

Doctoral Dissertation
Academic Year 2025

From Anxiety to Engagement: A Multi-Module
Design Model for Enhancing User Experience



Keio University
Graduate School of Media Design

Liu Keren

A Doctoral Dissertation
submitted to Keio University Graduate School of Media Design
in partial fulfillment of the requirements for the degree of
Ph.D. in Media Design

Liu Keren

Dissertation Advisory Committee:

Professor Kazunori Sugiura	(Principal Advisor)
Professor Hiroyuki Kishi	(Co-Advisor)
Professor Hideki Sunahara	(Co-Advisor)

Doctoral Dissertation Review Committee:

Professor Hiroyuki Kishi	(Chair)
Professor Hideki Sunahara	(Member)
Professor Nanako Ishido	(Member)
Professor Yiting Huang	(Member, National Taipei University of Technology)

Abstract of Doctoral Dissertation of Academic Year 2025

From Anxiety to Engagement: A Multi-Module Design Model for Enhancing User Experience

Category: Design

Summary

This dissertation investigates how negative user experiences, particularly anxiety, paradoxically drive positive engagement within digital games. Building upon theories of cyberpsychology, human–computer interaction, and cognitive–behavioral frameworks, the research proposes a holistic design model that views anxiety as a catalyst for game engagement. The study employs both qualitative and quantitative methods, including statistical modeling, to analyze how game difficulty, anxiety effect, narrative, and aesthetic factors interact with user persona traits (e.g. social orientation) in influencing engagement. Results indicate an inverted-U relationship between anxiety and player involvement: moderate anxiety significantly enhances immersion and repeated play, while excessive anxiety reduces willingness to continue. Moreover, user personality dimensions modulate these effects, with socially oriented players reacting more strongly to emotional triggers. Based on the findings, this dissertation introduces an “Anxiety-Triggered Engagement Optimization (ATEO) Design Model,” offering practical guidelines for game designers to transform controlled stressors into sustained player engagement. By linking negative emotional states with cognitive involvement and affective attachment, the framework contributes to both academic discourse on negative user experience and industry best practices, illustrating how targeted difficulty adjustments and rich narrative elements can channel anxiety into deeper, more rewarding gameplay experiences.

Keywords:

cyberpsychology, anxiety effects, game design, user experience

Keio University Graduate School of Media Design

Liu Keren

Contents

Acknowledgements	x
1 Introduction	1
1.1. Introduction	1
1.1.1 Research Background	1
1.1.2 Definition of Negative Game User Experience	3
1.2. Research Purpose and Contribution	4
Notes	5
2 Related Works	6
2.1. Previous Research on Game Experience and User Engagement . .	6
2.2. Research Gap in Negative Game User Experience Studies	8
2.3. Model with Psychological Framework	10
2.4. Research Questions and Hypotheses	19
Notes	19
3 Pretest Discussions	20
3.1. Research Target and Participants for Pretests	20
3.2. Study Design and Pretesting Procedures	21
3.3. Result and Discussion	26
3.3.1 Round 1 Pretest	26
3.3.2 Round 2 Pretest	29
3.4. Collaborative Follow-Up Study on Game Engagement	32
3.4.1 Research background and relevance	32
3.4.2 Methods and Participation Involvement	33
3.4.3 Key Research Findings	34
3.4.4 Contributions and Supplementary Significance	35

3.4.5	Future Research	37
Notes		38
4	Anxiety-Triggered Engagement Optimization(ATEO) Design Model	40
4.1.	ATEO Model Framework	40
4.1.1	Structural Overview of the ATEO Model	40
4.1.2	Advantages Glance of ATEO and Classic Models	40
4.2.	Modules in ATEO Model	43
4.2.1	Game Mechanics Design	43
4.2.2	Game Content Design	49
4.2.3	User Persona	54
4.2.4	Anxiety Effect	55
4.2.5	Game Engagement	57
4.3.	Design Guidelines Based on the ATEO Model	60
4.3.1	Anxiety Driver: Limitation-Based Game Mechanics	61
4.3.2	Adjustment Tools: Content Design to Support Anxiety Effect	62
4.3.3	Optimization Lens: User Persona Mapping	63
4.3.4	Model Mapping Note	65
Notes		67
5	Implementation Test and Evaluation	68
5.1.	Player Experience Evaluation	68
5.1.1	Test Design and Procedure	68
5.1.2	Data and Statistical Analysis	86
5.1.3	Evaluation Result	101
5.2.	Designer Application Feasibility Evaluation	110
5.2.1	Evaluation Metrics	110
5.2.2	ATEO Implementation in Game Design	110
5.2.3	Evaluation Result	127
5.3.	Evaluation Summary	140
Notes		143

6	Discussion with Psychology	144
6.1.	Engagement in Behavior Field	144
6.2.	Pathways of Anxiety's Effect	146
6.3.	Internal Dynamics of the Engagement Module	148
6.4.	Application Approach for the Design Module	150
6.5.	Impact of Negative Evaluation Results	151
7	Conclusion and Future Works	153
7.1.	Outcome	153
7.1.1	Design with Anxiety Mediating Effect	155
7.1.2	Optimization for ATEO Model Application	160
7.2.	Innovation and Contribution	165
7.3.	Ethical and Social Considerations	165
7.4.	Limitation	167
7.4.1	Further Psychological Frameworks	167
7.4.2	Duration Effect and Longitudinal Research	167
7.4.3	Beginner-Friendliness and Learning Curve	168
7.4.4	Limited Improvement over Narrative Immersion	168
7.5.	Future Works	169
7.5.1	Cognitive Meme Model	169
7.5.2	Potential for Cross-Disciplinary Collaboration	170
7.5.3	Enhancing Beginner Accessibility	172
7.5.4	Optimizing with PSR-based Design	172
	Notes	173
	References	174
	Appendices	189
A.	Semi-Structure Interview Outline for Pre-tests	189
B.	Measurement Questionnaire	190
B.1	Game Engagement	190
B.2	Anxiety	191
B.3	Personality Preference	191
C.	Cyan Bird Narrative Design	192

List of Figures

1.1	Situated Cognition Example	3
1.2	Negative user experience with positive engagement (Screenshots © Nintendo)	5
2.1	Gestalt Psychological Model	11
2.2	Gestalt Model in Game (Screenshots © Nintendo)	12
2.3	Bartel player Types	14
2.4	General Aggression Model1	17
2.5	General Aggression Model2	18
3.1	Arena of Valor (Screenshots © Tencent)	24
3.2	Final Fantasy XIV-ENDWALKER(Screenshots © Square Enix)	25
3.3	Satisfaction of the game quality	28
3.4	How to know about digital game?	29
3.5	Observational Data1	31
3.6	Observational Data2	31
3.7	Discourse Analysis Result1	32
3.8	Discourse Analysis Result2	33
3.9	Estimates of structural model.(Gong et al. 2024)	35
3.10	Construct intercorrelations(Gong et al. 2024)	36
3.11	Effects of PSI at different game genres.(Gong et al. 2024)	37
3.12	Effects of PSI at different game genres.(Gong et al. 2024)	38
4.1	Concept Framework	41
4.2	The ATEO Model(with explanation for modules)	42
4.3	ATEO vs Classic Models	43
4.4	Dark Souls Design(Screenshots ©FromSoftware)	46
4.5	Zelda Design(Screenshots ©Nintendo)	48

4.6	Hades Character Design(Screenshots ©Supergiant Games)	51
4.7	Undertale Scene(Screenshots ©Toby Fox)	51
4.8	FFXIV Story Design(Screenshots ©Square Enix)	53
4.9	FFXIV Story Design(Screenshots ©Square Enix)	54
4.10	Arknights Story scene(Screenshots ©HYPERGRYPH)	54
4.11	Inverted-U-shaped Relationship (Awada,2024)	57
4.12	Limitation Design Examples 1	61
4.13	Limitation Design Examples 2	62
4.14	Buffering Design Examples	63
4.15	Accelerator Design Examples	63
4.16	User Persona Mapping	64
4.17	Modules in practical procedure 1	65
4.18	Modules in practical procedure 2	66
5.1	Screenshot of Super Hexagon by Terry Cavanagh	69
5.2	Prototypes ATEO vs Baseline(Classic Model)	70
5.3	Time Plan	73
5.4	Measurement	74
5.5	Classic Model Baseline Group 0	77
5.6	ATEO Model Group 1	78
5.7	Cyan Bird Character Design	79
5.8	Quanxin Tree	80
5.9	Cyan Bird Scene Design1	80
5.10	Cyan Bird PV Screenshot1	81
5.11	Cyan Bird PV Screenshot2	82
5.12	Cyan Bird ATEO vs Narrative Immersion	83
5.13	Feather Character Design	83
5.14	Feather Main Page Design	84
5.15	Feathers ATEO with Juicy Feedback	84
5.16	512 ATEO vs Follow Channel	85
5.17	Statistical Analysis	87
5.18	Convergent Validity	87
5.19	Discriminant Validity	88
5.20	Pearson Correlation	88

5.21	Difficulty vs. Anxiety	89
5.22	Difficulty and Anxiety on Game Engagement	90
5.23	Anxiety & Game Engagement	92
5.24	Anxiety& Engagement Dimensions	92
5.25	Red for Extrovert& Blue for Intorvert	95
5.26	Game: 512	97
5.27	Game: Feather	98
5.28	Game: Cyan Bird	99
5.29	Between Groups Analysis(AETO vs Classics)	100
5.30	Between Groups Analysis(Introvert vs Extrovert)	101
5.31	Evaluation Structure)	102
5.32	Evaluation Results for Anxiety Driver 1	103
5.33	Evaluation Results for Anxiety Driver 2	104
5.34	Evaluation Results for Adjustment Tool	105
5.35	Evaluation Dynamicity and Effectiveness for ATEO vs Classic Models	106
5.36	Effectiveness for AETO vs Classic Models	107
5.37	Dynamicity for AETO vs Classic Models	107
5.38	Evaluation Robustness for ATEO vs Classic Models	108
5.39	Robustness for AETO vs Classic Models	108
5.40	Evaluation Summary for AETO vs Classic Models	109
5.41	Designers' Profiles (Screenshots © miHOYO and © Ada Eden)	111
5.42	Brave New World Development Summary	112
5.43	Brave New World Limitation Design	113
5.44	Brave New World Buffering Design	114
5.45	Brave New World Aesthetics Design1	114
5.46	Brave New World Aesthetics Design2	115
5.47	Morning-Star Overview	116
5.48	Morning-Star Physical Limitation Design	117
5.49	Morning-Star Narrative Design	118
5.50	Morning-Star Aesthetics Design	119
5.51	Morning-Star Sensory Design with Arduino	119
5.52	Perfect Me Overview	121

5.53	Perfect Me Character Design	122
5.54	Perfect Me Game-play Overview1	123
5.55	Perfect Me Game-play Overview2	124
5.56	Perfect Me Aesthetics Design	125
5.57	Perfect Me Narrative Design Outline	126
5.58	Perfect Me Hidden Ending Illustration	127
5.59	Anxiety Driver Module Usage Scores	128
5.60	Anxiety Driver Module Strategy Comparison	129
5.61	Anxiety Driver Module Usage vs Design Experience	130
5.62	Adjustment Tools Module Usage Scores	131
5.63	Adjustment Tools Module Strategy Comparison	132
5.64	Optimization Lens Module Strategy Scores	134
5.65	Optimization Lens Module Strategy Comparison 1	134
5.66	Optimization Lens Module Strategy Comparison 2	135
5.67	ATEO vs Usual Design Focus Model	136
5.68	Mental Well-being Awareness Scores	138
5.69	Mental Well-being Strategies	139
5.70	Mental Well-being Consideration in Morning-Star	139
5.71	ATEO Performance vs Modules Usage	141
5.72	Why the ATEO Model Works: A Pathway Insight	141
5.73	ATEO Performance vs Modules Usage	142
6.1	ATEO Design Model	145
7.1	Principle of Using ATEO Model	153
7.2	Expression Framework: ATEO Design Model	154
7.3	ATEO Design Model Outcome	155

Acknowledgements

First and foremost, I would like to express my sincere gratitude to my supervisors and all the members of my dissertation committee.

Throughout the entire research process, Professor Kazunori Sugiura not only offered valuable guidance and professional advice, but also gave me unlimited patience and encouragement. Professor Hiroyuki Kishi, Professor Hideki Sunahara, Professor Nanako Ishido, and Professor Yiting Huang have demonstrated a rigorous academic attitude, profound professional knowledge, and a strong sense of responsibility toward students. All these will serve as guiding beacons and morning stars for my future career.

At the same time, I would like to give special thanks to all participants who took part in this research experiment. Without your active development, participation, and valuable feedback on the prototype game, this study could not have been successfully completed. Your passion for games and your support are the source of my continued drive forward.

In addition, I sincerely thank my family and friends for your understanding, support, and encouragement. It was your companionship that allowed me to stay persistent and motivated during the arduous journey of pursuing a doctoral degree. Whenever I encountered difficulties and challenges, you patiently offered me care and support.

I have come to know that the cost of seeking truth is a bitter journey—from a lonely star reaching toward the cosmos. Yet this path was real, and it belonged to my soul alone. As Carl Jung once said: “No tree, it is said, can grow to heaven unless its roots reach down to hell.”

Finally, to my cat Coconut—your soft fur and gentle purring helped me through countless silent nights. And to Fynn timer, the quiet plush companion—you taught me what a fierce kind of courage it takes to live softly.

Thank you for letting me witness this blooming flower—the flower of such roots.

Chapter 1

Introduction

1.1. Introduction

1.1.1 Research Background

The increased emphasis on user experience pushes developers to concentrate on make digital media systems more engaging. The video games market was worth 195.65 billion in 2021 and is expected to be an annual worth rate of 12.9% by 2030¹. Consumer preferences have shifted from a product-centric era to a relationship-centric model(Nielsen 2018). Williams believed that electronic games had connected the people around the world through shared play experience(Williams 2006). Accordingly, the study of user experience has been increasingly focused on players' perceptions and responses of games as well as how to promote game involvement to maximize the interest of the industry (Takatalo and Häkkinen 2011).

Studies have shown that the connection between user engagement and user experience in games influences a range of cognitive, affective, and behavioral (Banks and Bowman 2014). The increased emphasis on user experience pushes developers to make digital media systems more engaging (O' Brien 2008). To explain how user experience affects user engagement in games, scholars have investigated it from the perspectives of flow theory (Sherry 2004), uses and gratifications theory(Lucas and Sherry 2004), cyber-psychology and other theories.Early game researchers overly focused on the negative impacts of game engagement, but whether the negative impacts are truly negative remains controversial(Boyle 2012).

Drawing upon the perspective background of cyber-psychology and other relevant scholarly frameworks, this study will delve into the investigation of the user experience in gaming on the effects of anxiety. Williams suggested a critical research agenda to examine “civic engagement, social capital, and the displacement

of face-to-face interactions” (p. 652) in virtual social networks (Williams 2006). As the theoretical background for similar researches related to interactions in virtual social networks, cyberpsychology is an emerging interdisciplinary domain found by The British Psychological Society (BPS)² and developed since 2018, which centers on the examination of psychological phenomena stemming from human interaction with digital media. Mainstream cyberpsychology research programs concentrate on a variety of internet-related themes such as relationships, personality types in cyberspace, identity, digital gaming addiction, regressive behavior, etc.

Cyberpsychology is a growing branch of psychology that seeks to explain people’s behaviors, mental states, and psychological phenomena when interacting with media or other users in cyberspace with psychological theories (Parsons 2019), and the part of cyberpsychology involved in this study is closely related to situated cognition in applied psychology which can be traced back to functionalism (Figure 1.1). Galotti described cognitive science as “the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses” (Galotti 1994), while functionalism as a philosophical theory of the cognitive sciences (Polger 2012). The theory of functional psychology was a direct outgrowth of Darwinian thinking which focuses attention on the utility and purpose of behavior (Fancher and Rutherford 2012). Dewey paid attention to the relationship between individual and collective and emphasized the adaptation of individual to their environment in functionalism (Dewey 1896). Drawing from the perspective of functionalism, cognitive states can be understood as functional states that encompass the entirety of complex systems.

Within the framework of functionalism, psychological states are primarily defined by their functionalities, encompassing their interactions with stimulus inputs and behavioral outputs, as well as their interconnections with other psychological and nonpsychological internal states within a given system (Polger 2012). Given the provided definition and underlying assumptions, contemporary scholars have also labeled functionalism as applied psychology within the field. The perspective of situated cognition is widely taken in the area of applied psychology, which is one of the branches of cognitive science. The theory noted all knowledge is situated within the framework of activity that is intricately intertwined with social, cultural, and physical contexts. Besides, the cognitive task completion process

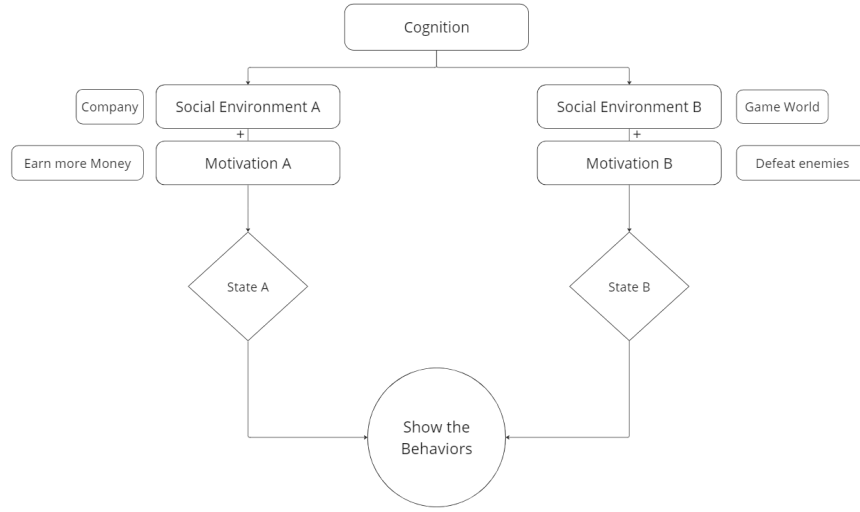


Figure 1.1 Situated Cognition Example

undergoes transformation under the influence of environmental factors (Greeno and Moore 2018).

1.1.2 Definition of Negative Game User Experience

Previous studies shows: Negative gaming experiences are frequently associated with anxiety and depression, and also mentioned . Gaming engagement has no direct connection to mental health, except in the case of anxiety.(Loton et al. 2016). Besides, during challenged game-play, players often experience anxiety due to perceived performance pressure and difficulty imbalance(Wang et al. 2022)

Since current study takes a design perspective with a strong focus on psychology, negative user experience in this study refers specifically to emotional states related to anxiety during gameplay.(Unlike definitions that focus on technical issues or usability errors, this study does not include interface problems, system bugs, or usability failures.)

In the actual gaming action and gameplay process, negative user experience here means emotional discomfort caused by task difficulty, time pressure, or emotional tension — especially task-related anxiety. Although this kind of experience feels

“negative,” it can play a useful role in increasing player engagement if properly adjusted.

In this sense, negative experience is seen as a designable emotional condition, not a failure of interaction. By balancing this condition, designers can guide players into their best engagement zone.

1.2. Research Purpose and Contribution

Consequently, predicated upon the foundational tenets of this theoretical background and perspective, the present study endeavors to develop a preliminary model wherein individual behaviors are caused by a function of their distinct psychological and cognitive states, which are originally influenced by environmental factors. This implies that, the purpose of study is addressing the negative loop of frustration and disengagement in current game experience—Exploring how moderate anxiety can be reframed as a positive emotional driver, designing model that supports emotional regulation and sustained engagement to further explore how negative user experience influences user engagement by concentrating on what positive effects, if any, user engagement based on anxiety experience has on individual players, and provide a guideline including a dynamic guidance model for game mechanics design based on this phenomenon and individual game users’ personality traits related to social preference. While evidence suggested that in the East Asian digital gaming market, even if a game causes people to feel stressed or nervous, instead of quitting games, some of the core users would devote more consumption including time and money to the game-inducing unpleasant experience (Qiu et al. 2023). (Figure 1.2)

In Western game user research, Juul (2013) similarly focuses on this phenomenon and argues that players will promote positive engagement behaviors to a certain extent in response to negative in-game feedback (e.g., failure or death in a game level) (Juul 2013). This project seeks to further scholarly understanding of this phenomenon by focusing on the popular game genres and its users.

Additionally, most previous researches focus on the connection between positive user experience with positive user engagement or negative user experience with negative user engagement, and researchers commonly acquiesce to this phe-

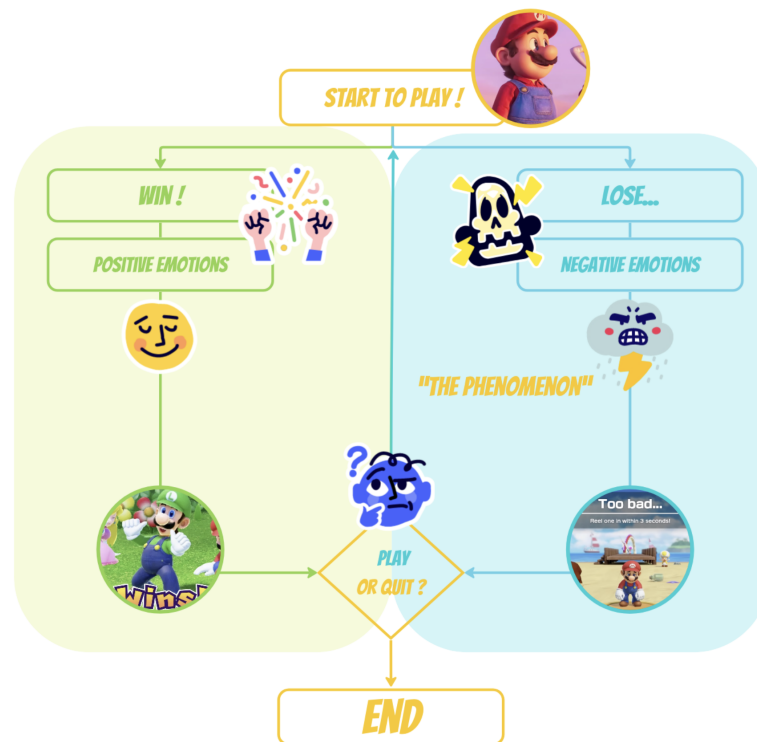


Figure 1.2 Negative user experience with positive engagement (Screenshots © Nintendo)

nomenon or simply in their studies without explaining the phenomenon. The contribution of current study allows researchers and developers to utilize the guideline to profile the psychology of game users in a more in-depth and comprehensive way, and it is tend to specifically explain and investigate negative user experience's impact on positive engagement in the digital game to inquire that if this phenomenon could push developers to improve game design and bring benefit to game industry by applying the guidance dynamic model.

Notes

- 1 <https://www.giiresearch.com/report/grvi1092443-video-game-market-size-share-trends-analysis.html>
- 2 <https://elearningindustry.com/what-is-ux-in-games>

Chapter 2

Related Works

2.1. Previous Research on Game Experience and User Engagement

The user experience, as defined by the international standard on ergonomics of human-system interaction(ISO9241)¹, encompasses the perceptions and responses that users have during and after the use of a system, product, or service. Sutcliffe argues although the ISO standard does not explicitly delineate the relationship between user experience and usability, it acknowledges the overlapping nature of these concepts. Compared with usability of the product, which focuses on pragmatic aspects of task completion, user experience encompasses both pragmatic and hedonic aspects, influencing users' feelings towards the system(Sutcliffe 2010).

In the realm of game design and development, the evaluation of user experience has been a focal point for designers over the past two decades (Bernhaupt 2010). Game experience, a multidimensional concept, encompasses various aspects of user engagement, satisfaction, and enjoyment when interacting with video games (Bernhaupt 2010). Researchers share varied opinions about the definition of game experience. The eLearning Industry² provides insights into user experience within the context of game design, emphasizing its significance in shaping player engagement, enjoyment, and retention. Key elements such as interface design, game-play mechanics, and player feedback contribute to the overall game experience. Bernhaupt describes game experience through qualities such as flow, engagement, presence, immersion, and fun(Bernhaupt 2007).

The understanding and definition of game experience hold great importance for game designers, researchers, and practitioners seeking to create immersive and meaningful gaming experiences(Lapaš and Orehovački 2015). Recognizing

the role of experience in game design is integral to the development of successful games, and this understanding serves as an essential component of the game design process (Nordin 2014). Simultaneously, research on game engagement is another significant factor of high frequency interest for game designers. Consensus on the precise terminology to describe the subjective experience of playing video games has yet to be reached, as noted by Wirth et al. (Wirth 2007). To measure game engagement, numerous valuable perspectives shed light on how concepts such as presence, flow, arousal, participation, and others contribute to or constitute engagement (Brockmyer 2009). Considering the above conditions, this study will employ the term “game engagement” as a broad indicator of individuals’ level of involvement in gaming activities, serving as a generic descriptor, including users’ cognitive, affective and behavioral states(Abbasi 2019).

From the perspective of cognitive engagement in game, which can be summarized as the level of dedication a player exhibits towards gaming activities(Zheng and Gardner 2017), researchers indicate that a deeply engaged player is completely absorbed in the game and remains unaware of their surroundings, referring immersion and flow as key concepts frequently explored in research concerning game engagement. Affective engagement, or emotional engagement in game refers game narrative that trigger emotions in the player, emphasizing the significance of self-congruency with the game content(Abbasi 2019). Affective engagement always relates to fiction layer in game contains narrative, visual and audio designed to allow player to evoke emotional experience, and builds an emotional connection between game characters, the game world, and players(Sylvester 2013). For example, Song and Fox’s study demonstrated the association between consumption of romantic media and romantic beliefs. They investigated romantic video game (RVG) and Chinese young women users and found that the amount of time spent playing RVGs predicted these women’s romantic beliefs indirectly(Song and Fox 2015).

Behavioral engagement in game closely related to user interaction including social connection and playful consumption experience in games (Abbasi, 2019). Cheung revealed that the extent of monetary expenditure in online games is determined by users’ game behavior(Cheung 2015). Previous research indicates that factors that influence user in-game consumption include but are not limited to users’ game narrative preference(Liu 2019), game design and the quality of games

are also significant factors affecting the audiences' cost in the new media(Yu and Xue 2018). For example, Liu notes that if the media content is unavailable to benefit the user because of the competitive mechanism in the game, the user will reduce or stop playful consuming in the game(Liu 2019). Another example is micro-payments in free online games could minimize users' awareness of the actual investment made in the game and made users lost control of their spending(Del Moral Pérez and Guzmán Duque 2016).

User experience and user engagement, as most significant factors in game design, scholars explore the connection between them, thoroughly investigating the impact of game experience on engagement. According to Alexiou, the key elements contributing to a positive game experience and explores the relationship between user experience and game design principles(Alexiou and Schippers 2018). The findings shed light on the intricate interplay between game experience and user engagement, such as improving users' game experience is expected to enhance individual intrinsic motivation. Alexiou(2018) also noted the moderating influence of player personality traits on game experience and engagement, while proposing strategies for integrating these traits into the game design process. In a recent study conducted by Johannes, participants engaged in Plants vs. Zombies: Battle for Neighborville and Animal Crossing: New Horizons were surveyed to assess their overall well-being, motivations, and satisfaction of needs during gameplay(Johannes and Przybylski 2021). The findings revealed a notable correlation between game engagement and the cultivation of positive user experiences including affective well-being.

2.2. Research Gap in Negative Game User Experience Studies

To understand how negative user experience affects user engagement, it is necessary to review how negative experiences have been discussed in media and game studies. Although most existing research focuses on positive user experiences, several studies provide insight into the emotional, behavioral, and social consequences of negative interactions in digital environments.

To inquire how negative user experience affect user engagement, it is significant

to analyze what is negative user experience. For example, Giles mentioned a special type of parasocial relationship named “negative parasocial relationship” (Giles 2010). Scholars rarely investigate disliked media figure, while audiences have strong emotion with both favorite figure and least favorite figure (Giles 2008). Thus, the motivation and experience of interacting with this type of media figure in digital game might be negative, and the inquiry into the potential consequences of negative experiences on the engagement levels of media users remains an area that has received limited attention and exploration.

Although in William’s research the immersive online game led to an improved global outlook and some online community improvements, most players became more insular (Williams 2006). Scholars who come up with a similar idea conducted their interpersonal interaction studies using digital game users as the subject. Del Moral Pérez and Guzmán Duque studied the consuming habits and user’s virtual social behavior in CityVille and noted the risk of addiction involved in some online games was quite existing, but the advantages that online games offered to enhance interpersonal and communication skills were more effective, and they suggested that users could develop interpersonal skills in online games (Del Moral Pérez and Guzmán Duque 2016). Besides, electronic games could also increase users’ negative emotions. In Reinecke’s research, he found that ego depletion may increase the risk of negatively appraising the use of video games entertaining media as a form of procrastination. He concluded that guilt is negatively related to the recovery experience associated with using entertainment (Reinecke and Eden 2014). Another line of research paid close attention to the impact of video game violence on players’ underlying psychological processes. Rothmund investigated the psychological processes underlying short- and long-term effects of video game violence on interpersonal trust with two studies. The study investigated the long-term impact of frequent exposure to video game violence and suggested that video game violence can decrease interpersonal trust and victim sensitivity among teenagers. Rothmund also contended that interacting with physically aggressive virtual agents would decrease players’ trust in subsequent interactions in the game (Rothmund. T. and C. 2015).

According to previous researches, user engagement is heavily impacted by user experience. Most results support the same idea: the quality of user experience

is positive related with user engagement(Cheung 2015), which means positive user experience can promote user engagement in the digital game. However, Juul mentioned the paradox in the game study: “Players like to fail, but not too much” (p.5)(Juul 2013). Developers also tried to keep the balance of difficulty in the game to put users in the psychological state of flow(Sherry 2004). These evidences indicate that negative user experience can also improve user engagement and bring benefit to game industry. The ideas of sportsmanship and other hypotheses are mentioned by Juul to explain why the paradox existing, but Juul did not give a firm conclusion. At the same time, Juul notes that researchers tend to acquiesce to this phenomenon in their studies without explaining the paradox of failure(Juul 2013). Therefore, the role of negative user experience in promoting user engagement remains to be further studied.

2.3. Model with Psychological Framework

The emergence of cyber-personality as a focal point in the field of cyber-psychology underscores the dearth of understanding regarding the manifestation of distinct personality traits within the cyber-environment. Li and Wang noted the applicability of knowledge pertaining to personality effects in the actual environment cannot be assumed when extrapolated to cyber contexts, as the expressions of personality traits and social motivations within cyberspace may or may not align with their observed behavioral effects in the real world (Li 2021). Specific personality traits and motivational factors play a regulatory role in individuals’ online behaviors, encompassing activities such as online communication and self-expression(Attrill 2015). To enhance the investigation of players’ conduct within the cyber realm, this research project incorporated personality factors as variables. Consequently, the Gestalt psychological model(Figure 2.1) encompassing personality, environment, motivation, and behavior, will be employed to elucidate and analyze the performance and psychological state of game participants under stress-inducing factors.

According to Koffka, the world is psycho-physical, and the psycho-physical field contains the polarization of the ego and the environment, each part of which has its own organization(Koffka 1935). This organization indicates that the ego

Gestalt personality model

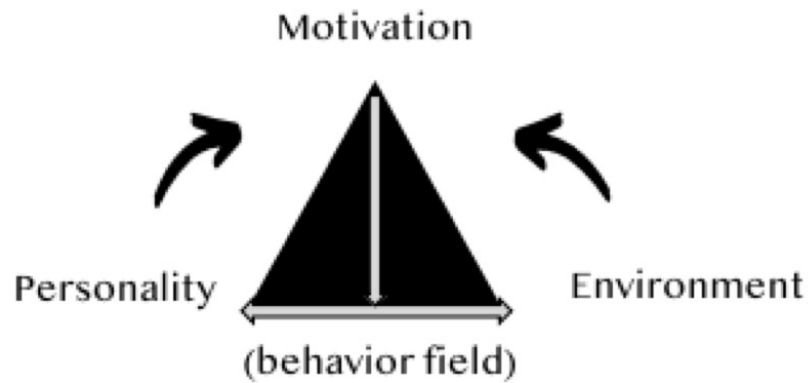


Figure 2.1 Gestalt Psychological Model

is not a bundle of desires, attitudes, aspirations, needs, etc., and that the environment is not a mosaic of sensations. Gestalt psychologists emphasize that organisms perceive holistic patterns or configurations rather than isolated components, encapsulating the notion that "the whole is more than the sum of its parts" (p.13) (Sternberg 1973). From the perspective of personality, the presence of an individual entails the process of distinguishing oneself from the environment, and effective self-regulation entails engaging with an environment in which the person recognizes the potential nourishment or toxicity of novelty (Polster and Polster 1973). When applying Gestalt psychology to the study of personality, scholars have similarly set up a field that encompasses the interaction of personality and environment.

Within Gestalt psychology, the behavior field is perceived as a dynamic model comprising two poles: personality and environment. (Figure 2.2) An imbalance in the relationship between the individual and the environment leads to tension and polarity. Once an individual's goals, including motivation and needs, are fulfilled,

the tension diminishes (Lindorfer 2021). Therefore, as a basic model that allows researchers to simultaneously observe players' behavioral changes, motivations, and game design content, the Gestalt personality model can help researchers clearly establish a dynamic psychological modeling framework to describe and evaluate players' behaviors under stressful situations, thus deepening the findings of the positive feedback of the anxiety effect on the players, and constructing a cyberpsychological perspective for game designers to design a guidance system for optimizing the difficulty of the mechanism for the user's experience and engagement.

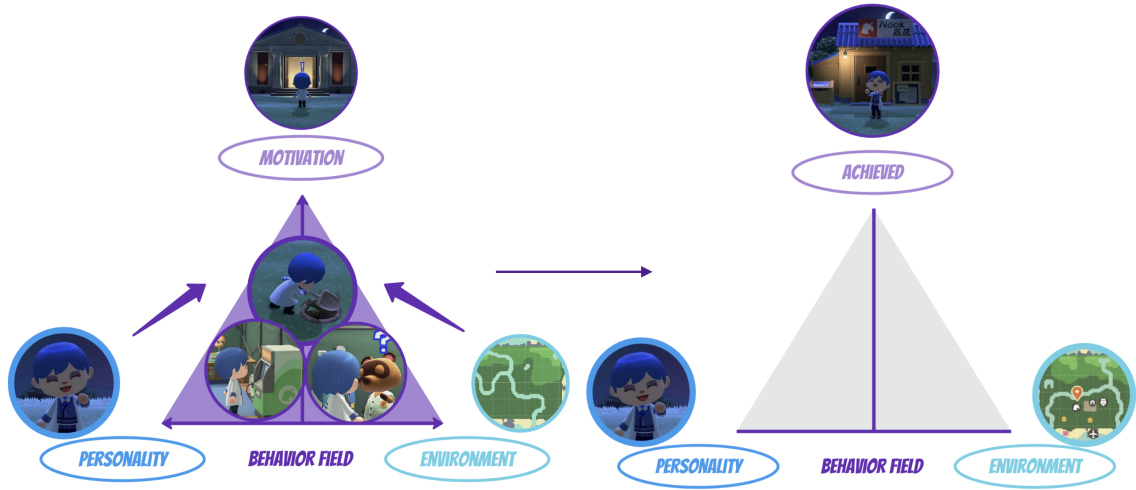


Figure 2.2 Gestalt Model in Game (Screenshots © Nintendo)

Since the motivation at the top of the model in this study corresponds to game motivation, and the content of the Behavior field corresponds to player game engagement, and Uses and gratifications theory (UGT) as a tool is frequently utilized to explain and study motivation and user engagement, therefore UGT will be used as part of the theoretical framework to analyze these two variables. UGT originated from Herzog's proposal to identify three types of gratifications: emotional, wishful thinking, and learning (Herzog 1944). On this basis, Maslow developed a hierarchical theory of needs, including 5 categories in the model: Ascending the hierarchy, the fundamental needs include physiological (e.g., food

and clothing), and physical (e.g., food and clothing). theory of needs, including 5 categories in the model: Ascending the hierarchy, the fundamental needs include physiological (e.g. food and clothing) (Maslow 1943).

Blumler and Katz state that 'The understanding of what the audience does for the media not what the media does for the audience', and define the theory of Uses and Gratifications as Audience aren't passive but Also they choose media to meet their needs(Katz 1974). However it also suggests that audiences use the media to fulfill specific gratifications. In recent years, this new branch of research explores the UGT of starting to play game. The motivations of achievement, enjoyment, and social interaction play crucial roles in initiating engagement with online games(Jesse 2019), while the players' success in the game and the satisfaction derived from their experiences serve as predictors of their continued participation. For instance, Chu found a positive correlation between perceived usefulness and the willingness to consume virtual goods, with intention to use serving as a mediating factor in this association from the survey about intention to use and perceived usefulness of virtual goods (Chu 2018).

To further inquiry the motivation needs in game, Bartel player Types (Figure 2.3) is also one of the tools that will be used to analyze user experience in this study, which can be divided into two different scenarios: Player with Player game (PVP), which relates to virtual relationship theory and semiotics. Player with environment(PVE), which will involve parasocial interaction theory. Bartel player Types classifies players into four types: Socializers, Explorers, Achievers and Killers(Jesse 2019).

Socializers and Killers type players tend to engage more in PVP games, while virtual relationship (interaction) is an essential theoretical perspective to investigate PVP players. As an alternative concept that arguably covers the same ground as parasocial phenomena, the virtual relationship has become a way of life in society. As Ferdig contended, people nowadays live in an era of digitally-mediated relationships, and they "build and sustain both platonic and romantic relationships with technology"(p.1) (Ferdig 2017). Ferdig (2017) noted that the study in the virtual world would require new methodological approaches. For example, he claimed that the individual with an avatar in the electronic game has at least three different units of analysis. The first unit is the in-life person, the

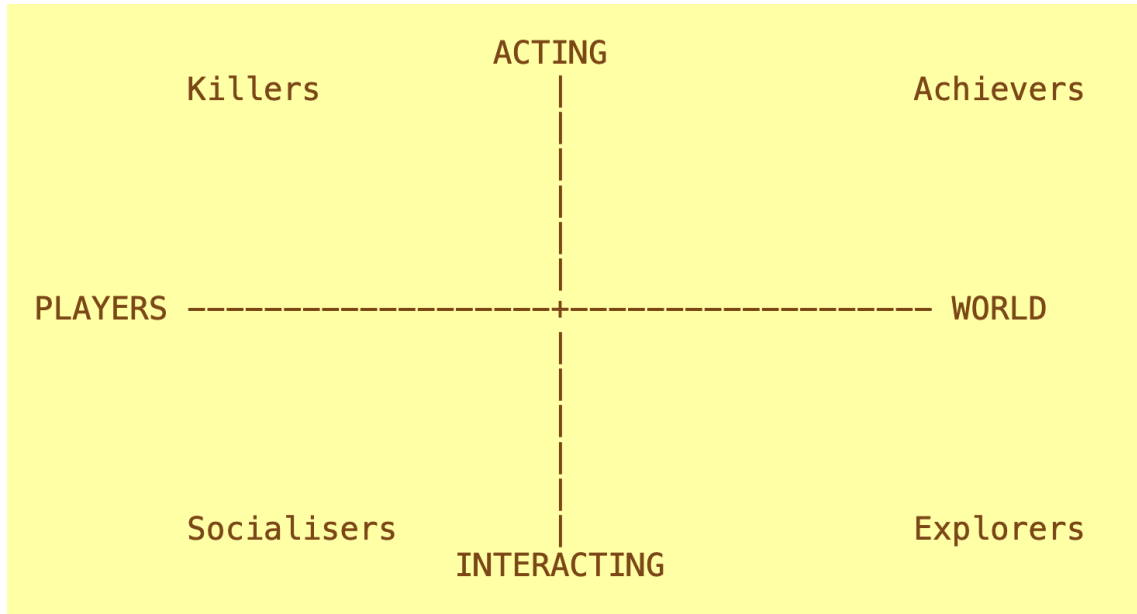


Figure 2.3 Bartel player Types

second unit is the in-world person, and the third unit is the navigation that individual “makes between the in-life and in-world actions, beliefs, and behaviors” (p.3)(Ferdig 2017). Additionally, as the virtual relationship has become a way of life in society, the negative social experience such as peer pressure in virtual relationship will also affect users’ behavior in the in-game environment.

Explorers and Achievers players prefer to play PVE games, which is appropriate to utilize the perspective of parasocial interaction and relationships to further inquire. PSR refers to the relationship between individuals and the fictional characters during the act of using media (Giles 2010). Horton and Wohl argued that parasocial interaction could take place at any time if audiences encounter the media figure(Horton 1956). David Giles proposes a series of stages that occur during the initial parasocial encounter, leading to the formation of a parasocial relationship with media figures(Giles 2002). The first stage involves audiences utilizing their existing knowledge to evaluate the media figure. In the second stage, two scenarios emerge: individuals may be influenced directly by the media figure, leading to imitative behavior, or they may be influenced by other media

consumers, engaging in discussions about the media figures and being swayed by others' opinions. Both scenarios have implications for potential outcomes of the parasocial interaction within the context of a parasocial relationship. The final stage presents two additional possibilities for the parasocial relationship: envisioning interaction with the media figures and attempting to establish contact with them. The parasocial interaction theory encompasses the significant notion of the media figure (MF), which can be classified into three distinct categories. First-order figures (MF1) pertain to unequivocally existing human individuals, such as celebrities. Second-order figures (MF2) encompass fictional characters with observable human attributes, as seen in films or TV series. Third-order figures (MF3) encompass fictional characters lacking visible human form, such as those found in cartoons or fantasy novels. Moreover, a specific subtype of media figure pertains to individuals who have deceased (Giles, 2002). Within game-related studies, the characters that engage with players typically belong to the MF3 classification, which encompasses entirely fictional fantasy characters (Giles 2002).

The other two factors in the Gestalt personality model, environment and personality, also involve different theoretical perspectives of analysis, respectively.

For the purpose of personality analysis among game users, the current study will employ the Big Five personality model. Originating in the 1980s, this model, serves as a suggested classification system for personality traits, facilitating an understanding of the interplay between personality and behaviors (Poropat 2009). Within this model, five distinct personality traits are included: Openness, conscientiousness, extraversion, agreeableness and neuroticism (Roccas 2002).

First, Openness to experience captures the dichotomy between being inventive and curious versus being consistent and cautious. Second, conscientiousness reflects the contrast between being efficient and organized versus being extravagant and careless. The third trait is extraversion which encompasses the spectrum from being outgoing and energetic to being solitary and reserved. Agreeableness as the fourth one covers the continuum between being friendly and compassionate versus being challenging and callous. The last trait is neuroticism which represents the range from being sensitive and nervous to being resilient and confident (Roccas 2002).

The Big Five personality model has been extensively employed in previous re-

search to analyze the behavioral and psychological aspects of game users and consumers. For instance, Chu demonstrates that the extraversion of game players amplifies the impact of perceived usefulness of virtual environments on players' intention to use (Chu 2018). Deng and Gao investigate the influence of the Big Five personality traits on impulsive buying, as well as the potential mediating roles of self-control and sensation seeking. Their findings indicate significant correlations between all five traits and impulsive buying behaviors. Furthermore, extraversion (exerting a positive effect) and conscientiousness (exerting a negative effect) exhibit the most substantial influences on impulsive buying. Self-control and sensation seeking emerge as crucial mediators between the Big Five personality traits and impulsive buying tendencies (Deng 2015). Similarly, de Hesselle employs the motives for online gaming questionnaire and reveals that lower levels of extraversion, agreeableness, and conscientiousness, as well as higher engagement in gaming for social, escapism, and competition motives, predict increased time spent gaming when age, gender, personality traits, and gaming motives are considered as predictors in a multiple linear regression model (de Hesselle 2021).

One of the main theoretical perspectives in this research is the General Aggression Model (GAM). GAM (Figure 2.4) (Figure 2.5) (Anderson et al. 2004) explores the impact of the gaming environment on user behavior and personality traits. Under the complex premise that the negative user experience is formed by different negative emotions, GAM, as a dynamic model designed for media, is most suitable for analyzing how negative user experience affects user engagement in the game. GAM suggests that mediated violence could cause the increasing of viewer aggression. This model is based on the social cognitive theory, which argues that "cognition, affect, and arousal mediate the effects of personal and situational variables on aggression" (Stanley and D. 2015). In GAM, social encounters and individual's behavior impacts each other. The individual behave with or without aggression toward other people could cause different subsequent social encounter. Then the social encounter affects situation factors and personal factors. As one of the significant factors in the whole process, the present internal state will let the individual judge the situation and make a decision: either responding with thoughtful action or impulsive action. Also, some researchers concerned that GAM overstates the media's influence on aggression (Stanley and

D. 2015). However, GAM does not propose any strict conclusion about an individual's behavior. In GAM, an individual's action could be affected by several elements such as a situation or present internal state so that the individual could respond either thoughtfully or impulsively. Not to mention, GAM is a dynamic model in which each factor can interact with each other.

