game can be available.
- The sound is accurately triggered and synchronized according to the two events (enemies' appearance and their reaching the target zones).

## Future Perspectives

- We intend to perform experimental tests to analyze collected in-game data (qualitative and quantitative) to validate our research hypothesis.
- The game is designed for VR headset with eye and heart rate tracking, and GSR, etc. To assess the players' cognitive functions (attention, gaze pattern, memory, spatial awareness, etc.).

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**THANK YOU**

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