



HAL
open science

Effects of game design choices on player experience in video games: a synthesis of four meta-analyses on presence, immersion, enjoyment and flow

Loïc Caroux, Morgane Pujol

► To cite this version:

Loïc Caroux, Morgane Pujol. Effects of game design choices on player experience in video games: a synthesis of four meta-analyses on presence, immersion, enjoyment and flow. 22nd Triennial Congress of International Ergonomics Association - IEA 2024, Aug 2024, Jeju Island, South Korea. hal-04916319v1

HAL Id: hal-04916319

<https://hal.science/hal-04916319v1>

Submitted on 28 Jan 2025 (v1), last revised 28 Jan 2025 (v2)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

EFFECTS OF GAME DESIGN CHOICES ON PLAYER EXPERIENCE IN VIDEO GAMES: A SYNTHESIS OF FOUR META-ANALYSES ON PRESENCE, IMMERSION, ENJOYMENT AND FLOW

SUMMATIVE STATEMENT: We present a synthesis of four meta-analyses of the effects of game design choices on key dimensions of player experience in video games. It has highlighted effects of varying types and sizes of information input/output techniques, in-game content, and multiplayer aspects.

KEYWORDS: Player experience, presence, immersion, enjoyment, flow

PROBLEM STATEMENT: Video games are typical virtual environments displaying complex and dynamic information with which players can interact. From a Human Factors/Ergonomics (HF/E) perspective, their main interest lies in the engagement and enjoyment that the user can experience during and induced by interacting with the game. As with other digital technologies, designing video games means first and foremost considering the people who interact with these systems, their psychological and cognitive functioning, their abilities, expectations, needs and so on. Consideration of HF/E in video games is essential if a game is to be played and appreciated by players.

The most commonly used concept to describe the experience of an individual interacting with a video game is “player experience” (PX), which is the individual, personal experience held by the player during and immediately after playing the game (Wiemeyer et al., 2016). However, this all-encompassing concept needs to be studied in depth in order to understand the complexity of the player's felt, lived, etc. experience.

OBJECTIVE/QUESTION: The present study addresses the issue of defining PX more precisely from a HF/E perspective. We are interested in the different dimensions that make up PX and the aspects of game design that can influence PX and its dimensions.

The literature has produced a number of state-of-the-art reviews on PX over the last decade. All of these literature reviews have shown that presence, immersion, enjoyment and flow are among the most important dimensions of PX and the most studied concepts in video game user research. However, while the contribution of these studies is of great interest to the research and game design community, they remain inherently limited when it comes to whether and how PX is specifically influenced by game design elements. We believe that we now need to rely on meta-analytic methods for a more comprehensive and quantitative view of the game design elements that affect these feelings. Recent studies have used meta-analysis to examine the concepts of presence (Caroux, 2023) and enjoyment (Caroux & Pujol, in press) in video games.

The aim of the present study is to provide a synthesis of the results of these two previous meta-analyses, to which we have added the results of two new, previously unpublished meta-analyses we conducted on other important dimensions of PX: immersion and flow.

METHODOLOGY: We conducted two meta-analyses of the effects of game design choices on immersion and flow. The methodology used in this study was modeled after that of Caroux

(2023). We then synthesized the results of our two meta-analyses with the results of Caroux's (2023) meta-analysis on presence, and Caroux & Pujol's (in press) meta-analysis on enjoyment.

RESULTS: The four meta-analyses included a total of 78 experimental studies, from 62 articles published between 2004 and 2022. They found effects of information input/output techniques, in-game content, and multiplayer aspects. These effects were of different types and sizes for each of the four dimensions of PX examined. Largest effects on presence were found for display mode (head-mounted vs. monitor), co-player nature (human vs. computer), co-playing mode (cooperative vs. competitive), and story presence (vs. absence). Largest effects on immersion were found for co-player nature, and co-play modality (co-localized vs. online). Largest effects on flow were found for difficulty modes (personalized vs. non-personalized ; adaptive vs. non-adaptive). Only one significant effect was found for enjoyment: music presence (vs. absence).

DISCUSSION: These meta-analyses allowed to quantify the sizes of the effects of game design choices on important dimensions of PX, based on combined results from different experimental studies. These results may help to optimize PX in video game design better than the results of isolated studies. Therefore, we are able to provide game designers with some design recommendations with their expected impact on four of the PX dimensions.

Another important finding was that the included studies had a limited explanatory approach. Rarely was it explained why the effects are observed, or on what psychological or cognitive basis it might be explained. The cognitive processes of players in the qualification of PX and the possible effects of design choices on these processes are almost never considered. Future research should be designed to fill this gap in the literature.

CONCLUSIONS: The meta-analyses revealed effects of different types and sizes of technical design aspects of games on each of the four dimensions of PX studied. Future meta-analyses should therefore focus on other important dimensions of PX, such as engagement, and emotional intensity and valence.

REFERENCES:

- Caroux, L. (2023). Presence in video games: A systematic review and meta-analysis of the effects of game design choices. *Applied Ergonomics*, *107*, 103936.
- Caroux, L., & Pujol, M. (in press). Player enjoyment in video games: A systematic review and meta-analysis of the effects of game design choices. *International Journal of Human-Computer Interaction*, 1–12.
- Wiemeyer, J., Nacke, L. E., Moser, C., & Mueller, F. 'Floyd.' (2016). Player experience. In R. Dörner, S. Göbel, W. Effelsberg, & J. Wiemeyer (Eds.), *Serious Games* (pp. 243–271). Cham, Switzerland: Springer International Publishing.