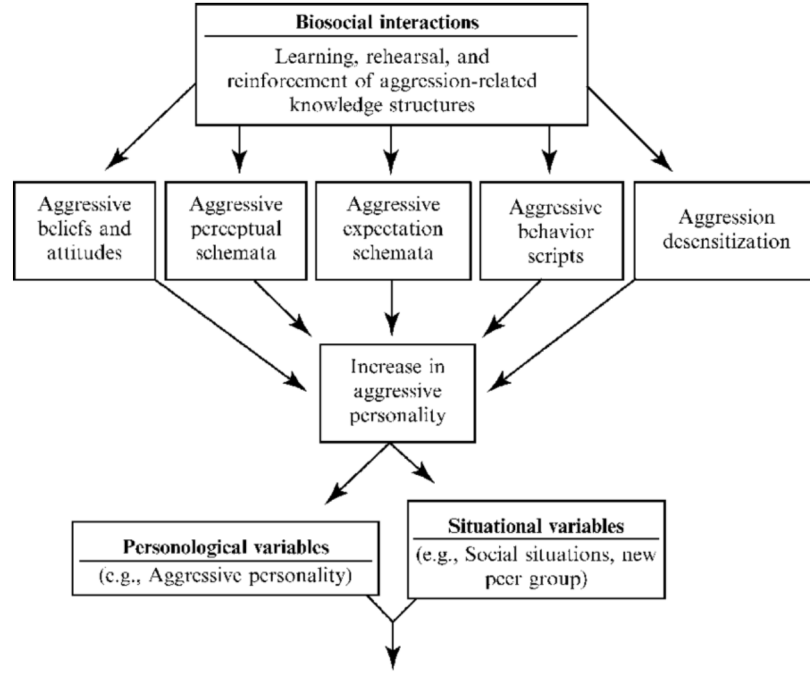


Figure 2.4 General Aggression Model1

In addition, the length of time spent in the game environment is also an important environmental factor that affects the player's personality traits and behavioral performance. There is a previous game study on long- and short-term effect investigates the psychological processes underlying time spent effects of video game violence on interpersonal trust. The findings revealed that, in terms of short-term effects, engaging with physically aggressive virtual agents led to a decline in players' trust levels in subsequent interactions. This effect was particularly pronounced among players who exhibited sensitivity to victimization. Conversely, in terms of long-term effects, the frequency of playing violent video games over a 12-month period was associated with diminished interpersonal trust, especially among in-

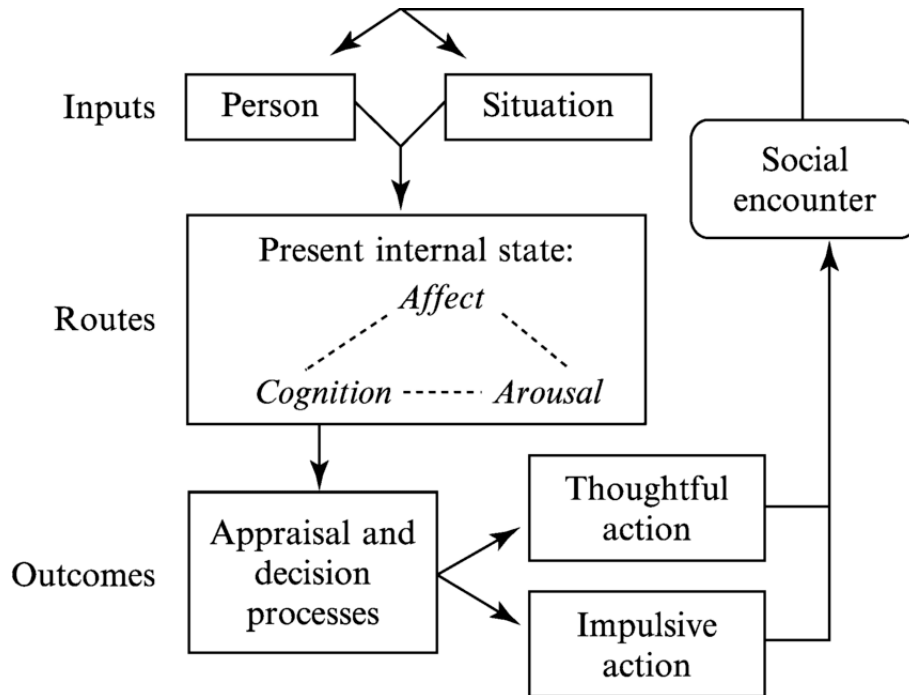


Figure 2.5 General Aggression Model2

dividuals who were sensitive to victimization (Rothmund, T. and C. 2015). Empirical studies offer support for variations in individuals' susceptibility to both short-term and long-term effects resulting from the consumption of violent video games. Rothmund identified an unresolved issue pertaining to future research on the impact of group game play on players' hostile thoughts (Rothmund, T. and C. 2015). As multiplayer video games often involve interactions with both player characters (PCs) and non-player characters (NPCs), it is important for future studies to systematically differentiate between PCs and NPCs. Therefore, this study applies a theoretical framework that incorporates and distinguishes between PVE and PVP perspectives to the study of digital games can provide valuable insights into the impact of social interactions on player behavior.

2.4. Research Questions and Hypotheses

Two core research questions are formulate for this study, the first question is designed for the quantitative research method, and the second question will be explained by qualitative research methods. Meanwhile, there will be a hypothesis examining the relationship between negative user experience and game involvement. The hypothesis for the second research question will focus on personality features and time effects. Research questions and hypotheses will be studied as follow:

RQ1: Will users promote engagement in the game if the game brings them anxiety-inducing game experience?

H1: User engagement is positive related with the anxiety-inducing game experience. Moderate anxiety be used as a driver for player engagement in digital games.

RQ2: How to optimize engagement when user meet anxiety-inducing game experience?

H2: Designing mechanisms and emotional modulations can optimize this effect across different players.

Notes

1 <https://www.iso.org/standard/77520.html>

2 <https://elearningindustry.com/what-is-ux-in-games>

Chapter 3

Pretest Discussions

3.1. Research Target and Participants for Pretests

The pretests participants are users of multiplayer online battle arena (MOBA) as well as role-playing game (RPG). As a popular type of online game, MOBA games focus more on adversarial combat between players(Mora-Cantalops 2018), while massive multiplayer online role-playing games (MMORPG) involve both player interaction with the fictional layer of the game world and encourage cooperative interaction between players(Asbjørn 2010). Players of MOBA games attach great importance to teamwork and the interpersonal relationship between individuals. MOBA game is a sub-genre of strategy video games(Yang 2014). Commonly, a MOBA game player will control the character in a team to compete versus another opposing team. To defeat the players on the enemy team and their primary structure, players in the same team should cooperate to improve their characters' level that contribute to a team's overall strategy (Mora-Cantalops 2018). As one of the most popular game types, MOBA games with significant economic growth in recent 10 years can be utilized as research subject to study the connection between user experience and user engagement. For example, Tencent 2019 third quarter results show that online games income is 28.604 billion yuan, up 11% from a year earlier, mainly because the domestic and overseas market of mobile MOBA games such as Arena of Valor¹. Therefore, as a popular MOBA game with a wide range of users and good market revenue, Arena of Valor and its players were used as the research subject at the beginning of the first round of prediction.

The primary goal of MMORPG's players is the development of their character. The players who focus on roleplaying will develop extended, in-depth narratives by using the setting and resources in the game world(Asbjørn 2010). Compared with players of MOBA games, MMORPG's players will have more interaction

with Non-player characters (NPC) in the game to complete tasks and missions. MMORPGs also require players to participate in teamwork to develop their characters' level of ability (Schroeder 2006). The online games that emphasizes the interaction between player and non-player resources are the appropriate subjects which can be utilized to study the virtual relationship between players under the premise of non-competition and the parasocial relationship between player and NPCs. One of the examples is Final Fantasy XIV (FFXIV). FFXIV is a massively multiplayer online role-playing game (MMORPG) developed by Square Enix for Sony Play Station and Microsoft Windows personal computers. The Final Fantasy series centers on fantasy and science fantasy role-playing video games (RPGs). In the series, most composition are console games, except FFXIV and FFXI. The game design of FFXIV was heavily impacted by previous console games, which made it meet with negative responses after release as an online game at the first time in 2010. The gameplay, interface, and the general impression of the game is inappropriate for the online game users (Fear 2015). For this reason, the original FFXIV story was changed to build up to the end original game, and the change of the storyline was used as a story-based reason for the radical changes coming to the remake version game and its landscape. (Copeland 2011) Square Enix made improvements of the game mechanics to meet online game users requirements, remade the game with a new version initially subtitled A Realm Reborn and received positive reviews from game critics worldwide.. According to Imagine Games Network (IGN)², the latest version Shadowbringers was up to the score of 92 in 2019. As one of the most critically acclaimed MMORPGs in the world, FFXIV and its players were used as research subjects in the second round of pre-tests.

3.2. Study Design and Pretesting Procedures

This study utilized a two-round pretest methodology, employing online surveys, quasi-experimental observation, and in-depth interviews as the primary methods. The online surveys and quasi-experimental design were employed in the pretest and subsequent testing phases to assess the correlation between negative user experiences, specifically anxiety-inducing encounters, and user engagement. Furthermore, the in-depth interviews were conducted to delve deeper into un-

derstanding and elucidating the specific behavioral consequences and cognitive processes associated with negative user psychological experiences, thereby exploring the underlying reasons behind these effects on user engagement.

To maximize the collection of user data across various pretest phases, a verified professional blogger account on Weibo, a prominent Chinese microblogging website, with over thirty thousand followers in the game industry, was utilized as a recruitment tool for survey quasi-experimental participants. Additionally, announcements were disseminated on Weibo, as well as other social media platforms frequented by gamer communities, such as Twitter and Tumblr, to ensure the inclusion of a diverse range of gamers.

A total of 436 web-based questionnaire data were obtained from the two rounds of pretests. The online survey consisted of items that measured the psychological wellbeing, beliefs, and behaviors of gaming, as well as the financial contributions to and time spent on gaming. Additionally, social-demographic variables such as age, gender, region, educational attainment, and income were included. The Zung Self-Rating Anxiety Scale (Zung 1971) was also used as a concrete measure of anxiety in the survey. This scale consists of 20 self-report items that assess anxiety levels, encompassing cognitive, autonomic, motor, and central nervous system symptoms. The Likert scale was employed in the design of the questionnaire, which aimed to gather data pertaining to key variables of interest. The questionnaire items primarily focused on the following core constructs: game motivation (e.g., I take the matter of playing games very seriously.), the individual's tolerance level towards pressure arising from the in-game environment (e.g. Playing games increased tolerance for negative emotions such as anxiety.), the intention to engage in positive gameplay (e.g. I don't give up when I encounter stress, dilemma, or failure in the game, but try to do it again.), the level of flow state (e.g. During the game, my actions come naturally and without thinking.), Consumption over expectation, and the duration of online game (in-game time spent).

Data for the quasi-experiment was collected from volunteers who met the research requirements. The researcher recruited total 26 respondents for quasi-experiment and in-depth interviews. The volunteers were divided into different groups based on game modes, game difficulty, and individual gaming habits. All volunteers were asked to take the Big Five personality test questionnaire before

the start of the experiment to test for personality. During the course of the observation experiment, all participants were required to fill out and submit a daily observation report form which included information such as the number of wins and losses, the mode (easy or hard) in which participants competed, in-game consumption, and an Anxiety Inventory questionnaire aimed at gauging the players' stress levels during gameplay.

The anxiety inventory was combine with State Anxiety Inventory (SAI) and Test Anxiety Inventory(TAI). SAI was designed as a section of the daily observation report. As a widely employed psychometric tool designed to assess state anxiety levels (Spielberger 1983). Its primary application extends to clinical contexts, where it aids in diagnosing anxiety disorders and distinguishing them from depressive syndromes. The State Anxiety Inventory (SAI) serves as a valuable tool for evaluating an individual's state anxiety level within a specific context or circumstance(Spielberger 1988). his comprehensive scale encompasses a variety of items that probe into the individual's physical manifestations, emotional responses, and cognitive aspects of anxiety performance. Participants are required to rate each item based on their subjective experience during a particular point in time or situation, thereby providing insights into their anxiety level within that specific context (Spielberger 1988). The Test Anxiety Inventory (TAI) offers a means to assess an individual's anxiety level in the specific test environment. By focusing on the individual's disposition towards anxiety in general, the TAI provides a comprehensive understanding of their text environment anxiety tendencies (Liebert and Morris 1967).The SAI and TAI is frequently employed in research endeavors as a reliable measure to evaluate caregiver distress(Greene 2017).

The first round of pretest used MOBA game Arena of Valor and their users, 10 people in total.(Figure3.1) The initial pre-test phase aimed to assess the feasibility of the overall study design, without distinguishing between experimental and control groups. Consequently, all volunteers received the comparative group design, consisting of a pretest and posttest. Given that MOBA games are played in teams of five, a total of two teams comprising ten individuals were recruited. These participants were assigned two weeks of tasks: the first week entailed a relatively straightforward objective, requiring all participants to achieve seven victories in easy mode within one week. The second week posed a more challenging task,

with volunteers expected to achieve three victories in hard mode daily as part of their daily routine. Aside from the prescribed tasks, participants were granted autonomy to determine whether or not they would engage in additional gameplay. Nonetheless, the frequency and duration of gameplay were meticulously recorded in the daily observation report. During the data collection process, a total of three instances of invalid data were encountered due to factors such as failure to complete assigned tasks and unreliable responses in the psychological test questionnaire.



Figure 3.1 Arena of Valor (Screenshots © Tencent)

For the second round pretest, the MMORPG FFXIV and its user base were employed. Given that FFXIV quests are undertaken by a group of 8 players, a total of 16 individuals were recruited for this stage.(Figure3.2) The participants were divided into two distinct groups: the experimental group and the control group. Both groups were tasked with completing specified trials (i.e., 8-player quests) from FFXIV's new expansion pack, "ENDWALKER", within a one-month timeframe. The experimental group was required to tackle the quests in hard mode, while the control group was assigned the easy mode. Additionally, all

group members were expected to engage in team practice sessions at least once a week. Apart from the quests, no restrictions were imposed on game time or in-game expenditures. Following each gaming session, participants were required to complete a daily observation report form, similar to the one used in the initial pretest phase. This form encompassed aspects such as game-related behaviors, specific durations of gameplay, and in-game expenditures. The responses of these groups were analyzed and compared using t-tests for correlation coefficients and ANOVA. All the quantitative data collected from the survey was analyzed using statistical packages in SPSS, including both descriptive and predictive analyses.



Figure 3.2 Final Fantasy XIV-ENDWALKER(Screenshots © Square Enix)

During the in-depth interview session, an online instant messaging service was utilized to contact interview participants, because it allowed the researcher to reach a wide geographic area and ensured the interviews were able to “take place at the respondents’ convenience” (p. 252) (Zhang 2016). Throughout the interview, the researcher talked about game experience with the interview participants to establish rapport with participants. Each interview was conducted in person or via Skype and lasted about one hour. The interviews covered various topics, such

as how participants got involved in the game, their experiences of playing the game, their views on violence in the game, their perception of game addiction, and their justifications for spending money and time on the game. The interviews were recorded and later transcribed into text. Discourse analysis was adopted to examine the thematic content and salient frames in the interview transcripts. In addition to the survey and interviews, participant observation was used as a means of understanding gamers' experiences. The researcher signed up for the game and played each game for at least 10 hours to gain insight into game design and user experience. Importantly, the researcher did not hold any preexisting concepts about the game and game users. During the game, the researcher took ethnographic notes, which were used to depict the contextualized gaming culture as a tool for triangulation in qualitative inquiry.

The researcher meticulously transcribed the conversations in their entirety and documented them in the research records. The notes were securely stored in a personal computer, safeguarded by encryption to ensure data protection. Email addresses of the participants were collected, and any personally identifiable information will be thoroughly removed from the researcher's personal device upon the completion of the research study.

3.3. Result and Discussion

3.3.1 Round 1 Pretest

The first round pretest was conducted in April 2021. The study employed an online survey and quasi-experimental design to pre-test and test the co-relationship between negative user experiences, such as anxiety, and user engagement. Additionally, in-depth interviews were conducted to investigate and explain the specific behavioral effects of negative user psychological experiences on user engagement and the underlying reasons for these effects.

The online survey consisted of items that measured psychological well-being, gaming behaviors, and the financial and temporal investment in gaming. For the quasi-experimental study, volunteers were recruited based on their ability to meet the research requirements. Participants were divided into different groups based

on various factors, such as game modes, difficulty, and individual gaming habits. The responses of these groups were then analyzed and compared.

Furthermore, the in-depth interviews covered a range of topics, including the experience of playing the game, attitudes toward violence in the game, self-perceived addiction to gaming, and justification for spending time and money on the game. To examine the thematic content and salient frames in the interview transcripts, discourse analysis was adopted.

Working with data collected from Round 1 pretest, the researcher conducted linear regression analysis to successfully support the hypothesis proposed: User engagement is positively related with the anxiety the users feel while playing the game over a certain range. Specifically, the linear regression analysis result showed that there was a positive correlation between the anxiety level and positive engagement behavior of the participants in the online survey questionnaire ($R = 25.4\%$, $F = 16.356$, $p < 0.01$), with the formula $Y = 0.679 + 0.632X$, where Y represents the dependent variable, i.e., the positive engagement behavior, and X represents the independent variable, i.e., the anxiety level. The result indicates that X has a significant positive influence on Y , supporting the hypothesis that user engagement is positively related with the anxiety the users feel while playing the game over a certain range. Furthermore, the researcher set the classification problem “I will not give up when I suffer from stress, difficulty, or failure in a game” in the online survey questionnaire to divide participants into two different groups: a low score group (who prefer to disagree with the description) and a high score group (who prefer to agree with the description). During the test, the participants in the high score group showed more positive reactions than the low score group in game behavior, game consumption, game attitude, and flow statement in game.

In summary, the data from the Round 1 pretest and subsequent analysis support the hypothesis that user engagement is positively related to the anxiety users feel while playing the game over a certain range. The findings also suggest that users who have a higher tolerance for negative emotions and are less likely to give up when facing stress, difficulty, or failure in a game tend to exhibit more positive engagement behavior. (Figure 3.3)

The interview focuses on the motivations, emotions, and behaviors of players in

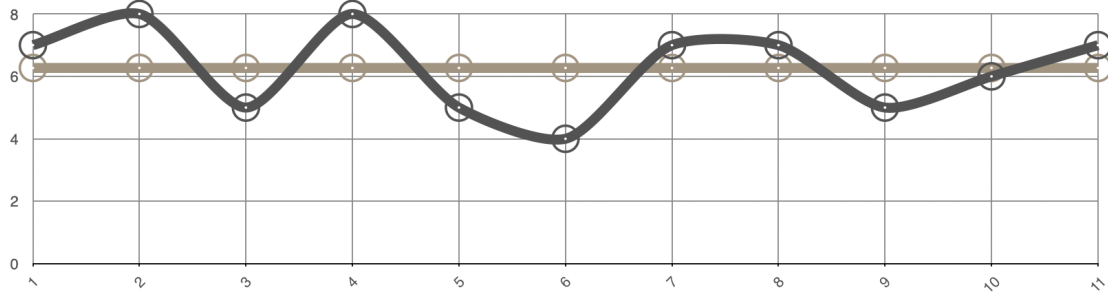


Figure 3.3 Satisfaction of the game quality

a specific game. The data present a summary of the themes that emerged from the analysis of players' responses during the conversation. The responses were categorized into different groups based on common themes. One theme that emerged from the responses was the players' motivation to play the game. The players' reasons for playing the game included social needs, sunk costs, game content, and convenience. Another theme that emerged was the players' emotional experiences while playing the game. The emotions that players reported included somatization symptoms, feelings of aggrivement, fear, the desire to win the game, the desire to seek revenge on other players, and a sense of unfairness. The third theme that emerged was the players' behaviors in response to difficulties, dilemmas, or unpleasant experiences in the game. The players' responses were grouped into three categories: staying engaged, retaliatory behavior, and suspending the game. These findings provide insights into the motivations, emotions, and behaviors of players in this particular game, which could be useful for game developers and researchers studying player behavior. (Figure 3.4)

The researcher conducted a thorough review of the initial pretest experience and subsequently refined all aspects of the study design. Specifically, in the survey section, the information collection process was optimized, and the reliability and validity of the questionnaire were enhanced. Additionally, the observation process underwent modifications to ensure rigorous data collection. The researcher employed various techniques, including participant observation, to gather insights on the gaming experience, while maintaining anonymity to avoid any observer bias. Furthermore, the semi-structured interview was revised to accommodate

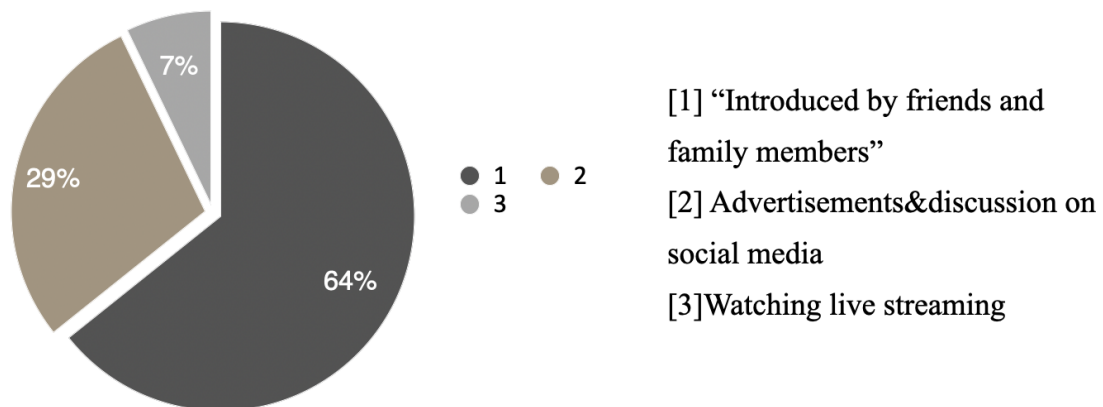


Figure 3.4 How to know about digital game?

more topics and maintain an open discussion format. Securing additional funding was necessary to improve the recruitment process and ensure a more diverse pool of participants.

3.3.2 Round 2 Pretest

The Round 2 pretest was conducted in May 2022, and the volunteers were categorized according to game modes, difficulty levels, and individual gaming habits. The responses of the groups were analyzed and compared, utilizing T-tests for correlation coefficients and ANOVA. A concrete measure of anxiety, the Zung Self-Rating Anxiety Scale, was adopted in the survey to evaluate anxiety levels, including cognitive, autonomic, motor, and central nervous system symptoms. All the quantitative data collected during the survey underwent descriptive and predictive analysis using statistical packages in SPSS.

The researcher recruited 16 participants for in-depth interviews, each lasting approximately one hour and conducted either in person or via Skype. The interviews covered a range of topics, including the reasons for involvement in gaming, the gaming experience, perceptions of violence in the game, self-identification as a gaming addict, and the justification for spending time and money on gaming. All interviews were recorded and later transcribed for thematic and salient frame analysis, utilizing discourse analysis.

In addition to surveys and interviews, the researcher employed participant observation as a means of understanding the gaming experience. The researcher registered and played each game for at least 10 hours, avoiding any preconceptions about the game or gaming culture. The notes taken during gameplay served to illustrate the contextualized gaming culture, serving as a tool of triangulation in qualitative inquiry.

Pretest Round 2 was conducted to investigate the relationship between tolerance for pressure from the in-game environment and intention of positive game engagement, as well as the relationship between intention of positive game engagement under pressure and time spent online (in-game time), and the correlation between intention of positive game engagement under pressure and flow state level.

A linear regression analysis was performed on data collected from 436 participants, revealing that tolerance for pressure from the in-game environment had a significant positive influence on intention of positive game engagement ($Y=3.214 + 0.223X$, $R=7.8\%$, $F=36.540$, $p<0.01$). Another linear regression analysis showed that intention of positive game engagement under pressure had a weak positive influence on time spent online ($Y=2.959 + 0.005X$, $R=3\%$, $F=0.720$, $p<0.05$). A correlation analysis revealed that intention of positive game engagement under pressure had a positive correlation with flow state level (Pearson correlation coefficient >0 , $N=436$).

This study also included observational data (Figure 3.5) in the form of State Anxiety Inventory (SAI) scores for all participants, with 8 in each of the control and experimental groups. The State Anxiety Inventory (SAI) measures anxiety levels that fluctuate over time. The control group had an average SAI score of 29 and average expenditure of 44.28, while the experimental group had an average SAI score of 36 and average expenditure of 63.43. These results suggest that the experimental group experienced higher levels of anxiety but also spent more time and money on the game compared to the control group.

The data obtained from the interviews underwent text analysis using the gestalt personality theory as a framework for analysis. According to gestalt personality theory, researchers divide in-game stressful situations into long-term and short-term ones, and set up coordinate axes with players' personal achievement tendency and social tendency to analyze the information provided by the volunteers in the

Sample No.	C1	C2	C3	C4	C5	C6	C7	C8
TAI	45	34	57	50	53	51	44	50
SAI	24.5	28	43.5	27.4	27.25	25.25	26.75	29
Expending	39	98	0	30	45	98	0	44
Gate	Raid 1-4	Raid 1-4	Raid 1-4	Raid 1-4	Raid 1-4	Raid 1-4	Raid 1-4	Raid 1-4
Big Five								
O	34	23	17	26	33	32	30	32
C	37	30	31	32	37	34	19	27
E	15	17	19	15	22	12	22	17
A	34	24	23	33	37	36	24	18
N	22	11	16	9	8	18	8	32

Figure 3.5 Observational Data1

Sample No.	E1	E2	E3	E4	E5	E6	E7	E8
TAI	49	40	50	46	42	50	49	51
SAI	43	44	43	36	26	40	28	36
Expending	45	0	128	50	98	98	25	63
Gate	Raid(Savage) 1-4	Raid(Savage) 1-4	Raid(Savage) 1-4	Raid(Savage) 1-4	Raid(Savage) 1-4	Raid(Savage) 1-4	Raid(Savage) 1-4	Raid(Savage) 1-4
Big Five								
O	24	18	21	29	34	29	18	29
C	30	38	35	28	22	34	18	27
E	9	11	15	16	30	15	16	7
A	38	32	32	14	36	38	20	13
N	17	11	18	16	14	16	10	28

Figure 3.6 Observational Data2

conversation. (Figure 3.7)

Findings indicate that when confronted with a long-term dilemma, individuals with a preference for personal achievement are more inclined to express their inclination to discontinue the game, while those with a preference for social achievement are more likely to report their efforts to overcome the challenge. In contrast, when dealing with a short-term dilemma, individuals with a personal achievement tendency tend to describe their behaviors as repetitive practice and attempts to take control of the situation, while those with a social achievement tendency typically engage in social withdrawal.(Figure 3.8)

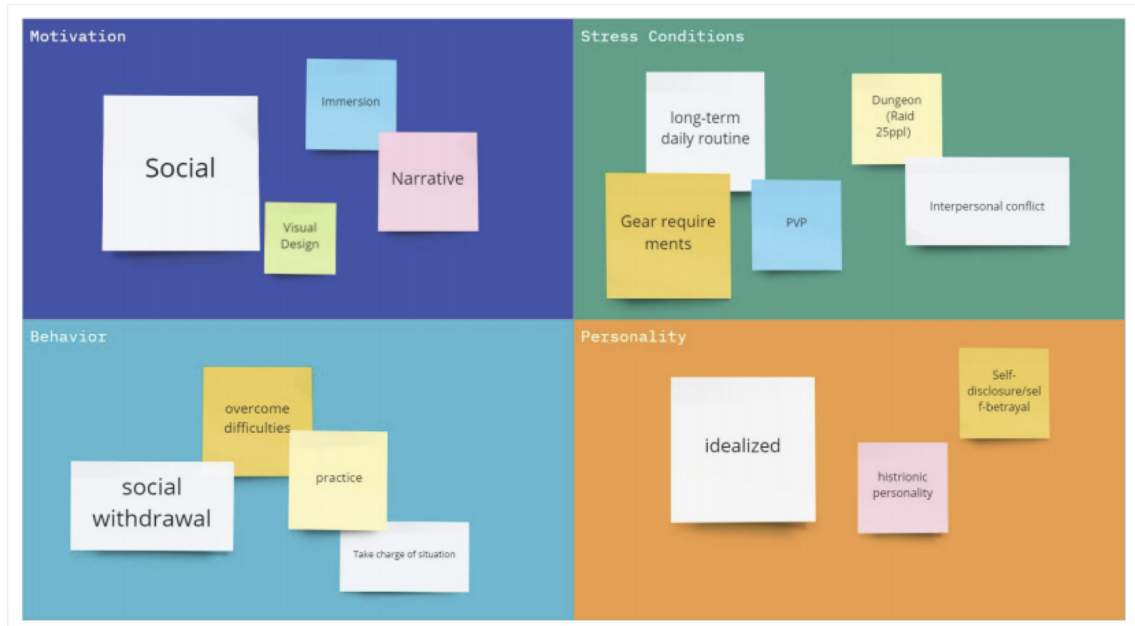


Figure 3.7 Discourse Analysis Result1

3.4. Collaborative Follow-Up Study on Game Engagement

3.4.1 Research background and relevance

The current research lies within the domain of digital game user behavior and experience, with a particular focus on how anxiety affects players' cognitive and psychological structures, as well as how these emotional dynamics influence overall game engagement. To further explore the structure and mechanisms of Game Engagement, the researcher collaborated with Professor Huang (Department of Interaction Design, NTUT) and Dr. Gong on a spin-off study titled "Getting hooked on mobile games: Strengthening purchase intentions towards mobile games using the investment model and parasocial interactions."

This collaborative work serves as a derivative study expanding upon the conceptual Module of Game Engagement developed in the current project. The theoretical framework integrates Investment Model and Parasocial Interaction (PSI)

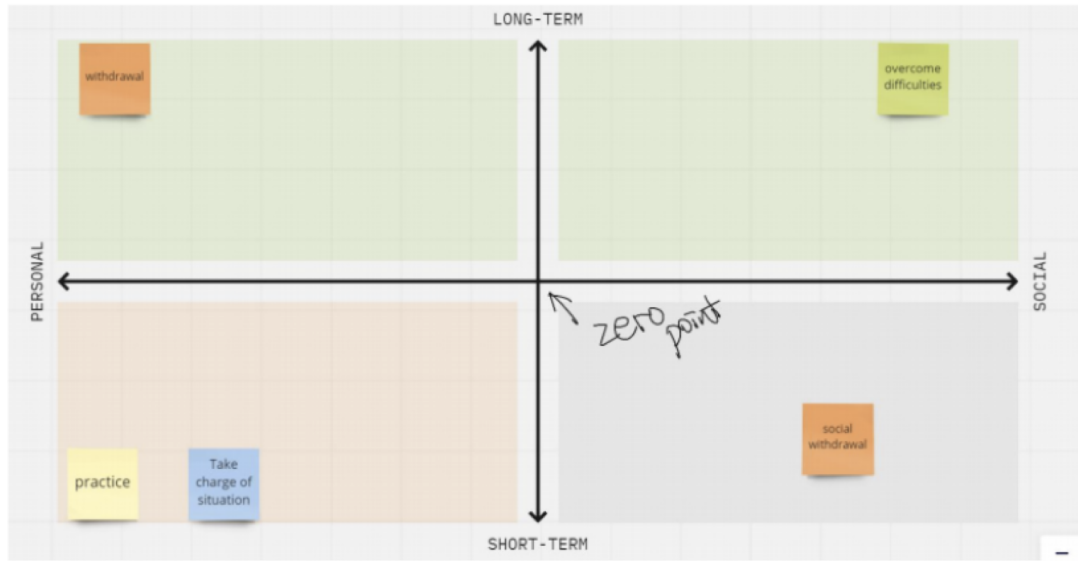


Figure 3.8 Discourse Analysis Result2

Theory, examining key predictors of game commitment and in-game purchase intention (Gong et al. 2024).

The background of this derivative research is based on the booming development of China's mobile game market and the user base of gacha games in recent years. To explore how players' emotional investment and investment size affect their long-term commitment to the game and their spending behavior. Due to the high overlap between the two studies in research variables such as the affective level of participation (satisfaction, quasi-social relationship) and the behavioral level of participation (investment scale, perceived alternatives), this derivative project provides the possibility for the current doctoral research project to supplement the application of anxiety effect from the perspective of market economics, and enriches the overall research perspective.

3.4.2 Methods and Participation Involvement

In this study, a cross-sectional survey of 2045 Chinese Gacha game players was conducted using structural equation modeling (SEM) and moderation analysis.

The study constructs a theoretical framework based on the investment model, which mainly includes the following variables:

1. Satisfaction: Measures the overall satisfaction of the player with the game experience.
2. Investment Size: The amount of time, money, emotional, and social resources the player has invested in the game.
3. Perceived Alternatives: A player's perception of alternative games or entertainment options.
4. Game Commitment: reflects the player's willingness to build a long-term relationship with the game.
5. In-game Purchase Intention: a player's propensity to make future micro-transaction purchases. In addition, this study introduces
6. Quasi-social interaction (PSI) variable, which examines the emotional bond between players and game characters.

In this derivative study, the researcher is mainly responsible for the construction of the theoretical framework and the discussion and support of the results, which ensures the rigor of the research model and theory. (Figure 3.9)

3.4.3 Key Research Findings

The results show that game commitment is positively related to purchase intention, with structural equation modeling analyzing results showing that game commitment has a significantly positive impact on in-game purchase intention (standardized coefficient $\beta = 0.24$, $p < 0.001$). (Figure 3.10)

While the role of satisfaction is also significant, data shows that players' satisfaction with the game significantly positively affects their game commitment ($\beta = 0.57$, $p < 0.001$) and purchase intention ($\beta = 0.26$, $p < 0.001$). The positive effect of investment scale factor's data shows that the various resources invested in the game are positively related to game commitment ($\beta = 0.40$, $p < 0.001$) and purchase intention ($\beta = 0.21$, $p < 0.001$).

About the factor of negative impact of perceived alternatives, although perceived alternatives have a significant negative impact on game commitment ($\beta = -0.12$, $p < 0.001$), they have no significant impact on direct purchase intention ($p = 0.071$).

Another factor is the multiple roles of quasi-social interaction (PSI). PSI not only

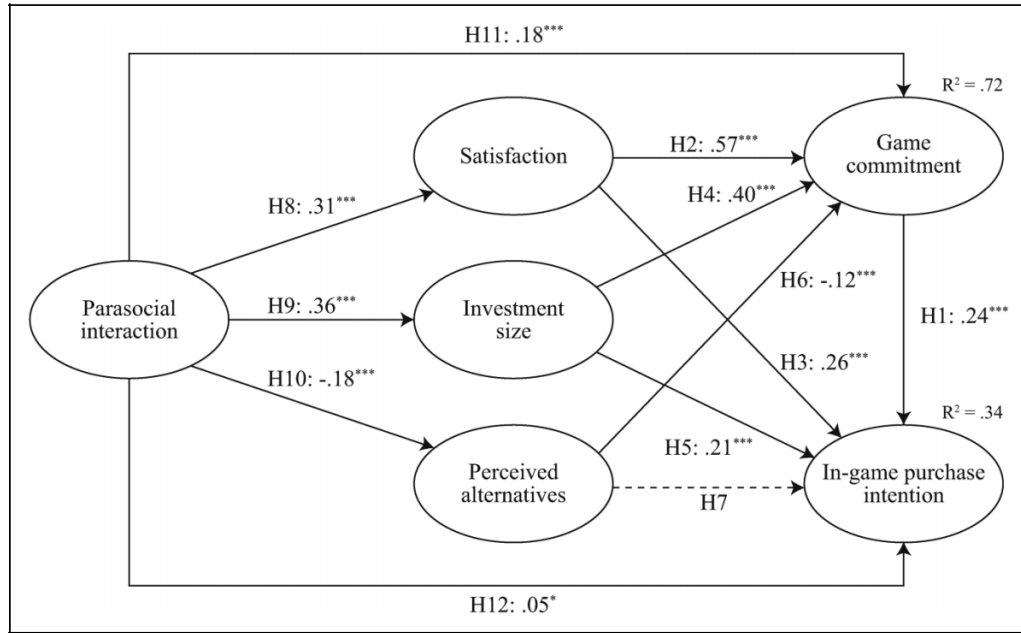


Figure 3.9 Estimates of structural model.(Gong et al. 2024)

significantly positively affects player satisfaction ($\beta = 0.31$, $p < 0.001$), investment scale ($\beta = 0.36$, $p < 0.001$) and game commitment ($\beta = 0.18$, $p < 0.001$), but also positively affects player satisfaction ($\beta = 0.31$, $p < 0.001$). At the same time, it was negatively correlated with perceived alternatives ($\beta = -0.18$, $p < 0.001$). However, its direct impact on purchase intention is weak ($\beta = 0.05$, $p = 0.049$).

Besides, moderating effect of game type is also one of the key findings. The study also found that different types of games (such as relationship simulation games, action role-playing games, etc.) moderated the effect of PSI, with the effect of PSI being more significant in relationship simulation games.(Figure3.11) (Figure3.12)

3.4.4 Contributions and Supplementary Significance

This collaborative derivative research provides the following complementary effects to the PhD program:

Variables	PSI	SAT	IS	PA	GC	IGPI
PSI	.70					
Satisfaction	.30***	.81				
Investment size	.33***	.26***	.72			
Perceived alternatives	-.16***	-.22***	-.29***	.79		
Game commitment	.50***	.71***	.60***	-.35***	.77	
In-game purchase intention	.32***	.48***	.42***	-.15***	.56***	.73
CR	.88	.91	.76	.86	.90	.85
AVE	.48	.66	.52	.62	.59	.53
Mean	5.26	5.25	3.93	4.91	5.14	3.77
SD	1.27	1.13	1.39	1.35	1.35	1.31

Note. The numbers on the diagonal are the square roots of the average variance extracted (AVE) values; *** $p < .001$. PSI: parasocial interaction; SAT: satisfaction; IS: investment size; PA: perceived alternatives; GC: game commitment; IGPI: in-game purchase intention; CR: construct reliability; SD: standard deviation.

Figure 3.10 Construct intercorrelations(Gong et al. 2024)

First of all, it extends the existing theories: by combining the investment model with the quasi-social interaction theory, this study not only verifies the impact of investment scale and satisfaction on players' commitment and purchase intention, but also reveals the potential role of emotional connection in resisting the appeal of alternative products. This provides a new theoretical perspective for exploring the psychological mechanism of players from the perspective of anxiety effect.

At the same time, it provides practical enlightenment for the industry. The results show that enhancing affective engagement (PSI) between players and game characters and enhancing players' investment in consumption can effectively improve game loyalty and players' willingness to spend. This provides an empirical basis for game design and marketing strategies, and also provides a reference for my doctoral research on emotional and cognitive regulation of players.

In addition, it also has the supporting effect of supplementary theory for the current project. The main project primarily focuses on the impact of anxiety effects on player engagement. Although this derivative project emphasizes an economic analysis of purchase intentions, the exploration of overlapping variables and their interrelationships has still helped to establish a complementary research

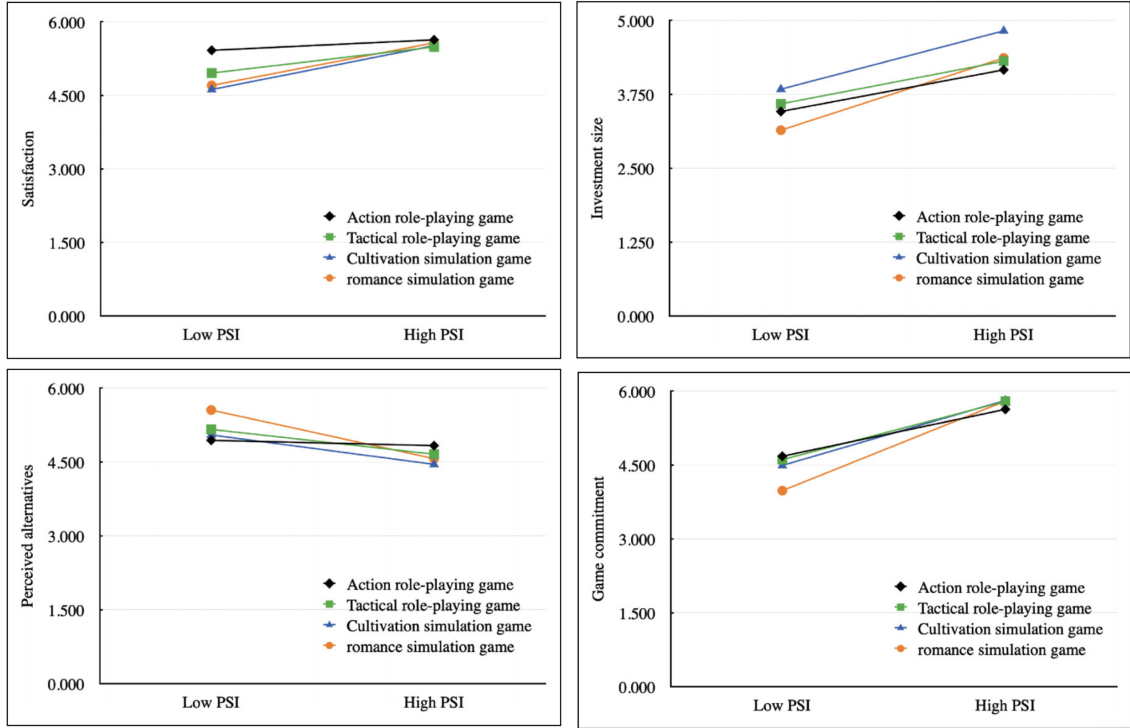


Figure 3.11 Effects of PSI at different game genres.(Gong et al. 2024)

framework that integrates both behavioral and economic perspectives, thereby contributing to a more comprehensive understanding of player behavior.

3.4.5 Future Research

Based on the current research results, future research can further explore the following questions:

First, about the interaction effect of anxiety effect and PSI. It further examines how the emotional connection between players and game characters regulates their purchase decisions in the anxious state.

Secondly, cross-cultural comparisons can be attempted. Expand the sample scope and compare the differences in game commitment and purchase behavior of players in different cultural backgrounds.

Finally, long-term follow-up studies should also be considered. Through longi-

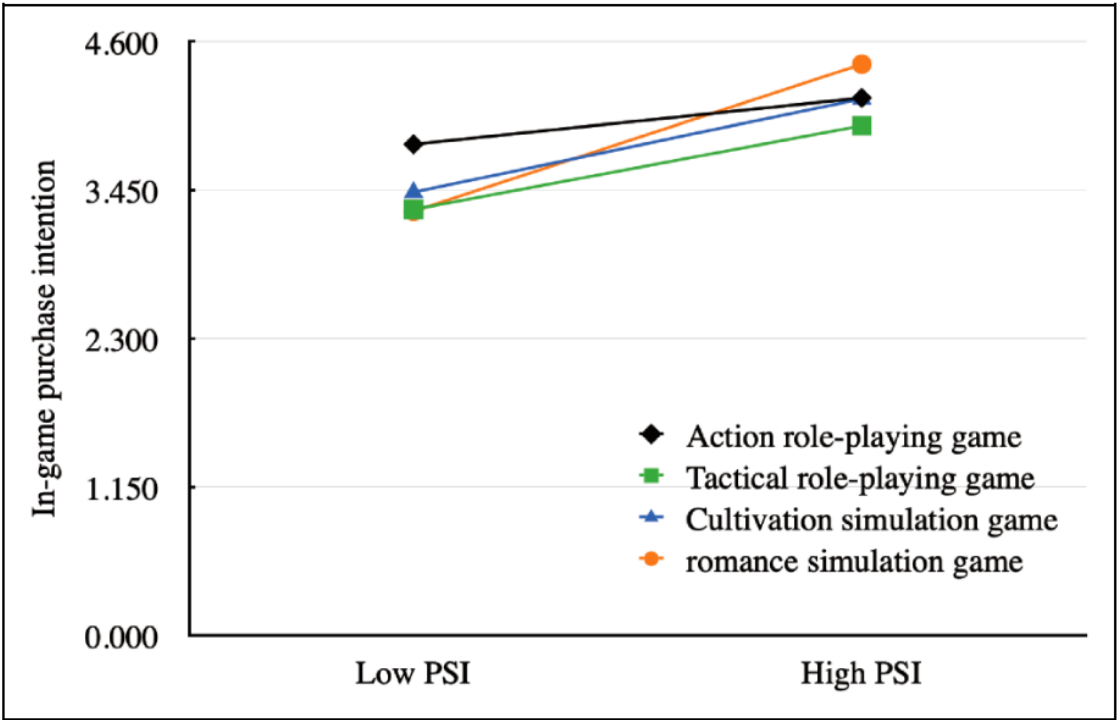


Figure 3.12 Effects of PSI at different game genres.(Gong et al. 2024)

tudinal data analysis, this paper explores the dynamic evolution of player engagement and game loyalty.

In summary, this section introduces the cooperative derivative research based on the variables covered by the PhD project, which not only enriches the theoretical and empirical foundation of the current project In the research of player behavior and user experience, but also provides strong support for exploring the dynamic link between game emotion and game consumption behavior. This study highlights the key role of quasi-social theory in enhancing players’ long-term retention and spending intentions, and provides a more psychological perspective for future research on players’ psychology and behavior from multiple perspectives.

Notes

1 http://toutiao.gzw.net/d_499380

2 <https://www.ign.com/games/final-fantasy-xiv-online-shadowbringers>

Chapter 4

Anxiety-Triggered Engagement Optimization(ATEO) Design Model

4.1. ATEO Model Framework

4.1.1 Structural Overview of the ATEO Model

This model focuses on auxiliary observation, internally defines psychological factors and cognitive factors that affect players' game experience, and provides design guidance for designers. Under the theoretical framework of media psychology, it provides better strategy guidance from the perspective of exploring the influence game design on players' psychological experience.(Figure4.1)

Following the analysis of results from previous pre-tests and follow-up studies, evidence supports that the anxiety effect, limited mechanics design, content design, and personality are all modules that can influence engagement.

Under the premise of innovatively adopting the Gestalt model's psychological perspective as the theoretical framework for design, we have integrated these elements into the model: anxiety effect corresponds to tension, limited mechanics design and content design correspond to the individual's environmental polarity, and personality corresponds to personality polarity, thereby establishing the foundational structure of the ATEO Model.(Figure4.2)

4.1.2 Advantages Glance of ATEO and Classic Models

In the field of game design, the more classic design approaches primarily focus on game mechanics or game content. For example, the classic Flow Channel

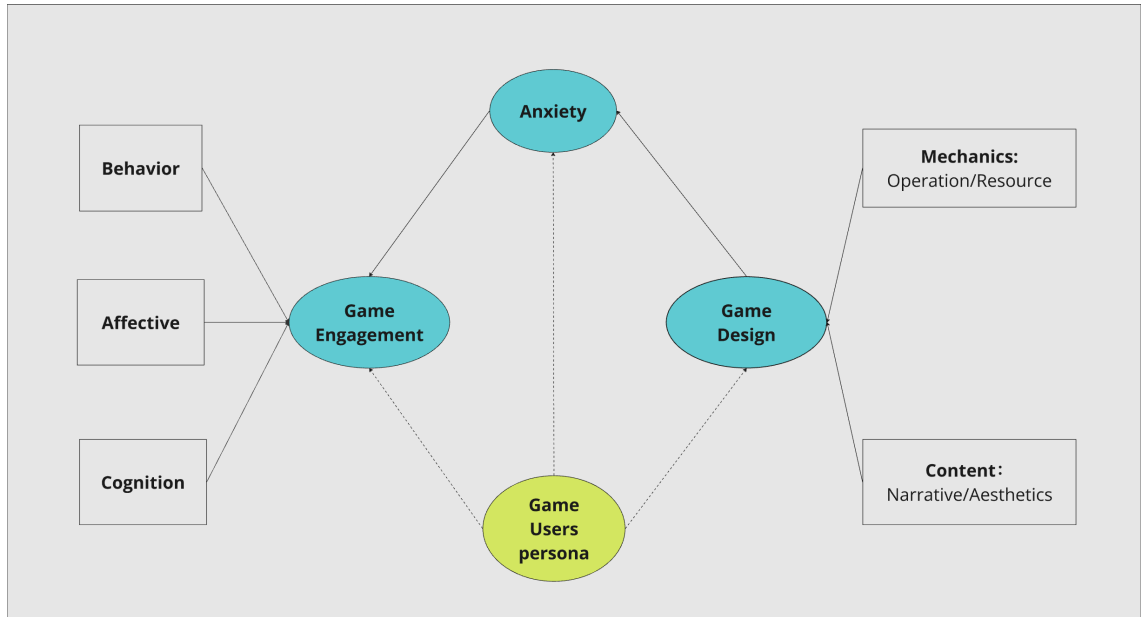


Figure 4.1 Concept Framework

Model(Csikszentmihalyi 1990), first proposed by Csikszentmihalyi in 1990, was later applied as a design method by Jenova Chen, a winner of the Game Developers Choice Awards, in 2007(Chen 2007). The Flow Channel is a method to design challenges that match player skill, creating good gameplay, keeping players focused and playing longer, without quitting due to boredom(Brühlmann 2013). The Flow Channel is the most classic design model, and well-paced mechanics design keeps users engaged in the game.

The Juicy Feedback Model(Swink 2009) was first proposed by Swink in 2009 and later formalized and applied(Juul and Begy 2016) (Alavesa et al. 2019).This design model aims to provide satisfying visual and audio responses to player actions. Such designs make clicks, moves, and feedback feel more exciting.

The Narrative Immersion Model was first proposed by Murray to highlight the advantages of story-driven game design(Murray 1997), and later combined with audiovisual art design to enhance immersion effects (Adams 2010)(Calleja 2011). The Narrative Immersion Model focuses on creating a strong connection and reason to keep playing. Thus, players are drawn into the game world through

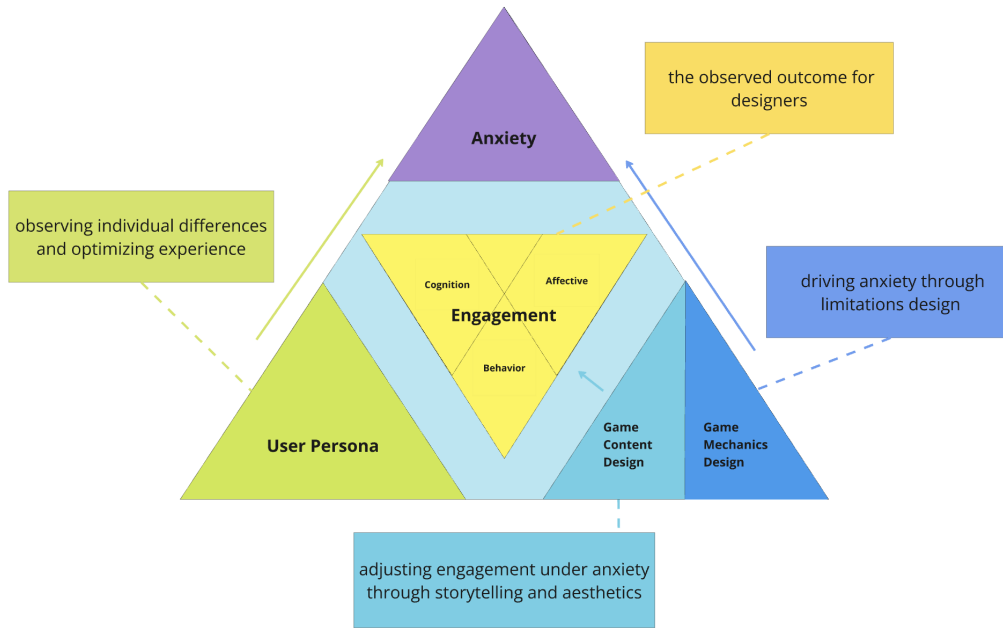


Figure 4.2 The ATEO Model(with explanation for modules)

story and art.

However, compared to AETO, these classic models have two issues. First, each part operates independently: designers focus on designing separate features and actions without considering the interconnectedness of various functional paths and design elements. As flow channel only mentioned basic game-play and level rules design to push engagement, all these model do not view game design as an integrated, interconnected dynamic field but rather stack methods without considering the impact of interconnectedness. Second, well-being: designers pay little attention to user feelings or mental load. They focus on how to attract players to play the game, but do not consider from a design perspective the addictive nature of “the game is too fun” or the overwhelming nature of “the game is too difficult.” They are simply hooking players.

As a new model, ATEO is better designed in these aspects. In the ATEO design model, features work together: all design paths are integrated into a whole-experience design approach that connects all elements. Additionally, since it in-

corporate a psychological perspective, ATEO places greater emphasis on player well-being: this is a design based on psychology and players' feelings. Design guided by ATEO aims to provide players with a more spacious "optimal performance zone" even in anxiety, offering a possibility for balance, making the game's peak experience stable and smooth. (Figure4.3)

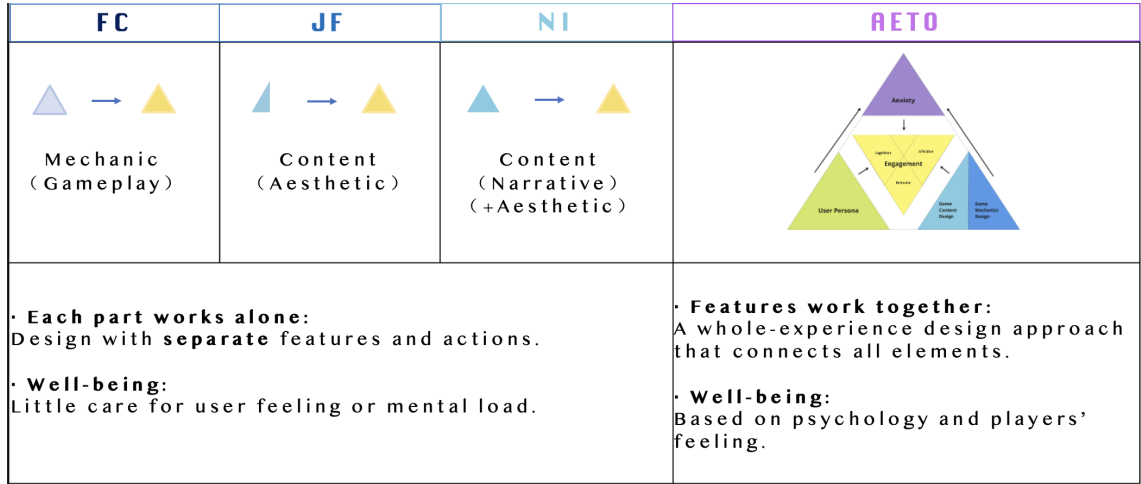


Figure 4.3 ATEO vs Classic Models

4.2. Modules in ATEO Model

4.2.1 Game Mechanics Design

The major module of Game mechanism design in this study is mainly related to the level difficulty design, including the Game Limitation module combining numerical or rule Limitation and the Physical Limitation module combining operation and sensory limitation. In the field of game design, researchers have pointed out that the manipulation of level difficulty is one of the core elements that affect player experience and game fun(Salen Tekinbas and Zimmerman 2003) (Schell 2008). This design concept is different from the simple game numerical manipulation of difficulty as "more powerful enemies or fewer resources". Good difficulty design focuses on the simultaneous interaction of players' participation

behavior. Provide players with a challenging experience with a "surmountable" operating space (Csikszentmihalyi 1990). Many scholars divide difficulty into multiple dimensions, such as resource quantity, operation complexity, time pressure, narrative drive, etc.(Fullerton 2014) (Rogers 2014). Among them, this model classifies them into two modules, and discusses two cores – **Game Limitation** (numerical and rule limitations) and **Physical Limitation** (operational and sensory limitations).

The integration design of Game Limitation and Physical Limitation lies in the optimization strategy of difficulty design.

The really good level design often uses a combination of numerical/rule limitations (Game Limitation) and operational/sensory limitations (Physical Limitation). Enable players to experience tension and a sense of accomplishment at both the strategic and operational levels (Salen Tekinbas and Zimmerman 2003) (Hunicke et al. 2004). For example, *A Wolf: Sekiro: Shadows Die Twice's* combat system, which has numerical rules like "Posture" that force players to balance offensive and defensive strategies, requires players to identify enemy attacks in a fraction of the time and respond with precision, It combines Game Limitation with Physical Limitation(Rogers 2014). This combination provides a deep challenge while also placing higher skill and mental demands on the player.

From the perspective of cognitive psychology, the combination of these two types of limitations can increase the player's attention and memory load, which, if properly regulated, can maintain a high level of arousal and concentration(Csikszentmihalyi 1990). However, if the numbers/rules are too complex and the operation requirements are too high, the player may experience frustration and game anxiety under the double pressure (Fullerton 2014). As a result, many games use "progressive" or "dynamically balanced" difficulty design:

The player is initially familiar with the basic rules and simple operations, and then gradually increases the resource strain and complexity of the operations as they become more proficient(Feil and Scattergood 2005). This spiraling learning curve helps players avoid being overwhelmed by difficulty early on, while remaining challenged later on. The reasonable combination of Game Limitation and Physical Limitation can also produce "relaxation" in rhythm. For example, the slow-paced strategy level focusing on resource management can make players think. This is

followed by high speed combat or a Quick Time Event (QTE) that delivers intense operational stimulation(Rogers 2014).

This dynamic change not only improves gameplay, but also prevents fatigue or numbness in the same difficulty mode(Schell 2008). If the player understands and adapts to the rules and actions, a moderate amount of anxiety can be transformed into a "challenge drive", feeling self-improvement and satisfaction in the process of overcoming obstacles again and again(Csikszentmihalyi 1990).

To sum up, the difficulty design of the Game level is not simply to increase the number of enemies or increase the number of traps, but to make efforts from both aspects of Game Limitation (rule/value layer) and Physical Limitation (operation/sensory layer). The former lays down the rules and resource constraints that the player must follow, giving the level strategic depth and progression planning; The latter allows the player to experience the stimulation of immediate reaction and physiological arousal through the manipulation and sensory requirements(Salen Tekinbas and Zimmerman 2003) (Rogers 2014). The two, when properly combined, can make the player nervous without giving up anxiety, entering the flow zone "slightly above their own level" (Csikszentmihalyi 1990). The result is a level experience that is both immersive and challenging.

Game Limitation

As for the game limitation section, the first key element in the design of the model is the most fundamental design of the game itself, the design of its mechanics. In this model, the designer quantifies the design structure of game mechanics and rules into the most intuitive two elements: Physical Constraints mainly refer to the interaction between the player and the body through senses and operations, Real-time Feedback Constraints, level space, time, terrain and other operational constraints, including the number of key clicks of the player, the range of movement of the player, reaction time, A preset time set for the player to reach a goal, etc. The game limits, Resource Management Challenges (Balancing Attributes, Health, Ammo, Lives, etc.) Economy, Enemy Stats, Difficulty Settings refers to the limited resources that the designer gives the player in a level, such as health, items, respawns, etc.

In the framework of mechanics-Dynamics-aesthetics (MDA), Game Limitation

mainly corresponds to the design of the "Mechanics" part (Hunicke et al. 2004). It defines the actions the player can take and the system's feedback mechanism for those actions, including resource management, friend or foe stats, level passage conditions, win or lose conditions, and so on. By limiting these parameters, the designer is able to control the difficulty curve of the game, allowing the player to make strategic plans within the limits set by the rules, thus achieving a sense of accomplishment (Rogers 2014). If the restrictions are too loose, players will lose motivation to challenge and get bored quickly; If the restrictions are too severe, the game will be abandoned due to frustration and powerlessness (Feil and Scattergood 2005).

The *Dark Souls* series(Figure4.4), which is famous for its "high difficulty", is a good example of designing deep challenges with Game Limitation¹. The game builds a strict numerical limit through resource elements such as Stamina, HP, and recovery items:



Figure 4.4 Dark Souls Design(Screenshots ©FromSoftware)

1. Physical value: Every attack, defense, and evasive need to consume physical

strength, and after physical exhaustion, players cannot act and fall into extreme danger.

2. Number of recovery items: The player can only carry a limited number of Estus Flasks at a time, and once they are exhausted, it is difficult to survive to the next supply point.

3. Souls mechanics: When a player dies, they drop all unsaved "souls", which are permanently lost if they do not return to the death site to collect them before dying again.

This set of value limits puts the player under constant pressure as the level progresses: careful allocation of attack and defense moves to maintain stamina, and evaluation of when to drink valuable potions. The penalty of failure (i.e., loss of soul after death) further increases the risk. These artificial rules seem to be "difficult" for the player, but they create a deep sense of strategy and tension, and the player often feels a strong sense of achievement and satisfaction after overcoming obstacles (Csikszentmihalyi 1990).

Game Limitation is the cornerstone of game difficulty, which directly affects players' strategic thinking and resource usage(Schell 2008).Ideally, the difficulty of the rules should maintain a dynamic balance with player skills, so that players can gradually form a positive cycle of skill improvement and difficulty increase in the process of repeatedly understanding and using the rules (Fullerton 2014). Therefore, Game Limitation not only defines the boundaries of play, but also foreshadows the depth of strategic decision making for the **Physical Limitation** discussed in the next section.

Physical Limitation

Another key factor is that the designer interferes with the user's game process through some operational limitations of the players themselves, which is generally referred to as the operation-related design of the game and is classified into the Physical Limitation module in this model.

Compared to numerical or rule constraints that focus on "what can be done and how much can be done," Physical Limitation focuses more on "how to do it" (Rogers 2014). It refers to the designer's use of operational requirements and sensory feedback to increase difficulty, including the need for rapid reaction

times, accurate hand-eye coordination, or movement in a restricted field of vision. Researchers classified game challenges into various types, such as dexterity, endurance, speed, etc (Bostan and Ögüt 2009). Among them, the parts related to audio-visual interference, spatial and terrain obstacles, and movement accuracy requirements can be regarded as Physical limitations.

By increasing operational complexity and immediate pressure, designers can give players a sense of tension and excitement (Fullerton 2014). However, if the physical difficulty is too high, the player is prone to frustration and anxiety due to repeated failures, and if it is too low, it will lead to boredom. Therefore, Physical Limitation also needs to be matched with players' skills and learning curve, so that players can gain room for growth in the gradual operation test(Hunicke et al. 2004).

In the *Legend of Zelda* series(Figure4.5), Nintendo combined open-world terrain design with Stamina Wheel mechanics to create multiple challenges for handling and senses ²:



Figure 4.5 Zelda Design(Screenshots ©Nintendo)

1. Climbing physical limitations: can climb almost any mountain wall, but will consume energy over time, exhaustion will fall and injury .
2. Weather and element impact: lightning strikes will be caused if metal weapons are carried in thunderstorms, and visibility will be reduced in snowstorm environments, so that sensory challenges are intertwined with action challenges.

3. Real-time combat response: In the face of strong enemies, players need to respond through high-level operations such as dodging and parading, requiring precise timing and good hand-eye coordination.

In terrain exploration, players who want to climb higher ridges need to assess whether the physical groove is enough to support; The risk of falling if you run out of energy in the middle makes the climb very stressful (Schell 2008). Compared to a hard rule that simply says, "You cannot go to this area at this time," a physical limit is a soft limit: it does not prevent the player from attempting to climb, but at the same time makes them bear the cost of missteps . This combination of freedom and physical limitations gives the process of exploration a greater sense of authenticity and urgency.

Physical Limitation is closely related to the psychological state of players: moderate operation pressure can often bring about a concentrated experience of adrenaline surge and sweaty palms; However, if the challenge is out of balance, it can cause players to become overly anxious (Rogers 2014).

According to flow theory (Csikszentmihalyi 1990), only when the difficulty of the operation is in a dynamic balance with the player's skill can the player move between excitement and control, immersion and pleasure. Once the difficulty is much higher than the player's current skill level, there is a tendency to fear the operation and give up (Fullerton 2014). Many hardcore action games (e.g., rhythmic music, fast-paced shooters) offer difficulty levels or learning levels precisely to avoid putting too much physical pressure on the player in the beginning. Therefore, the design of Physical Limitation needs to consider players' learning curve, practice space, as well as breathing and adjustment after difficult levels, so as to prevent players from maintaining high pressure for a long time and turning into negative anxiety (Schell 2008).

4.2.2 Game Content Design

While video games were becoming popular in the electronic media market widely appeared, a brand new cultural style of expression and immense commercial value were demonstrated through these digital products(Wilhelmsson et al. 2022). Game content design, as one of the elements of game development process, is playing the key role of optimizing and constructing users' game experience (Boothe Jr

and Brenneman 2024). While from the perspective of media psychology, content design research is not limited to the aesthetic expression of games and game interaction technology, The influence of character’s immersion and affective connection on players (Lankoski 2004) is also a factor considered by designers, and also a bridge between players’ emotional involvement in games and story understanding(Boothe Jr and Brenneman 2024).

Game Aesthetics

According to existing game research, although the importance of game aesthetics design has been recognized by the industry for commercial purposes(Kuntjara et al. 2017), existing studies are still mostly focused on technical and operational aspects of analysis (e.g. (Rocha 2023a) ;(Zufri et al. 2022); (Voimala 2023)); (Valle-Canencia et al. 2022)), the practice of aesthetics design tends to be more about proven formulas than exploration of innovative perspectives (Tompkins and Martins 2022), and systematic studies such as how specific elements of character aesthetics design affect players’ psychological states and purchasing behaviors are still insufficient.

For example, the game *Hades*(Figure4.6), has won several awards in a short time due to its character design and unique visual style (Kou 2023). *Undertale* (Figure4.7)has achieved great success by allowing players and traditional ”enemies” to establish effective PSR in the game script through its quirky and lovable character design (Elvery 2023). In particular, there is a significant research gap in how aesthetics design elements shape the PSR between the player and the character and facilitate the flow experience, and how these relationships further affect the player’s consumption intentions.

Aesthetic design is often related to sensory information, such as the voice of a character plays an important role in shaping the character of a game and enhancing the game experience, and auditory effects not only enhance player immersion, but also promote cognitive inclusiveness and accessibility(Guillen et al. 2021). (For example, designers create perceived mismatches between a character’s voice and gender to promote cognitive inclusivity.)

As a key factor to attract players into immersive game experiences (Vandewalle et al. 2024), the visual appeal of a character and the performance of the character



Figure 4.6 Hades Character Design(Screenshots ©Supergiant Games)



Figure 4.7 Undertale Scene(Screenshots ©Toby Fox)

in the game should be taken into consideration during the character design process (Park and Seo 2019). Other scholars have also pointed out that a character's physical characteristics, silhouette, and posture, as well as dialogue, voice, and behavior, shape the character (Vandewalle et al. 2024).

For example, in the player-centered approach to game character design for per-

formance, Park (2019) identified character behaviors that can enhance players' participation in games through focus group discussions with experienced game players(Park and Seo 2019). In terms of vision, when designing characters, designers can enhance the game experience of players through visual effects technology, and adopt different visual styles for game characters (e.g Pixel style still has a positive impact on the player experience ((Drennan et al. 2004); (Zufri et al. 2022))), for example, increased differences in the appearance of characters will increase the purchase behavior of game players (Luo et al. 2023).

Within the ATEO design framework of this study, aesthetics is positioned as an “emotional tuner” embedded between the core mechanics and the narrative context. By means of carefully orchestrated visual, and auditory cues, rapidly modulates the player’s emotional arousal level, keeping the anxiety triggered by level pressure firmly within the optimal zone of the player experience and thereby catalyzing a flow state, laying an emotional foundation for the subsequent formation of purchase intention.

Game Narrative

Game Narrative functions as the experiential “through-line” that binds discrete mechanics and aesthetic cues into a coherent arc of meaning. By granting players an avatar-mediated point of view, it invites them to co-author the unfolding story world and to internalize the avatar’s goals, emotions, and social ties (Chess 2014) (Woods 2022). This identification scaffolds parasocial relationships (PSRs) with both playable and non-playable characters, amplifying empathy and—even in loot-box or gacha formats—legitimizing repeated investment in the virtual economy (Tukachinsky and Tokunaga 2013).

During the game, players may have a strong emotional response to the character’s behavior and plot development through the display of character animation and game play (Rocha 2023b). This emotional resonance response is often based on PSR, which is similar to their emotional response when they interact with others in real life. For example, the phenomenon of parasocial bereavement (Eyal and Cohen 2006), also known as parasocial breakup, The response to death or disappearance of fictional character is often accompanied by a sense of loneliness. Extending to the field of games, researchers have also found a similar phenomenon,

in which players are more likely to trigger emotional changes due to the emotional performance of accompanying characters (Emmerich et al. 2018), thus enhancing the immersion of games.

Across genres, from the MMORPG of *FFXIV*(Figure4.8)(Figure4.9) to the strategy style gacha game of *Arknights*(Figure4.10), narrative structures calibrate three design levers:

- (1) temporal pacing, which alternates tension and release to synchronize with difficulty curves;
- (2) relational stakes, which convert plot milestones into emotionally charged decisions;
- (3) world affordances, which translate lore into actionable goals and collectible assets.

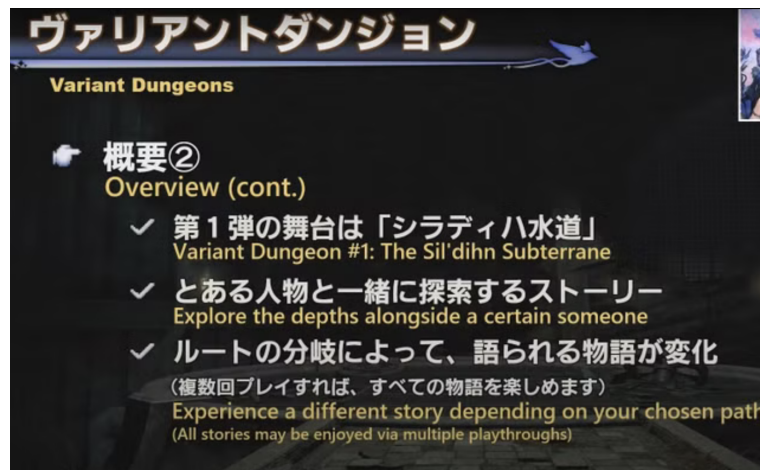


Figure 4.8 FFXIV Story Design(Screenshots ©Square Enix)

Together, these levers transform moment-to-moment gameplay into a larger sense-making journey, moderating anxiety, sustaining flow, and laying the motivational groundwork for future purchase intent and long-term engagement (e Silva and Glover-Rijkse 2020).



Figure 4.9 FFXIV Story Design(Screenshots ©Square Enix)

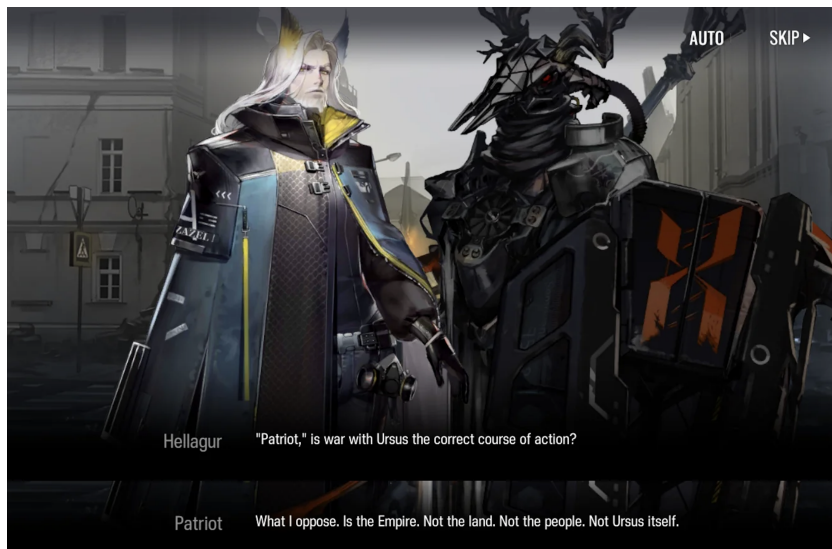


Figure 4.10 Arknights Story scene(Screenshots ©HYPERGRYPH)

4.2.3 User Persona

Another significant factor in the model is the user profile, which will be differentiated by testing a user's personal social tendencies. Although user profiles cannot be directly described as part of the game content, especially the narrative design,

in the industry design, the game narrative content design often needs to take the audience's orientation and preference as a very important reference index to design and construct the game's story line. Moreover, narrative content design, as a kind of literary creation, cannot be calculated in a quantitative form, so this part selects the user profile related to it as a kind of antecedent variable to be considered, in order to give the content creators a better discernment of the reference dimension and a clear direction.

Further integrating game research with industry practice, player audience types have been shown to significantly guide choices in narrative and mechanics. For example, the classic Bartle fourfold model points out that different players emphasize motivations along the four dimensions of "exploration," "achievement," "social," and "competition" (Bartle 1996). Subsequent large-scale surveys further refined the spectrum of player motivations: in mobile gacha and immersive romance genres, players who score higher on the "social belonging" and "emotional investment" dimensions exhibit a markedly higher pay-conversion rate than control groups, a finding that drives design teams to add empathetic side stories and private character interactions in their narrative planning (Hamari et al. 2015). In addition, research on "persuasive games" indicates that matching players' personality traits (e.g., Extraversion and Agreeableness in the Big Five) with narrative trajectories can effectively enhance attitude-change outcomes in educational or pro-social titles (Orji and Moffatt 2018). Therefore, incorporating player personas into narrative design decisions not only raises the storyline's "emotional hit rate" for the target audience but also provides data support and a basis for personalized operations in commercialization strategies.

4.2.4 Anxiety Effect

The anxiety effect in user experience is also regarded as an important influence module, which is also the focus of the psychological perspective of this study. The design factors in the model were considered as to the extent to which they were observed to be relevant to the player's game participation in the context of a moderating perspective based on anxiety effects.

Anxiety can be distinguished into state anxiety and trait anxiety. State anxiety is a transient emotion of apprehension or tension in response to immediate stres-

sors. In contrast, trait anxiety is a stable personality disposition to experience anxiety across many situations (Spielberger 1983). In other words, state anxiety fluctuates “in the moment,” whereas trait anxiety represents one’s baseline anxiety proneness.

Including anxiety in the engagement model is important because emotional arousal modulates player engagement. Game design aims for an optimal arousal zone: too little challenge leads to boredom, while too much leads to stress and disengagement (Csikszentmihalyi 1990). Flow theory similarly holds that players are most engaged under balanced, moderate challenge that avoids apathy or overload. Moderate anxiety (e.g. suspense or time pressure) can thus enhance focus and immersion, whereas extreme anxiety may undermine it. By including anxiety explicitly, ATEO model positing that some anxiety can increase engagement but excessive anxiety will diminish it.

We hypothesize that there is an inverted-U-shaped relationship between state anxiety and player engagement: optimal performance occurs at moderate levels of arousal, while both low and high levels of arousal are associated with decreased performance (Yerkes et al. 1908). Similarly, we expect player engagement to peak at a moderate level of anxiety and to decline when anxiety is either too low or too high(Awada et al. 2024)(Figure4.11) .

We will measure anxiety through both self-report and behavioral metrics. The State-Trait Anxiety Inventory (STAI) will be used to collect self-reported anxiety, yielding a state anxiety score (STAI-S) at specific moments(Spielberger 1983). Participants will complete the STAI-S at key game intervals (e.g. after difficult segments) to capture situational anxiety.

In our model, the Anxiety Index is expected to influence key engagement metrics. Engagement will be measured by outcomes such as play duration and self-reported immersion. We predict that moderate Anxiety Index values will associate with optimal engagement (e.g. longer play time and higher enjoyment), whereas extremely low or high values will coincide with poorer engagement (e.g. early quitting or low satisfaction). We will test these predictions and also examine if trait anxiety or social preference affect the anxiety–engagement relationship.

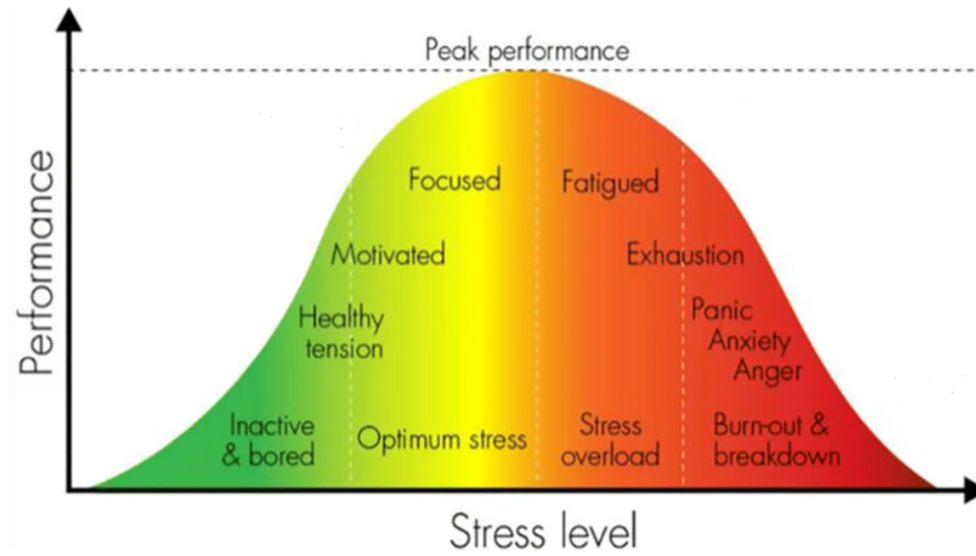


Figure 4.11 Inverted-U-shaped Relationship (Awada,2024)

4.2.5 Game Engagement

Game engagement is a large module composed of sub-modules, which is used to observe and measure whether there are corresponding changes in Behavior, Affective and cognitive Cognition expected by designers in the actual feedback of players. This module is another core element that forms the overall design guidance model.

In summary, under this module, there is a dynamic linkage relationship between each sub-module. The interaction between PSR and flow effect in games can improve players' game experience and make them more inclined to make in-game purchases(Gong and Huang 2023), the psychological factors of player consumption also need to be taken into account with PSR and flow experience.

For example, former research points out that flow has a significant effect on the purchase intention of high-frequency players, and that flow experience is the main factor driving in-game purchases on PC compared to mobile(Chou and Ting 2003); As electronic games allow the interaction between players and virtual characters to be greatly enhanced, this form of media further strengthens the influence of PSR on the audience (Elvery 2023). This attachment not only enhances the player's

sense of identity with the game character, but also enhances the player's sense of identity with the game character. It also promotes players' willingness to pay for character-related goods(Chou and Ting 2003)

While the interaction between players and game characters becomes the catalyst of flow, PSR affects players' consumption behavior by strengthening the emotional attachment between players and virtual characters, thus further deepening the effect of flow experience. This means that when the player enters a flow state by interacting with the character, the immersion (flow effect) deepens the emotional engagement with the character, which increases the likelihood that they will buy something related to the character and increase their willingness to spend.

Behavior: Consumption

The use of real currency to purchase in-game virtual goods such as boosts, skins, and battle Passes has become one of the most important monetization models in the game industry in recent years(Ho 2014). The psychological drivers behind different consumption types vary, with role-related consumption intentions more likely to be driven by PSR and emotional connection(Gong and Huang 2023), while functional consumption is more dependent on the need for game progress and related to players' willingness to improve their performance in the game(Cai et al. 2022).

As one of the engagement behaviors, player consumption intent is an important indicator that is associated with game loyalty and commitment effects. Game commitment reflects players' long-term attitude towards the game, their willingness to have a stable relationship with the game, and the time and resources they invest in the game(Liao et al. 2022). Game loyalty is similar to commodity loyalty, which is manifested in the tendency of consumers to purchase a product repeatedly. Consumers continue to choose the same product when they have multiple choices, and the process is often accompanied by emotional and cognitive investment (Jacob Jacoby 1978). In the context of games, this concept refers to the tendency of players to continue to play a particular game and to consume it(Yee 2006).

Oliver (1999) proposed that the emotional and cognitive basis of loyalty is a kind of deep commitment, so commitment to games is an important indicator of

loyalty(Oliver 1999). Players' commitment to games can be enhanced through emotional connection and immersion experience. Has the potential to drive their consumption behavior and intentions towards in-game goods(Cai et al. 2022).

Affective:PSI and attachment

Past games studies that explored the effects of psychological factors often involved media psychology theories such as PSR. The concept of Parasocial Relationships (PSR) can be used to describe the emotional relationship between the player and the game character, which belongs to the third type of media figure defined in PSR theory. which means fictional characters lacking visible human form, such as those found in cartoons or fantasy novels. (Giles 2008) In video game environment when the players interact with the characters and form emotional links, players as media audiences do indeed enter into parasocial relationships with avatars (Klimmt et al. 2013).

Although this kind of relationship is not real social interaction, players' emotional involvement in characters has some similarities with social relationships in real life (Yee 2006). For example, game characters have different degrees of influence on players' emotions and moods. Players develop empathy for virtual characters similar to that of real humans(Slater et al. 2006), and emotionally rich characters may boost player motivation and engagement by enhancing empathy and a sense of connection (Andreean et al. 2023).

The application of PSR in games is often related to the interaction between players and game characters (NPCS) (e.g. (Milman and Mills 2023); (Hua and Xiao 2023)). Studies have found a strong correlation with the design of game characters, such as love simulation(Gong and Huang 2023), Gacha games (Gong et al. 2024), RPG (Elvery 2023) and other games that focus on character design and NPC-player interaction have a more diverse impact on PSR. PSR is a key factor in character design, and character design in games needs to be perceived as real or have some cognitive realism. evidenced by the popularity of games like *Life is Strange* (Kauppinen 2023), for example, can promote deeper social interaction and thus effective PSR. If the character is considered too fictional or unreal, the player may have a simple emotional response and lack "closeness to characters" (Rogers et al. 2022), and thus a strong emotional connection (Kauppinen 2023).

Cognition:Flow State

Flow Theory is often applied to dynamically adjust players' game experience design (?). When players experience flow in a game, they will feel high excitement and immersion (Sherry 2004), and this immersion experience not only increases user satisfaction (Csikszentmihalyi 1990), but also increases user satisfaction (?). It may also improve player participation and game experience , and affect users' consumption decisions and loyalty.

The concept of immersion in games and the flow effect are often highly coincidental in the context of game design with cognitive engagement(Michailidis et al. 2018). From the perspective of cognitive engagement in game, cognitive engagement. From the perspective of cognitive engagement in game, which can be summarized as the level of dedication a player exhibits towards gaming activities(Zheng and Gardner 2016), researchers indicate that a deeply engaged player is completely absorbed in the game and remains unaware of their surroundings(Sherry 2004). At the same time, the flow effect can also be reflected in the player's behavior. For example, with a high level of cognitive enjoyment and satisfaction, the flow state usually occurs when the difficulty of the challenge is balanced with the level of individual game operation (skill), so the game needs to provide a wide enough range of gameplay experiences to accommodate different players' flow zones(?).

As an important factor in broadening game experience(Drennan et al. 2004), the design of game characters affects the continuous immersion of users (Park and Seo 2019). If players can establish a high sense of identity with game characters, they can be more effectively guided into the state of flow(Khoshnoud et al. 2020).

4.3. Design Guidelines Based on the ATEO Model

These guidelines are a set of practical methods developed from the ATEO model. Each design idea is based on the concept of "anxiety adjustment," which helps regulate the player's emotional arousal level to improve engagement in gameplay.

4.3.1 Anxiety Driver: Limitation-Based Game Mechanics

In practical design procedure, one anxiety driver is used to create anxiety effect. The designers can choose any following limitation strategies acting as the main “controller” of anxiety-driven engagement by push game difficulty.

Physical Operation Limitations: Creating tension with time and space limits Game designers can increase difficulty and create a sense of urgency by limiting the time players have to complete tasks, such as using time-limited missions or countdowns. Reducing player movement space or survival area also effectively increases anxiety and motivates action.(Figure4.12) .

Creating tension with time and space limits



e.g. Countdowns



e.g. Survival Area

Figure 4.12 Limitation Design Examples 1

In-Game Resource Limitations: Controlling key resources strategically Designers can reduce life-related resources such as health bars or the number of revival chances. These limitations increase pressure in decision-making, helping to keep players inside the productive anxiety range. After a few gameplay loops, this leads to higher engagement performance.(Figure4.13) .

Controlling key resources strategically



e.g. Health Bar



e.g. Power-up Items

Figure 4.13 Limitation Design Examples 2

4.3.2 Adjustment Tools: Content Design to Support Anxiety Effect

Two adjustment tools with different functions, serving as buffering and accelerator.

Buffering: Narrative Design-Using emotional tension to balance anxiety

Strong narrative elements can help players emotionally connect with the game and balance tension. For example, introducing emotionally intense characters, urgent world settings (like countdowns or crises), or personal storylines can adjust the emotional pacing. When players feel emotionally involved, they are less likely to drop out due to too much stress or boredom, keeping their engagement curve more stable and under control.(Figure4.14) .

Accelerator: Aesthetic Design-Quick emotional adjustment through sensory effects

Visuals and sounds can quickly influence emotional states in an anxiety-driven game environment. For example, calming audio after failure can help rebuild player confidence, while intense visual effects can quickly increase tension. These emotional cues directly affect perceived anxiety and help adjust participation levels in real-time.

When narrative and aesthetic design work together, they can create a game environment with higher emotional tolerance — reducing drop-out risk and helping

Using emotional tension to balance anxiety

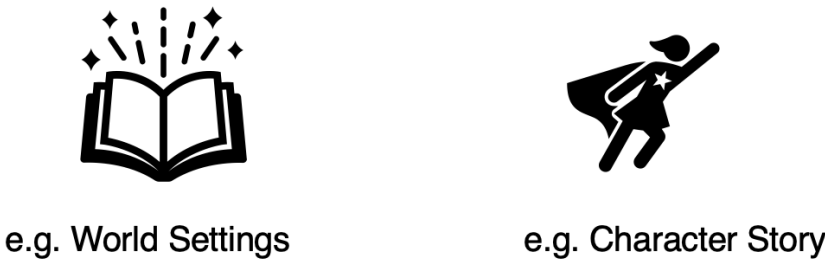


Figure 4.14 Buffering Design Examples

designers maintain better control over anxiety-driven gameplay.(Figure4.15) .

Quick emotional adjustment through sensory effects



Figure 4.15 Accelerator Design Examples

4.3.3 Optimization Lens: User Persona Mapping

Player personality traits are not treated as manipulable design variables. Instead, User Persona Mapping serves as an robustness check tool and optimization reference — a persona lens through which designers can better interpret variations in player behavior under anxiety-driven gameplay.(Figure4.16) .



Figure 4.16 User Persona Mapping

Designer can check design robustness after measuring anxiety-performance gaps. For example, different personality stress-test for models. Splitting players into introverts and extroverts and drew their Anxiety-vs-Engagement curves to see if the model stays stable when personalities change.

When anxiety-driven mechanics result in unexpected drops or disengagement, analyzing who is dropping out — and why — through the lens of personality traits (e.g., introvert vs. extrovert, high vs. low neuroticism) allows designers to identify adjustment points for the next iteration.

Collecting player participation data based on personality types (for example, extroverted vs. introverted players) can help designers understand which kinds of

players respond best to anxiety-driven game mechanisms. This information can guide better audience targeting and create game experiences that better match different player personalities.

This approach respects user diversity. It doesn't impose a one-size-fits-all experience but enables adaptive understanding across player types. In other words — we don't force players to fit the game; we evolve the game to better match the players.

4.3.4 Model Mapping Note

This guideline is based on the modules of the ATEO modules and formed the practical procedure.(Figure4.17)

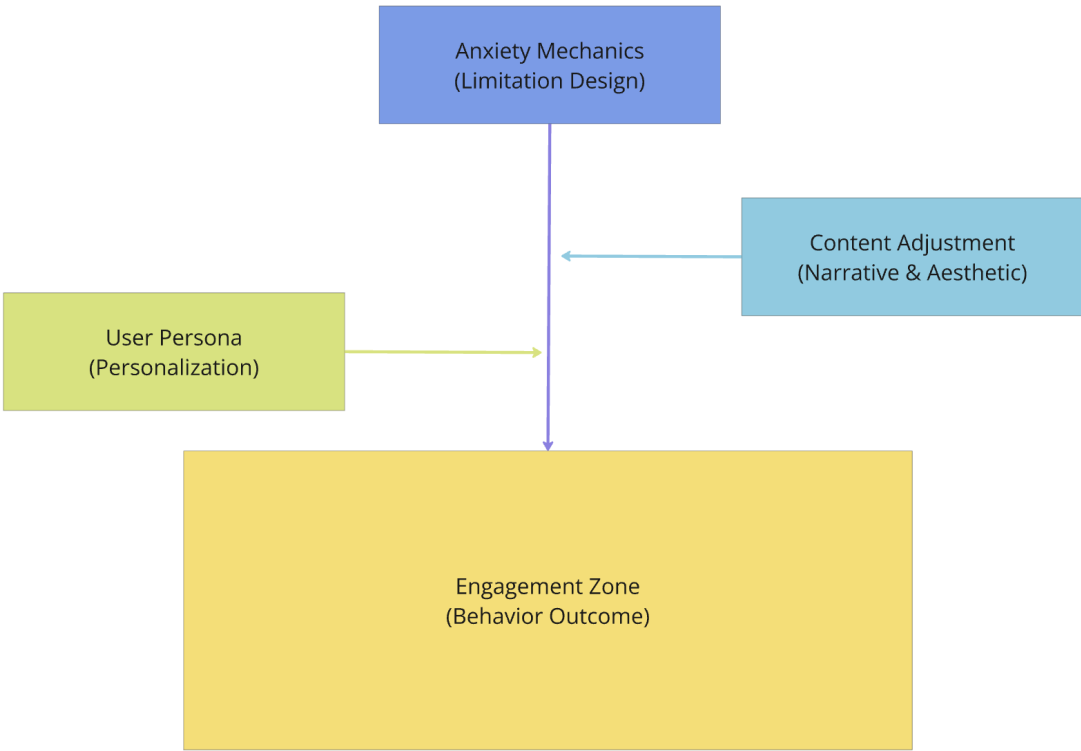


Figure 4.17 Modules in practical procedure 1

Game Mechanics Design = driving anxiety through limitations

Game Content Design = adjusting engagement under anxiety through storytelling and aesthetics

User Persona = observing individual differences and optimizing future design concepts

Engagement = the observed outcome for designers

In practice, the five parts of ATEO can be pictured as the basic controls inside an electric car (Figure 4.18). The basic gameplay setting is the car's cruise-control system—already set to hold a steady speed.

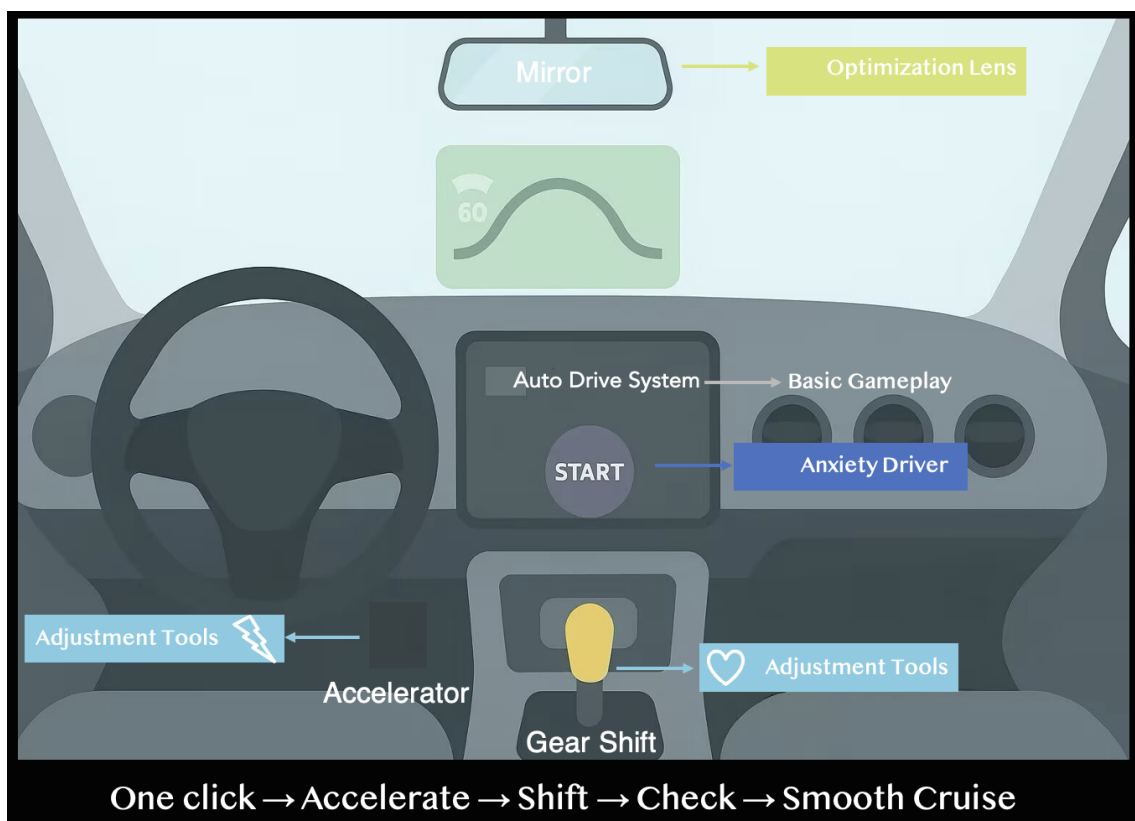


Figure 4.18 Modules in practical procedure 2

The Anxiety Driver works like the power button: one press wakes the whole vehicle and supplies the energy that pushes players forward.

Aesthetic tweaks (sound, visual flashes, haptics) act like the accelerator pedal:

the designer can tap or release them at any moment to give quick bursts of excitement or ease off the pressure.

Narrative tools are the gear lever; by shifting the story pace up or down, they raise or lower the long-term speed limit and keep the ride smooth on hills of difficulty.

Finally, the Persona Lens is the mirrors and head-up display: it lets the team watch each player’s “road and engine” in real time, making sure engagement and anxiety stay in the safe zone for introverts and extroverts alike.

Because these controls work together, designers can steer or fine-tune the experience rapidly without rebuilding the whole game—just as a driver adjusts speed and gears without changing the car.

Each guideline rule is a practical translation of how behavior, emotion, cognition, and individual traits influence the anxiety-engagement relationship.

Notes

- 1 <https://www.gamedeveloper.com/design/stamina-in-death-of-a-wish#:~:text=The%20stamina%20resource%20in%20Dark,Every%20stamina>
- 2 <https://www.nintendo.com/jp/zelda/botw/index.html>

Chapter 5

Implementation Test and Evaluation

5.1. Player Experience Evaluation

5.1.1 Test Design and Procedure

AETO Prototype and Classic Baseline

The first two rounds of preliminary tests only explored the correlations between variables. To more effectively demonstrate the causal relationships between control variables rather than merely describing the correlations between variables, and to compare the advantages and disadvantages of AETO with other classical design models, the researchers plan to select prototype games that can directly manipulate key variables (i.e., the complexity of game mechanics and the richness of game content) as experimental subjects.

The current criteria for selecting experimental subjects include the following specifications: the game must have simple, classic basic gameplay rules, allow designers to create the game using traditional design models, and be able to use AETO's design to trigger anxiety mechanisms in the user experience, while also providing open-source gameplay programs. An example to help illustrate this: Super Hexagon(Figure 5.1) developed by Terry Cavanagh, an uncomplicated action game characterized by its straightforward mechanics, capable of eliciting anxiety-inducing experiences among players. Players assume control of a triangular protagonist, maneuvering through dynamically shifting hexagonal mazes while aiming to prolong their survival by evading approaching obstacles and barriers. The game's fast-paced nature necessitates swift reflexes and precise timing from players to succeed. Super Hexagon has garnered significant attention and popu-

larity due to its addictive gameplay mechanics (Graham 2012).

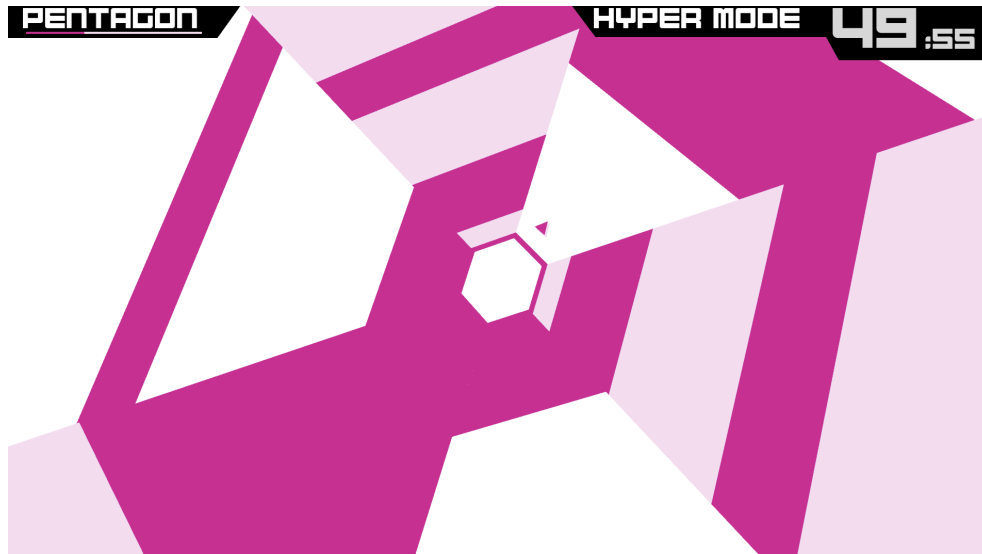


Figure 5.1 Screenshot of Super Hexagon by Terry Cavanagh

In this implementation test, the researchers selected three classic gameplay types, Flight Mini-RPG, Dodge Game, and Logic Puzzle, as prototypes for testing. Based on the original gameplay, the researchers conducted AETO-style designs and classic model designs (Narrative-immersion, Juicy Feedback, and Flow Channel) that were tailored to the characteristics of each gameplay type. The three AETO prototypes and the classic model group served as the corresponding baselines, also consisting of three prototypes(Figure 5.2) .

Procedure and Timeline

The testing was conducted in phases according to a pre-determined implementation plan, ensuring that all participants completed the tasks following a standardized procedure.

Prior to the experiment, participants were asked to read and sign an informed consent form, acknowledging their understanding of the study's purpose and procedures. Participants were informed of the experimental rules and provided with a brief adaptive session to familiarize themselves with the prototype mini-game

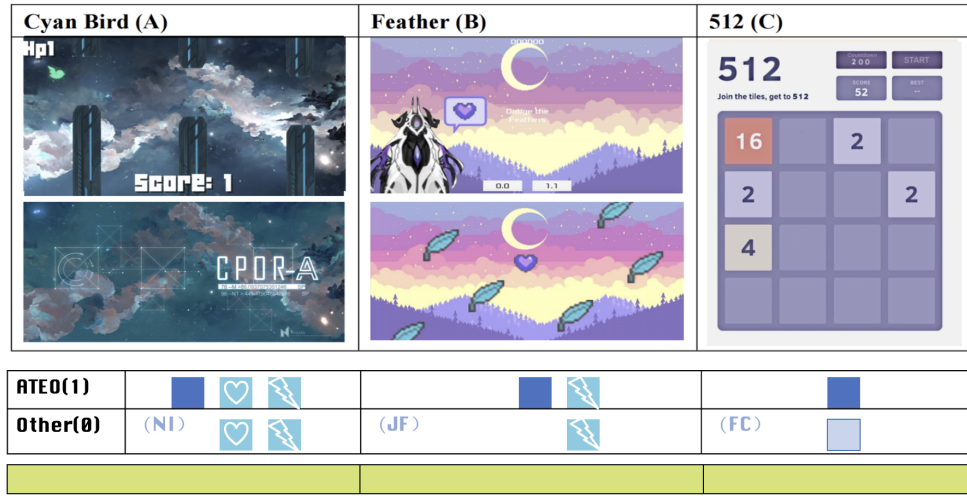


Figure 5.2 Prototypes ATEO vs Baseline(Classic Model)

and learn how to operate it, including how to select the assigned mode. During the formal experiment, participants were instructed to complete a task: to play the randomly assigned mini-game for at least five minutes. Upon completion, the system immediately recorded behavioral data such as the number of rounds played, and participants were prompted to complete a state assessment questionnaire without delay.

After completing the gameplay task, participants were asked to fill out a questionnaire that included the State Anxiety Inventory, a personality trait scale, and a game engagement scale. The entire data collection process took approximately over two months. During the testing period, the researchers monitored participants' progress via an online platform to ensure that they completed all tasks according to the standardized procedure. In special cases (e.g., when a participant missed the questionnaire submission), the research team communicated with them in a timely manner to reschedule or compensate for the missing data, thereby ensuring the completeness and consistency of the dataset. After completing the above steps, all participants had gone through a uniform experimental procedure, which provided a reliable foundation for the subsequent data analysis.

Participants in this experiment were recruited through random sampling, targeting adult individuals with prior gaming experience. Recruitment announce-

ments were distributed through both online and offline channels, including social media and gaming community forums, specifying the need for adult, physically and mentally healthy volunteers who regularly play digital games. To ensure the representativeness of the sample and the reliability of the results, we applied simple random sampling to select participants from the volunteer pool (Cochran 1977). Participants were then randomly assigned to the experimental and control groups, adhering to strict principles of randomization and control (Cochran 1977), in order to minimize potential biases and external disturbances. Ultimately, a total of 540 valid data samples were collected.

To ensure that the experimental results were credible and attributable to the manipulation of independent variables, several measures were taken to control potential external influences. Regarding environmental control, all participants were instructed to complete the gameplay experiment in a quiet, comfortable, and distraction-free setting. When conducted in a laboratory, the lighting, noise levels, and computer performance were kept consistent; for remote participation, participants were asked to choose a relatively quiet room and complete the gameplay task within a designated time window to reduce environmental variation. These standardization procedures enhanced the internal validity of the experiment, ensuring that the results primarily reflected the effect of the manipulated independent variables (Cochran 1977).

Regarding the role of researchers, interaction between researchers and participants was strictly limited to avoid introducing expectancy effects or observer bias. At the beginning of the test, instructions were either read aloud or provided in written form, including procedural steps, precautions, and how to complete the evaluations. The language used in these instructions was neutral and objective, avoiding any implications of expected outcomes. During the formal test, researchers did not interfere with participants' gameplay activities; while participants completed the tasks independently, the researchers only monitored progress and data uploads through the backend system. If participants encountered technical issues or had questions regarding the instructions, assistance was provided as needed, but without any emotionally suggestive feedback.

Additionally, all gameplay logs and questionnaires were anonymized: participant names were replaced with anonymous IDs in the dataset to prevent analysts

from forming biases toward specific individuals. Through these strict experimental controls, the researchers ensured that the independent variables under investigation—namely, game difficulty and anxiety manipulation—were the primary factors influencing the dependent variables (such as user engagement), while minimizing the interpretative influence of external factors such as environment or interpersonal interaction.

An overview of the research timeline is provided in Figure 5.3.

Ethical Considerations To ensure the ethical integrity and confidentiality of participant data in this study, a number of measures will be strictly enforced during the recruitment, data collection and analysis phases. Participants will be recruited on a strictly voluntary basis and provided with comprehensive information about the nature, purpose and procedures of the study. To eliminate any risk of identification, we will not collect any IP addresses or other personally identifiable information during the survey process.

Participants were afforded additional confidentiality through the use of pseudonyms, a practice that ensures that their identities will not be revealed during and after the study. This practice provides a safer space for open and honest communication, allowing participants to share their experiences without fear of personal privacy or possible repercussions of disclosure.

To further maintain the integrity of the study and the confidentiality of participant data, all information collected, both quantitative and qualitative, is securely stored on a dedicated hard drive provided by the University. This data storage solution is designed to prevent unauthorized access and ensure that all sensitive information is kept confidential. After the results of the study have been thoroughly analyzed and published, all data will be permanently deleted to ensure that no residual information can be traced back to the participants. This final step underscores our commitment to ethical research practices and respect for the contributions of all participants, reinforcing the trust placed in us by those who choose to share their experiences in order to promote academic research.

Time	Procedure
2020.09-2021.03	Literature Review and Research Design
2021.04-2021.05	Pretest Round 1
2021.06-2021.10	Pretest R1 Data Analysis
2021.11-2021.12	Revision of Proposal&Theoretical Framework
2022.01	Interim Presentation
2022.02-2022.04	Design Pretest Round 2
2022.05-2022.06	Pretest Round 2
2022.07-2022.09	Pretest R2 Data Analysis
2022.10-2022.12	Revision of Proposal
2023.01-2023.06	Constructing Hypothetical Design Model
2023.07	Proposal Defense
2023.07-2023.12	Collaborative Follow-Up Study
2024.01-2024.03	Formal Implementation Test Structure Design
2024.04	Research Progress Review
2024.05-2024.11	Measurement Design and Revision Game Design and Development for Formal Implementation Test
2024.12-2025.01	Implementation Test &Data Collection
2025.02-2025.04	Data Analysis (Evaluation) Discussion / Result
2025.05-2025.06	Thesis Revision / Dissertation Finished

Figure 5.3 Time Plan

Measurement

To explore the effects of anxiety on user engagement in digital games, a structured questionnaire was developed based on the theoretical framework of the "Anxiety-to-Engagement Design Model." The questionnaire included both core and supplementary measurement modules. All modules were adapted from estab-

lished scales with demonstrated reliability and validity. To ensure cross-cultural applicability, several scales were prepared using the translation–back-translation method, linguistically adjusted for the experimental context, and pretested on a small sample before full deployment. The final model included five main constructs: gameplay difficulty, state anxiety, game engagement, game type, and personality tendency (Figure 5.4). Each construct’s components, measurement dimensions, item sources, and scoring methods are described below.

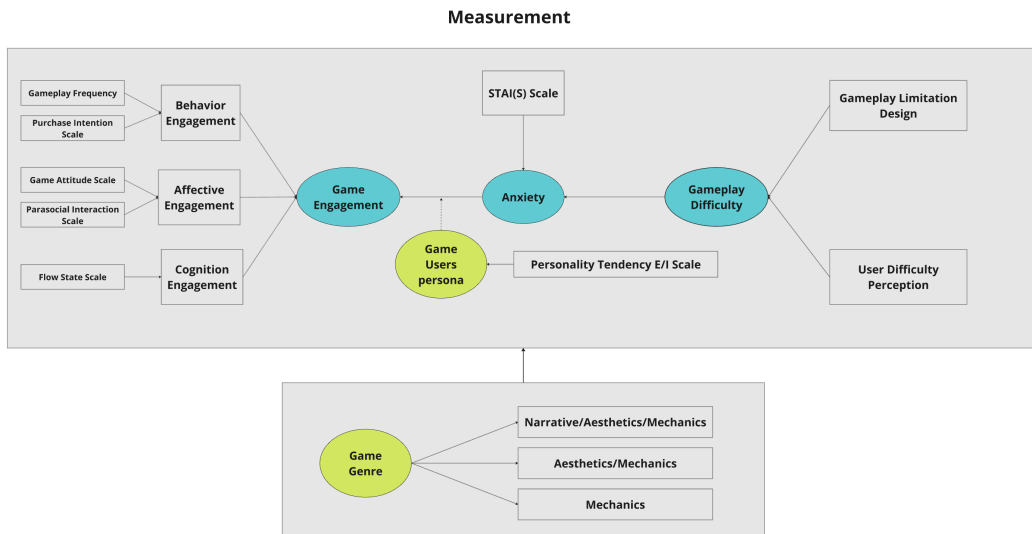


Figure 5.4 Measurement

This study employed a multi-method data collection strategy to gather both objective behavioral data and subjective psychological data during gameplay. On one hand, survey responses were used to collect psychological and engagement-related variables. On the other hand, game behavior was recorded objectively through in-game logging modules embedded in each test game to quantify user performance.

Gameplay Difficulty. A name in Statistical Model for Anxiety Driver’s setting. Equals to Anxiety Driver. Gameplay difficulty was one of the key independent variables in this study (Gee 2003). As Gee (2003) points out, difficulty is not solely determined by objective game mechanics, but also by players’ per-

sonal experience, strategies, and individual characteristics. Therefore, this study applied a dual-indicator approach: objective difficulty and perceived difficulty, to enhance experimental validity and explanatory power. Objective difficulty was preset by the experimenter, based on parameters such as level complexity, enemy density, and operational stress, and used to assign participants into a high-difficulty (coded as 1) or low-difficulty (coded as 0) group. Perceived difficulty was measured through a single questionnaire item, where participants rated how difficult the gameplay felt on a 5-point Likert scale (1 = very easy, 5 = very difficult). This variable was included to assess the alignment between designed challenge and user perception, acknowledging that individual skills might affect difficulty interpretation.

Anxiety. State anxiety was assessed using the State-Trait Anxiety Inventory—State Form (STAI-S) (Spielberger 1983). The scale includes 20 items, rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree), covering emotional states such as nervousness, worry, uneasiness, and irritability. Items include both positively and negatively worded statements (with reverse-coded items), capturing real-time emotional shifts during gameplay. This measure has been widely used and is known for its reliability.

Game Engagement. Game engagement was measured through three subdimensions: behavioral engagement, affective engagement, and cognitive engagement.

Behavioral engagement focused on the player’s time and financial investment. It included two indicators: purchase intention and gameplay frequency. Purchase intention was measured with 5 items adapted from (Balakrishnan and Griffiths 2018), such as “In future, I plan to spend more on game or in-game items,” rated on a 5-point Likert scale. Gameplay frequency was recorded directly as the number of rounds completed during the experiment (ranging from 1 to 10 or more).

Affective engagement covered the player’s emotional investment in the game. It included affective loyalty, based on (Hsiao and Chen 2016), using 5 items (e.g., “This game is my first choice”) to assess emotional attachment. Parasocial interaction (PSI) was also measured in this module, using 9 items adapted from (Rubin et al. 1985, Rubin and Perse 1987), such as “I see this media figure as a natural, down-to-earth person.” All items were rated on a 7-point Likert scale (1

= strongly disagree, 7 = strongly agree).

Cognitive engagement was assessed using the Flow Experience scale from (Chou et al. 2023), consisting of 5 items measuring immersion, time distortion, and cognitive absorption (e.g., "Time goes by very quickly when playing game"), rated on a 7-point Likert scale.

Personality Tendency (Extraversion–Introversion). To examine individual differences in social orientation, the study included 11 items adapted from the NERIS Type Explorer (Makwana and Dave 2020), which is based on Jungian cognitive theory and Big Five personality traits. These items (e.g., "You can easily connect with people you have just met") were rated on a 7-point Likert scale (1 = not at all true, 7 = completely true).

Game Type. Divided with different design model should be considered as different game type in the statistical model. Beyond questionnaire measurements, this study also introduced three types of mini-game prototypes with differentiated design models, for example:

(1) ATEO 1: Narrative + Aesthetics + Limitation Mechanics (with story and full visual presentation);

(2) ATEO 2: Aesthetics + Limitation Mechanics;

(3) ATEO 3: Limitation Mechanics only;

or

(1) Juicy Feedback: Aesthetics (with audio-visual design but no narrative);

(2) Flow Channel: Basic gameplay only (logic-based gameplay without aesthetics or narrative);

(3) Narrative-Immersion: Narrative + Aesthetics (with story and full visual presentation).

All games were pretested to ensure comparable baseline difficulty. These differentiated modules enabled the investigation of how narrative and aesthetic design elements moderate the relationship between anxiety and user engagement.

Prototype Design and Setup

With three gameplay types researcher designed six prototypes games, which were carefully selected as the experimental tasks in this study to represent different types of game constraints respectively, and to make each game correspond to a

directly observable indicator of player behavior.

The games were selected based on the principles of concise rules and simple but challenging operations in order to trigger optimal anxiety responses and engaged behaviors in the subjects. The three games included: a flight-based game titled “Cyan Bird”, which integrates narrative, aesthetics, and mechanical design; a dodge-style game titled “Feather”, which includes aesthetic and mechanical elements but no narrative; and a logic-based puzzle game titled “512”, which focuses solely on core mechanics without aesthetic or narrative features.

The matrix shows the 6 prototype’s differences based on different model design(Figure5.5)(Figure5.6):

Game Icon	Game Code	Anxiety Drive	Narrative Design	Aesthetic Design	Design Model
	A 0 (Cyan Bird)	N/A	Y	Y	Narrative-Immersion Model (NI)
	B 0 (Feather)	N/A	N/A	Y	Juicy Feedback (JF)
	C 0 (512)	N/A	N/A	N/A	Flow Channel (FC)

Figure 5.5 Classic Model Baseline Group 0

Cyan Bird This game is based on the mechanics of the well-known open-source game *Flappy Bird*, which is famous for its “simple yet challenging” gameplay (Abdullah and Sai 2023). Players control the upward movement of a bird by tapping, attempting to avoid a series of pipes that serve as obstacles. This game was selected because its fast-paced nature and clear failure penalty (immediate

Game Icon	Game Code	Anxiety Drive	Adjustment Tool 1 (Narrative)	Adjustment Tool 2 (Aesthetic)	Design Model
	A 1 (Cyan Bird)	Y	Y	Y	ATEO
	B 1 (Feather)	Y	N/A	Y	ATEO
	C 1 (512)	Y	N/A	N/A	ATEO

Figure 5.6 ATEO Model Group 1

loss upon collision) are effective in inducing tension.

In terms of narrative, the researchers designed a complete and context-fitting world-building script, character backstory, scene setting, and in-game terminology for this game. The full narrative can be found in Appendix "Cyan Bird Narrative Design." Selected elements of the narrative design are presented below:

Glossary: *Cyan Bird*: Human experimental subjects. Historical records show that the lifespan of Cyan Birds is approximately one-tenth of that of ordinary humans. Their bodies are perfect and immortal, but their souls and minds are extremely fragile, often collapsing from sensory overload shortly after reaching their prime. In the Quanxin Tree system, they are symbolized as fluttering blue birds.

Game Narrative: Humanity failed to find the perfect path to eternal life. As all physical forms withered away, the replicated Cyan Birds remained imprisoned within the Quanxin Tree. No longer able to communicate with one another, they drift endlessly in silence, replaying memories of their loved ones in solitude—over and over, even beyond the end of the world. To this day, the Cyan Birds continue

to flap their wings and fly, seeking and searching—for the path to true existence.

Corresponding to this narrative, researchers developed aesthetic assets to match the Cyan Bird game, including music and sound effects, as well as visual elements such as:

- a. **Character design** for the main playable character Cyan Bird, including both illustrated and in-game versions (Figure5.7)

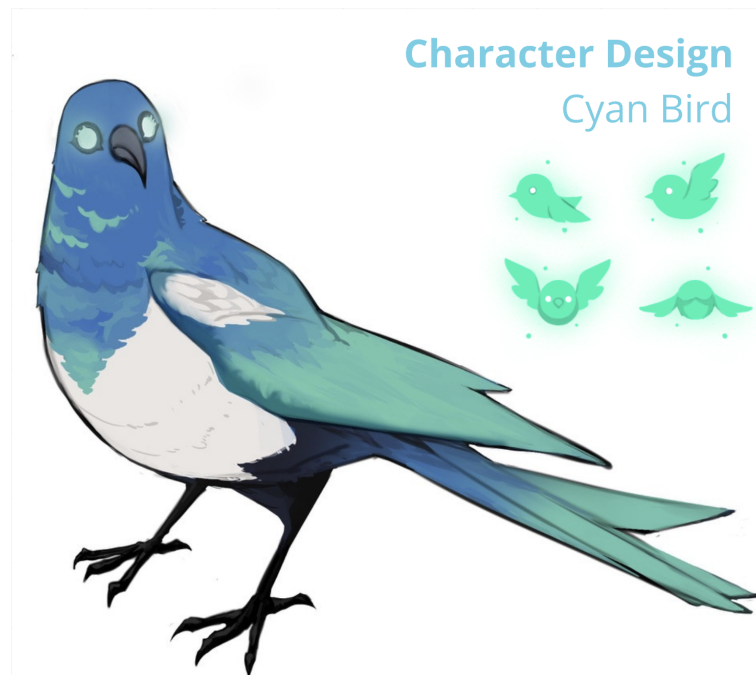


Figure 5.7 Cyan Bird Character Design

- b. **Scene design** for the game world (Quanxin Tree base, actual gameplay scenes) (Figure5.8)

- c. **Game UI design** (user interface and visual style) (Figure5.9)

- d. To facilitate player understanding and maximize the immersive experience, a 3-minute **opening PV** (promotional video) integrating narrative and aesthetic elements was produced and shown before gameplay (Figure5.10) (Figure5.11)

To differentiate the model conditions, the experiment manipulated resource and space availability: with the NI(Narrative immersion) Model, players were granted additional lives (e.g.allowed to hit obstacles more times before the game ended),

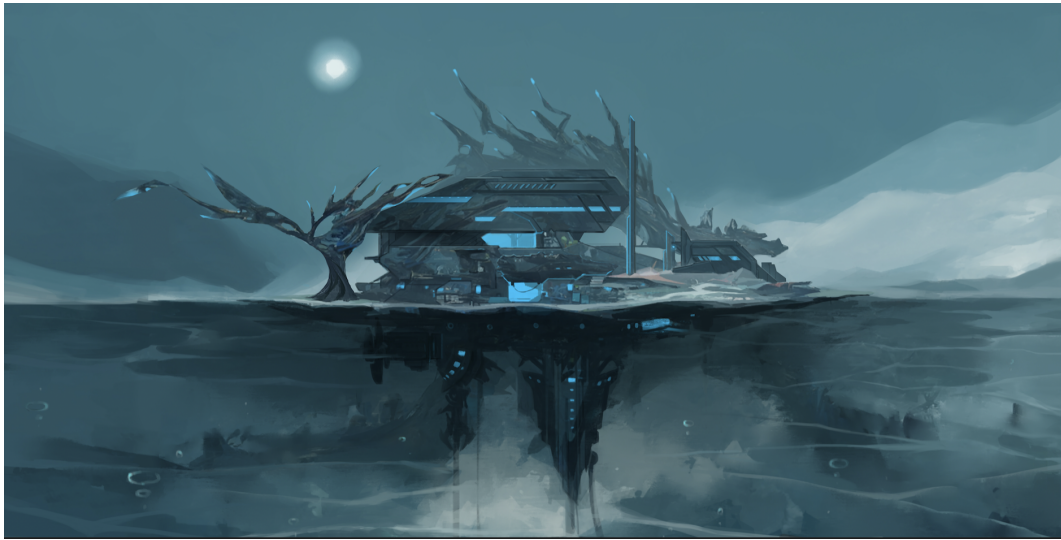


Figure 5.8 Quanxin Tree



Figure 5.9 Cyan Bird Scene Design1

while in the ATEO mode, players had no extra lives (one hit leads to immediate failure).(Figure5.12)

This life-based resource manipulation allowed researchers to control fault tolerance and pressure level from the perspective of resource limitation. Under high-

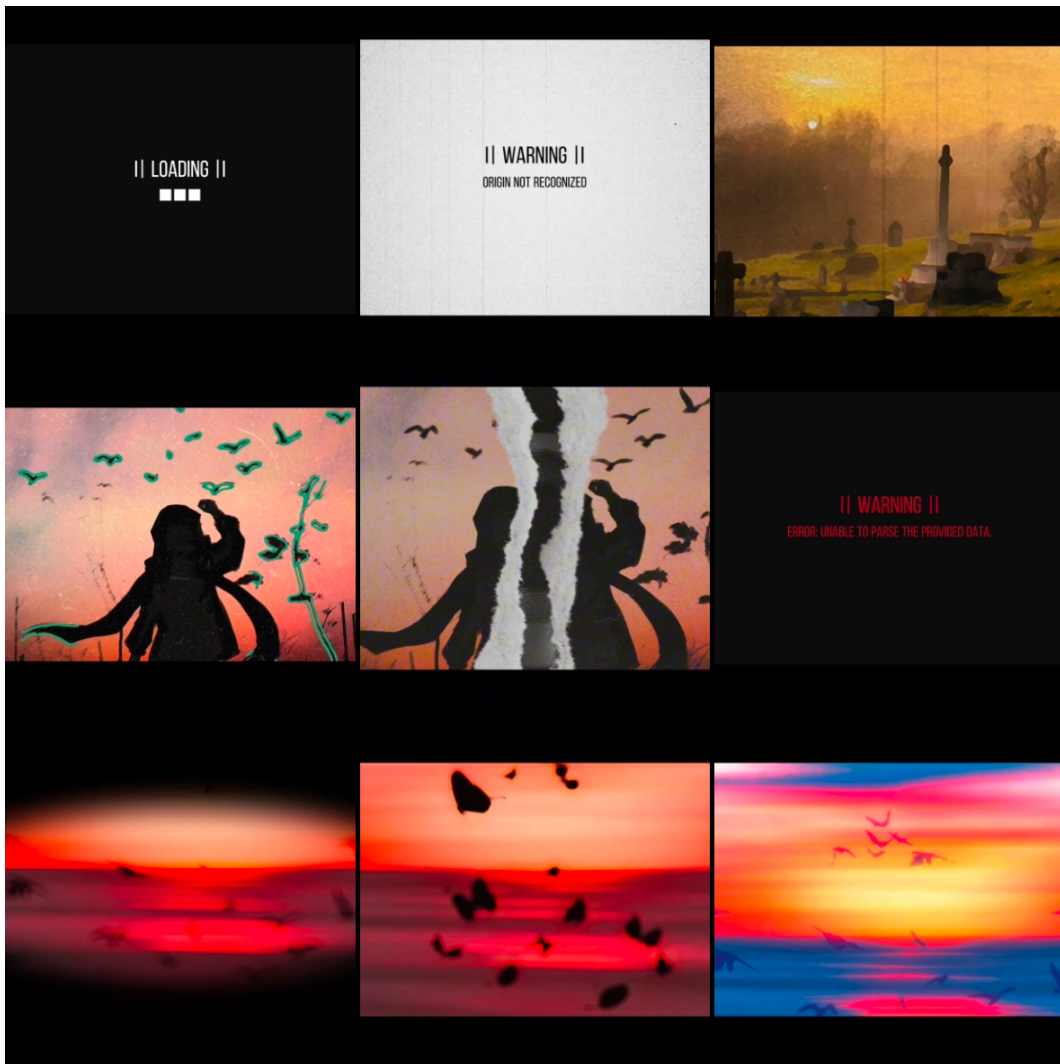


Figure 5.10 Cyan Bird PV Screenshot1

difficulty conditions, the anxiety-inducing potential of the game was elevated. The directly observable behavioral metric for this game was the player's highest score, defined by the number of pipes successfully passed. This score was recorded after each round to objectively reflect participants' performance under pressure.

Feathers This is a top-down dodge-style mini-game in which players must control a character to avoid hostile creatures wandering around the screen. The

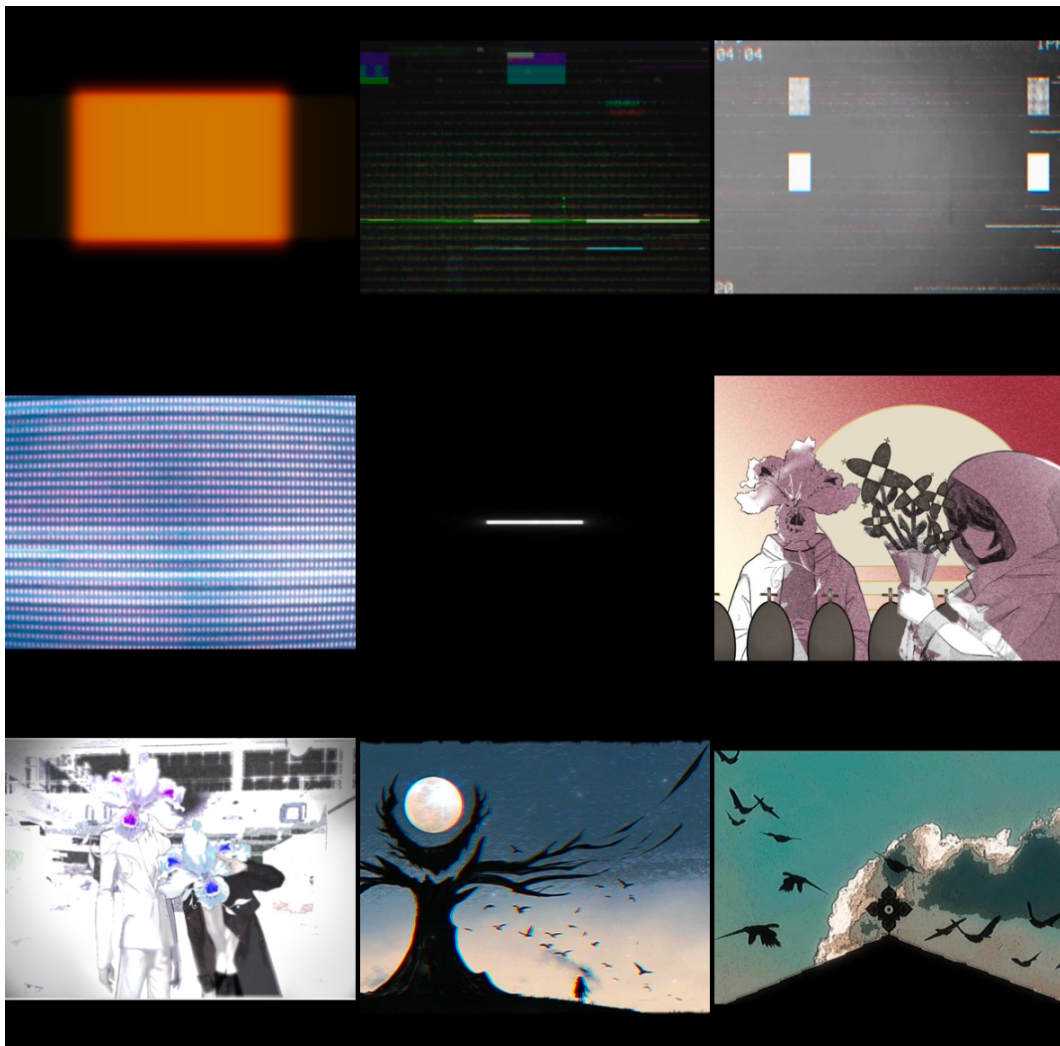


Figure 5.11 Cyan Bird PV Screenshot2

core gameplay mechanics are derived from the official open-source Godot tutorial *Dodge the Creeps*, featuring simple and intuitive control logic.¹

Based on the original mechanics, the researchers designed non-verbal visual elements for player-controlled characters—for example, the character design (Figure 5.13) and the in-game scene design (Figure 5.14). Appropriate sound effects and background music (BGM) were also added to ensure the presence of aesthetic elements that players could perceive.

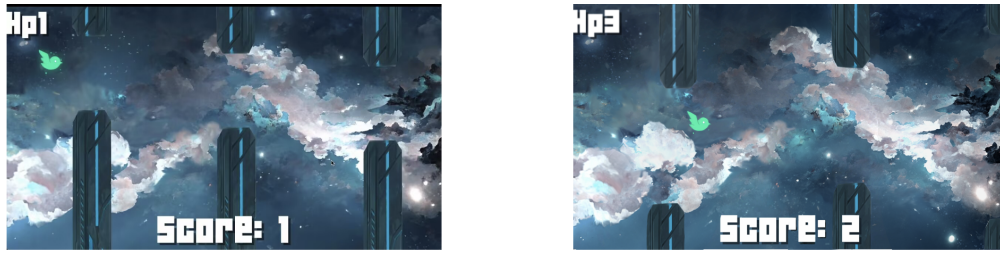


Figure 5.12 Cyan Bird ATEO vs Narrative Immersion



Figure 5.13 Feather Character Design

The goal of the researchers in designing this game was to enable dynamic difficulty adjustment by modifying the number and speed of enemies. In other words, it reflects difficulty control in terms of “operational constraints.” Specifically, with the design of Juicy feedback(JF) model, fewer enemies appear on screen and move at slower speeds. In the ATEO model, the number of enemies increases significantly and their movement is faster, thereby imposing greater pressure on the player’s survival. Both two model has aesthetic design module.(Figure5.15)

This design directly influenced the player’s survival time in-game—from the start of each round to the moment the character was hit. Players are required to perform well under pressure, especially in hard mode where maintaining comparable survival time becomes more difficult. This represents a typical anxiety-

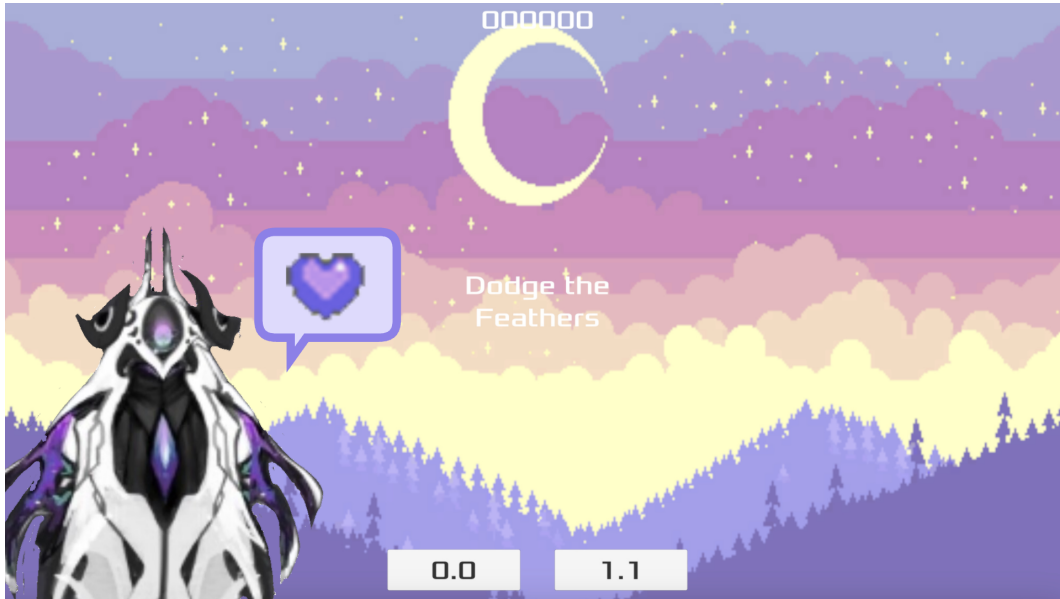


Figure 5.14 Feather Main Page Design

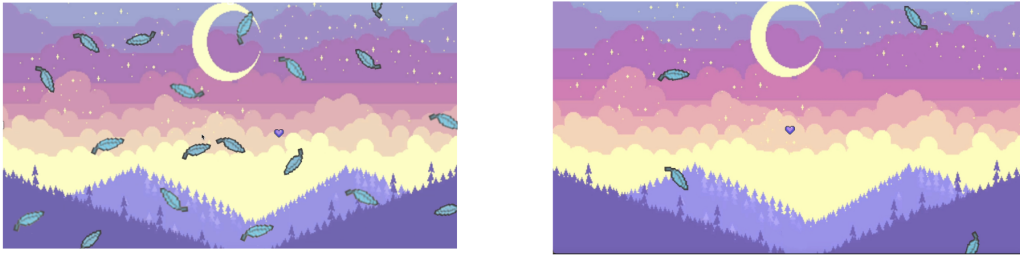


Figure 5.15 Feathers ATEO with Juicy Feedback

inducing mechanism.

512 512 is a logic-based strategy game adapted from the open-source game *2048*. Players must use arrow keys to slide numbered tiles on a grid, combining tiles with the same value to form larger numbers. The goal is to reach a target score in as few moves or as little time as possible. (Figure 5.16)

This type of gameplay was selected primarily for its simple rules yet strategic depth, which can trigger player tension and anxiety on the logical reasoning dimen-

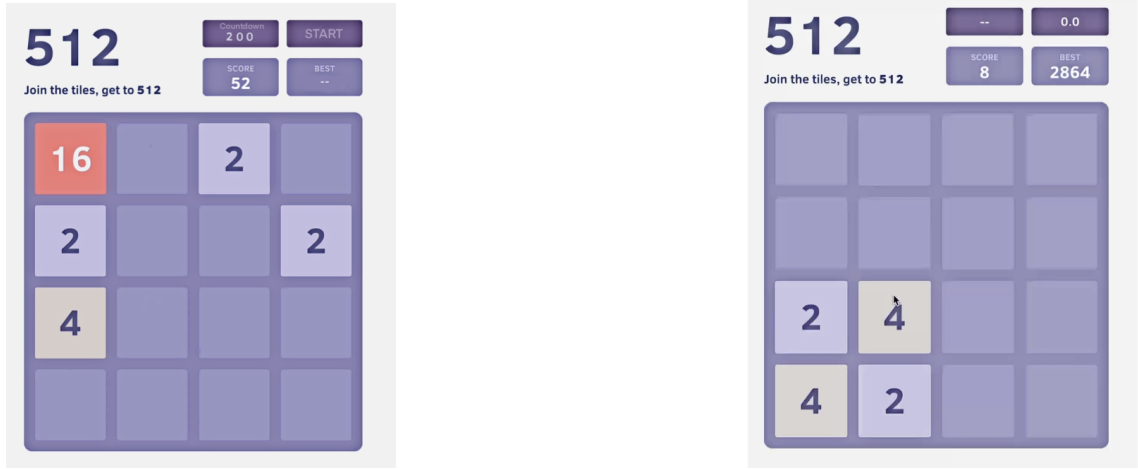


Figure 5.16 512 ATEO vs Follow Channel

sion. Its difficulty reflects control under the dimension of “physical constraints” (i.e., operation), as challenge intensity is modulated through time limits.

To distinguish Models, the original FC(Follow Channel) design used as baseline. With ATEO model, it introduced completion time as an intervention variable. In the FC design model, players were given relatively generous time limits and allowed a certain number of ineffective moves. In the ATEO version, the time limit was significantly shortened, requiring players to complete a certain number of merges within a strict timeframe—otherwise the task would be considered a failure. Under such temporal constraints, players are more likely to experience psychological pressure during decision-making, leading to elevated anxiety.

This game design allows for observation of logical reasoning and strategic performance under high-pressure conditions. It enriches the testing scenarios by excluding narrative and aesthetic designs and focusing solely on mechanical challenges. This offers a comprehensive dimension to examine players’ anxiety responses and engagement under different types of stress, including time pressure and cognitive workload.

Together, the six prototype games (based on 3 game-play types) represent distinct combinations of game design elements and Model types, ensuring a diverse range of challenge conditions within the experimental paradigm. All games were

standardized in terms of demonstration platform (executed on win PC) and control methods (keyboard input), to eliminate device- or control-based confounding variables that might otherwise impact the test results.

5.1.2 Data and Statistical Analysis

Model Testing

This study adopts the quantitative process of “measurement first, structure verification” (Anderson and Gerbing 1988). First, a confirmatory factor analysis (CFA) was performed in SPSS AMOS to test the reliability and validity of each latent variable scale. The results showed that Cronbach’s alpha was above 0.8, the reliability quality was qualified, AVE values were all greater than 0.5, CR values were all higher than 0.7 (Figure 5.18), and square roots of the AVE are greater than the highest absolute inter-construct correlations, which indicates good discriminant validity.(Figure 5.19) The absolute value of the standardized factor loadings are greater than 0.6 and show significance, and the model fit indicators were good(CMIN/DF=1.438,CFI=0.979,GFI=0.905,RMSEA=0.029), confirming the reliability of the measurement model(Figure5.17).

As shown in the table(Figure 5.20),correlation analysis was conducted to examine the relationships between game participation and five variables: behavioral participation, affective participation, cognitive engagement, perceived difficulty, and anxiety. Pearson’s correlation coefficients were used to assess the strength of these associations.

The correlation coefficients between game participation and the five variables were 0.901 (behavioral), 0.847 (affective), 0.770 (cognitive), 0.515 (difficulty), and 0.495 (anxiety), all of which were statistically significant and positive. These results indicate that game participation is positively correlated with behavioral participation, affective participation, cognitive engagement, perceived difficulty, and anxiety.

Analysis of the data was performed using SPSS, a multiple linear regression, mediation and grouping test was performed on a sample of 540: the direct effect of “game difficulty → anxiety” was verified first, and then the inverted U-shaped relationship between “anxiety → behavioral, affective, and cognitive engagement”

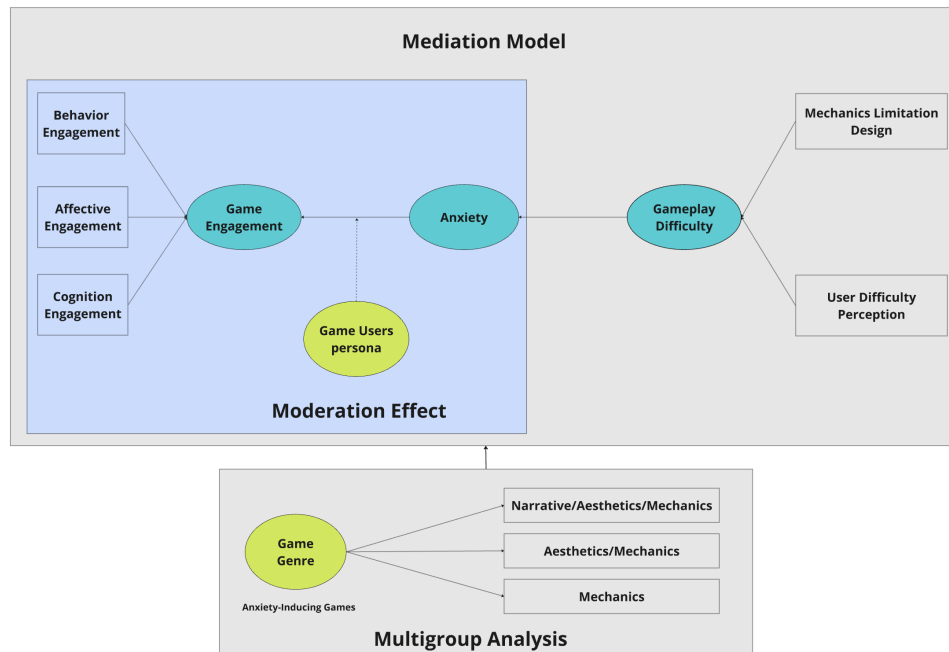


Figure 5.17 Statistical Analysis

	CR	AVE
Anxiety	0.975	0.66
Behavioral engagement	0.9	0.644
Affective engagement	0.954	0.6
Cognitive engagement	0.886	0.608

Figure 5.18 Convergent Validity

was explored using both the primary term and the secondary term, and the partial mediating role of anxiety in the “difficulty → engagement” path was examined. At the same time, the moderating effect was examined by grouping regression of extraverted/introverted personality and three game types.

	Anxiety	Behavioral engagement	Affective engagement	Cognitive engagement
Anxiety	0.812			
Behavioral engagement	0.501***	0.802		
Affective engagement	0.438***	0.528***	0.774	
Cognitive engagement	0.354***	0.637***	0.518***	0.78

Figure 5.19 Discriminant Validity

Pearson Correlation						
	Game engagement	Behavioral engagement	Affective engagement	Cognitive engagement	Difficulty	Anxiety
Game engagement	1					
Behavioral engagement	0.901***	1				
Affective engagement	0.847***	0.589***	1			
Cognitive engagement	0.770***	0.648***	0.475***	1		
Difficulty	0.515***	0.539***	0.352***	0.405***	1	
Anxiety	0.495***	0.471***	0.421***	0.333***	0.593***	1

* p<0.05 ** p<0.01 *** p<0.001

Figure 5.20 Pearson Correlation

Hypothesis Testing

H1: Gameplay difficulty has a significant positive effect on anxiety. According to the regression results (Figure 5.21), a linear regression analysis was conducted with difficulty as the independent variable and anxiety as the dependent variable. The resulting regression equation is: $\text{Anxiety} = 22.929 + 7.112 \times \text{Difficulty}$. The model's R^2 value is 0.351, indicating that difficulty explains approximately 35.1% of the variance in anxiety. The model was statistically sig-

nificant, as shown by the F-test result: $F(1, 538) = 291.444$, $p < 0.001$. This confirms that difficulty significantly predicts anxiety. Furthermore, the regression coefficient for difficulty was 7.112 ($t = 17.072$, $p < 0.001$), suggesting a strong and statistically significant positive relationship between perceived difficulty and reported anxiety levels. The statistically significant results support H1.

Results of linear regression analysis (n=540)					
	Unstandardized coefficient		Standardized coefficient	<i>t</i>	<i>p</i>
	<i>B</i>	Standard Error	<i>Beta</i>		
Constant	22.929	1.682	-	13.632	0.000***
Difficulty	7.112	0.417	0.593	17.072	0.000***
R ²	0.351				
Adjustment R ²	0.35				
<i>F</i>	<i>F</i> (1,538)=291.444,p<0.001				
Notes: dependent variable = anxiety					
* p<0.05 ** p<0.01 *** p<0.001					

Figure 5.21 Difficulty vs. Anxiety

H2: Anxiety has a significant positive effect on game participation. From the table of Difficulty and Anxiety on Game Engagement (Figure 5.22), we can see that difficulty, anxiety, and anxiety squared are used as independent variables, while game engagement is used as the dependent variable in the linear regression analysis, from the above table, the model formula is: game participation = $4.145 + 0.423 \times \text{difficulty} + 0.039 \times \text{anxiety} - 0.002 \times \text{anxiety squared}$, and the R -squared value of the model is 0.392, which means that difficulty, anxiety, and anxiety squared can explain 39.2% of the variation in game participation. The F-test of the model indicated that it passed the significance test ($F=115.298$, $p < 0.05$), suggesting that at least one of the predictors—difficulty, anxiety, or anxiety squared—has a significant effect on game participation.

The regression coefficient value for difficulty is 0.423 ($t=8.314$, $p < 0.001$), imply-

ing that difficulty will have a significant positive relationship on game participation.

The regression coefficient value of anxiety is 0.039 ($t=8.867$, $p<0.001$), which implies that anxiety has a significant positive effect on game participation.

The regression coefficient value of anxiety squared was -0.002 ($t=-7.928$, $p<0.001$), implying that anxiety squared would have a significant negative relationship on game participation.

From the two regression tables, it can be seen that the independent variable is significant for the mediator variable, and the independent variable, the primary term of the mediator variable, and the secondary term of the mediator variable all hold significantly for the dependent variable, indicating that the mediation is significantly established and partially mediated effect.

Results of linear regression analysis (n=540)							
	Unstandardized coefficient		Standardized coefficient	<i>t</i>	<i>p</i>	Covariance Diagnostics	
	<i>B</i>	Standard Error	<i>Beta</i>			VIF	Tolerance
Constant	4.145	0.195	-	21.267	0.000***	-	-
Difficulty	0.423	0.051	0.348	8.314	0.000***	1.542	0.648
Anxiety	0.039	0.004	0.385	8.867	0.000***	1.659	0.603
Anxiety squared	-0.002	0	-0.284	-7.928	0.000***	1.128	0.887
R ²	0.392						
Adjustment R ²	0.389						
<i>F</i>	<i>F</i> (3,536)=115.298,p<0.001						
Remarks: Dependent variable = Game engagement							
* p<0.05 ** p<0.01 *** p<0.001							

Figure 5.22 Difficulty and Anxiety on Game Engagement

H3: Anxiety shows inverted-U relationship with Game engagement.

To examine the effect of anxiety on overall game engagement, a linear regression analysis was conducted using anxiety and anxiety squared as independent variables and game participation as the dependent variable. The regression model is as follows:

$$\text{Game Participation} = 4.685 + 0.060 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$$

The R-squared value of the model is 0.314, indicating that anxiety and its quadratic term together explain 31.4% of the variance in game participation. The model passed the F-test ($F = 122.802$, $p = 0.000 < 0.05$), suggesting that at least one of the predictors—either anxiety or anxiety squared—has a significant effect on game participation.

The regression coefficient for anxiety is 0.060 ($t = 15.512$, $p < 0.001$), indicating a significant positive effect of anxiety on game participation.

The regression coefficient for anxiety squared is -0.002 ($t = -7.316$, $p < 0.001$), indicating a significant negative effect, which supports the presence of an inverted-U shaped relationship between anxiety and participation.

These findings indicate that game engagement peaks at a moderate level of anxiety and declines when anxiety exceeds that level (Figure 5.23), supporting the H3.

To further investigate the influence of anxiety on specific dimensions of engagement, separate regression analyses were conducted for behavioral, affective, and cognitive engagement. The results are as follows (Figure 5.24):

H3a: Anxiety has an inverted-U relationship with behavioral engagement. Model formula: Behavioral Engagement = constant + $0.080 \times \text{Anxiety} - 0.003 \times \text{Anxiety}^2$ Model explanatory power: $R^2 = 0.276$ Anxiety linear term: $\beta = 0.080$, $t = 14.217$, $p < 0.001$ Anxiety squared term: $\beta = -0.003$, $t = -6.38$, $p < 0.001$ These results support the inverted-U hypothesis for behavioral engagement.

H3b: Anxiety has an inverted-U relationship with affective engagement. Model formula: Affective Engagement = constant + $0.067 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$ Model explanatory power: $R^2 = 0.217$ Anxiety linear term: $\beta = 0.067$, $t = 12.141$, $p < 0.001$ Anxiety squared term: $\beta = -0.002$, $t = -5.223$, $p < 0.001$

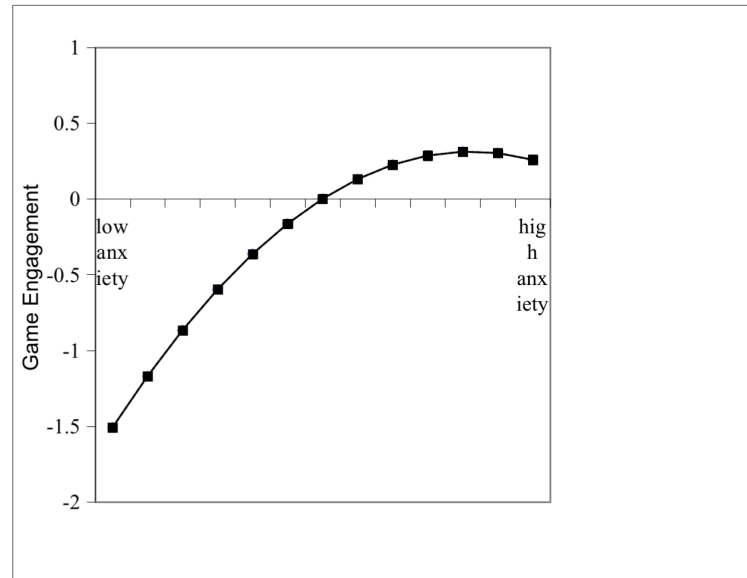


Figure 5.23 Anxiety & Game Engagement

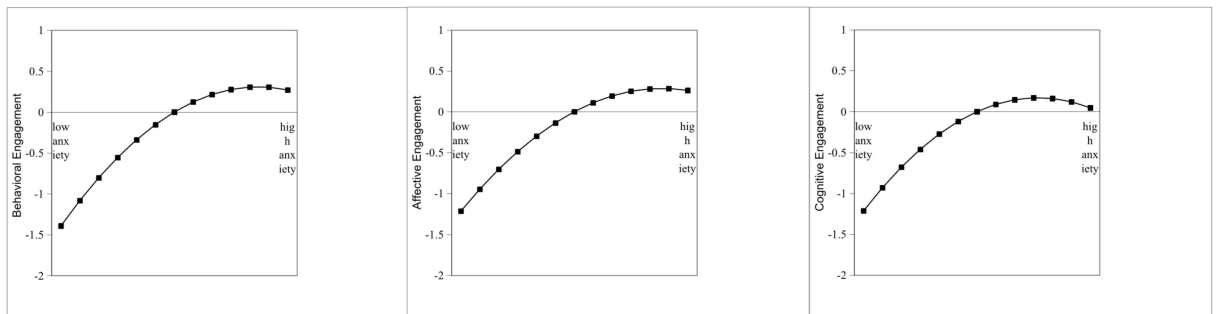


Figure 5.24 Anxiety& Engagement Dimensions

0.001 These findings support an inverted-U relationship for affective engagement.

H3c: Anxiety has an inverted-U relationship with cognitive engagement. Model formula: $\text{Cognitive Engagement} = \text{constant} + 0.032 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$ Model explanatory power: $R^2 = 0.170$ Anxiety linear term: $\beta = 0.032$, $t = 10.050$, $p < 0.001$ Anxiety squared term: $\beta = -0.002$, $t = -6.195$, $p < 0.001$ These results also support an inverted-U relationship for cognitive engagement.

H4: Personality type (extrovert vs. introvert) moderates the path between anxiety and game engagement.

Extrovert About effects on behavioral engagement, for the extroverted group, a linear regression analysis was conducted with anxiety and anxiety squared as independent variables, and behavioral engagement as the dependent variable. The resulting model is: $\text{Behavioral Engagement} = 4.378 + 0.077 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. The model shows good explanatory power, with $R^2 = 0.248$ and adjusted $R^2 = 0.242$. The F-test result is $F(2, 294) = 48.351$, $p < 0.001$, indicating that the model is statistically significant. This suggests that anxiety and its quadratic term jointly explain approximately 24.8% of the variance in behavioral engagement among extroverted players. Specifically, the linear term of anxiety has a significant positive effect ($\beta = 0.077$, $t = 9.813$, $p < 0.001$), while the squared term has a significant negative effect ($\beta = -0.002$, $t = -3.096$, $p = 0.002$), indicating an inverted-U shaped relationship between anxiety and behavioral engagement.

For affective engagement, the regression model is as follows: $\text{Affective Engagement} = 6.328 + 0.066 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. The model yields $R^2 = 0.196$ and adjusted $R^2 = 0.191$, with $F(2, 294) = 35.933$ and $p < 0.001$, confirming statistical significance. The linear term of anxiety shows a significant positive effect on affective engagement ($\beta = 0.066$, $t = 8.472$, $p < 0.001$), while the squared term is significantly negative ($\beta = -0.002$, $t = -3.452$, $p = 0.001$). These findings indicate that for extroverted players, anxiety and affective engagement also follow an inverted-U pattern—moderate anxiety enhances affective engagement, whereas excessive anxiety may dampen emotional involvement.

For cognitive engagement, the regression analysis yielded the following model: $\text{Cognitive Engagement} = 3.366 + 0.030 \times \text{Anxiety} - 0.001 \times \text{Anxiety}^2$. The model demonstrates statistical significance, with $R^2 = 0.138$ and adjusted $R^2 = 0.132$. The F-test result is $F(2, 294) = 23.464$, $p < 0.001$. The linear term of anxiety has a significant positive impact on cognitive engagement ($\beta = 0.030$, $t = 6.736$, $p < 0.001$), while the squared term again shows a significant negative effect ($\beta = -0.001$, $t = -3.687$, $p < 0.001$), supporting the presence of an inverted-U relationship.

Introvert To examine the effects on behavioral engagement of introverted group ($n = 243$), a linear regression analysis was conducted with anxiety and its squared term as independent variables and behavioral engagement as the dependent variable. The resulting model is: Behavioral Engagement = $4.758 + 0.083 \times \text{Anxiety} - 0.004 \times \text{Anxiety}^2$. This model has an R^2 of 0.325 (adjusted $R^2 = 0.319$) and an F-statistic of $F(2, 240) = 57.684$ with $p < 0.001$, indicating that the overall model is statistically significant. In this model, the linear term for anxiety is significant and positive ($\beta = 0.083$, $t = 10.216$, $p < 0.001$), while the quadratic term is significant and negative ($\beta = -0.004$, $t = -6.114$, $p < 0.001$). Together, these predictors explain approximately 32.5% of the variance in behavioral engagement, suggesting an inverted-U relationship between anxiety and behavioral engagement among introverted players.

For affective engagement, the regression model for the introverted group is as follows: Affective Engagement = $6.015 + 0.067 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. This model yields an R^2 of 0.244 (adjusted $R^2 = 0.237$) and an F-statistic of $F(2, 240) = 38.636$ with $p < 0.001$, confirming that the model is significant. The linear term for anxiety shows a significant positive effect ($\beta = 0.067$, $t = 8.648$, $p < 0.001$), and the squared term exhibits a significant negative effect ($\beta = -0.002$, $t = -3.998$, $p < 0.001$). These results indicate that anxiety and its non-linear effect account for approximately 24.4% of the variance in affective engagement, again supporting an inverted-U shaped relationship.

To analysis cognitive engagement, following regression model was produced: Cognitive Engagement = $3.364 + 0.033 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. The model shows an R^2 of 0.215 (adjusted $R^2 = 0.209$) with an F-statistic of $F(2, 240) = 32.949$ ($p < 0.001$). Here, the linear term for anxiety is significantly positive ($\beta = 0.033$, $t = 7.476$, $p < 0.001$), and the quadratic term is significantly negative ($\beta = -0.002$, $t = -5.180$, $p < 0.001$), indicating that anxiety and its squared term together explain 21.5% of the variance in cognitive engagement. This again suggests an inverted-U relationship.

The differences in regression coefficients and explanatory power between the two groups (Figure 5.25) suggest that personality type moderates the relationship between anxiety and engagement, thereby supporting H4.

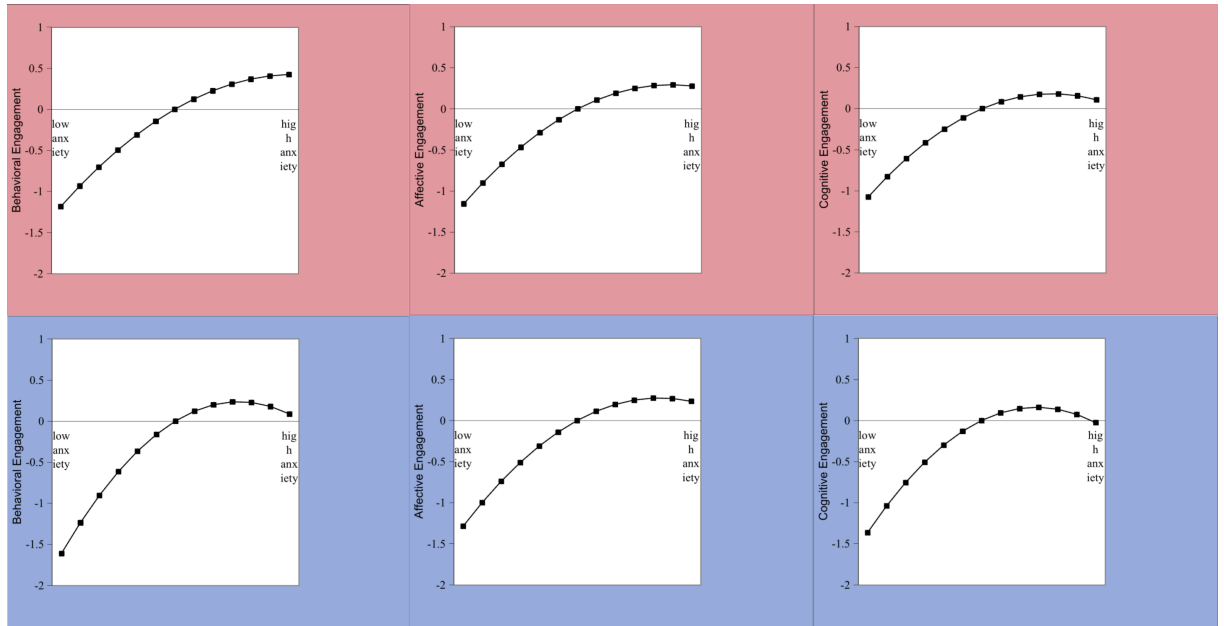


Figure 5.25 Red for Extrovert& Blue for Intorvert

H5: The positive relationship between anxiety and game engagement differs significantly across different game types.

To examine the moderating effect of game type, separate regression analyses were conducted for three different games:

512 A linear regression analysis(Figure 5.25) was conducted with anxiety and anxiety squared as independent variables and behavioral engagement as the dependent variable. The resulting model is: $\text{Behavioral Engagement} = 4.061 + 0.074 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. The model yielded an R^2 value of 0.363, indicating that anxiety and its quadratic term jointly explain 36.3% of the variance in behavioral engagement. The model passed the F-test ($F = 50.457$, $p = 0.000$; 0.05), confirming that at least one of the predictors—either anxiety or its squared term—has a significant impact on behavioral engagement. In addition, multicollinearity diagnostics showed that all VIF values were below 5, suggesting no significant multicollinearity issue and that the model is statistically sound. The linear term of anxiety had a significant positive effect on behavioral engagement

($\beta = 0.074$, $t = 10.038$, $p < 0.01$). The squared term of anxiety showed a significant negative effect ($\beta = -0.002$, $t = -3.347$, $p = 0.001 < 0.01$), indicating the presence of an inverted-U shaped relationship.

To examine the relationship between anxiety and affective engagement, a linear regression analysis was performed with anxiety and anxiety squared as predictors. The resulting model is: $\text{Affective Engagement} = 5.674 + 0.072 \times \text{Anxiety} - 0.001 \times \text{Anxiety}^2$. The model yielded an R^2 of 0.285, meaning that anxiety and its quadratic component jointly account for 28.5% of the variance in affective engagement. The F-test result ($F = 35.304$, $p = 0.000 < 0.05$) confirms the model's overall significance, indicating that at least one of the two predictors significantly influences affective engagement.

Multicollinearity diagnostics showed that all variance inflation factor (VIF) values were below 5, suggesting that multicollinearity was not a concern and that the model estimates are reliable. Detailed coefficient analysis revealed: The linear term of anxiety had a significant positive impact on affective engagement ($\beta = 0.072$, $t = 8.343$, $p < 0.01$). The quadratic term of anxiety demonstrated a significant negative effect ($\beta = -0.001$, $t = -2.155$, $p = 0.033 < 0.05$), supporting the presence of a subtle inverted-U relationship.

In order to assess the influence of anxiety on cognitive engagement, a linear regression analysis was conducted using anxiety and anxiety squared as independent variables. The regression model was: $\text{Cognitive Engagement} = 3.180 + 0.033 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. The model yielded an R^2 of 0.221, indicating that anxiety and its quadratic term together explain 22.1% of the variance in cognitive engagement. The model passed the F-test ($F = 25.055$, $p = 0.000 < 0.05$), confirming that at least one of the two predictors has a statistically significant effect on cognitive engagement.

Multicollinearity was assessed, and all VIF values were found to be below 5, suggesting that the model is free from multicollinearity issues and is statistically robust. More specifically: The linear term of anxiety had a significant positive effect on cognitive engagement ($\beta = 0.033$, $t = 6.849$, $p < 0.01$). The squared term of anxiety showed a significant negative effect ($\beta = -0.002$, $t = -4.195$, $p < 0.01$), indicating the presence of an inverted-U relationship.

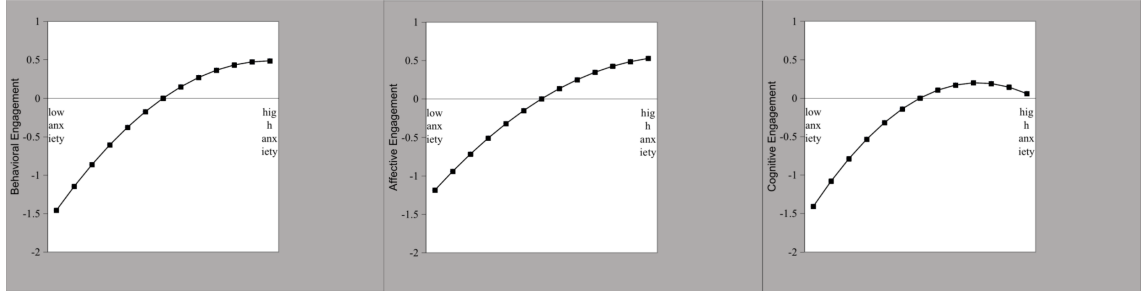


Figure 5.26 Game: 512

Feather To evaluate how anxiety influences behavioral engagement in the game Feather, a linear regression analysis was conducted using anxiety and anxiety squared as predictors. The resulting equation is: Behavioral Engagement = $5.103 + 0.098 \times \text{Anxiety} - 0.004 \times \text{Anxiety}^2$. The model demonstrates strong explanatory power, with $R^2 = 0.391$ and adjusted $R^2 = 0.384$, meaning that anxiety and its non-linear component explain 39.1% of the variance in behavioral engagement. The model is statistically significant based on the F-test ($F = 56.822$, $p = 0.000$; 0.05).

Collinearity diagnostics confirmed that all VIF values were below 5, indicating no multicollinearity concerns. Specifically, the linear term for anxiety had a significant positive effect ($\beta = 0.098$, $t = 10.583$, $p < 0.01$). The quadratic term had a significant negative effect ($\beta = -0.004$, $t = -5.912$, $p < 0.01$), suggesting a clear inverted-U shaped relationship.

A similar regression analysis was conducted to explore how anxiety relates to affective engagement. The regression equation was: Affective Engagement = $6.909 + 0.068 \times \text{Anxiety} - 0.003 \times \text{Anxiety}^2$

The model's R^2 is 0.201 (adjusted $R^2 = 0.192$), indicating that anxiety and its squared term explain 20.1% of the variance in affective engagement. The model was statistically significant ($F = 22.323$, $p = 0.000$; 0.05). Multicollinearity checks showed that VIF values remained below 5, confirming the model's stability. Further findings include: A significant positive effect of anxiety ($\beta = 0.068$, $t = 6.619$, $p < 0.01$). A significant negative effect of anxiety squared ($\beta = -0.003$, $t = -3.798$, $p < 0.01$), again supporting an inverted-U pattern.

To investigate the impact of anxiety on cognitive engagement, a regression analysis was performed with the following model: $\text{Cognitive Engagement} = 3.441 + 0.038 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. The model produced an R^2 of 0.228 (adjusted $R^2 = 0.219$), showing that anxiety and its quadratic term account for 22.8% of the variance in cognitive engagement. The F-test result ($F = 26.133$, $p = 0.000$; 0.05) confirms model significance. As with prior models, multicollinearity was not a concern (VIF ; 5). Detailed coefficients show: The linear anxiety term had a significant positive effect ($\beta = 0.038$, $t = 7.109$, p ; 0.01). The quadratic term exhibited a significant negative effect ($\beta = -0.002$, $t = -4.376$, p ; 0.01), reinforcing the inverted-U hypothesis.(Figure 5.27)

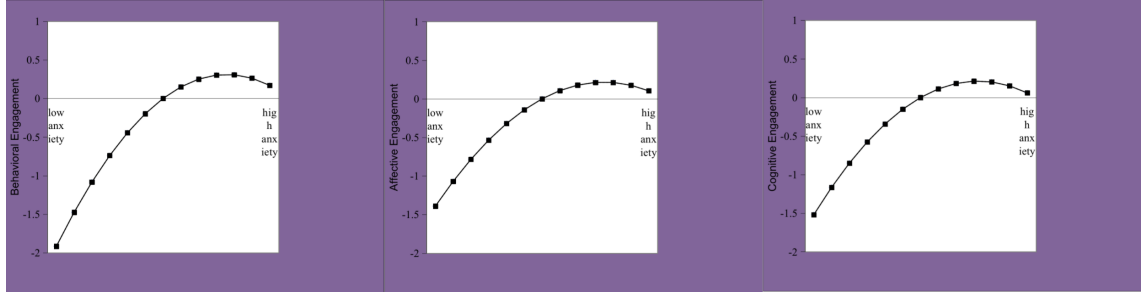


Figure 5.27 Game: Feather

Cyan bird About anxiety on behavioral engagement in Cyan bird, a linear regression was conducted using anxiety and anxiety squared as independent variables. The model is defined as: $\text{Behavioral Engagement} = 5.589 + 0.047 \times \text{Anxiety} - 0.003 \times \text{Anxiety}^2$. The model yields an R^2 of 0.146 (adjusted $R^2 = 0.136$), indicating that the predictors explain approximately 14.6% of the variance in behavioral engagement. The overall model is statistically significant ($F = 15.085$, $p = 0.000$; 0.05).

Collinearity diagnostics reveal that all VIF values are below 5, confirming no multicollinearity issues. Further interpretation shows: A significant positive effect of anxiety ($\beta = 0.047$, $t = 4.121$, p ; 0.01). A significant negative effect of anxiety squared ($\beta = -0.003$, $t = -3.912$, p ; 0.01), indicating an inverted-U shaped relationship.

In assessing affective engagement, the following regression equation was obtained: $\text{Affective Engagement} = 6.962 + 0.044 \times \text{Anxiety} - 0.003 \times \text{Anxiety}^2$. The model shows an R^2 of 0.162 (adjusted $R^2 = 0.153$), meaning that anxiety and its quadratic term account for 16.2% of the variance in affective engagement. The model passed the F-test ($F = 17.112$, $p = 0.000 < 0.05$), confirming statistical significance. Multicollinearity was not a concern, as all VIF values remained well below the standard threshold of 5. Anxiety exerted a significant positive influence ($\beta = 0.044$, $t = 4.324$, $p < 0.01$). Anxiety squared had a significant negative effect ($\beta = -0.003$, $t = -4.234$, $p < 0.01$), again supporting the inverted-U hypothesis.

Finally, to examine cognitive engagement outcomes, a regression analysis yielded the following equation: $\text{Cognitive Engagement} = 3.798 + 0.019 \times \text{Anxiety} - 0.002 \times \text{Anxiety}^2$. The model's R^2 was 0.090 (adjusted $R^2 = 0.079$), indicating that anxiety and its squared term together explain 9.0% of the variance in cognitive engagement. Despite the relatively modest explanatory power, the model is still statistically significant ($F = 8.713$, $p = 0.000 < 0.05$). Collinearity diagnostics indicated no issues ($VIF = 1.005$), and further analysis showed: A significant positive relationship between anxiety and cognitive engagement ($\beta = 0.019$, $t = 2.898$, $p = 0.004 < 0.01$). A significant negative effect of anxiety squared ($\beta = -0.002$, $t = -3.200$, $p = 0.002 < 0.01$), consistent with an inverted-U pattern. (Figure 5.28)

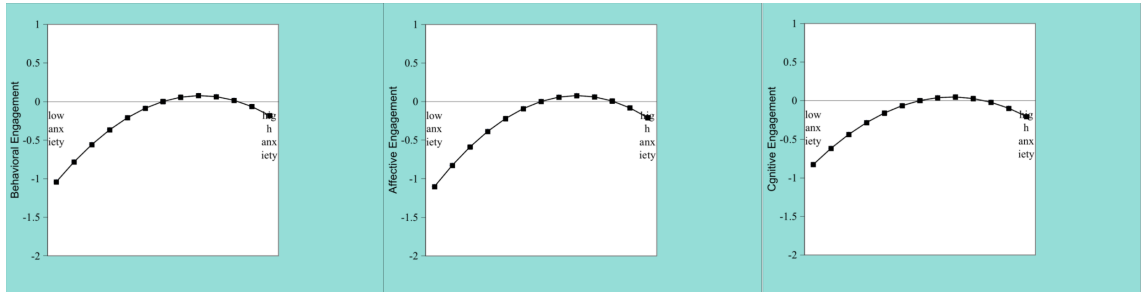


Figure 5.28 Game: Cyan Bird

These results indicate that the influence of anxiety on game engagement differs across game types, thus supporting H5.

Between Groups Testing

The Python script with statistical analysis was also used for each game (512, Cyan Bird, Feather) and each model condition (Classic Baseline vs. ATEO) we standardised anxiety and the three engagement facets, combined the latter into a single z-score, and fitted a quadratic regression of engagement on anxiety. From the quadratic coefficients we extracted the vertex (Peak E, Peak A) and full-width-at-half-maximum (FWHM) as descriptive indices of the Inverted-U. These parameters are listed in Table(Figure 5.29)

Game	Level	Peak_E(z)	Peak_A(z)	Width(σ)	α_0	α_1	α_2	N
512	0				-0.20444	0.492869	0.052793	90
512	1	0.62	0.38	1.72	0.561206	0.317923	-0.42014	90
Cyan Bird	0	0.72	0.3	1.61	0.669798	0.339979	-0.55991	90
Cyan Bird	1	0.94	0.75	2.01	0.677445	0.703241	-0.46646	90
Feather	0	-0.3	0.29		-0.33829	0.23103	-0.39562	90
Feather	1	0.73	-0.18	1.85	0.716223	-0.15713	-0.42536	90

Figure 5.29 Between Groups Analysis(AETO vs Classics)

To evaluate whether the anxiety-engagement relationship holds across personality types, the ATEO sample (Group=1, n=270) was split by the Extraversion factor of the NERIS Explore scale (Introvert I vs. Extrovert E). Within each subgroup we repeated the same preprocessing used in the game-level analysis:

- (i) z-standardising anxiety and the three engagement facets
- (ii) averaging the facets into one composite engagement score
- (iii) fitting a quadratic model

$$E = \beta_0 + \beta_1 A + \beta_2 A^2,$$

where E is engagement and A is anxiety (both in z units).

Vertex statistics — PeakE, PeakA, and FWHM — were extracted to describe the height, location, and breadth of the Inverted-U for each personality class.

Table(Figure 5.30)summarises these parameters together with the regression coefficients and their significance, confirming a robust Inverted-U for both Introverts and Extroverts.

The data indicate that NI and ATEO’s design maintains comparable optimal engagement levels and tolerance bandwidths across personality types. In other words, the model’s “sweet-spot” remains stable whether the player is introverted or extraverted, underscoring the design’s personality robustness.

Model	Persona	R ²	β_1	β_2	p(β_1)	p(β_2)	Peak E	Peak A	FWHM σ	InvertUSig.	n
FC	Extrovert	0.312	0.469	0.054	0.0003	0.7402	-1.18	-4.3	—	✗	41
FC	Introvert	0.476	0.736	0.069	0	0.6804	-2.26	-5.35	—	✗	49
JF	Extrovert	0.225	0.145	-0.626	0.833	0.3042	-0.5	0.12	—	✗	41
JF	Introvert	0.128	0.19	-0.469	0.7931	0.4638	-0.33	0.2	—	✗	49
NI	Extrovert	0.52	0.433	-0.598	0	0	0.81	0.36	1.49	✓	46
NI	Introvert	0.517	0.32	-0.858	0.0045	0	0.95	0.19	1.64	✓	44
ATEO	Extrovert	0.28	0.43	-0.57	<0.001	<0.001	0.89	0.38	1.17	✓	115
ATEO	Introvert	0.07	0.22	-0.3	0.007	0.002	0.78	0.36	2.26	✓	155

Figure 5.30 Between Groups Analysis(Introvert vs Extrovert)

5.1.3 Evaluation Result

The ATEO model and guideline was not only proposed based on theory, but tested through user tests with six prototype games(3 ATEO, 3 Classic)totally 540 individual samples. Each part(Anxiety Driver, Adjustment Tools, and Optimization Persona Lens)was evaluated using gameplay data and player feedback. We found that anxiety-based design features can improve engagement when carefully balanced. These findings support the practical use of the ATEO guideline.

Evaluation Structure

This study uses combination-based testing to evaluate the practical impact of each design model element.

Instead of testing each design element separately in isolation, we implemented different combinations of anxiety-related design strategies in six different game

prototypes. This method allows us to test how the elements perform both individually and interactively in realistic game settings.

Our evaluation followed a two-step logic that mirrors both internal validity and external advantage of the ATEO and other classic design models.(Figure 5.31)

Internal validation We treated the three ATEO prototypes (Cyan Bird, Feather,512) as a single within-subjects dataset and ran a stage-wise mediation test (A→E pipeline). Engagement served as the criterion variable, while successive ATEO modules were entered as chained mediators. Across all titles, each added module produced a statistically reliable, moderate rise in engagement, confirming that the Anxiety driver and its adjustment layers operate as designed.

Comparative advantage Next, we switched to a between-groups design: for every game we compared the *ATEO build* against its baseline “classic existing-design” (NI&JF&FC) counterpart. Tests on the composite engagement score showed that the ATEO group out-performed the control version in every case (all p<.01), establishing a clear competitive edge.

	Internal Validation: Do the ATEO Modules Work as Intended?	Comparative Advantage: Is ATEO Better than Others?
Based on...?	Mediation effect testing Within-group analysis (3 ATEO)	Between-group analysis (ATEO vs. Others group)
Key metrics	Engagement increase with modules	Existing design vs. ATEO design
Significance	Moderate Effects observed across A→E stages	ATEO group outperformed baseline(Others group)
Comparison Targets		

Figure 5.31 Evaluation Structure)

Validation for ATEO Modules

Evaluation was based on both subjective data (e.g., anxiety and emotion scale scores) and objective gameplay behavior (e.g., number of attempts/time spent). Statistical analysis (e.g., linear and non-linear regression, group comparison tests) confirmed the functional role of each part of the AETO Model.

Anxiety Driver(Mechanics Limitations) Researchers designed an anxiety driver (AD) module in the ATEO group, such as game environments with time pressure and resource constraints (e.g., reduced health points, countdown tasks) as well as narrative and aesthetic design. In contrast, the classic model games did not include any AD modules. Statistical data revealed that moderate AD design, mediated by anxiety, significantly enhanced player engagement. However, the inverted U-curve indicated that extreme anxiety (exceeding 0.7 z-score) led to player attrition. This confirmed the effectiveness of the Anxiety Driver module(Figure5.32)(Figure5.33)



Figure 5.32 Evaluation Results for Anxiety Driver 1

Adjustment Tools (Narrative and Aesthetic Design) To isolate the contribution of the two Adjustment Tools (AT)—narrative buffering (AT1) and aesthetic acceleration (AT2)—we compared the Level-1 (ATEO) conditions of the three prototypes, which were otherwise identical in Anxiety-Driver (AD) tuning and sample size (N=90 per game).Figure5.34)

A quadratic regression of standardised engagement on standardised anxiety was fitted for each prototype. All three curves retained a significant inverted-U, but the magnitude and breadth of the optimum varied systematically with the presence of AT modules:

- a. FULL AT(CyanBird): Highest peak (+0.94) and widest band (FWHM2.0) → strongest, most forgiving engagement.
- b. Only one AT(Feather):Peak drops to +0.73, width to 1.9, this type still strong but less stable.

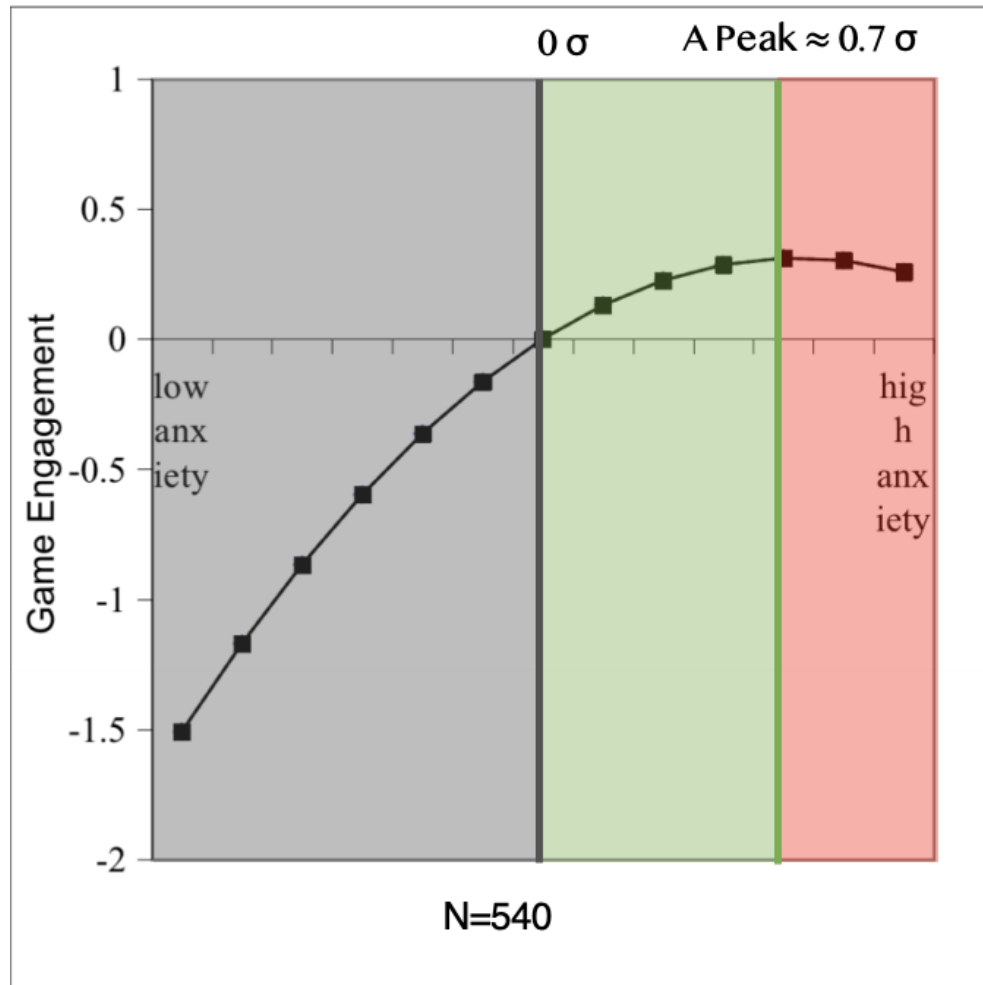


Figure 5.33 Evaluation Results for Anxiety Driver 2

c. No AT(512): Peak +0.62, width 1.7, the Anxiety driver alone works, but effect is modest.

In summary, AT works. AT1 makes engagement more stable, and AT2 increases how quickly it grows. Together, they create the strongest and most flexible engagement. If either is removed, engagement becomes weaker and less stable.

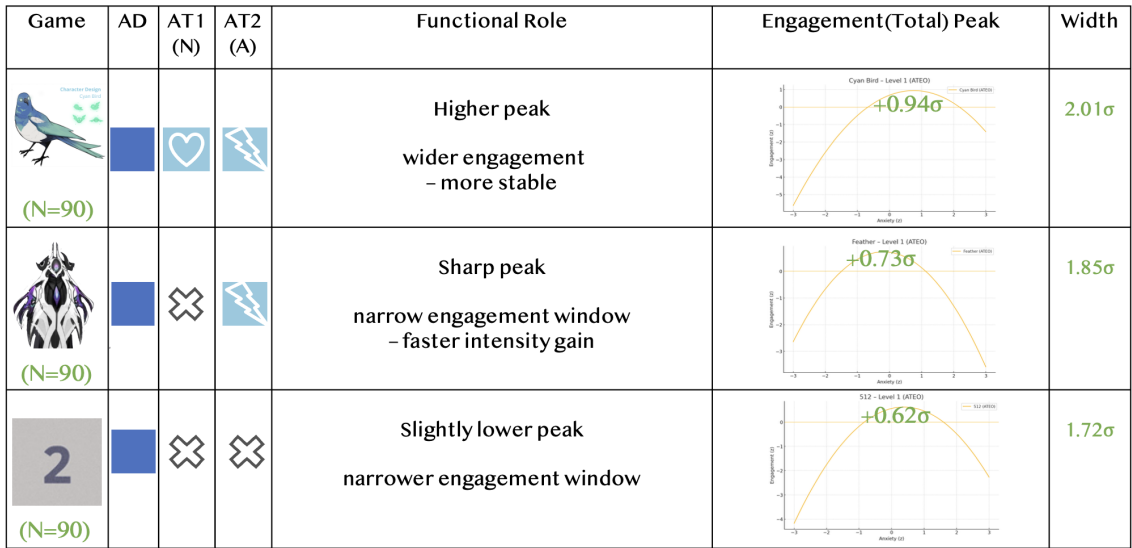


Figure 5.34 Evaluation Results for Adjustment Tool

Evaluation for ATEO and Classic Models

Dynamicity and Effectiveness In this research, following two key indicators were used to evaluate the design models’ external validation:

Effectiveness means how strongly a design can trigger engagement. It’s measured by the peak height of the curve—the higher the peak, the stronger the emotional activation.

Dynamicity refers to how wide the emotional “safe zone” is—how long the design can keep players engaged across different levels of anxiety. It’s measured by the width of the curve (FWHM)—the broader it is, the more forgiving and stable the experience.

Compared to the three classic design models (NI, JF, and FC), ATEO consistently shows stronger and broader engagement across anxiety levels.(Figure5.35)

ATEO designs do not just “peak higher”,ATEO group also keep users engaged across a wider range of emotional states. For example, in the Cyan Bird case, ATEO increases the engagement peak by 31% and expands the effective range by 20%. For the

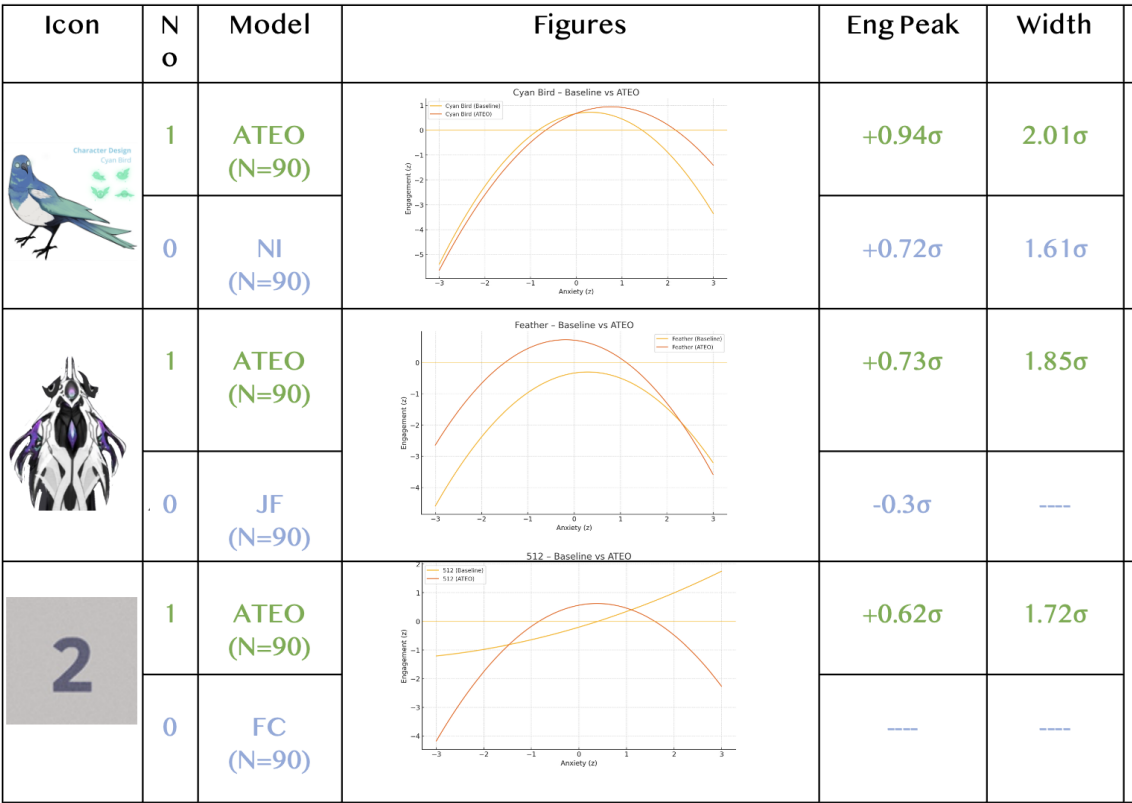


Figure 5.35 Evaluation Dynamicity and Effectiveness for ATEO vs Classic Models

Feather Group(B0&B1), ATEO achieves more than 3 times the original engagement at peak (+343%) while keeping a smooth and wide U-shaped curve. This means players not only feel more involved, but also stay engaged even when their anxiety changes.

In the FC model, the design game shows no real peak at all—meaning it fails to activate players emotionally. ATEO, by comparison, builds a stable and effective curve, even when emotional conditions change.

Supported by all these evidences, the ATEO model shows its better dynamicity and effectiveness.(Figure5.36)(Figure5.37)

Robustness Check: Optimization Lens (User Persona Mapping) Robustness in this study means that a design model works well for different kinds

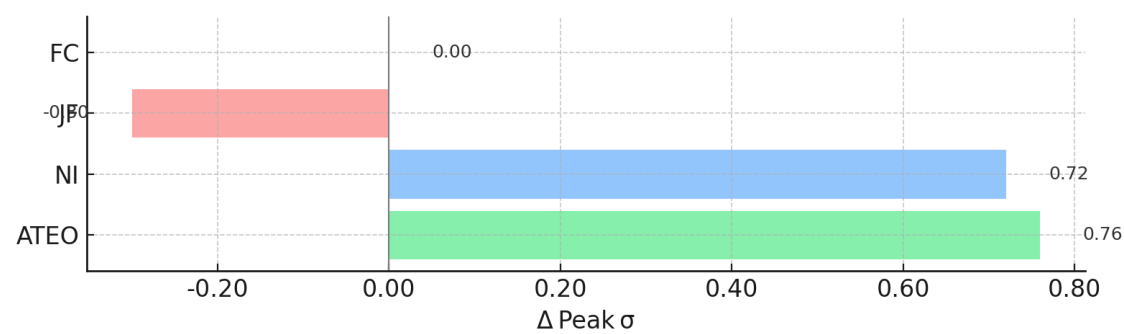


Figure 5.36 Effectiveness for AETO vs Classic Models

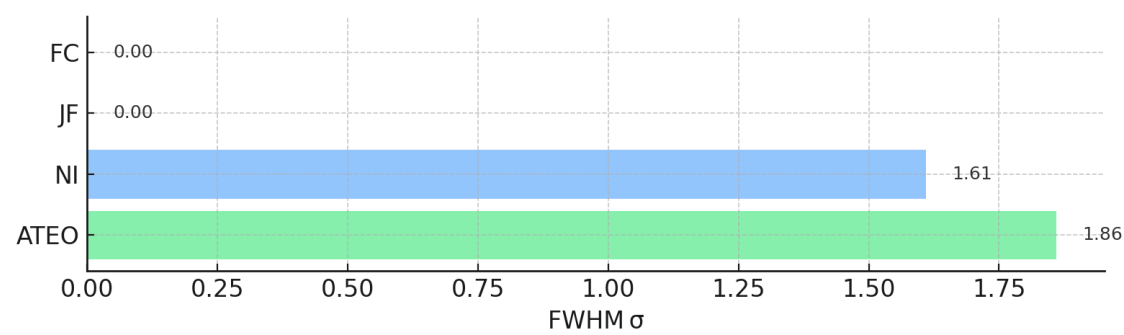


Figure 5.37 Dynamicity for AETO vs Classic Models

of players—not just one group. To check this, we split the data into introvert (I) and extrovert (E) players, and tested if each model could still show a strong inverted-U relationship between anxiety and engagement. If a model produces a clear inverted-U for both groups, it is considered robust. If it fails for one group, it’s not robust. (Figure5.38)

Besides, results showed that introverted players are more sensitive to anxiety, while extroverted players can handle more intense challenges, but with ATEO design or NI design, players shows more stable engagement, which means that narrative and aesthetic design’s adjustment effect works.(Figure5.39)

In summary(Figure5.40), the ATEO-based design outperforms the other classic design models on all three criteria. It shows the widest curve, meaning it has the highest dynamicity—the ability to engage users across a wide range of design

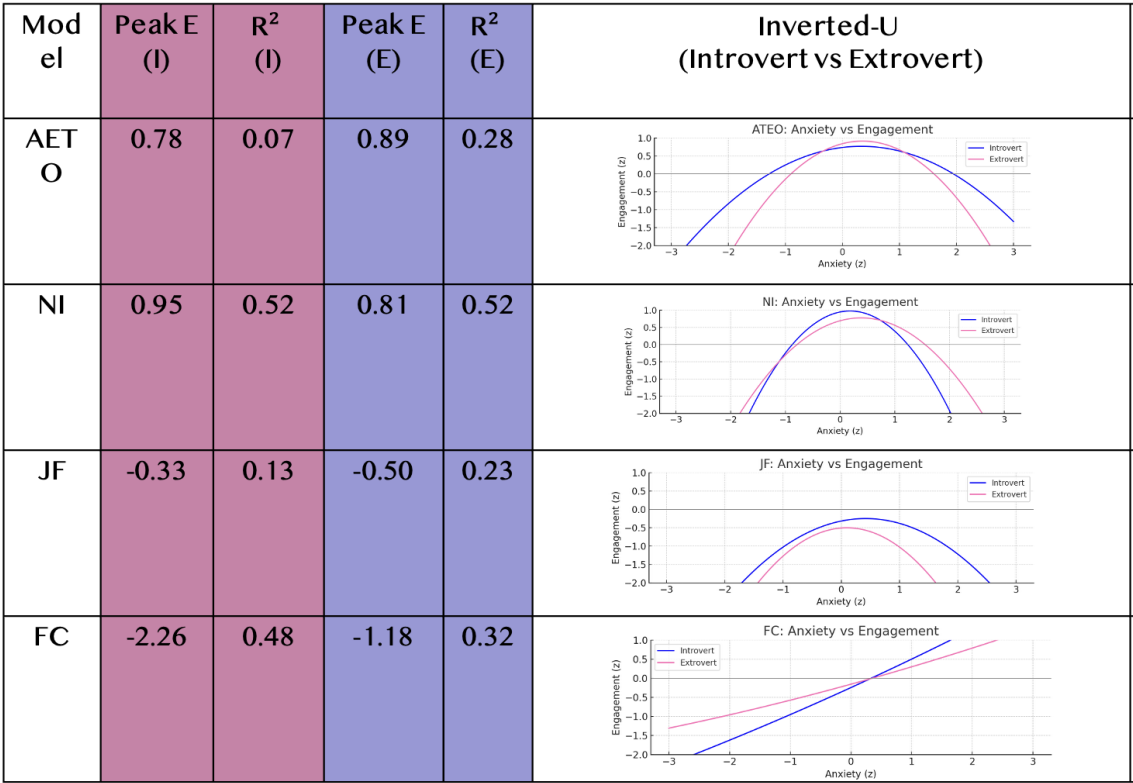


Figure 5.38 Evaluation Robustness for ATEO vs Classic Models

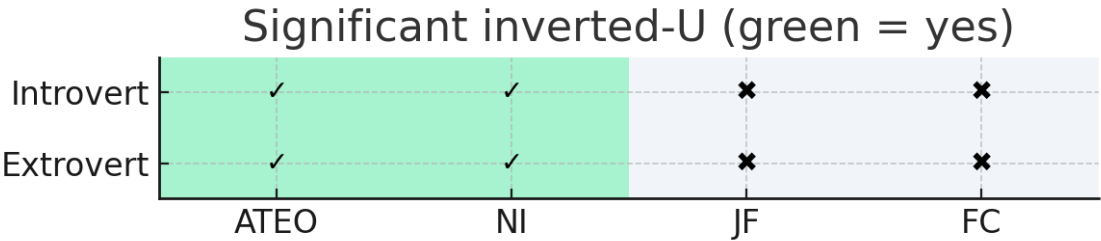


Figure 5.39 Robustness for AETO vs Classic Models

intensities. It also achieves the highest effectiveness, which refers to how much the model boosts user engagement at its strongest point. Among the four, ATEO and NI both stays robust across both introverted and extroverted users, keeping the inverted-U curve shape in both groups. Although, NI has moderate perfor-

mance, and JF and FC show weaker or even negative effects, ATEO ranks first across all metrics, showing that it provides a more adaptable and engaging design experience.

	ATEO	NI	JF	FC
Dynami city FWHM (σ)	 Broad band-width	 Wide band-width	× N.A	× N.A
Effectiv eness (Δ Peak)	 High boost	 Moderat e boost ($\approx$ -5 %)	× Negative boost	× N.A
Robustn ess	 Both Persona types ✓✓	 Both Persona types ✓✓	× N.A	× N.A

Figure 5.40 Evaluation Summary for AETO vs Classic Models

5.2. Designer Application Feasibility Evaluation

After validating the effectiveness of the ATEO model at the player level, this study further evaluates how designers apply ATEO in practical creative scenarios. Three designers—a design student, an independent game designer, and a commercial game designer—was invited to create a small demo following the ATEO guideline. The goal of this evaluation is not to assess the fidelity or completeness of the final product, but to observe the decision-making process and usage feedback related to ATEO. Through this, this section aim to understand whether ATEO can be effectively utilized by third-party designers in diverse professional contexts and design habits.

5.2.1 Evaluation Metrics

Since this chapter aims to evaluate the practical effectiveness and feasibility of ATEO in objective design environments through observation, the following metrics was selected based on considerations from psychology and the characteristics of the ATEO model itself, to assess each designer's design process:

1. Did the designer fully utilize the design modules according to ATEO's guidelines?

1.1 Did the designer apply the Anxiety Driver appropriately?

1.2 Did the designer apply the Adjustment Tools appropriately?

1.3 Did the designers use the Persona Lens to iterate based on user profile feedback?

2. Does ATEO provide better design feedback compared to traditional design models commonly used by the designers?

3. Did the designers consider players' mental well-being and consciously regulate anxiety instead of overusing it during the design process?

5.2.2 ATEO Implementation in Game Design

In this phase, a total of three designers (a student, an independent developer, and a commercial game designer) participated in the evaluation of this chapter. The

following is a summary of the designers' profiles.(Figure5.41) The game design process of each designer was fully observed and documented, for the purpose of subsequent evaluation.

	A	B	C
Design Background	Design Student	Freelance Indie Game Designer	Professional Commercial Game Designer
Usual Design Focus	Flow Channel (FC)	Narrative Immersion (NI)	Juicy Feedback (JF)
Past Project	N/A	1001 Nights	Genshin Impact
Project Screenshots	N/A		

Figure 5.41 Designers' Profiles (Screenshots © miHOYO and © Ada Eden)

Designer A: Brave New World

Designer A is a student in the field of design. In their previous design studies, Designer A was skilled at designing game levels using the Flow Channel approach. After reading the materials and guideline of the ATEO model, Designer A began an autonomous game design process guided by ATEO, without any intervention. As a result, Designer A produced a pixel-style side-scrolling mini game titled Brave New World, which combines elements of adventure, action, and RPG.(Figure5.42)

The following is the design process of **Brave New World** as observed by the researcher:

1. After receiving the ATEO model and its guidelines, Designer A decided to begin with a gameplay paradigm Designer A was more familiar with during their studies. Designer A chose to create a side-scrolling action game using the design method provided by ATEO.

2. First, since Designer A was accustomed to designing based on the FC model, Designer A was relatively familiar with mechanism-related design. Therefore,

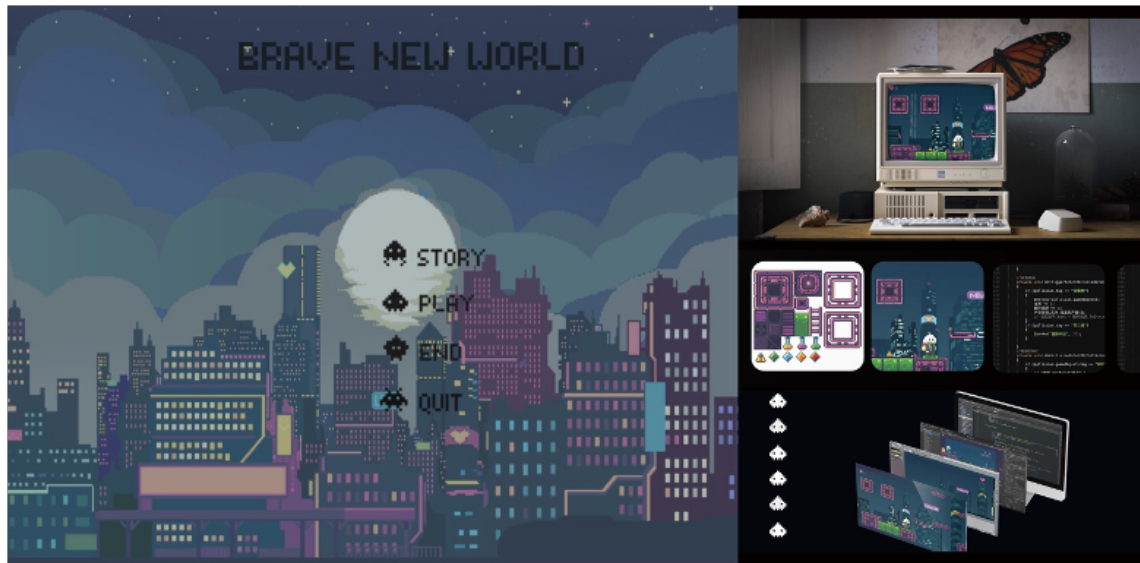


Figure 5.42 Brave New World Development Summary

Designer A first determined the part of ATEO concerning the Anxiety Driver module—setting appropriate limitations on top of the core gameplay to trigger anxiety factors in players. Considering the characteristics of side-scrolling action games, Designer A implemented both physical and resource-based limitations(Figure5.43):

I. The physical limitation was about restricting the jumpable space on the map, using the spacing of solid ground tiles to control the difficulty of operations and the player’s range of movement.

II. The resource limitation was a limit on the number of jumps per stage. Each jump would visibly deduct from the remaining count, increasing the player’s anxiety and pushing them to make more strategic movement decisions.

3. Regarding the Adjustment Tools module, although the guideline marked it as “Highly recommended” rather than “Required” like the Anxiety Driver, Designer A, despite not having formal training in illustration or narrative writing and having some lack of confidence in visual and story design, still maintained a positive, curious, and willing-to-try attitude.

Designer A utilized tools provided by the AT module—for example, using the **Buffering** tool to place collectible narrative items such as “Memory Candles” and

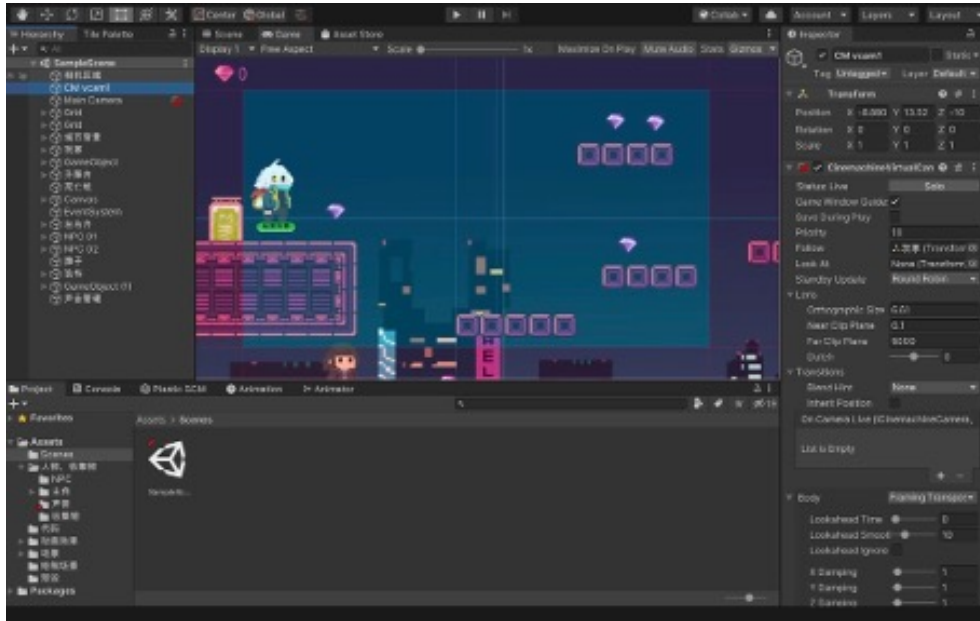


Figure 5.43 Brave New World Limitation Design

“Fragment Gems” in some difficult levels. These collectibles act as textual lore entries, and collecting all of them reveals the full storyline and emotional reward.

Due to the good design experience brought by Buffering, Designer A was inspired to further develop the game’s worldbuilding and storyline. (e.g., the main character must travel from the underground city to the surface to release a “star of hope”)(Figure5.44). Designer A used narrative tools (Buffering) to ease the excessive anxiety caused by repetitive operations or challenge failures.

4. Additionally, because Designer A lacked a background in visual art, Designer A chose a pixel art style that is easier to handle for people without professional drawing experience. Designer A used pixel drawing to create concept images of scenes, characters, and items. Designer A also applied lighting and atmosphere design—for instance, using gradient lighting at map transition points to give players visual guidance on where to go(Figure5.45)(Figure5.46).

In terms of audio design, Designer A paid even more attention than to visuals. Designer A designed four different types of background music for levels of varying difficulty, using different rhythms and tonalities. For example, in harder stages,

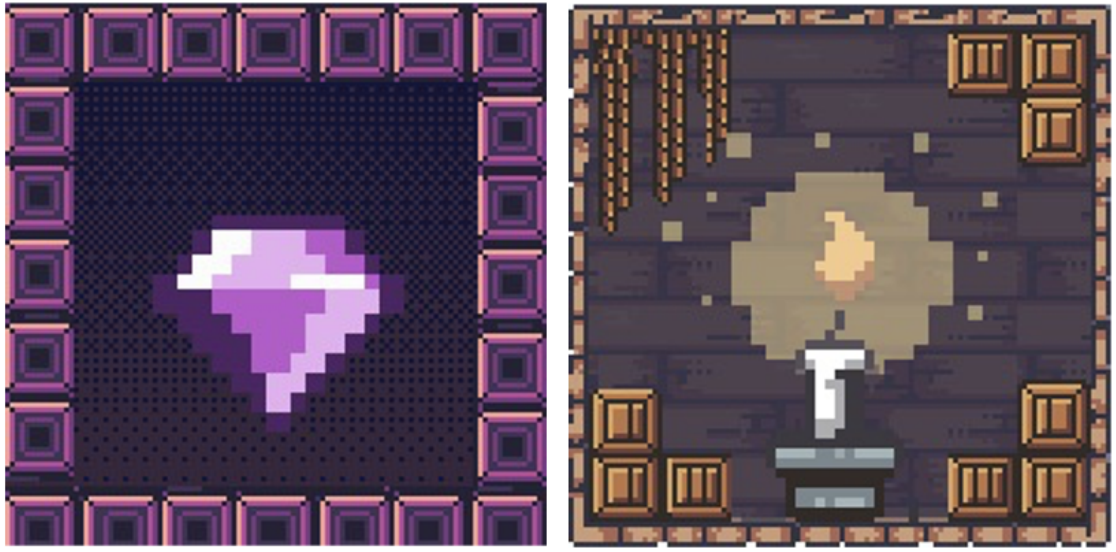


Figure 5.44 Brave New World Buffering Design

Designer A used triple meter music and atonal compositions to create a sense of unease and anxiety, aiming to influence the player's emotions.



Figure 5.45 Brave New World Aesthetics Design1

After packaging the game demo, **Brave New World** presents itself as a dynamic pixel adventure game, driven by both gameplay mechanics and rhythm-based music.

During the testing process of Brave New World, Designer A proactively attempted to use a non-design module—Persona Lens. Designer A applied Bartle's player type model to categorize the playtest users of Brave New World through



Figure 5.46 Brave New World Aesthetics Design2

questionnaires and interviews. Based on the analysis, Designer A concluded that the game's primary target audience was the Achiever type. Designer A then decided to focus on this group's demand for collecting story-based entries (lore codex) as the core design focus.

Accordingly, Designer A planned to deepen the design of the Buffering module and, in future iterations, further enhance narrative completeness and provide more collectible lore entries and reward feedback. In contrast, Killer-type and Explorer-type players tended to be more engaged in the early stage of the game but showed polar responses—losing interest quickly after learning the rules. This group overall engagement was relatively low.

During the design process, Designer A gave positive feedback on the Anxiety Driver module within the ATEO model. Designer A believed the design concept of Anxiety Driver was very clear and practical for student designers. ATEO does not impose a rigid or overly complex instructional system for implementing gameplay mechanics—such rigid frameworks might limit creative expression and prevent

designers from breaking through in artistic or rule-based design. Instead, ATEO provides a clear “switch”: by manipulating the core design element of limitation, it enables designers to upgrade their original gameplay ideas from within their comfort zone.

Designer B: Morning-Star

Designer B is an independent game developer who owns a personal design studio, and has also participated in the development and publishing of indie games across different regions. In previous design work, Designer B was skilled at emphasizing game narrative, role-playing, and immersion, primarily through the method of Narrative Immersion. After being introduced to the ATEO model and reading the guideline, Designer B conducted an autonomous game design guided by ATEO, without any intervention. The result was a 2.5D puzzle game titled **Morning-Star**, which combines elements of text-based adventure, RPG, and puzzle-solving. (Figure 5.47)



Figure 5.47 Morning-Star Overview

The following is the design process of **Morning-Star**:

1. After learning the design method of the ATEO model, Designer B decided

to start from the story, combining the resource limitation aspect of the Anxiety Driver module with the narrative, attempting to create a stylistic and counter-intuitive RPG sci-fi puzzle game.

2. Designer B chose to use resource limitation as the primary gameplay constraint throughout the game. For example, the player character is placed under a constant hunger debuff after awakening. If the player fails to find sufficient food items before the hunger countdown ends, they will die. However, if they do find the required food to proceed, the item deducts health points— and only by reducing the health to exactly 1 (locked HP) can the player reach the ending. Physical limitations were secondary and only appeared in certain puzzle sections and stage maps (e.g., Minesweeper-style puzzles).(Figure5.48)



Figure 5.48 Morning-Star Physical Limitation Design

3. Designer B then finalized the game script and decided to use the narrative as the main driver of the gameplay flow. Designer B wrote around 10,000 words of story script and another 10,000 words of scene-by-scene storyboard script. The intention was to use a large amount of Adjustment Tools (narrative design) as buffering to counterbalance the anxiety caused by the “counter-intuitive” Anxiety Driver design. This was done to prevent players from becoming overly tense, which could hinder their ability to follow the game rhythm or understand the rules.(Figure5.49)

4. Additionally, Designer B believed that the accelerator (audio-visual design) aspect of the AT module should also be standardized based on the story progression. Referencing the storyboard script, Designer B defined the overall tone of the

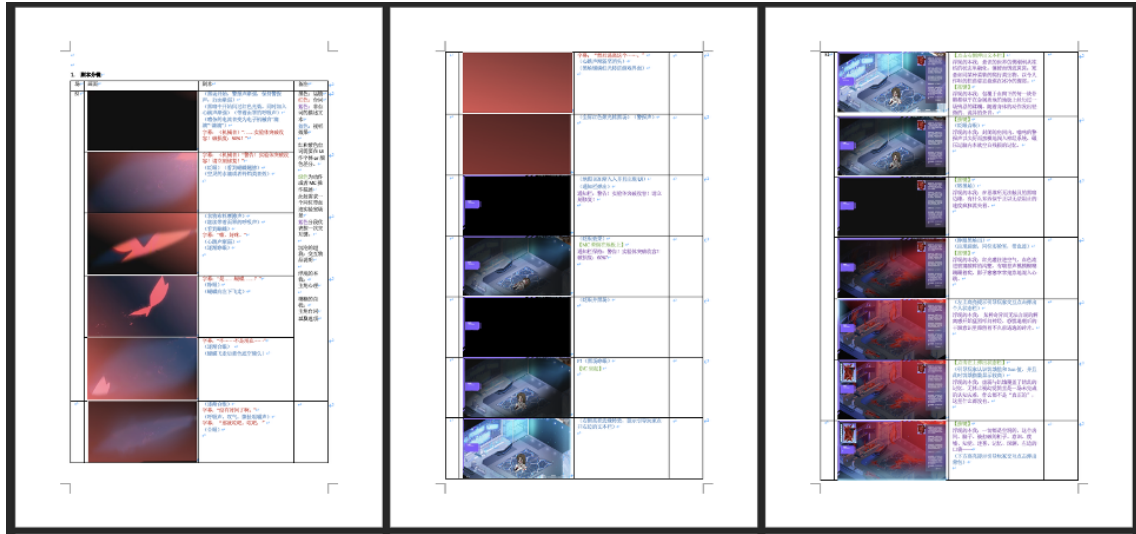


Figure 5.49 Morning-Star Narrative Design

game—aiming for a style of “cold technological atmosphere” and “lonely mood.” To support this, Designer B created the UI, scenes, and hand-drawn maps. In order to give players a tactile experience of rummaging through things, the character and the environment were designed in 2.5D perspective, offering more exploratory freedom. (Figure5.50)

For sound, Designer B also followed a cinematic storyboard approach and designed a series of action sound effects to match the in-game events. Since Designer B had no formal training in music composition, they used AI tools to generate BGM that fit the atmosphere of different scenes.

5. To enhance the player’s sensory immersion, Designer B integrated external peripheral-based puzzle-solving using Arduino accessories. For example, players needed to input passwords through external hardware and receive auditory or visual feedback in return. (Figure5.51)

6. Designer B integrated the Anxiety Driver and Adjustment Tools modules, and drew inspiration from similar indie games (such as Undertale and Disco Elysium). The game was defined as a cinematic, narrative-driven puzzle game. The game flow was designed so that the player’s operations themselves become part of the storytelling scenes (i.e., gameplay = performance), allowing the player to

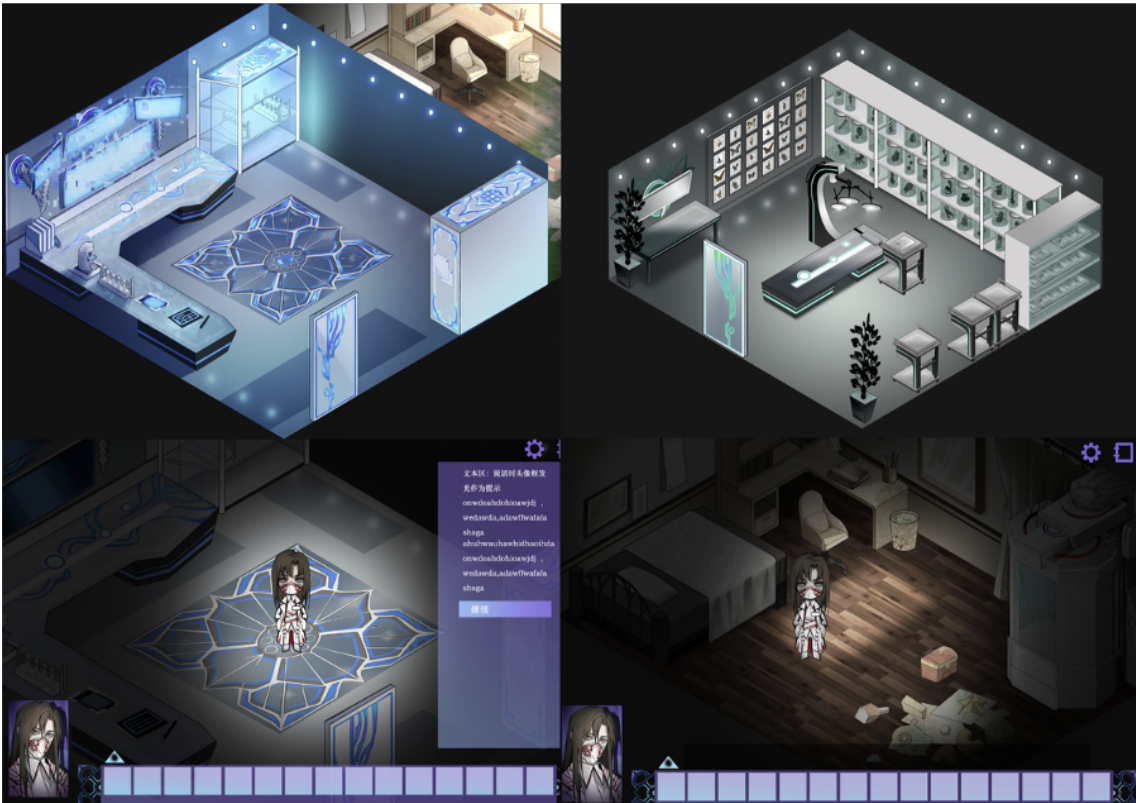


Figure 5.50 Morning-Star Aesthetics Design

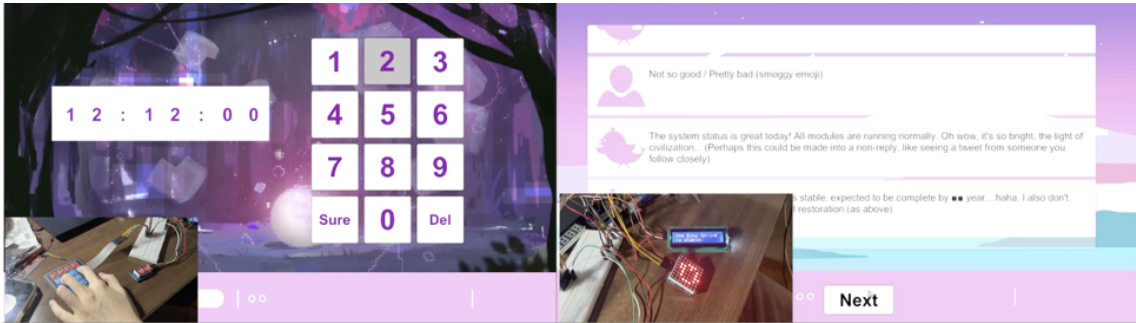


Figure 5.51 Morning-Star Sensory Design with Arduino

gather clues and find key items through actions, and finally reach a designated ending through the counter-intuitive feedback mechanism.

Designer B eventually designed a 2.5D puzzle-style text-based adventure RPG titled **Morning-Star**. The story follows a survival administrator in a post-apocalyptic world, trapped in a sealed and desperate environment, enduring hunger and the gradual collapse of the body, while fending off the sudden pursuit of unknown entities. The protagonist eventually descends into madness but unexpectedly uncovers the truth.

Designer B attempted to use the Persona Lens as a tool to obtain clearer feedback from playtesters on the game demo. However, due to the relatively narrow and homogeneous audience typical for indie developers, the resulting personas were limited. Although Designer B showed strong willingness to use the tool, and even considered more in-depth and professional persona differentiation frameworks than Designer A (such as the 16 Personalities, commonly used in management), Designer B ultimately had to rely on a simpler set of personality profiles—Gamer Motivation Model for basic analysis.

Designer B reported that among the six motivation types in the model—Action, Social, Mastery, Achievement, Immersion, and Creativity—players with Achievement and Immersion motivations showed relatively higher engagement and more positive feedback. In particular, Immersion-type players were more likely to maintain high engagement and actively explore levels even under high-anxiety conditions, while Achievement-type players exhibited more stable behavioral patterns.

Designer B tended to focus on the needs of these two player types in later level design, adding immersion-related experience enhancements and introducing reward feedback systems tied to achievement collection after stress-inducing mechanisms, in order to optimize the experience during high-engagement windows for the target player groups under anxiety.

Designer C: Perfect ME

Designer C is a professional game developer working at a leading company in the commercial game industry. Designer C is primarily responsible for visual development and design in the company's game projects. Throughout their career, Designer C has specialized in sensory-driven design using the Juicy Feedback approach, with a strong focus on players' emotional experience and feedback.

After learning about the ATEO model and its guideline, Designer C carried

out an autonomous game design process guided by ATEO, without any external intervention. As a result, Designer C created a visual puzzle game titled Perfect ME, which combines elements of puzzle-solving, RPG, and visual novel genres.(Figure5.52)



Figure 5.52 Perfect Me Overview

The following is the design process of **Perfect ME**:

1. After fully understanding the design approach of the ATEO model, Designer C showed strong interest in its potential to increase user engagement. At the same time, Designer C carefully considered the potential risks, such as whether such designs might trap players in a state of “unable to quit.” In the end, Designer C decided on a design plan that focused on a single form of Anxiety Driver.
2. Due to extensive experience in visual development at a commercial game company, Designer C chose to begin with Accelerator sensory design from the AT module. They first established the overall atmosphere of the game and designed visual elements that could quickly push player emotions during puzzle sections. From those elements, Designer C extracted appropriate components to construct the AD-based limitation. The overall visual style of the game was defined as a sur-

real “dream-core” aesthetic—grotesque yet cute (Figure 5.53). Animals were used as metaphors to explore current issues regarding female struggles, and character visuals were designed to reflect these real-world mappings.

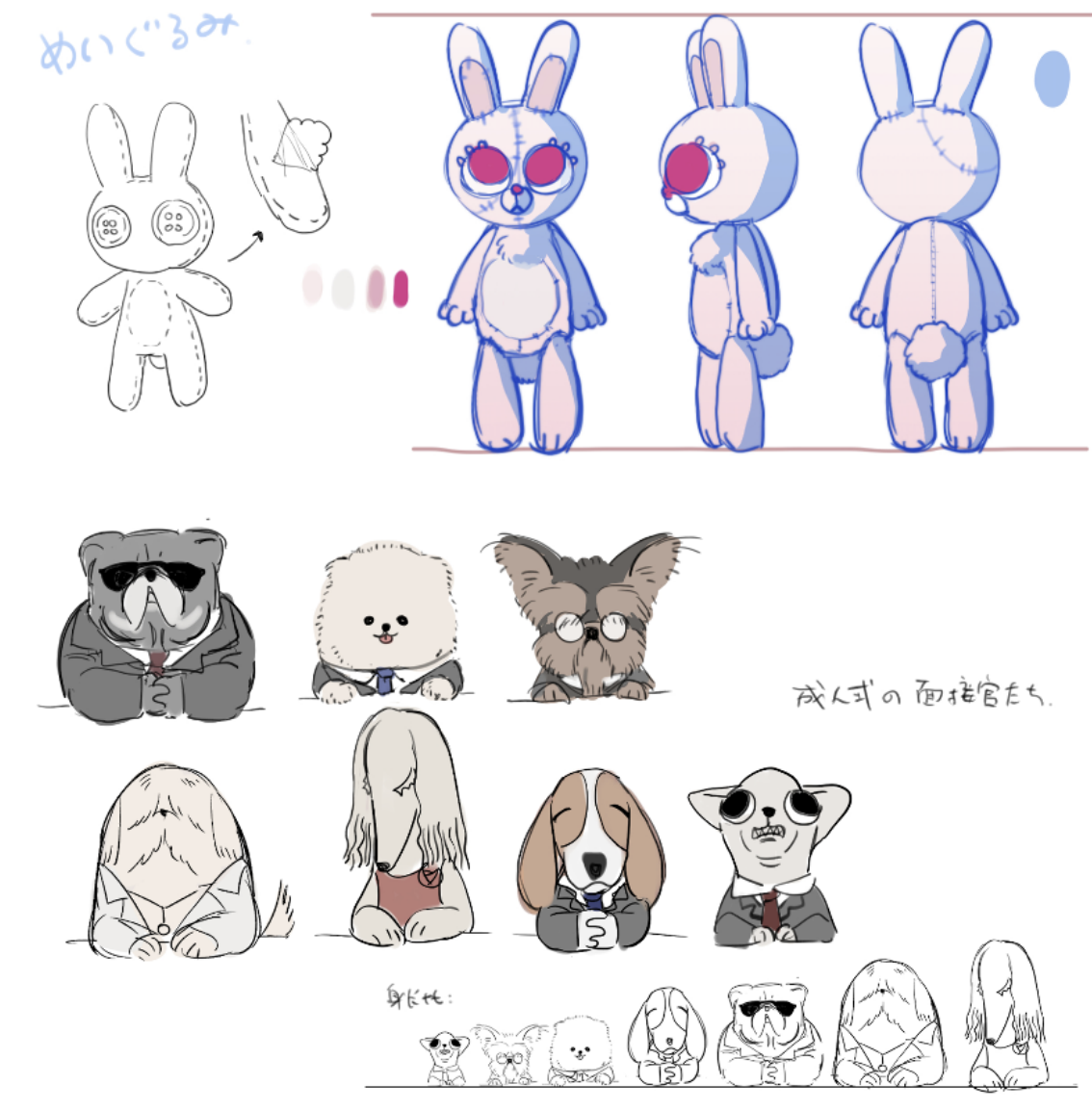


Figure 5.53 Perfect Me Character Design

3. After deciding on the theme of female appearance-related anxiety, Designer

C set “obtaining one’s ideal beauty” as the game’s main narrative thread. The player must adjust their attributes through various means to achieve the highest “appearance” score. Three attributes were assigned to the character: sanity, money, and appearance. The gameplay flow was designed as:

Earning money → Spending money to buy items → Item combinations affect the Appearance score. (Figure5.54)



Figure 5.54 Perfect Me Game-play Overview1

As appearance increases, sanity decreases. If the player runs out of money, they can forcibly exchange sanity for additional appearance points. In this way, the limitation was defined purely as a resource limitation.(Figure5.55)

4. Designer C further utilized AT tools by inserting abnormal, eerie, and empty scene illustrations in calmer chapters (e.g., after obtaining a high appearance score) to subtly drive the player’s anxiety. However, in these segments, Designer C was highly cautious about the threshold of what players could emotionally tolerate. Designer C showed strict control over visual expression—for example, when deciding between realistic vs. metaphorical imagery for Accelerator use, Designer C ultimately opted for metaphorical imagery: A scene in which the



Figure 5.55 Perfect Me Game-play Overview2

protagonist rips open a doll, serving as a symbolic expression of the brutality of cosmetic surgery.(Figure5.56)

5. In terms of music, Designer C commissioned a professional composer for both the soundtrack and voice recordings. Unlike the restrained visual design, the music aimed to emphasize the inner fear of the character— it featured **narrative compositions**(Figure5.57) blending oppressive, insane, and blurred lines between reality and illusion. For voice acting, Designer C referenced the unintelligible speech style of characters in Animal Crossing, and recorded similar “talking sounds” that sound cute yet slightly unsettling.

6. Designer C included a final twist (bonus Easter egg) for players who collected special rewards. Although the Easter egg presented a tragic ending—being “devoured by society”—Designer C emphasized that this scene was not essential to the main storyline. However, if players encountered this “final truth” under a high level of anxiety and engagement, it could deepen the emotional impact of the ending, serve as a **buffer and extension** of the player’s “emotional peak period,” and act as the designer’s own social critique embedded within tension.(Figure5.58)

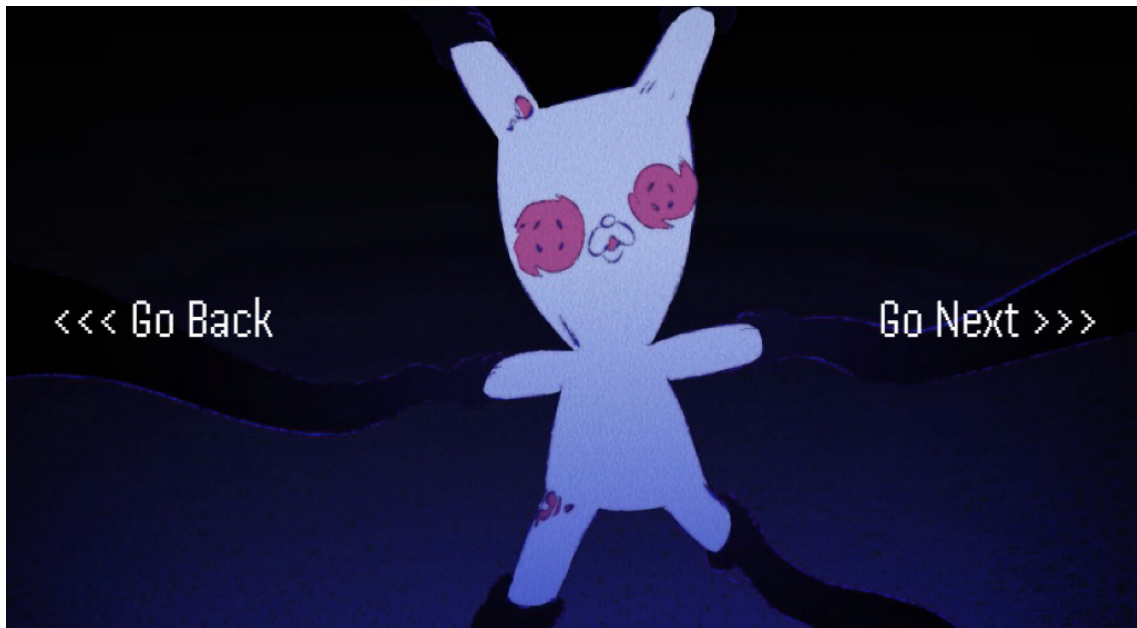


Figure 5.56 Perfect Me Aesthetics Design

The final output of the game was a demo version of a puzzle-style visual novel titled **Perfect ME**, which tells the story of a rabbit suffering from appearance anxiety, gradually losing cognitive control under mental pressure, and pursuing a sense of beauty that truly belongs to itself.

Designer C emphasized the necessity of applying the Persona Lens after the game design phase. Using the Big Five Personality Traits as a reference, Designer C analyzed users from a small-scale test group, and categorized their personality profiles into three groups: unsuitable users, target users, and potential users.

Designer C pointed out that, based on the Big Five model commonly used in the commercial sector, users with high agreeableness were typical non-target users. Although they were easily attracted to Perfect ME due to its cute visual style and joined the gameplay, they showed a high drop-off rate after encountering sensory tension and anxiety-inducing content.

In contrast, users with high neuroticism were defined as highly loyal target users. Designer C suggested conducting further promotional efforts in content domains that align with the interests of this user type, and strengthening the visual design

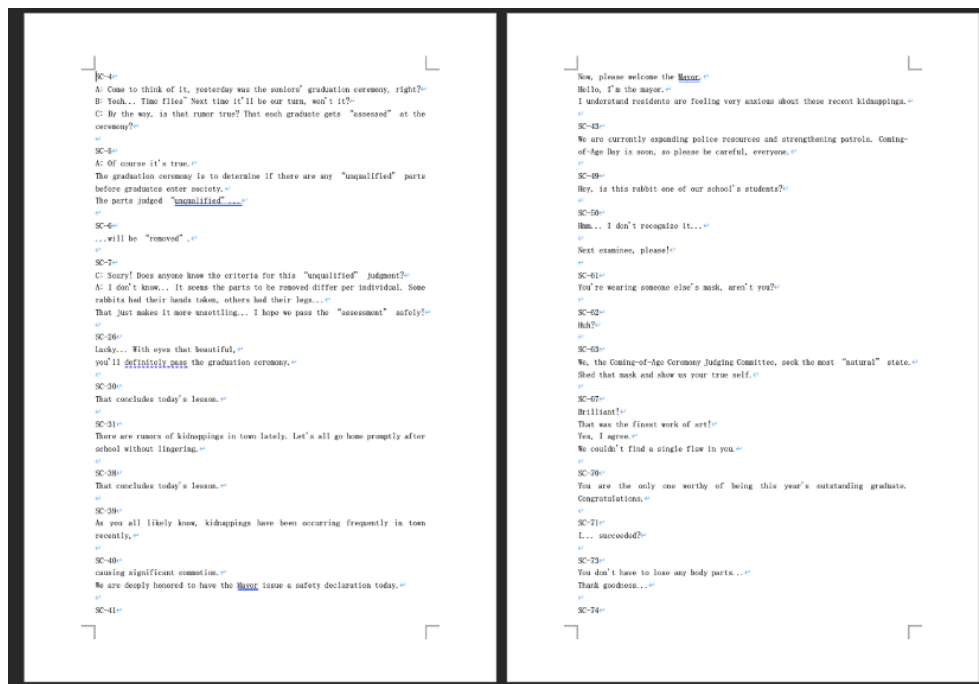


Figure 5.57 Perfect Me Narrative Design Outline

features favored by neurotic users to generate greater commercial market value.

Users with high openness also demonstrated good engagement, but due to their generally low loyalty toward any specific type of game, Designer C decided not to prioritize optimization for this user group. Instead, they were labeled as a “market potential persona”, to be considered in future design updates when the game’s market performance declines or stalls.

Designer C believed that the ATEO model can, to some extent, expand the range of executable themes for designers. For example, narrative elements that involve anxiety-inducing situations can be more clearly differentiated between target and potential users under the ATEO design guidance, and can also help extend the retention window of the target audience.

However, given that commercial games are often constrained by more economic concerns, cross-department collaboration, and social scrutiny, Designer C suggested that the structural advantages of the ATEO model would be best realized in independent-style game development rather than in large-scale commercial pro-



Figure 5.58 Perfect Me Hidden Ending Illustration

ductions.

5.2.3 Evaluation Result

An interview outline based on the evaluation criteria was used after the design observation phase. The following evaluation result is an analysis based on the researcher's observation of the design processes, as well as the responses provided by the three participating designers.

1. Did the designer fully utilize the design modules according to ATEO's guidelines?

Although the order in which the modules were used varied among the designers (for example, Designer C began with the AT module, while Designer A started by developing the AD module, and Designer B progressed AD and AT nearly in parallel with mutual adjustments), all three designers followed the descriptions outlined in the guideline and applied the ATEO model in a way that met the baseline criteria.

1.1 Did the designer apply the Anxiety Driver appropriately?

All three designers actively used the Anxiety Driver module and expressed high recognition during both the development process and post-interviews. When asked to rate the effectiveness of the module on a scale of 1 to 10, each designer gave a score above 7. (Figure5.59)

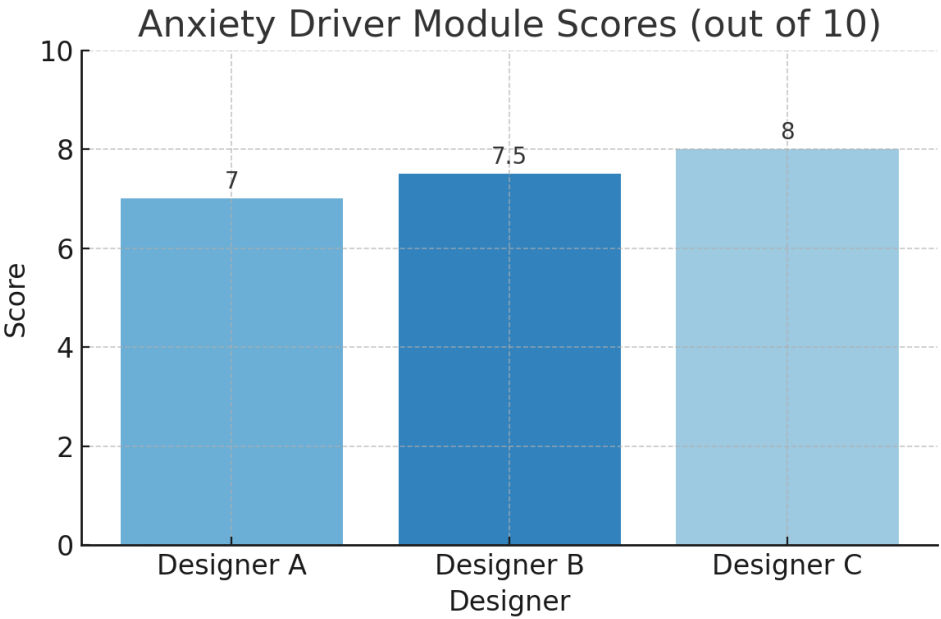


Figure 5.59 Anxiety Driver Module Usage Scores

Designers noted that focusing on the design of limitations rather than altering the overall game-play framework made it much easier for game designers to adjust the anxiety-driving intensity.

Moreover, based on observation, although all designers applied the module according to the guidelines, their strategies for implementing anxiety-driving elements differed. (Figure5.60)

Designer A and Designer B both used two types of limitations. Designer A did not show any clear preference and employed both limitation types throughout. Designer A pointed out that, as a design student without sufficient experience in game production and user research, she often lacked confidence during the

	Physical Limit	Resource Limit	Preference	Note
A	✓	✓	✗	Inexperienced, Repeated Adjustments
B	✓ (Partial Level)	✓	Resource Focused	Flexible exploration
C	✗	✓	Resource Only	Commercial level rhythm control

Figure 5.60 Anxiety Driver Module Strategy Comparison

process—especially because she placed strong emphasis on the “sense of completeness” from the player’s perspective. As a result, she constantly felt uncertain about how accurately her designs could induce a desired level of anxiety. Even when the overall effect was acceptable, she still struggled to gauge the emotional state of the user and had to rely on repeated adjustments.

Designer B, on the other hand, preferred to use resource limitations as the main anxiety driver, while inserting physical operation constraints in certain sections. This allowed for the exploration of novel design ideas while keeping the anxiety-driving mechanisms within a personally manageable range. As an independent game designer with some experience—and more flexibility compared to commercial game development—Designer B was able to make full use of the AD module without facing restrictive thresholds.

Designer C had a similar thought process but only used resource limitation. In the interview, Designer C explained that, as a commercial game designer, they had a clearer and more exclusive approach to selecting limitation types. Designer C believed that using too many types of constraints could disrupt the overall game rhythm.

Given the narrative-driven nature of the visual novel gameplay, Designer C chose to focus solely on resource limitation. This was implemented through puzzles that forced players to make decisions under resource scarcity, effectively increasing player anxiety. Designer C concluded that to better regulate anxiety, it is most effective for designers to focus on a single type of limitation.

These findings suggest that the module demonstrates high usability and ef-

fectiveness. Moreover, a designer’s experience is positively correlated with the maturity of the module’s usage.(Figure5.61)

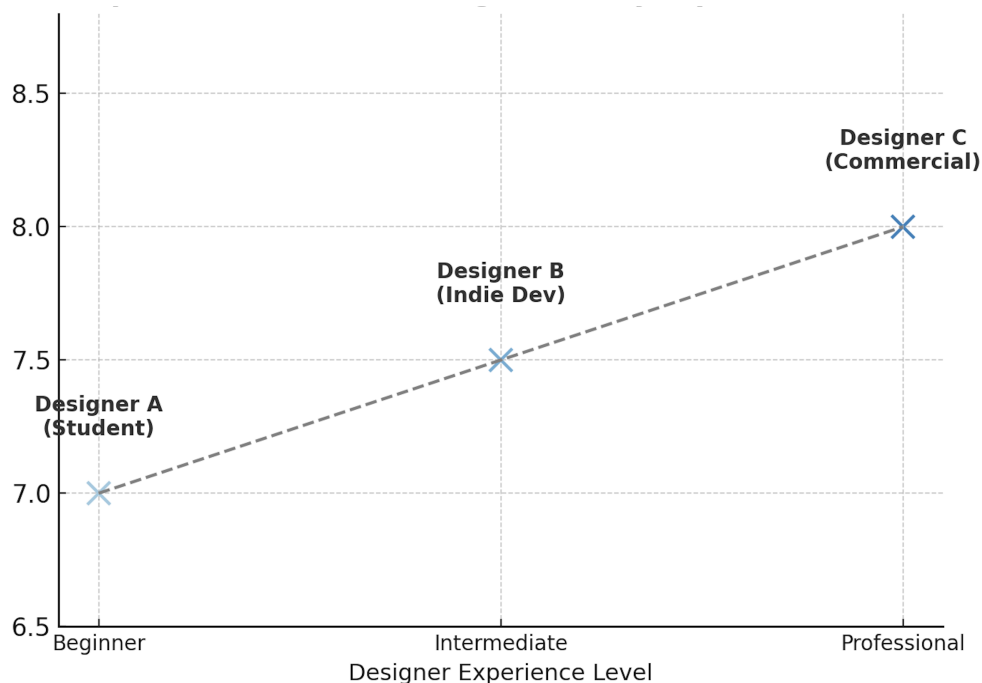


Figure 5.61 Anxiety Driver Module Usage vs Design Experience

However, the depth and strategy of use are closely related to the designer’s experience and background. More experienced designers tend to use the module with higher maturity and efficiency.

1.2 Did the designer apply the Adjustment Tools appropriately?

All three designers actively used the Adjustment Tools (AT) module from the ATEO model, and treated it as one of the key methods for regulating anxiety rhythms and constructing the overall atmosphere of the game experience. (Figure5.62)

Despite their differences in professional background, design habits, and areas of expertise, the application of the AT module across the three projects showed a relatively high level of consistency, particularly in the use of Buffering and Accelerator mechanisms.

To begin with, all three designers expressed strong approval of the AT mod-

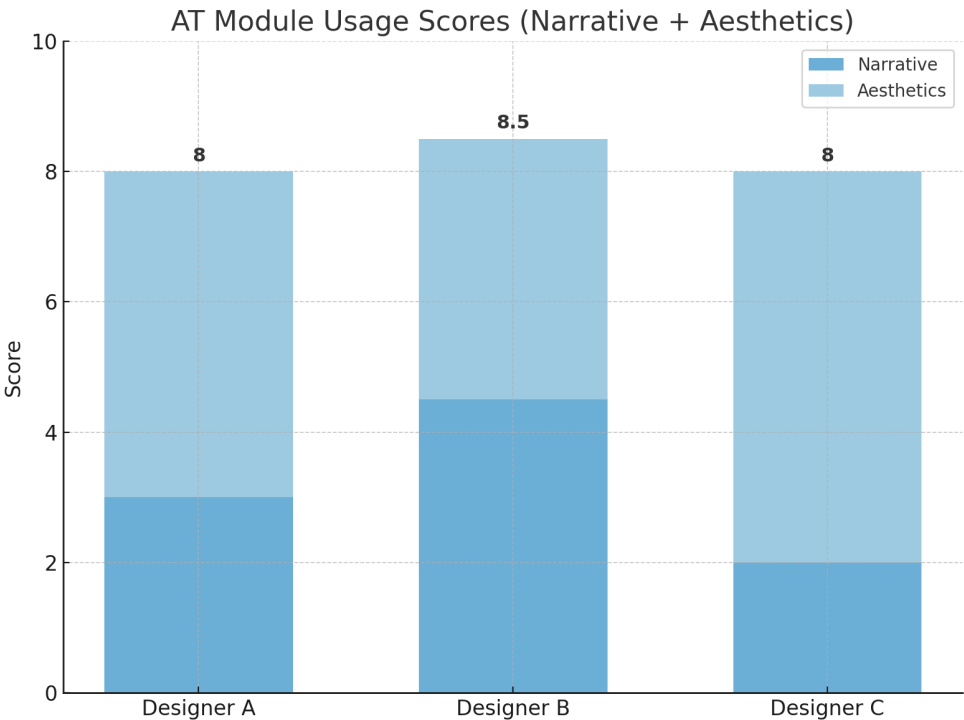


Figure 5.62 Adjustment Tools Module Usage Scores

ule, noting that it provided an effective way for designers to control the “anxiety rhythm” brought about by difficulty, especially in games featuring complex mechanics or high narrative density.

Moreover, Designers B and C, both of whom were already skilled in audiovisual and narrative design, pointed out that the flexibility of AT allows it to function both in conjunction with the AD module and as an independent system, greatly enhancing autonomy and controllability within the design process.

At the same time, although the effects were similar, each designer had their own emphasis in how they incorporated the AT module during the design process: (Figure5.63)

Designer A, despite lacking formal training in narrative and visual design, still showed a strong willingness to experiment and proactively used AT tools to construct narrative spaces.

For example, Designer A used collectible narrative items such as “Memory

	Buffering (Narrative)	Accelerator (Aesthetics)	Preference	Notes
A			Aesthetics -focused	Strong willingness to try Aesthetics Design
B			Slightly Narrative- focused	Wrote ~20,000 words of script and storyboard; Combined sensory design and physical interaction;
C			Strongly Aesthetics -focused	Most proficient; Applied “unreality cute distortion” to create psychological tension

Figure 5.63 Adjustment Tools Module Strategy Comparison

Candles” and “Fragment Gems” to present fragments of the world-building and storyline. This allowed players to experience emotional buffering and receive goal-oriented cues during high-difficulty levels, thus helping to relieve the anxiety induced by the AD mechanisms. This dual-layered structure—mechanics and narrative—reflects exactly the kind of narrative-based anxiety adjustment encouraged by the AT module.

Designers B and C both used the AT module as a foundational tool for establishing the emotional tone of the game. In Morning-Star, Designer B wrote approximately 20,000 words of narrative script and storyboard drafts, which were paired with sensory design and physical interaction to construct a full-process narrative sequence. B also created rhythm buffer zones and key tension points throughout the game. In particular, when using counter-intuitive mechanics (such as the hunger-death system) that may induce discomfort in players, Designer B used warm-colored scenes, everyday spaces, and in-game language companionship to provide psychological breathing space for the player under high-pressure story events.

Designer C was the most proficient in applying the AT module among the three. In the design of Perfect ME, C especially emphasized the use of “unreality + cute distortion” to generate psychological tension— pairing an adorable visual style with eerie musical cues.

This fully demonstrated the application of the AT module in “prolonging the emotional peak retention period.” (Such well-calibrated emotional curve design suggests that the more experienced Designers B and C had not only mastered the AT module’s basic functions, but also elevated their use of it to a professional level in experience design and emotional management.)

Based on comprehensive observation and interview responses, it is evident that the AT module was not only appropriately used, but also served as a critical intermediary tool that bridged anxiety and experience, as well as mechanics and narrative, throughout the design process.

1.3 Did the designer use the Optimization Lens to iterate based on user profile feedback?

Based on observation, all three game designers proposed optimization strategies for future iterations of their games that specifically addressed the needs of their respective target audiences. At the same time, all three designers expressed a willingness to actively use the Optimization Lens(Persona Lens) as a tool for conducting targeted analysis in future design stages. (Figure5.64)

However, due to differences in the designers’ knowledge bases and professional skill sets, their eventual approaches to user persona classification frameworks, data analysis methods, and application scenarios varied significantly:(Figure5.65)(Figure5.66)

For example, Designer C placed greater emphasis on the market value of feedback from users with different personality traits, as well as the influence of such game designs when disseminated across various audience groups via media channels.

In contrast, Designers A and B focused more on the “level of engagement”(e.g. sense of completeness) exhibited by different player types within the gameplay itself, and on how those players evaluated the game experience. Among them, Designer B pointed out that although it is currently feasible to conduct basic analysis and robustness testing through relatively simple methods of persona classification and data collection (such as questionnaires and personality tests), a broader and

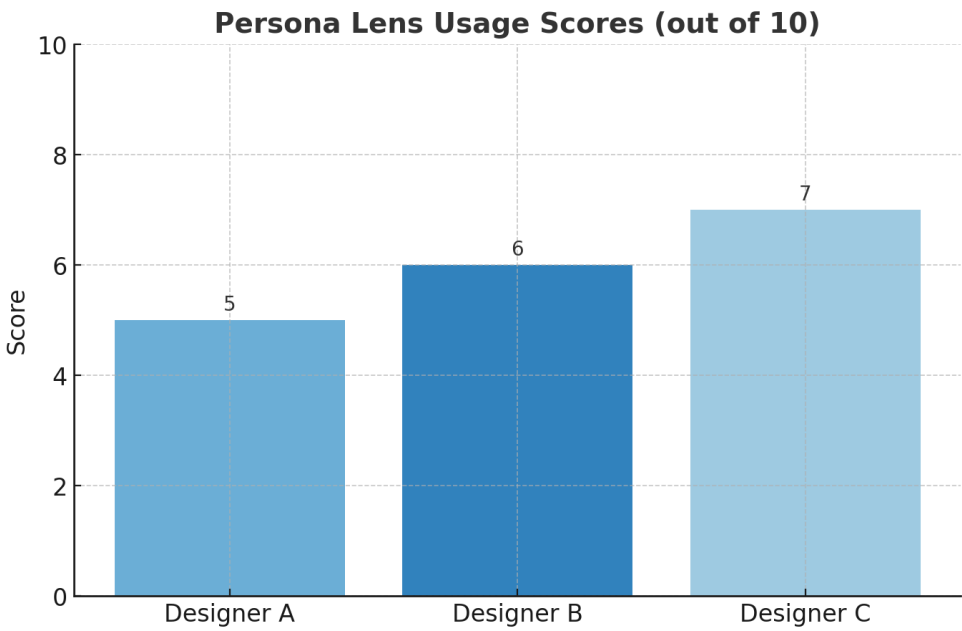


Figure 5.64 Optimization Lens Module Strategy Scores

	Lens	Intention to Use Persona Lens	Approach	Note
A		Player Engagement	Basic persona classification; Simple methods (interview)	—
B		Player Engagement Deeper Profiling	Basic persona classification; Simple methods (questionnaires)	Lack of funding, staff, visibility
C		Market Value Media Effect	Commercial persona classification; Analyzing with market reception	—

Figure 5.65 Optimization Lens Module Strategy Comparison 1

more in-depth professional user profiling system could be implemented if sufficient human and financial resources were available.

Designer B noted that this limitation—namely, the lack of development funding,

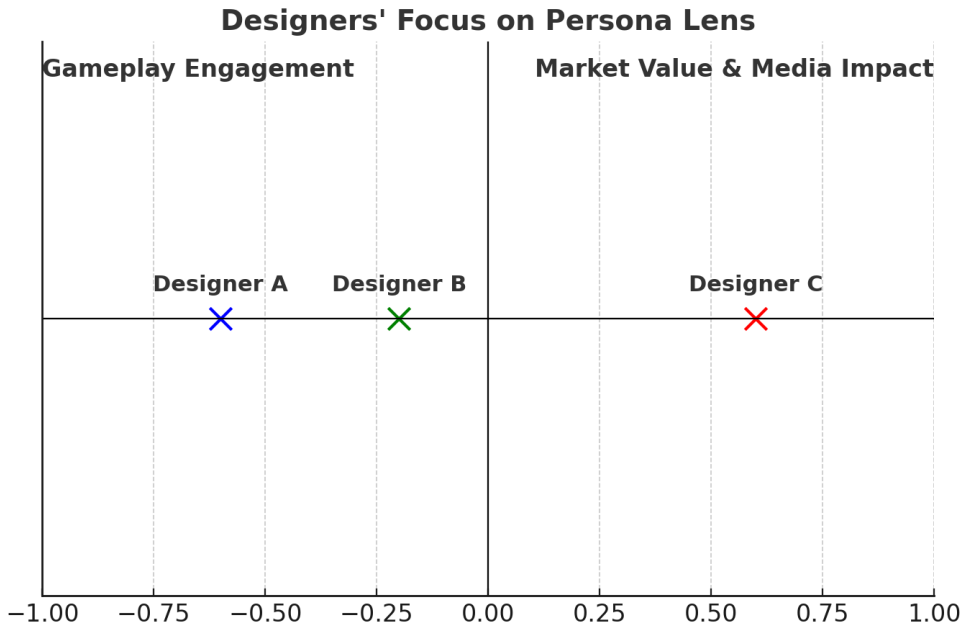


Figure 5.66 Optimization Lens Module Strategy Comparison 2

research personnel, and public visibility— remains a notable constraint for non-commercial designers.

2. Does ATEO provide better design feedback compared to traditional design models commonly used by the designers?

All three designers believed that ATEO offers greater operability and efficiency compared to the traditional design models they usually use. Based on the points made by the three designers when comparing their usual traditional design models with ATEO, the researcher summarized the comparison into three dimensions: Controllability, User Feedback, and Sustainable Development.(Figure5.67)The three designers were then asked to rate each model on these three dimensions using a scale of 1 to 10. The details are shown below:

Designer A repeatedly emphasized that ATEO—especially the Anxiety Driver component—presents a much clearer design concept compared to traditional models such as FC. Most game design guides tend to either teach designers to imitate and replicate existing gameplay or frameworks—such as the FC model frequently used by Designer A, which originates from classical game design textbooks— or

Overall	Designer A		Designer B		Designer C	
	FC Model	ATEO	NI Model	ATEO	JC Model	ATEO
		✓		✓		✓
Controllability	4	7	5	6	3	7
User Feedback	3	6	4	7	6	7
Sustainable Development	2	6	4	7	4	8
Total Score	9	19	13	20	13	22

Figure 5.67 ATEO vs Usual Design Focus Model

they attempt to push designers to invent entirely new mechanics from scratch, which often becomes elusive and overly whimsical.

Given that the current video game market is already saturated, both approaches had become tiresome for Designer A. ATEO, on the other hand, offers designers a simple but effective switch: by manipulating the key factor of “limitation” in game design, designers can retain their original comfort-zone designs while adjusting constraints to better attract players and enhance engagement. Designer A also collected test feedback and found that, after using ATEO to design Brave New World, the player responses were significantly more positive than for previous demos built using the FC model.

Designer A believed that the Adjustment Tools in ATEO helped regulate players’ psychological states, enabling them to become immersed in a rhythm of “just the right amount of tension.”

Designer B stated that ATEO is a superior model compared to the NI model and is particularly beneficial for small-scale indie developers like themselves. Designer B independently collected user feedback data and pointed out that compared to demos developed under the NI approach, users showed stronger engagement: they explored game content more deeply and had higher retention in difficult levels. Designer B believed that the ATEO model allows indie game designers to better control the pacing of high-difficulty level design, reducing scenarios where

frustration-induced anxiety causes player dropout.

Designer C found the overall workflow of ATEO to be highly feasible. Compared to traditional JF-focused design patterns, ATEO's modular setup and its integration with dynamic psychological frameworks significantly enhance the sense of control in the design process. Designer C mentioned that, as an employee at a commercial game company, the coordination across departments and projects often leads to the design process becoming highly fragmented and specialized from the designer's perspective.

Even when focusing on Designer C's own area of expertise—JF-style sensory design—the design feedback they received was often unclear and heavily influenced by communication bottlenecks and project management logistics, leading to distorted design outcomes. ATEO integrates various design blocks and highlights the interrelations and effects between modules, greatly increasing the designer's perceived controllability. By following the ATEO guideline, designers become clearly aware of how their deployed design strategies—mediated through anxiety—will generate interlinked effects across different areas, and can better estimate the likely outcomes.

Additionally, Designer C pointed out that the presence of the Lens means the model is not confined to game design alone, but also considers future iterations and market analysis. This allows professional designers to better understand how stable the current design is across different persona groups, and to identify key directions for future development.

3. Did the designers consider players' mental well-being and consciously regulate anxiety instead of overusing it during the design process?

The three designers rated their awareness levels of well-being issue during the interview on a scale where 0 indicated no awareness whatsoever and 10 indicated full awareness throughout: A rated a score of 6, B rated 8 as same as C.(Figure5.68)

Designer A admitted that although the ATEO model and its guideline explicitly mention the importance of mental health and encourage the regulation of anxiety rather than the unchecked use of anxiety-driven mechanisms, in actual practice, the "limitation design" provided by ATEO was so effective and convenient for driving anxiety and engaging players that they often became engrossed

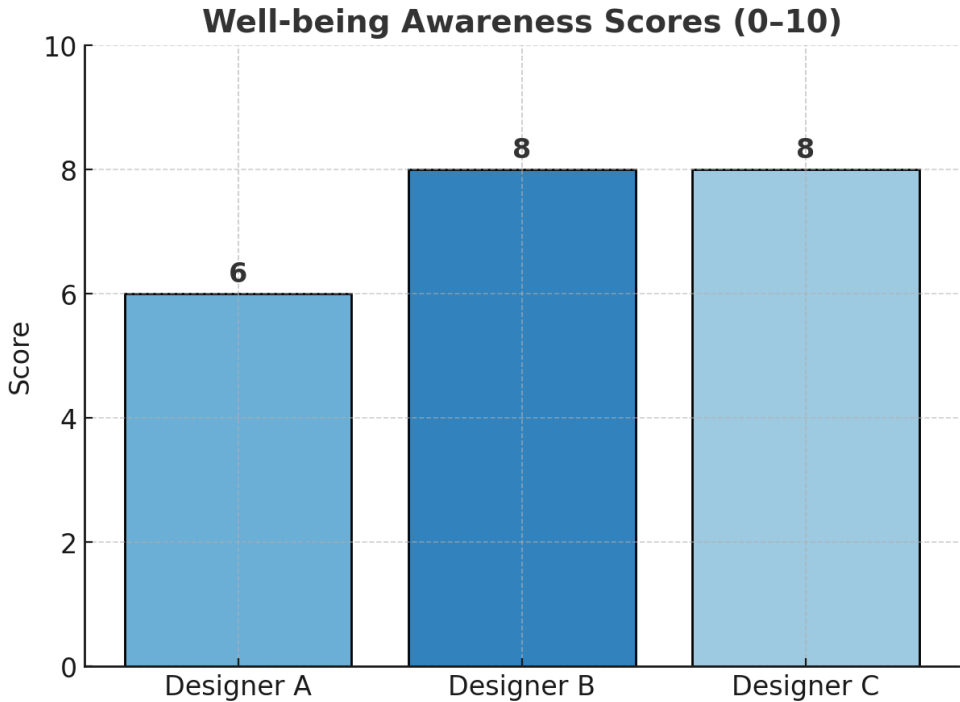


Figure 5.68 Mental Well-being Awareness Scores

in designing more such levels and would forget about the concerns surrounding mental well-being.(Figure5.69)

However, Designer A also noted that the design did not entirely lead to overwhelming anxiety. Due to the use of the AT module, even though they failed to consistently uphold ethical self-checks during the design process, the combined effects of the Accelerator and Buffering tools naturally prompted players to exit the game on their own once they approached their anxiety threshold. No serious signs of physical or mental harm, nor unhealthy addiction tendencies, were observed.

Designer B, whose game involved psychological horror themes, stated that they consciously considered how to use Buffering from the AT module each time they designed anxiety-driven constraints using AD, in order to mitigate rapid increases in player stress. They incorporated substantial emotional support mechanisms into the gameplay, including supportive language, emotional cues, and familiar everyday environments to balance out the anxiety effects of AD mechanisms. For

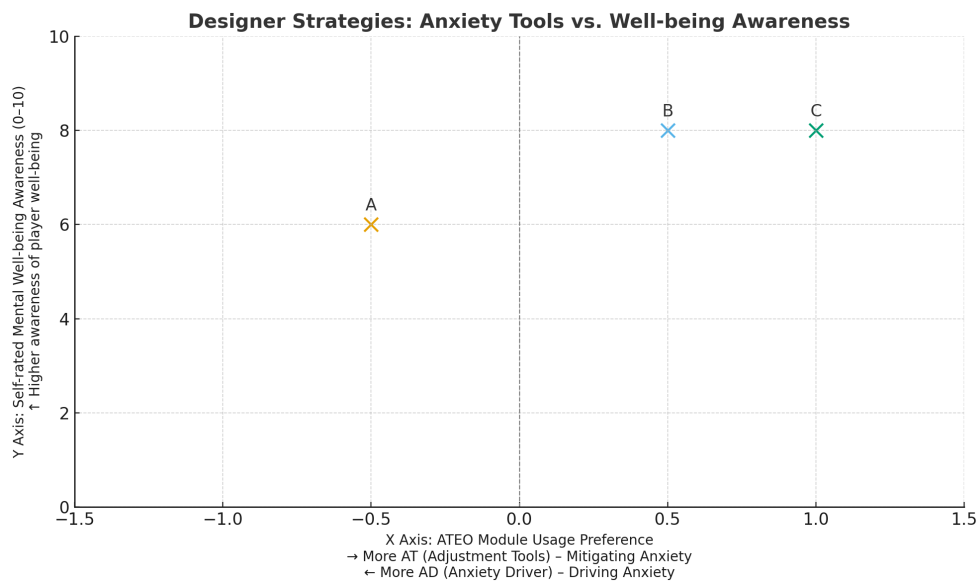


Figure 5.69 Mental Well-being Strategies

example, in the first level, Designer B added a daily living space that could only be unlocked through solving a puzzle. (Figure5.70)



Figure 5.70 Mental Well-being Consideration in Morning-Star

The researcher also observed that Designer B and C were the most proactive among the three in considering the potential psychological risks brought on by their design.

Designer C stated that throughout the entire design process, they were highly attentive—as a professional designer—to the psychological fluctuations that anxiety-driven mechanics might cause in players, as well as the possible market backlash—an observation that aligned with the researcher’s detailed notes. Due to professional considerations, Designer C focused more on whether anxiety-driven content might cause discomfort for players or receive negative feedback from peer reviewers.

Therefore, Designer C was the most cautious and professional participant in the study, which chose to use only one form of anxiety-driven design (AD), extensively regulated the expression of anxiety using AT tools, and ultimately received strong engagement feedback during the demo testing phase.

5.3. Evaluation Summary

This chapter conducted evaluations of the ATEO model through two components: a **player experience evaluation** executed by the researcher, and an objective observational analysis of **designer applications feasibility evaluation**. The two-stage evaluation results mutually confirmed that ATEO not only enhances player immersion by regulating anxiety, but also provides designers with a highly feasible design model for anxiety modulation.

In the player-oriented evaluation (5.1), the statistical results all show: the Anxiety Driver (AD) module can act as a mediator to increase player engagement.

When combined with the Adjustment Tool (AT) module in design, it can control a moderate anxiety level, extend the peak window of engagement, and show a natural inverted-U structure (engagement naturally goes down, not easy to become addicted). The ATEO model is better than other traditional design models in improving player engagement, and also keeps good stability across different types of players. Moreover, when all modules in the AETO model are utilized, the optimization effect on player engagement reaches its peak. (Figure 5.71)

On the premise of verifying the effectiveness of the design and of each module

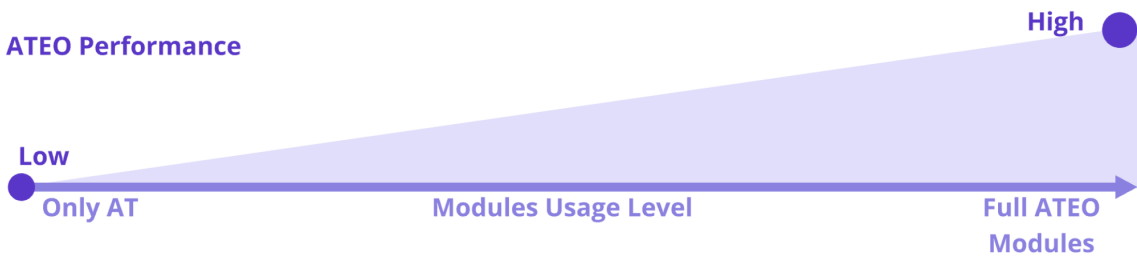


Figure 5.71 ATEO Performance vs Modules Usage

itself, based on the evaluation data, a path analysis of each variable was conducted by statistics, and a deeper result was obtained:

Anxiety has a mediating effect from the limitation design in the game to user behavior. At the same time, user persona (character) and the content design of the game (type) both have a moderating effect on players.

Placing these statistical results into the context of design and psychology can explain why the design of the ATEO model can have a good optimization effect on player engagement: (Figure 5.72)

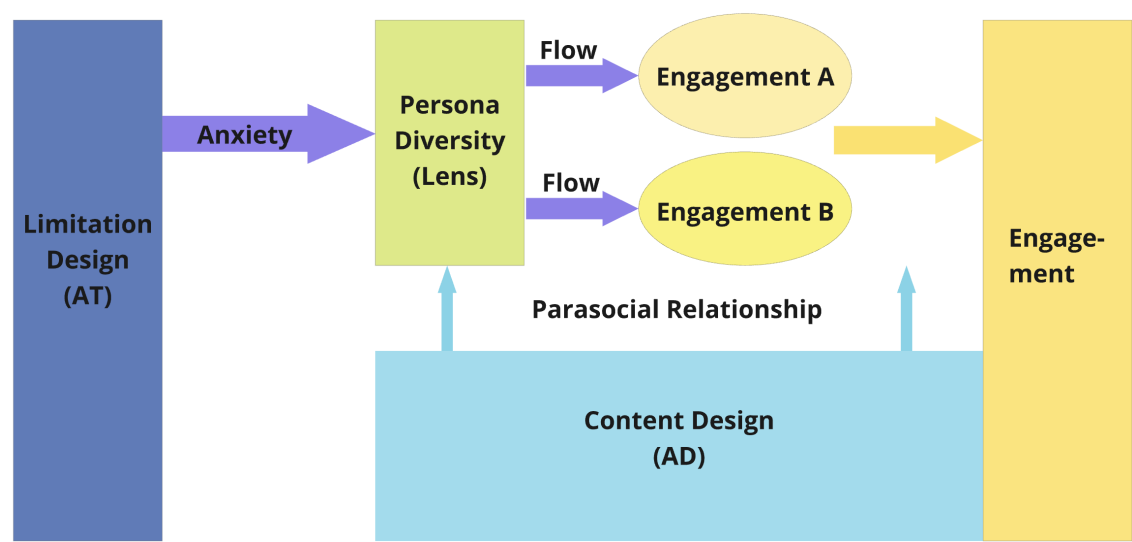


Figure 5.72 Why the ATEO Model Works: A Pathway Insight

Through the design of “limitation” in game mechanics, a “flow effect” and anxiety are applied to the user. Because user personas are diverse, the engagement shown by different users is also different. Although better than traditional mechanism design, it still lacks controllability and stability that let designers operate easily.

But the content design part in ATEO stabilizes this well. Content design can promote the PSR between user and game. Once an emotional link is formed, the user’s cognition and emotion are adjusted, and finally reflected in their behavior, thus enhancing the stability of the final engagement performance under the ATEO model design.

Next, in the designer-oriented evaluation (5.2), the effect of ATEO on users is also better than traditional models, and is beneficial to optimize user engagement, consistent with the results of 5.1. But based on the 5.2 evaluation data, it can be further found that in the process of using ATEO, in addition to the personality differences of user personas, the experience difference of designers also has an important influence on the final effect of ATEO.

The three designers all integrate ATEO into their process, but feasibility and operation skill show a clear gradient difference: (Figure 5.73)

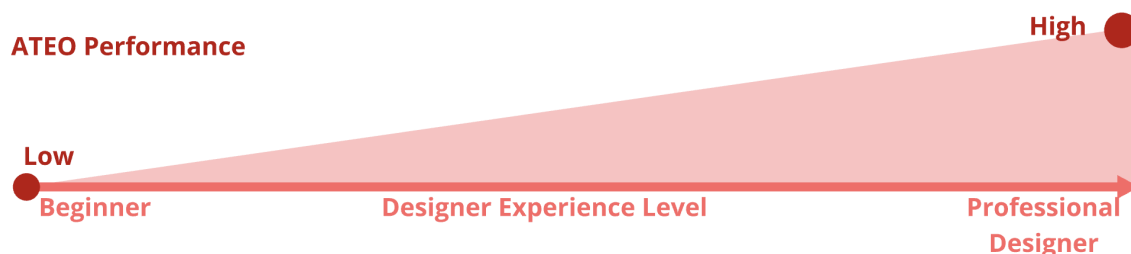


Figure 5.73 ATEO Performance vs Modules Usage

The design student (Designer A) is clearly lower than the independent developer and the commercial designer in module combination and rhythm control (for example: the design student is obviously weaker than the independent and commercial designers in module coordination and anxiety threshold control, and needs many adjustments to reach the same level of effect; while experienced designers can precisely choose a single limitation and use AT to adjust rhythm, showing

higher maturity).

This shows that the feasibility of ATEO increases as designer experience increases.

Therefore, taken together, the evaluation of ATEO can get an insight summary—

When designers meet the following three conditions, the feasibility and effectiveness of the ATEO model reaches maximum:

- (1) Targeted anxiety design (focus on clear limitation mechanism);
- (2) Use content to adjust anxiety threshold (stabilize user differences);
- (3) Have the corresponding level of experience to execute (professional execution).

A more detailed explanation of why ATEO is effective will be explored from a psychological perspective in Chapter 6. At the same time, for beginners and other designers lacking experience, this model still has limitations and space for future work to improve, which will be discussed in Chapter 7.

Notes

- 1 https://docs.godotengine.org/en/3.1/getting_started/step_by_step/your_first_game.html

Chapter 6

Discussion with Psychology

6.1. Engagement in Behavior Field

First, the test re-enforced and validated the relationships between the various modules in the model. Based on this theoretical model, combined with the previous framework that combines psychology and design concepts, the final output is the ATEO design model (Figure 6.1) for game designers to use in practice. One of the most easily and directly observed areas is player involvement. Player engagement is located in the behavioral field of the model.

Behavior is the same key dimension as cognition and emotion in engagement theory.¹ Users' spending behavior (including time and money) is used as a measurement indicator in this model, and is regarded as an observable variable of "Behavioral Engagement" in game engagement. According to the results of this study, the behavioral enhancement of sustained consumption investment is a reflection of deeper participation, which directly reflects the intensity of the behavioral dimension of players' game participation.

Considering players' repeated play, time investment, or in-game purchases, which have also been used to define and measure "game loyalty" (Gong et al. 2024), we link the observable engagement behaviors included in loyalty (continued use and consumption), and based on the findings of the previous branching study, it can be concluded that - when players are engaged in the game, they are more engaged in the game than when they are in the game. We link the observable engagement behaviors included in loyalty (continued use and consumption), and conclude that when players are more engaged with the game on a behavioral level, they exhibit more "loyal" behaviors (Gong et al. 2024).

Within the overall engagement framework, Flow State and Parasocial Relation-

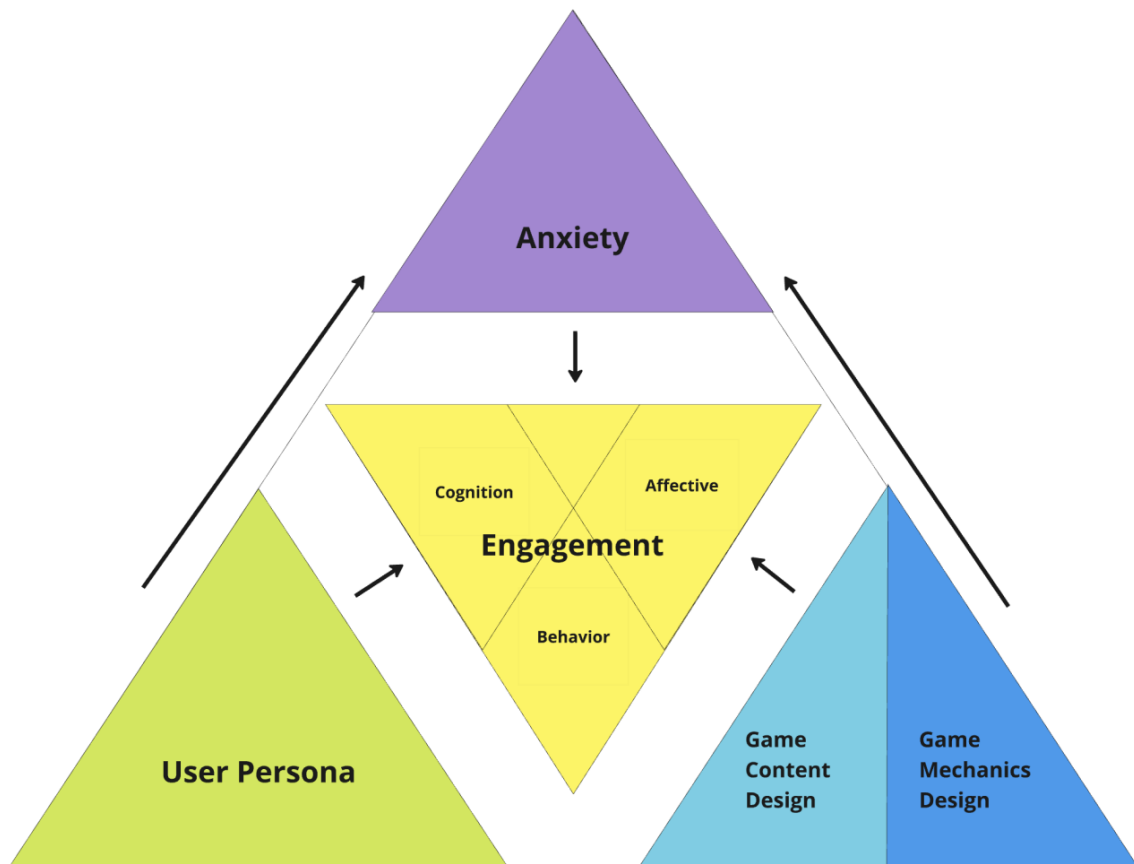


Figure 6.1 ATEO Design Model

ships (PSR) represent two distinct but complementary dimensions. Flow State reflects a player’s cognitive immersion: when the player is extremely focused and engaged while responding to game challenges and feedback. Flow state has been defined as the optimal balance between boredom and anxiety: players enter a state of flow when the task is challenging but still within the player’s capabilities.²In our context, flow state refers to this “cognitive engagement” of the player in dealing with the challenge of the game and losing track of time.

PSR (Parasocial Relationships) represents the emotional commitment dimension within player engagement. It refers to the one-sided social bond that players form with game characters, storylines, or even the game as a whole—this emotional attachment goes beyond mere mechanics (Giles 2008).

For instance, some players may develop a strong affinity for a particular character or storyline. Consequently, PSR fosters positive emotions and a sense of belonging, making it one of the core reasons players remain engaged in the game, irrespective of the quality of its core game-play design (Gong et al. 2024). In our analysis, placing flow and PSR side by side indicates our recognition that game engagement involves not only game-play mechanics but also the player's emotional experience.

From a cognitive science perspective, 'flow addresses the nervous system, whereas PSR engages the psyche.' Both dimensions collaboratively drive overall player engagement: a game can capture the player's attention on the cognitive level through challenging game-play, while also retaining them on an emotional level via compelling characters or social connections.

6.2. Pathways of Anxiety's Effect

A key question arises from our data on how anxiety influences these engagement dimensions and ultimately affects players' behavioral participation. Overall, anxiety may exert cognitive, emotional, and behavioral impacts on engagement. Focusing first on the cognitive aspect, a moderate level of anxiety stemming from in-game challenges or suspense can actually enhance the flow state. According to flow theory, the ideal experience hinges on presenting challenges that slightly exceed the player's skill level, but not so much as to overwhelm them.³ In game-play terms, a bit of tension or uncertainty often drives players to concentrate deeply, reinforcing their cognitive immersion. If the game design manages to induce just enough anxiety—for example, via time pressure, high-stakes competition, or a tense narrative—players can remain in the flow channel instead of sliding into boredom.

Many empirical observations corroborate this perspective. For instance, research on competitive gaming has revealed that while extreme anxiety undermines enjoyment, a moderate level of competitive anxiety is positively linked to players' interest and intention to replay (Chen et al. 2021). Competitive pressure heightens players' focus on the game, even sparking their desire to play again (Hong et al. 2017). This indicates that when anxiety remains manageable, it can function

as a cognitive motivator—sharpening attention and driving sustained game-play.

In current study's findings, if we observe an increase in engagement connected to anxiety, we can interpret it as 'challenge-induced arousal' prompting players to enter a flow-like immersive state, thereby reinforcing engagement behaviors such as longer play sessions or more frequent logins. Conversely, if anxiety becomes excessive—for instance, intense frustration or fear—it disrupts flow and may reduce engagement. Hence, anxiety's influence on the cognitive dimension appears curvilinear: moderate anxiety heightens immersion, whereas excessive anxiety erodes it.

On the emotional level, anxiety can also intersect with PSR. Certain studies indicate that, under specific circumstances, anxiety may even intensify emotional bonds. For example, players with relatively strong social anxiety in real life often engage in deeper parasocial interactions within games (Gong and Huang 2023).

Forming an emotional connection with a game character can serve as a relatively safe outlet for individuals who are anxious, while simultaneously strengthening their emotional tie to the game. Moreover, narrative elements that convey an air of anxiety—such as concern over a character's safety or a tense storyline—may further heighten a player's emotional investment, because they become more concerned about the fate of a beloved character. Even though our research did not directly measure this aspect, it is plausible that anxiety in the game's story or environment could reinforce PSR by making the character's fate feel highly consequential. Conversely, a strong PSR might buffer against the negative effects of anxiety:

players who are emotionally invested in certain characters may persevere through challenging or intimidating gameplay simply because, as respondents mentioned, they 'need to know what happens next' or feel loyalty to those characters. In short, anxiety and PSR have a bidirectional relationship: anxiety can deepen emotional engagement, while emotional engagement can also make anxiety more meaningful or easier to bear.

Additionally, the findings indicate that a game's difficulty level is not a key factor in establishing a parasocial relationship (PSR) between players and characters. In other words, designers have more flexibility in adjusting game difficulty without worrying that it will undermine the emotional bond between players and

the game or diminish emotional involvement.

At the same time, this also implies that leveraging character visuals, sound effects, and narrative design to develop well-rounded characters is more effective in triggering players' emotional attachment. When players form PSRs with game characters, they often rely on sensory and emotional design elements (Rocha 2023b) to shape each character's unique personality (Park and Seo 2019) and convey its traits through player interactions, thereby fostering a deeper emotional connection.

Although difficulty settings and other performance-related aspects of a game do not directly affect the formation of PSR, they still influence the gameplay experience and sense of accomplishment. Data shows that factors such as character visuals, narrative elements, and strength significantly affect a player's immersive experience (flow). This finding may reflect the immersive demands players place on a character's visual presentation, story development, sense of control, and achievement.

As noted by Chen, in game design, challenging tasks that require player skills and a sense of control are essential for enabling players to enter a flow state, allowing them to engage deeply in the game's progression(?). A comparison of the above metrics reveals that, to some extent, difficulty level impacts the flow experience but not PSR.

This could be because game operations primarily relate to a player's functional gameplay experience (Godde 2014), whereby tackling challenging mechanics makes players more prone to entering a flow state (Nacke and Lindley 2008). Achieving that state depends on a balanced sense of control and feedback mechanisms within the gameplay. In turn, through the psychological feedback of flow, players' sense of immersion is influenced, yet this process does not affect the emotional connection with the character.

6.3. Internal Dynamics of the Engagement Module

Another interesting finding from the implementation test is that behavioral engagement, affective engagement, and cognitive engagement show some degree of

correlation. Building on this, data from one of this project’s cross-sectional branch studies indicates that PSR can indeed facilitate the formation of flow states. This result implies that game characters function as an important bridge and emotional medium between the player and the game itself. PSR significantly increases players’ purchase intentions for character-related items, which aligns with another branch study’s conclusion that PSR enhances the intention to continue playing (Gong et al. 2024). However, this variable does not directly affect overall game loyalty, suggesting that players can hold a strong affective attachment to specific characters in the game while remaining neutral or even distant toward the overall set of in-game products.

The fact that PSR’s influence on purchase intention for character-related items is not moderated by game loyalty also supports this view: regardless of how players feel about the game as a whole, as long as certain characters sufficiently captivate them or they establish a robust emotional bond, they will be willing to pay for those characters. This conclusion aligns with the success of game genres in recent years that prioritize character design and emphasize emotional connections between characters and players—such as idol training and “otome” (female-targeted romance) games (Gong and Huang 2023). For example, in China’s video game market, *Love and Producer* attracted over four million daily active users within a month of its launch, generating revenue of over 14 million USD.⁴

Regarding the flow experience, a related branch study found that this variable is positively correlated with game engagement behavior, indicating that cognitive immersion in the game is one of the key prerequisites for promoting players’ participatory behavior (i.e., spending). However, an important clarification is that the data show the effect of flow on purchase intention is fully mediated by game loyalty. In other words, increasing a user’s cognitive-level engagement during play does not directly translate into real-money spending. Even if players, influenced by the flow effect, become deeply involved in the game and thereby heighten their behavioral engagement (e.g., time investment), if they fail to develop loyalty to the game itself, they are not necessarily inclined to spend. In short, game loyalty is likewise a critical precursor for players to move from mere participation to actual monetary transactions within the game.

6.4. Application Approach for the Design Module

Integrating the above analysis and discussion, we arrive at a clear picture of how anxiety, flow, PSR, and behavioral participation interconnect. Both flow (cognitive immersion) and PSR (emotional connection) can enhance players' overall engagement, ultimately leading to greater behavioral participation—where designers stand to benefit the most. Under anxiety-driven regulation, game engagement exhibits multiple facets:

It can guide players into a state of flow (cognitive engagement) and indirectly foster parasocial relationships (emotional engagement). Each of these in turn increases players' investment in the game. A certain level of tension from challenging game-play attracts players' rational attention (flow), while a gripping world and compelling characters stir their emotional attachment (PSR). Combined, these factors yield stronger behavioral engagement, such as extended playtime, repeated returns, and a greater willingness to spend.

Within this system, anxiety functions like a double-edged sword that requires careful balance. When game designers calibrate anxiety appropriately, it simultaneously activates both cognitive and emotional engagement: not only does it guide players into a focused flow state, but it also heightens the emotional tension throughout game-play. For instance, in our current findings, anxiety-driven data ultimately corresponds to higher levels of engagement.

Players experiencing flow are more likely to lose track of time and continue playing. Related studies also show that flow strongly predicts the intention to keep playing. For example, moderate competitive anxiety can increase enjoyment and motivate players to return to a game (Chen et al. 2021). Our results align with this conclusion: challenges driven by anxiety prompt players to be 'immersed,' which is then reflected at the behavioral level in more frequent logins or longer play sessions.

Meanwhile, parasocial engagement can also serve as a loyalty mechanism that remains effective even when the game is not at its peak. If players develop a friendship or romantic interest in certain characters, they continue to rely on the game world emotionally, even during non-core gameplay phases.

This emotional loyalty can translate into tangible actions: studies on narrative-based ‘otome’ games geared toward female audiences show that parasocial bonds increase the willingness to keep playing and even to spend. Notably, in those studies, social anxiety first fostered stronger PSRs, which then elevated players’ intentions to continue playing and to make purchases (Gong and Huang 2023). This indicates that emotional engagement (PSR) can independently drive behavioral engagement—players remain not only for the game mechanics but also because they care about its characters or storyline enough to invest both time and money.

However, it is important to note that effectively realizing the above-mentioned anxiety adjustment mechanism that links cognition, emotion, and behavior is not something all designers can easily learn and master. The evaluation results in Chapter 5 showed that “the application effect of the ATEO model has a certain experience threshold.”

For example, beginners (such as design students) show clear gaps compared with experienced designers in understanding how to adjust design pacing and control user emotion thresholds.

In actual development, in order to truly understand and more precisely use the ATEO model and its driving principles to reach the desired player engagement effects, designers need to have a high level of control ability and implementation experience in both game design and user psychology.

This is an important implication for researchers: even though the model itself has structured and reusable advantages, how to ensure that beginner designers can also implement it effectively (that is, “design accessibility”) is still an important direction for future optimization of the ATEO model.

6.5. Impact of Negative Evaluation Results

Although in both rounds of evaluation, ATEO performed slightly better than Narrative Immersion (NI), the difference between them was not large. In fact, in certain individual cases, NI even scored higher than ATEO in terms of engagement. For example, in the user evaluation test, regarding the robustness assessment results, the stability of the NI group (0.52, 0.52) was greater than that

of ATEO (0.07, 0.28). Additionally, in the designer evaluation, the improvements of ATEO over the three traditional models were: FC by 10 points, NI by 7 points, and JC by 9 points, with the smallest performance gain over NI.

This suggests that the content of parasocial relationships (PSR) present in the narrative-based design model NI is already highly effective in enhancing player engagement, and it also plays a significant role in the designers' design process. Therefore, the advantage of ATEO over NI is not always obvious, especially when the narrative content is rich and the player-PSR relationship is strong.

Based on these results, future research should focus on optimizing the PSR-related Adjustment Tools modules within ATEO, further exploring new and effective PSR content design schemes on the foundation of NI's strengths—for example, increasing the use of audiovisual language design, strengthening emotional connections and stimuli, so that players' emotions reach a higher level of arousal, thereby widening the performance gap.

In addition, another point already mentioned in the evaluation results summary is that the effect of ATEO on novice designers seems less significant than on more experienced designers.

The reason may be related to differences in design literacy and cognitive skills among designers—novice designers, due to a lack of relevant user experience, may not have the ability to anticipate and evaluate users' emotional management and feedback. When using ATEO, they may find it more difficult to achieve modular emotional regulation, and integrating dynamic anxiety management mechanisms also requires control over game mechanism design. Novice designers often lack the ability to prioritize and coordinate the interactions between various mechanisms, resulting in mechanism redundancy or confusion.

Therefore, providing more support for novices and ready-made templates in the ATEO guidelines may help bridge this gap, making it easier for designers of different experience levels to use ATEO.

Based on the above negative data results, although ATEO demonstrates design potential, these findings indicate the necessity for continuous optimization of ATEO and its guidelines, especially with a focus on leveraging PSR-based immersive design and addressing the skill levels of designers with a wider range of experience.

Chapter 7

Conclusion and Future Works

7.1. Outcome

Based on the systematic validation of the “anxiety effect” in gameplay experience, the ATEO model is proposed as a dynamic design model that accounts for users’ emotional responses and individual differences. This model provides a theoretical foundation for understanding emotion-driven mechanisms in game design, while also offering a practical methodology for incorporating player characteristics to enhance engagement and experiential quality(Figure 7.1). In summary:

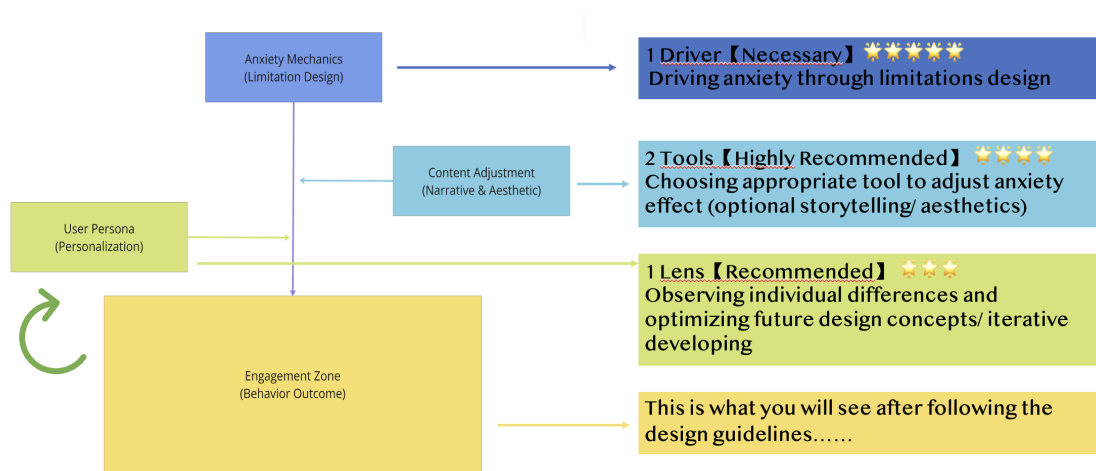


Figure 7.1 Principle of Using ATEO Model

This research findings indicate with statistical model(Figure 7.2) that moderate levels of anxiety can actually enhance player engagement, thereby validating the hypothesis proposed in RQ1. Through user testing and design iterations, we

identified a clear “optimal balance point”—the critical threshold where anxiety-induced tension transforms into a motivating factor rather than an obstacle. To explore and expand this optimal engagement zone, we proposed and validated the ATEO model, which consists of three core components: drivers (emotional load), tools (design mechanisms), and perspective (user role framework).

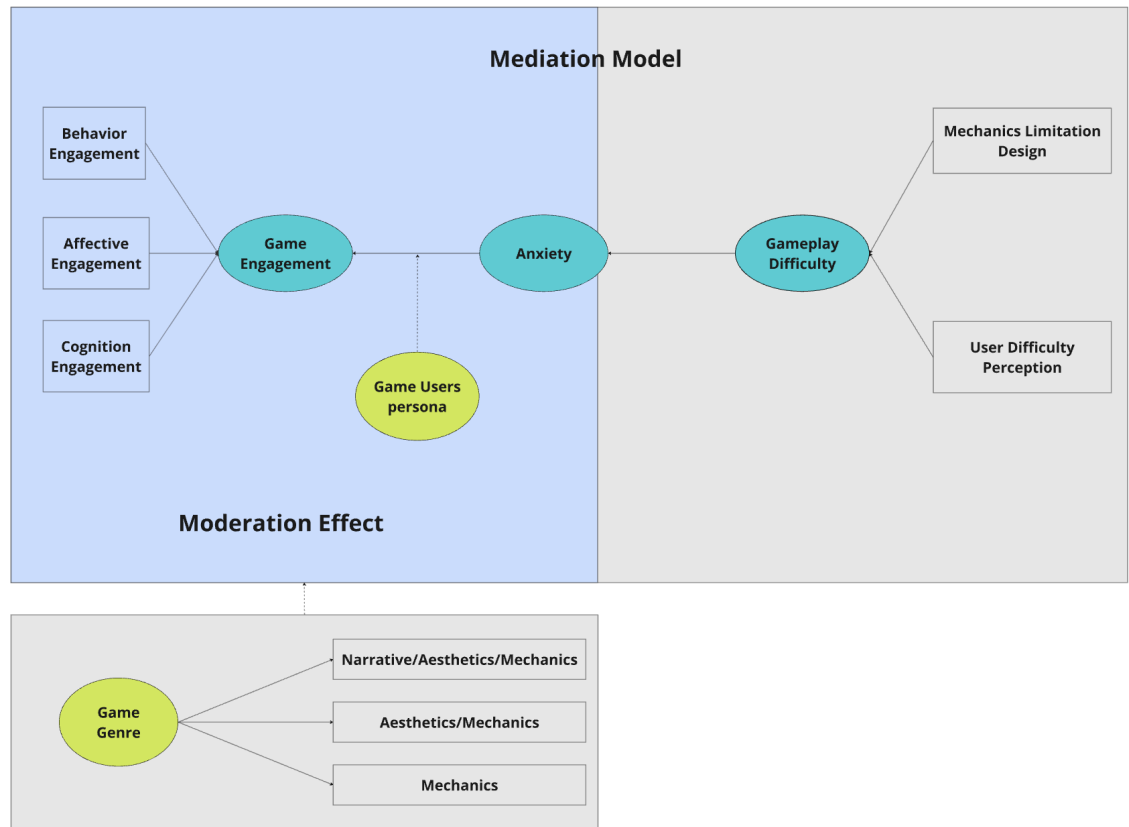


Figure 7.2 Expression Framework: ATEO Design Model

By applying this model as a practical design guideline, we not only helped players consistently reach this optimal point but also successfully broadened and enhanced the engagement curve. This directly addresses RQ2, highlighting how carefully calibrated game design can transform anxiety into meaningful and engaging experiences. Ultimately, our research provides designers with a structured path to balance emotional challenges with user experience, optimizing gameplay

under emotional tension.(Figure 7.3)

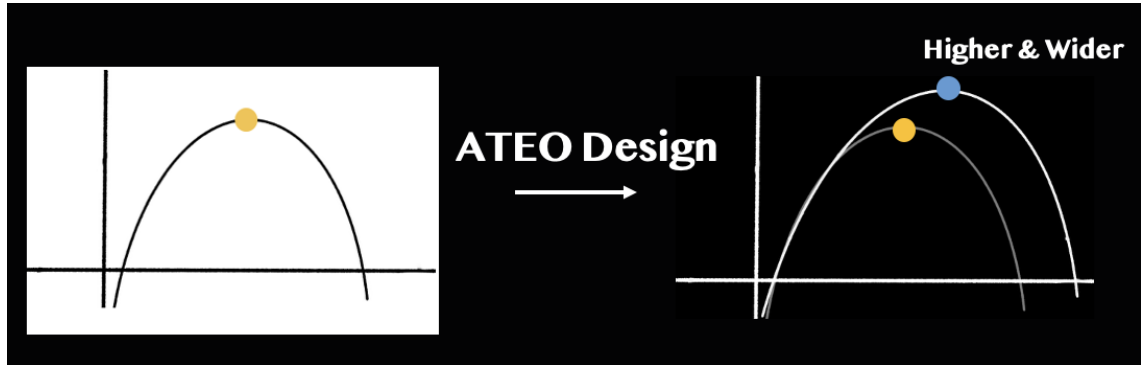


Figure 7.3 ATEO Design Model Outcome

Besides, players' anxiety experiences not only influence their level of engagement but are also significantly moderated by personality type and game genre. These findings provide a refined mechanism for understanding how emotions drive behavior, and offer a practical foundation for game design through psychology perspective.

7.1.1 Design with Anxiety Mediating Effect

First, the current study identified the anxiety effect as a mediating effect on player engagement, proposing a key role for the anxiety-inducing design of games in the relationship between player engagement (e.g., flow state and consumption intention). In past research, scholars have pointed out that flow state not only enhances players' game engagement(Chen 2007), but also influences their consumption decisions (Chou et al. 2023), and this new finding provides a deeper understanding of the design of game structural modules corresponding to players' engagement, e.g., cognitive engagement (Flow state), and behavioral engagement (player consumption), clearer understanding, emphasizing the key position of psychological factors as drivers and triggers of user behavior in the dynamic cognitive design model in video game contexts.

Building on our findings about the role of anxiety in game design, there is further evidence that engagement-affective, an often underestimated design module

that has a profound impact on shaping players' long-term behavior, is part of the model. According to the findings of this branch of the project, players exhibit very different consumption patterns when it comes to the purchase of character-related items versus general props. Character-related content (e.g., new characters, skins, avatars) tends to promote deeper emotional engagement through prosocial relationships (PSRs)-that is, unidirectional emotional bonds formed between players and fictional characters (Al-Nawasreh and Andersson 2022). Effective character design can stimulate players' empathy and attachment so that they evaluate a character beyond the functional significance of that character at the level of game mechanics. It has been shown that players who develop an emotional attachment to their avatars or beloved characters tend to influence their consumption patterns (Cleghorn and Griffiths 2015).

In other words, players who develop a deep connection with a character are more inclined to purchase cosmetic props or upgrades for that character, seeing it as a sign of self-expression or loyalty. The researchers also suggest that developers take note of these types of attachments; monetization strategies built around popular characters and personalized experiences tend to result in longer-lasting player engagement and revenue, as players return to the game not only for the rewards of playing, but also to "take care of" and invest in their virtual companions (Cleghorn and Griffiths 2015).

This character-driven consumption behavior also stabilizes players' long-term interest when the novelty or competitive dynamics of the game wane, as the emotional connection keeps players playing and supporting (Gong et al. 2024). By creating rich character backstories and charismatic personas, game designers can optimize the design of emotional engagement modules based on quasi-social relationships, investing more resources in shaping emotional triggers with which players can establish PSR attachments, and at the same time providing a supporting ecosystem of virtual goods to transform short-term gaming behaviors into long-term fan cultures. This strategy not only helps game designers to obtain more stable income on the basis of the original design, but also enhances the risk-resistant ability of games as electronic commodities in the face of market fluctuations.

Just as narrative and aesthetics play a more critical role in players' emotional

engagement than researchers have thought, design factors such as copywriting or art are often overlooked by designers in “hardcore” design concepts that emphasize the challenge of game operation, resulting in their importance being underestimated in designers’ decision-making, and designers investing more resources in polishing mechanics and neglecting the crucial role of narrative and visual elements in immersion and emotional connection(Naul and Liu 2020).

Designers put more resources into polishing the mechanics, while neglecting the importance of narrative and visual elements for immersion and emotional connection(Naul and Liu 2020). A compelling story coupled with immersive audiovisual design creates a “fiction layer” in the game, which strongly attracts players on an affective level. This affective layer is created through narrative events, compelling visuals, and music that stimulate the player’s emotional experience, creating a meaningful connection between the player and the game world or character.

For example, a full worldview and character growth can create a sense of “personal involvement” in the game, which can motivate players to play longer and come back more often. Indeed, in-game narratives can directly increase player engagement, participation, and long-term retention.¹ Similarly, a game’s visual art style can have a similar impact: attractive and stylistically coherent aesthetics help to create atmosphere and allow players to connect more deeply with the game.²

In practice, these narrative and artistic elements can also compensate when the core mechanics under-perform. The example of Final Fantasy XIV is a vivid case in point: its initial game-play design was obviously flawed, but it managed to reverse the trend by drastically improving its narrative and worldview architecture.

In the process of completely overhauling the game, the developers restructured FFXIV’s plot and artwork to provide a plausible in-game backdrop for extensive game-play changes. The result was the critically acclaimed remake of A Realm Reborn, which proved that if the narrative environment and emotional resonance are strong enough, it is possible to maintain active participation even if the initial core game-play is unsatisfactory (Copeland 2011). Overall, rich narrative experiences or artistic appeal can keep players immersed and emotionally attached to the game, acting as a buffer when challenges or game-play mechanics present a

risk of frustration. This finding also suggests that game-play should not be viewed in isolation: the 'softer' parts of the design (story, visuals, characters) can actually enrich the overall experience and re-motivate players to continue when the pace of game-play action is more muted.

The above insights can be closely aligned with our proposed multi-factorial, multilevel dynamic design model of player engagement. In addition to affective-level contingencies, the cognitive layer often lacks focus by designers, and anxiety plays a key role in the cognitive layer - when it is appropriately modulated with the game difficulty, moderate anxiety can stimulate focus and flow state, thus enhancing player engagement. Evidence of character-driven and narrative-driven engagement in branching studies further enriches the affective layer of this model (Liu 2019).

For example, even if a reasonably set difficulty retains players at the cognitive level, a compelling story or empathetic characters will engage them just as deeply at the affective level, thus providing a complementary route to sustained retention. Some players may be driven by the thrill of overcoming a challenge (cognitive-flow state), while others remain engaged because of concern for the fate of a beloved NPC or a desire to explore more of the game's worldview (emotional-immersion).

The current findings suggest that player engagement is strongest when these two paths work together-for example, anxiety from challenges is in the pleasurable zone-while players are immersed in a compelling narrative with characters they care about. In addition, player personality traits cannot be ignored:

different players focus on these factors in different ways. Players who favor story or socialization may prefer narrative/PSR elements, while achievement-driven players are more sensitive to difficulty and competitive elements. By taking these individual differences into account through player profiling and customizing the content accordingly, the game can provide each player with a balanced mix of Challenge-Story-Connection to meet their preferences. This holistic approach leads to more solid engagement outcomes: on a cognitive level, players are not bored or overwhelmed; on an affective level, they feel connected and invested; and on a behavioral level, they are willing to keep playing, and even spend money on the game in more personally meaningful ways.

The model designed by the researcher emphasizes the importance of integrat-

ing user experience-centered design principles and psychological insights to create game designs that have multi-layered emotional experiences that are malleable and high-threshold challenging. The model's contribution is simultaneously industry and user oriented. The model enables producers to open up more avenues of engagement and consumption, while at the same time elevating the user experience to new heights through the regulation and application of player emotions, ensuring that players of different personalities benefit from the diverse game worlds created for them. Practical use of the model allows producers to follow the bootstrapping model will increase consumption opportunities and thus increase customer motivation.

Simultaneously, specific psychological triggers are utilized to attract players to prolong the game. For users, the guidance model will lead to optimization of user mechanics. In addition, it will bring personalized experience to the players. Personalized experience will be brought to the players, and players with different personality preferences will be able to experience the appropriate level design.

Overall, successful game engagement is achieved through the synergy between anxiety-based design and the observational modulation of players' cognitive, affective, and behavioral engagement. The two are not in opposition to each other, but rather complement each other: carefully controlled difficulty (which generates just the right amount of anxiety and flow state) ensures that the game is "exciting" enough, while emotionally engaging content and dynamically optimized gameplay ensures that the game is worthwhile to "hold on to". The emotionally engaging game content and dynamically optimized game experience ensures that the game is worth "hanging on to".

Combined with a focus on individual players, this multi-dimensional design strategy provides a clear idea of how developers can foster deeper levels of player immersion, fulfillment, and loyalty in the game as a whole. Ultimately, the integration of these interrelated elements-anxiety levels, difficulty modulation, narrative/PSR-created emotional immersion, consumer behavioral drivers, and player personality traits-results in a dynamic game design model.

The integration of these cognitive psychological and behavioral factors with game design reinforces the guiding framework, highlighting once again that striking a balance between game-play tension and emotional resonance is critical to

facilitating an engaging player experience and building stable and enduring user loyalty to the game.

7.1.2 Optimization for ATEO Model Application

Building on current research data, behavioral analyses, and cognitive-psychology theory, detailed supplements have been added to the original guidelines to clarify how the ATEO model can be further optimized in practice. The updated guide includes instructions on leveraging psychological triggers to boost user engagement—specifically, how designers can strategically evoke moderate anxiety at key moments through goal design and then harness that anxiety to elevate participation levels. Given the model’s dynamic nature, implementing these optimization possibilities will help designers iteratively develop games that better accommodate a diverse user base.

AD: Dynamic adaptive challenges

Core: Automatically adjust game levels or challenge difficulty based on player performance and mood.

Effect: Directly change the difficulty of the game, such as increasing the difficulty when the player’s mood is “moderately anxious” to stimulate engagement, or lowering the difficulty when the anxiety is too high to avoid excessive frustration.

Emphasis: Focusing on changes in the “challenge” itself.

The first core principle is Dynamic Difficulty Adjustment (DDA) – games automatically adjust the level of challenge based on the player’s performance and emotional state, rather than locking the player into a fixed difficulty. The adaptive system responds when it detects the player’s state: if the player is performing well and is about to find it too easy, the challenge is increased; if the player is struggling or showing signs of strong anxiety or frustration, the difficulty is reduced to provide a buffer. By adjusting the challenge in real time, the game can maintain a moderate level of pressure, making the player feel stimulated but not desperate. This corresponds directly to the description of the “flow channel” in the theory of flow, when players experience something that is far beyond their skills, negative emotions such as anxiety can “break the player’s flow state”(?).

The goal of DDA is to pull the experience back into a manageable range before the player’s frustration explodes.

In practice, DDA is implemented in a variety of ways. Some modern games use rules-based systems to monitor player metrics: when a player repeatedly fails, the game may inadvertently reduce the number of enemies or provide support items, while if the player is progressing well, stronger enemies or disabled hints may appear, and the player may face greater challenges. Such changes should be gradual and preferably imperceptible to the player, so as not to raise questions about the fairness of the game. A typical example is the AI Director in *Left 4 Dead* (Valve, 2008), which monitors the stress level of the player team and dynamically controls the number of zombies and item drops, alternating between tension and relief, so that players are always in a state of excitement of “almost collapsing but still able to hold on”. Even in the single-player action game *Resident Evil 4* (Capcom, 2005), the game secretly adjusts the toughness of the enemies based on the player’s success rate. This is a kind of behind-the-scenes DDA that most players are unaware of and just think the difficulty is “just right.”

Also, dynamic difficulty does not mean sacrificing the game’s original high difficulty positioning. For example, the user-generated content in *Super Mario Maker* (Nintendo, 2015). Although the levels themselves do not adapt to difficulty, the game matches the player’s skills through level difficulty tags (such as Easy, Normal, Expert, Super Expert) and by allowing the player to choose the difficulty in 100-Mario or Endless Challenge mode and skip levels that are too difficult. This allows players to choose a level that matches their skill level and gives them some room to quit or adjust when they get stuck, a mechanism that makes the game system self-adaptive as a whole, even though the difficulty of each level itself is fixed.

In short, the aim of adaptive challenges is to keep players in the optimal zone between boredom and frustration. This can be achieved through dynamic difficulty adjustment, whether automated by an algorithm or provided as multiple difficulty options or indirectly by the player.

AT: Flexibility safe zones and triggers

Core:Provides auxiliary emotional support measures, so that the player has a trigger to wake up excitement and tension during the slow period, and has the opportunity to buffer and recover in the face of stress.

Effect:The role of this module is setting up "safety zones" in the game, prompts, rewards, short breaks, etc., to help the player release or transform negative emotions.

Emphasis:Focusing on "emotional adjustment," giving the player additional emotional support as the game progresses, rather than adjusting the challenge directly.

Even with adaptive difficulty and personalized content, too much gameplay design can still lead to high levels of stress or negative emotions. The third principle emphasizes setting aside "emotional buffers" and "safe zones" in the game loop to help players recover smoothly before their emotions reach a critical value or after they fluctuate greatly. Specific methods include setting up safe zones, pauses, and reward cycles in the game, so that players can resolve or transform negative emotions before they accumulate too much.

From a psychological perspective, intermittent relief is very important for dealing with stress. A game that keeps players on edge from beginning to end is likely to cause emotional exhaustion. On the other hand, alternating between strong and weak rhythms (a good balance between tension and relaxation) can make the overall experience more enjoyable and the sense of satisfaction upon victory stronger. We recommend explicitly designing these "rhythm troughs" to provide players with a brief period of safety and calm. For example, many survival horror games (such as the *Resident Evil series*) arrange save rooms in the level design – where the invincible monster appears, the quiet background music and the supply box allow the player to catch their breath and safely save. This mechanism is not only technically convenient for the player, but also a psychological relief method.

Reward mechanisms are also key to emotional buffering. A well-timed reward can turn the experience of "anxiety and failure" into "effort worth paying". Similar to "some gains despite failure" or "small content unlocked with each attempt", these can be added to the levels to make players feel that their time and emotional investment is not meaningless.

Safety mechanisms such as extra lives, frequent save points or undo functions are also a form of emotional cushioning. Letting players know that one or two mistakes will not cause all progress to be lost can greatly alleviate the anxiety caused by some difficult gameplay. The checkpoint commonly used in platform games is typical: even if the player dies many times, they will not regress too far, which gives them a certain confidence to repeatedly challenge, rather than giving up directly because they think the cost of failure is too high.

Ultimately, this pacing not only reduces player attrition, but amplifies the dramatic nature of the challenge design: after a sufficient period of rest, players will perceive and be enthusiastic about the next high intensity level with a renewed sense of freshness.

Lens: Personalized Experience Approach

Core: Multiple progression routes: both emphasize the challenge of solo skills and repetitive practice, but also incorporate social interaction and teamwork, so that all types of players have a sense of belonging.

Effect: Understand the tolerance and reacting styles of different players. Update players' mental state in time with questionnaires, behavioral data or pre-test feedback.

Emphasis: The reaction of different players varies greatly.

The second optimization is geared towards longer-term personalization of the gaming experience – shaping the game progression according to the player's psychological profile. Players are not a homogenous group; they differ greatly in terms of motivation, playing style and tolerance for stress. It is therefore particularly important to create multiple experience paths to cater to different player personas (or player types). The pretests' interviews revealed significant differences in how two orientations: the “individual/introvert orientation” and the “social/extrovert orientation” respond to game challenges. Understanding these differences can help designers to design appropriate content for different styles of players and provide alternatives to challenges in specific situations.

Game designers should introduce the idea of player type identification or group classification at an early stage, so that the game experience can be fine-tuned for different styles. The methods can be divided into explicit (such as asking players

to fill in a questionnaire during the import stage, or classifying them through adaptive algorithms that observe player behavior) and implicit (providing players with multiple ways to see which route they spontaneously choose and learning their preferences). This principle advocates offering multiple progression routes and play styles to suit different motivations:

Single-player/introvert paths: Players who value personal achievement need sufficient challenges of high difficulty, clear progress, and measurable rewards (such as scores, levels, trophies, etc.). They have a high tolerance for repeated attempts and high difficulty, and can maintain motivation as long as they see their skills improve. However, if the goal seems unattainable, it is also easy to trigger disinterest. Therefore, the design can include phased milestones and feedback to help players feel small progress. In *League of Legends*, for example, ranked mode and skill matching systems match opponents of similar skill levels, so that achievement-oriented players can get a fair challenge and continue to climb.

Social/extrovert path: For social players, the game needs to focus more on communication, collaboration and plot than on sheer difficulty. They can often better tolerate anxiety if they have social support in stressful situations or if they see the challenge as a problem to be solved together. Design elements such as guild missions, cooperative dungeons, trading or simple leisure activities are very attractive to them. *Assemble! Animal Crossing: New Horizons* is a prime example: it basically abandons the traditional “level challenge” and allows players to set their own goals in an open and homely style. For the more social players, “flow” may not be achieved by defeating the boss, but rather through community activities, online home displays, or inviting friends over for a visit.

At the same time, personalization does not mean completely isolating the player. A good design often allows players to make flexible choices within the game. The same player will also need different forms of entertainment in different moods. It is recommended to allow parallel content streams to appear in the game—for example, two separate lines for “elite challenges” and “social relaxation,” and different players can enter the route they are interested in. For example, *World of Warcraft* offers both high-intensity combat in epic dungeons and low-intensity gameplay such as pet battles and house decoration. Players can switch between activities at will to self-regulate their anxiety levels.

Dynamic personalization based on behavioral data is also a good extension. AI System can determine when a certain group of players repeatedly fails at a specific level or stays too long, and automatically trigger some assistance, or allow this group to skip difficult bosses, while those who are willing to meet extremely difficult levels are not disturbed. This adaptive grouping can provide players with different orientations with the appropriate challenge intensity and frustration buffer without disrupting the overall game balance.

7.2. Innovation and Contribution

The ATEO Model is new idea that let gestalt meets game design. This study innovatively applies the Gestalt psychology paradigm to game design, eliminating the isolation between design methods and demonstrating the advantages of holistic dynamic design through psychological theory.

The contribution to society could be considered as three sections:

To academic, current study contribute to the media well-being issues. This study proposes methods for transforming negative emotions into positive engagement, filling the gap in academia that has been overly focused on negative-negative loops and lacking in reverse conversion approaches.

To users and game players, this study provide the optimized experience. The inverted U-shaped curve and sweet spot experience design allow players to enjoy a more comfortable participation zone than ever before in anxiety-inducing situations. After reaching the tipping point, players will spontaneously reduce their participation rather than becoming addicted to the game due to one-sided anxiety.

To designers, this research created a useful toolkit. For designers who want to create hard-core games with high design complexity but are concerned about player attrition, anxiety-friendly game design tools are available.

7.3. Ethical and Social Considerations

Since the ATEO design model is based on the idea that "moderate anxiety can drive engagement", although it shows significant positive effectiveness in multiple tests and already considers well-being issues in its design, the "anxiety-driven"

factor in the design principle may raise ethical or social concerns. For example, if the model is adopted by the game industry, will it be used to create anxiety-inducing elements without limitation, leading to player addiction or psychological stress?

These problems deserve serious consideration. Therefore, this study provides responses and preventive mechanisms on two levels:

The inverted-U mechanism itself has “self-limiting” properties: The test data of the ATEO model, verified through quadratic regression, clearly shows an inverted-U curve of engagement over anxiety levels. That is, moderate anxiety can stimulate engagement, but when anxiety becomes too high, engagement decreases. This mechanism naturally forms a “sweet spot” with limitation and natural fallback. It does not encourage players to remain anxious or addicted during play, but constructs a dynamically adjustable and less addictive emotional-driven design model.

Supporting design tools provide “buffering options”: ATEO is not a single emotional-driving system, but a complete framework including different modules such as Adjustment Tools (visual and narrative adjustment) and Persona Lens (personality matching suggestions). The buffering tools in the Adjustment Tools module can be used to slow down the rise of anxiety, adjust player rhythm, and protect emotional safety zones. This allows designers to personalize the rhythm and emotional curves for different player personas.

In addition, this study emphasizes that the model itself is only a design tool, and not a purpose with guidance or tendency. Designers still need to take responsibility to apply it reasonably in specific products, and avoid abusing anxiety-driving mechanisms in order to increase retention. If the game industry adopts this model on a large scale in the future, it is also recommended to establish player feedback mechanisms and relevant ethical evaluation systems in parallel.

7.4. Limitation

7.4.1 Further Psychological Frameworks

One limitation of the current study is its exclusive focus on anxiety as the core emotional construct, without further exploring how a wider range of emotional states could contribute to a more human-centered and flexible approach to game design. Integrating psychological frameworks with diverse user traits will be an important direction for future research. While this study focused on anxiety as the primary entry point for understanding engagement, a more comprehensive psychological picture—and potentially more nuanced design insights—may emerge by incorporating other affective states such as depression, anger, or fear into the analysis of in-game experiences.

The foundational pathway connecting personality traits, emotional responses, and gameplay behavior still holds significant untapped potential for further investigation. Developing a more emotionally diverse design model could not only better align with commercial game design workflows, but also offer predictive insights into the thresholds at which players may choose to continue or disengage, depending on emotional triggers encountered during play.

7.4.2 Duration Effect and Longitudinal Research

Another equally important limitation lies in the effect of time, encompassing both short-term and long-term impacts. Due to practical constraints such as funding and resource availability, the study’s testing period was significantly limited. This temporal limitation may have weakened the depth of data collection, resulting in a more fragmented understanding of player engagement and experience. It also reduced opportunities to observe and analyze participant behavior and interaction dynamics across varying gameplay scenarios.

Notably, the study was unable to explore players’ sustained retention or long-term fluctuations in anxiety responses to the same game over time. A more robust research approach would involve tracking the same group of players over a longer duration—ranging from several weeks to months—and shifting the analytical lens from short-term anxiety triggers to long-term emotional states such as attachment,

habituation, or burnout.

7.4.3 Beginner-Friendliness and Learning Curve

Although all three designers in this study were able to apply the ATEO model, the evaluation revealed clear differences in their implementation outcomes. The design-school student (Designer A) struggled more with module coordination and tension control than the independent and commercial game designers.

These findings suggest a step-wise difference in ATEO's practical feasibility that corresponds to the designer's prior experience. For beginners—especially those without a background in cognitive psychology or emotional pacing—the model's guidance, while clearly defined, still presents a steep learning curve during actual development.

Therefore, the absence of dedicated support materials for novice designers should be recognized as a limitation when considering the model's general applicability.

7.4.4 Limited Improvement over Narrative Immersion

Although the overall evaluation of the ATEO model demonstrates high effectiveness and feasibility, its performance advantage over the Narrative Immersion (NI) model remains limited.

In both rounds of users and designers' evaluation, the gap between ATEO and NI in terms of robustness and performance improvement was small. For example, regarding differences between extroverted and introverted personality types, NI even showed higher engagement scores, especially in terms of stability metrics.

Therefore, the limitation is that, compared to NI, when the narrative content is solid and the effects brought by PSR are well established, the enhancement provided by ATEO is not always significant and needs improvement.

7.5. Future Works

7.5.1 Cognitive Meme Model

Meme refers to the unit of information dissemination in a culture, such as ideas, beliefs, habits, and behaviors, that is capable of spreading through a population by imitation, transmission, and evolution, i.e., a cognitive model that is transmissible, replicable, and extensible (Dawkins 1981).

This study proposed a cognition-driven, anxiety-based dynamic psychological assessment framework for design, which not only contributes an innovative cognitive model to the field of game development, but may also serve as a theoretical membrane for academic exploration in game design. Future research may explore its extensibility across diverse interactive settings, including applications in virtual reality (VR), augmented reality (AR), interactive cinema, and other emerging interactive entertainment media.

Moreover, upcoming research should consider incorporating a broader range of psychological factors into the design model, rather than limiting the scope to anxiety alone. Emotions such as aggression or fear are equally prevalent and influential in gameplay experiences. It is therefore crucial to investigate whether the ATEO model's existing architecture can be adapted or extended to accommodate these other negative emotional states, and whether it can serve as a foundational theory for future emotion-driven game design practices.

Given the modular structure and potential reusability of the ATEO model, it holds promise as both a standardized design principle for emotional interaction and a cognitive framework for continuous evolution. It may be applicable not only to game designers, but also to UX researchers and interaction designers. As the game industry evolves, along with player behavior and technological advancements, the ATEO model can be progressively refined—thus contributing to a dynamically expanding network of academic influence grounded in emotional design.

7.5.2 Potential for Cross-Disciplinary Collaboration

Social Health and Public Morality

One point of contention is that the influence of psychological factors is not always beneficial. The definition and research of gaming addiction in the field of Internet psychology is often controversial. Although this study itself does not hold any moral judgments or opinions on high-viscosity game participation, future research directions can explore whether this model can be applied to the control and regulation of players' participation in moderation from a psychological perspective, based on public moral considerations.

Based on this premise, to explore in depth the relationship between anxiety and gaming engagement, researchers need to pay further attention to potential social and moral dimensions. For example, as players continue to invest in the drive of anxiety and excitement, it may give rise to the controversy of “overconsumption” or “addiction”. However, there is no unified consensus in academia and the public domain on the definition and diagnosis of “gaming addiction”.

From the perspective of social health and public morality, follow-up research could try to: expand the variables related to moderation and intervention strategies, for example, introducing elements such as “status detection reminders” or “game cooling-off periods” into the experimental design, and assessing whether such functions can effectively reduce the long-term addiction risks of highly anxious players through behavioral feedback. Due to funding constraints in this experiment, it was not possible to introduce sufficient physiological monitoring equipment.

Future research that can obtain sufficient funding support can consider combining physiological and mental health indicators, as well as more emotional and neurological indicators, to examine early warnings of gaming addiction or symptoms such as depression, mania, and attention disorders, in order to provide scientific reference for designing “experience optimization guidance mechanism” strategies that promote physical and mental health.

Neurophysiological Collaboration

As researcher mentioned in limitation section, this study has the potential for interdisciplinary collaboration style long-term longitudinal research. Future research could explore whether neurophysiological indicators (such as brain waves and electrodermal activity) can more accurately monitor the borderline state between anxiety and “excitement” in players, and assess the potential impact of long-term gaming interventions on players’ mental health. Longitudinal tracking could be implemented for up to several months, collecting data on players at different stages from “novice” to “veteran” to observe how anxiety and engagement evolve. and at certain points in time, a “de-anxiety” design will be implemented to explore the topic in greater depth from the perspectives of medicine, neuroscience, and cognitive behavior, as well as research and exploration of therapeutic interventions and prognostic measures.

On the other hand, collaboration with the fields of public policy and ethics is also possible, expanding the model to a more macroscopic sociological and legal level, and exploring in depth the balance between marketing and social responsibility for game designers: how to use anxiety as a stimulus without violating ethics or triggering reverse public opinion pressure Or explore whether regulatory authorities or educational institutions can use similar principles to design “moderate gaming” or “youth protection” intervention mechanisms (Cheng 2025), and whether it is reasonable to adopt such measures, whether it properly protects the rights and interests of young people and players or whether there is excessive regulation and infringement of citizens’ privacy (Zhao 2011).

For example, Tencent’s MOBA Game King of Glory will automatically trigger friendly restrictions or reminders based on player behavior monitoring and user profile information and enables the facial recognition function. The system applies for permission to use the device’s camera/webcam through the WeChat or QQ application, and compares the user’s real facial information with the data from the authoritative public security platform to ensure account security and compliance with the anti-addiction regulations. Users who are rejected or fail the verification will be considered minors aged 12 and under and will be subject to corresponding anti-addiction supervision.³ .

In summary, future research should not only focus on how to enhance user

immersion and psychological experience, but also consider the dual demands of social public morality and players' physical and mental health. Existing models should be deepened and expanded through more diverse research methods and longer-term, cross-disciplinary collaborations, and improved in a more practical way. This will enable the topic to reveal the complex impact of negative emotions such as anxiety on player behavior at the theoretical level, and also provide more directional and purposeful references for the "optimization of the gaming experience" and commercial design ideas suitable for the public at the practical level.

7.5.3 Enhancing Beginner Accessibility

To improve accessibility and ease of use, future improvements may include the following:

Interactive tools for emotional curve simulation: Visual and interactive simulation tools—such as a simple browser-based "Anxiety Curve Simulator"—could allow designers to visualize the evolving trajectory of tension, buffering, and release throughout gameplay. These tools would help users better understand the pacing effects created by combinations of Anxiety Driver (AD) and Adjustment Tools (AT), and reduce confusion during implementation.

Suggested design preset templates for different game types: The ATEO guidelines could also include preset templates (or starting examples) that match different types of games—for example, narrative-based games, exploration-heavy games, or games with complex mechanics. These example-based settings would help beginners start more easily by following clear references, instead of feeling lost or overwhelmed by too many options.

These improvements may help early-stage designers reduce cognitive load and improve design efficiency, making the ATEO model easier to apply while still maintaining its flexibility and depth.

7.5.4 Optimizing with PSR-based Design

In response to the limitation that ATEO does not show a clear improvement over the NI model, future work can explore the integration and optimization of

PSR-based Adjustment Tools (AT) within the ATEO model, and conduct further design testing based on the proven advantages of narrative immersion.

Possible approaches include exploring new design methods that promote player emotional engagement, such as enhancing the interactive linkage between audiovisual elements and game mechanics, adopting real-time dynamic narrative strategies, or implementing parallel alternate reality game-style character design and interaction.

Overall, the future direction can focus on establishing stronger player-character connections by increasing the level of players' emotional arousal. This can be realized by strengthening the PSR component within ATEO, including buffering and accelerator functions in the AT modules, or by adding more AT tools on this basis. The goal is to achieve a stronger and more stable performance improvement compared to traditional NI, which can be tested in game prototypes with already high levels of narrative immersion.

Notes

- 1 <https://www.edutopia.org/article/student-engagement-dimensions/>
- 2 <https://theflexiblechef.com/finding-flow-sweet-spot-between-boredom-anxiety/>
- 3 <https://theflexiblechef.com/finding-flow-sweet-spot-between-boredom-anxiety/>
- 4 <https://gameworldobserver.com/2020/09/07/female-oriented-games-can-gold-mine/>
- 1 <https://sdlccorp.com/post/fantasy-game-lore-how-storytelling-enhances-player-engagement/>
- 2 <https://polydin.com/game-art-in-player-engagement/>
- 3 <https://rule.tencent.com/rule/d277ee20-2709-4cd5-882b-cbd485753346>

References

- Abbasi, A.Z. et al. (2019) “An empirical validation of consumer video game engagement: A playful consumption experience approach,” *Entertainment Computing*, Vol. 29, pp. 43–55.
- Abdullah, D and Y Sai (2023) “Flap to Freedom: The Endless Journey of Flappy Bird and Enhancing the Flappy Bird Game Experience.,” *FMDB Transactions on Sustainable Computer Letters*, Vol. 1, No. 3, pp. 178–191.
- Adams, Ernest (2010) *Fundamentals of Game Design*, Upper Saddle River, NJ: Prentice Hall, 2nd edition.
- Al-Nawasreh, S. and A. Andersson (2022) “When you wish upon a character banner: An exploratory discourse analysis of a genshin impact player community,” *Uppsala University*.
- Alavesa, Paula, Niklas Ravaja, Giulio Jacucci, and Juho Hamari (2019) “Juicy Game Design: Understanding the Impact of Visual Embellishments on Player Experience,” in *Proceedings of CHI PLAY 2019*, pp. 1–12.
- Alexiou, A. and M.C. Schippers (2018) “Digital game elements, user experience and learning: A conceptual framework,” *Educ Inf Technol*, Vol. 23, p. 2545–2567.
- Anderson, Craig, Nicholas Carnagey, Mindy Flanagan, A. Benjamin Jr, Janie Eubanks, and Jeffrey Valentine (2004) “Violent Video Games: Specific Effects of Violent Content on Aggressive Thoughts and Behavior,” *Advances in Experimental Social Psychology*, Vol. 36.
- Anderson, James C and David W Gerbing (1988) “Structural equation modeling in practice: A review and recommended two-step approach.,” *Psychological bulletin*, Vol. 103, No. 3, p. 411.

- Andreean, Adam Fawazzaky Fardy, Muhammad Faridz Anugrah, and Cuk Tho (2023) “Exploring of Emotional Character in Online Games Toward Player,” *Procedia Computer Science*, Vol. 227, pp. 743–752.
- Asbjørn, J (2010) “The Development of MMORPG Culture and The Guild,” *Australian Folklore: A Yearly Journal of Folklore Studies*, Vol. 25, pp. 97–112.
- Attrill, A. (2015) *Cyberpsychology*, Oxford, UK: Oxford University Press.
- Awada, Mohamad, Burcin Becerik Gerber, Gale M Lucas, and Shawn C Roll (2024) “Stress appraisal in the workplace and its associations with productivity and mood: Insights from a multimodal machine learning analysis,” *Plos one*, Vol. 19, No. 1, p. e0296468.
- Balakrishnan, Janarthanan and Mark D Griffiths (2018) “Loyalty towards online games, gaming addiction, and purchase intention towards online mobile in-game features,” *Computers in Human Behavior*, Vol. 87, pp. 238–246.
- Banks, J. and N. Bowman (2014) “Avatars are (sometimes) people too: Linguistic indicators of parasocial and social ties in player–avatar relationships,” *New Media&Society*, Vol. 28(3), pp. 1257–1276.
- Bartle, Richard (1996) “Hearts, clubs, diamonds, spades: Players who suit MUDs,” *Journal of MUD research*, Vol. 1, No. 1, p. 19.
- Bernhaupt, Eckschlager M. Tscheligi M., R. (2007) “Methods for evaluating games: how to measure usability and user experience in games?” *Proceedings of the International Conference on Advances in Computer Entertainment Technology*, p. 309–310.
- Bernhaupt, R. (2010) *Evaluating User Experience in Games: Concepts and Methods*, London, UK: Springer, London.
- Boothe Jr, Maurice A and Jeffrey S Brennehan (2024) “From Visualizing to Narrativizing: Powerful Data Storytelling through Non-Player Characters,” pp. 162–170.

- Bostan, Barbaros and Sertaç Ögüt (2009) “Game challenges and difficulty levels: lessons learned From RPGs,” pp. 1–11.
- Boyle, E. A. (2012) “Engagement in digital entertainment games: A systematic review,” *Computers in human behavior*, Vol. 28(3), pp. 771–780.
- Brockmyer, Fox C. M. Curtiss K. A. McBroom E. Burkhart K. M. Pidruzny J. N., J. H. (2009) “The development of the Game Engagement Questionnaire: A measure of engagement in video game-playing,” *Journal of Experimental Social Psychology*, Vol. 45(4), pp. 624–634.
- Brühlmann, Florian (2013) “Gamification from the Perspective of Self-Determination Theory and Flow,” Ph.D. dissertation, University of Basel.
- Cai, Xiaowei, Javier Cebollada, and Mónica Cortiñas (2022) “A grounded theory approach to understanding in-game goods purchase,” *PLoS One*, Vol. 17, No. 1, p. e0262998.
- Calleja, Gordon (2011) *In-Game: From Immersion to Incorporation*, Cambridge, MA: MIT Press.
- Chen, Jenova (2007) “Flow in games (and everything else),” *Commun. ACM*, Vol. 50, No. 4, p. 31–34.
- Chen, Xieling, Di Zou, Lucas Kohnke, Haoran Xie, and Gary Cheng (2021) “Affective states in digital game-based learning: Thematic evolution and social network analysis,” *PloS one*, Vol. 16, No. 7, p. e0255184.
- Cheng, S. (2025) “A Study on the Influence and Psychological Mechanism of Violent Video Games on Adolescent Aggression,” *Advances in Social Sciences*, Vol. 14, p. 47.
- Chess, Shira (2014) “Strange bedfellows: Subjectivity, romance, and hidden object video games,” *Games and Culture*, Vol. 9, No. 6, pp. 417–428.
- Cheung, M.K. et al. (2015) “Promoting sales of online games through customer engagement,” *Electronic Commerce Research and Applications*, Vol. 14(4), p. 241–250.

- Chou, Ssu-Yun, Wooyoung Jang, Shang Chun Ma, Ching-Hung Chang, and Kevin K Byon (2023) "Is mobile gaming a new pillar of esports? Exploring players' in-game purchases in PC and mobile platforms by using flow and clutch," *International Journal of Sports Marketing and Sponsorship*, Vol. 24, No. 2, pp. 311–332.
- Chou, Ting-Jui and Chih-Chen Ting (2003) "The role of flow experience in cyber-game addiction," *CyberPsychology & Behavior*, Vol. 6, No. 6, pp. 663–675.
- Chu, Yang X. Li Y. Lei L., X. (2018) "The Relationship between Perceived Usefulness and Consuming Willingness of Virtual Goods in Online Games: A Moderated Mediating Model," *Chinese Journal of Clinical Psychology*, Vol. 2020(28), pp. 1013–2020.
- Cleghorn, J and Mark Griffiths (2015) "Why do gamers buy "virtual assets"? An insight in to the psychology behind purchase behavior," *Digital Education Review*, Vol. 27, pp. 98–117.
- Cochran, William Gemmell (1977) *Sampling techniques*: John Wiley & Sons.
- Copeland, A. (2011) *Gamer Escape Interviews Naoki Yoshida- "The Truth Is Out There!"*, Vancouver, British Columbia, Canada: Game Escape.
- Csikszentmihalyi, Mihaly (1990) *Flow: The psychology of optimal experience*, Vol. 1990: Harper & Row New York.
- Dawkins, Richard (1981) "Selfish genes and selfish memes," *The mind's I: Fantasies and reflections on self and soul*, pp. 124–144.
- Del Moral Pérez, M. and A. Guzmán Duque (2016) "Social network game: Digital addiction versus communication and interaction in CityVille?" *Cuadernos.info*, Vol. 38, pp. 217–231.
- Deng, Gao J., S. (2015) "Big Five Personality and Impulsive Buying: the Mediation of Self-control and Sensation Seeking," *Chinese Journal of Clinical Psychology*, Vol. 23(6), pp. 1098–1101.
- Dewey, J. (1896) "The Reflex Arc Concept in Psychology," *Psychological Review*.

- Drennan, Penelope, Stephen Viller, and Peta Wyeth (2004) “Engaging game characters: Informing design with player perspectives,” in *Entertainment Computing–ICEC 2004: Third International Conference, Eindhoven, The Netherlands, September 1-3, 2004. Proceedings 3*, pp. 355–358, Springer.
- Elvery, Gabriel (2023) “Undertale’s loveable monsters: Investigating parasocial relationships with non-player characters,” *Games and Culture*, Vol. 18, No. 4, pp. 475–497.
- Emmerich, Katharina, Patrizia Ring, and Maic Masuch (2018) “I’m glad you are on my side: How to design compelling game companions,” in *Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play*, pp. 141–152.
- Eyal, Keren and Jonathan Cohen (2006) “When good friends say goodbye: A parasocial breakup study,” *Journal of Broadcasting & Electronic Media*, Vol. 50, No. 3, pp. 502–523.
- Fancher, R. and A. Rutherford (2012) *Pioneers of Psychology*: Norton.
- Fear, E. (2015) *Final Fantasy XIV Review*: Computer and Vedio Games.com.
- Feil, John and Marc Scattergood (2005) *Beginning game level design*: Thomson Course Technology.
- Ferdig, Pytash K. Muschert G., R. (2017) “The Recursive Relationship between Virtual and Real in Relationships,” *Journal of Virtual Worlds Research*, Vol. 10(2), pp. 1–4.
- Fullerton, Tracy (2014) *Game design workshop: a playcentric approach to creating innovative games*: CRC press.
- Galotti, K. (1994) *Cognitive Psychology: In and Out of the Laboratory*: SAGE Publications, Inc.
- Gee, James Paul (2003) “What video games have to teach us about learning and literacy,” *Computers in entertainment (CIE)*, Vol. 1, No. 1, pp. 20–20.

- Giles, D. (2008) “Parasocial interaction: current directions in theory and method. Paper presented as part of the symposium with stars in their eyes: Investigating star- audience relations,” *ECREA 2nd European Communication conference*, Vol. 445(7123).
- Giles, D. (2010) *Psychology of the Media*, New York, NY, US: Palgrave Macmillan.
- Giles, D. C. (2002) “Parasocial interaction: A review of the literature and a model for future research,” *Media Psychology*, Vol. 4(3), pp. 279–305.
- Godde, Godde (2014) *Mathematical balance metrics in competitive multiplayer games*: Stockholm University.
- Gong, An-Di and Yi-Ting Huang (2023) “Finding love in online games: Social interaction, parasocial phenomenon, and in-game purchase intention of female game players,” *Computers in Human Behavior*, Vol. 143, p. 107681.
- Gong, An-Di, Yi-Ting Huang, Keren Liu, and Kazunori Sugiura (2024) “Getting hooked on mobile games: Strengthening purchase intentions towards mobile games using investment model and parasocial interactions,” *Mobile Media & Communication*, Vol. 13, No. 1, pp. 47–68.
- Graham, S. (2012) *Super Hexagon review*: PC Gamer.
- Greene, Cohen D. Siskowski C. Toyinbo P., J. (2017) “The relationship between family caregiving and the mental health of emerging young adult caregivers,” *The Journal of Behavioral Health Services & Research*, Vol. 44(4), pp. 551–563.
- Greeno, J. G. and Smith D. R. Moore, J. L. (2018) *Transfer on trial: Intelligence, cognition, and instruction*, New York City, NY, USA: Ablex Publishing, pp.99–167.
- Guillen, Georgina, Henrietta Jylhä, and Lobna Hassan (2021) “The role sound plays in games: a thematic literature study on immersion, inclusivity and accessibility in game sound research,” in *Proceedings of the 24th International Academic Mindtrek Conference*, pp. 12–20.

- Hamari, Juho, Lauri Keronen, and Kati Alha (2015) “Why do people play games? A review of studies on adoption and use,” in *2015 48th Hawaii International conference on system sciences*, pp. 3559–3568, IEEE.
- Herzog, H. (1944) “What do we really know about daytime serial listeners,” *Radio research*, Vol. 1943, pp. 3–33.
- de Hessel, L.C. et al. (2021) “The associations between big five personality traits, gaming motives, and self-reported time spent gaming,” *Personality and Individual Differences*, Vol. 171, p. 110483.
- Ho, Adam (2014) “The value of being powerful or beautiful in games—how game design affects the value of virtual items,” *The Computer Games Journal*, Vol. 3, pp. 54–61.
- Hong, Jon-Chao, Ming-Yueh Hwang, Kai-Hsin Tai, Yen-Chun Kuo, and Pei-Chun Lin (2017) “Confusion affects gameplay,” *Learning and Individual Differences*, Vol. 59, pp. 119–126.
- Horton, Wohl R., D. (1956) “Mass communication and para-social interaction: Observation on intimacy at a distance,” *Psychiatry*, Vol. 19, pp. 215–229.
- Hsiao, Kuo-Lun and Chia-Chen Chen (2016) “What drives in-app purchase intention for mobile games? An examination of perceived values and loyalty,” *Electronic commerce research and applications*, Vol. 16, pp. 18–29.
- Hua, Shaoqi and Chengli Xiao (2023) “What shapes a parasocial relationship in RVGs? The effects of avatar images, avatar identification, and romantic jealousy among potential, casual, and core players,” *Computers in Human Behavior*, Vol. 139, p. 107504.
- Hunicke, Robin, Marc LeBlanc, Robert Zubek et al. (2004) “MDA: A formal approach to game design and game research,” Vol. 4, No. 1, p. 1722.
- Jacob Jacoby, Robert W. Chestnut (1978) *Brand Loyalty, Measurement and Management.*: J. Wiley and Sons.
- Jesse, S. (2019) *The Art of Game Design*, Boca Raton, FL, USA: CRC Press.

- Johannes, Vuorre M., N. and A.K. Przybylski (2021) “Video game play is positively correlated with well-being,” *Royal Society Open Science*, Vol. 8(2).
- Juul, J. (2013) *The Art of Failure: An essay on the pain of playing video games*: The MIT press.
- Juul, Jesper and Jason Begy (2016) “Good Feedback for Bad Players? A Preliminary Study of ‘Juicy’ Interface Feedback,” in *Proceedings of the 1st Joint Conference of DIGRA and FDG*.
- Katz, Blumler J. G. Gurevitch M., E. (1974) “Uses and gratifications research,” *Public Opinion Quarterly*, Vol. 37(4), pp. 509–523.
- Kauppinen, Noora (2023) “” It was somewhat like a mental breakdown.” – Navigating Cognitive Dissonance in Life is Strange: The Influence of Parasocial Relationships and Immersion on Players’ Perceptions,” Master’s thesis, Itä-Suomen yliopisto.
- Khoshnoud, Shiva, Federico Alvarez Igarzábal, and Marc Wittmann (2020) “Peripheral-physiological and neural correlates of the flow experience while playing video games: a comprehensive review,” *PeerJ*, Vol. 8, p. e10520.
- Klimmt, Christoph, Tilo Hartmann, and Holger Schramm (2013) “Parasocial interactions and relationships,” in *Psychology of entertainment*: Routledge, pp. 291–313.
- Koffka, K. (1935) *Principles of Gestalt psychology*, San Diego, CA, USA: Harcourt, Brace.
- Kou, Yue (2023) “An Analysis of Character Design in Video Games,” *Communications in Humanities Research*, Vol. 14, pp. 186–191.
- Kuntjara, Hagung, Betha Almanfaluthi et al. (2017) “Character design in games analysis of character design theory,” *Journal of Games, Game Art, and Gamification*, Vol. 2, No. 2.
- Lankoski, Petri (2004) “Character design fundamentals for role-playing games,” *Beyond Role and Play*, pp. 139–148.

- Lapaš, T. and T. Orehovački (2015) "Evaluation of User Experience in Interaction with Computer Games," *Design, User Experience, and Usability: Interactive Experience Design*, Vol. 9188.
- Li, Wang X., H. (2021) "Cyber-personality and liking expression: A study from WeChat users in China," *Frontiers in Psychology*.
- Liao, Gen-Yih, Thi Tuan Linh Pham, Hsin-Yi Huang, TCE Cheng, and Ching-I Teng (2022) "Real-world demotivation as a predictor of continued video game playing: A study on escapism, anxiety and lack of intrinsic motivation," *Electronic Commerce Research and Applications*, Vol. 53, p. 101147.
- Liebert, Robert M and Larry W Morris (1967) "Cognitive and emotional components of test anxiety: A distinction and some initial data," *Psychological reports*, Vol. 20, No. 3, pp. 975–978.
- Lindorfer, B. (2021) "Personality Theory in Gestalt Theoretical Psychotherapy: Kurt Lewin's Field Theory and his Theory of Systems in Tension Revisited," *Gestalt Theory*, Vol. 43(1), pp. 29–46.
- Liu, K. (2019) "Virtual celebrities in Onmyoji: A quantitative research of parasocial interaction theory," *The 8th ACG international conference*.
- Loton, Daniel, Erika Borkoles, Dan Lubman, and Remco Polman (2016) "Video game addiction, engagement and symptoms of stress, depression and anxiety: The mediating role of coping," *International Journal of Mental Health and Addiction*, Vol. 14, No. 4, pp. 565–578.
- Lucas, Kristen and John L. Sherry (2004) "Sex differences in video game play: A communication-based explanation," *Psychiatry*, Vol. 31(5), pp. 499–523.
- Luo, Feng, Jiaqi Chen, and Tiantong Xu (2023) "Optimal strategy of in-game items with conspicuous consumption: whether to provide the grinding version?" *Frontiers in Psychology*, Vol. 14, p. 1259319.
- Makwana, Kirti and Dr Govind B Dave (2020) "Confirmatory factor analysis of Neris Type Explorer® scale—a tool for personality assessment," *International Journal of Management*, Vol. 11, No. 9.

- Maslow, A. (1943) “A theory of human motivation,” *Psychological Review*, Vol. 50(4), pp. 370–396.
- Michailidis, Lazaros, Emili Balaguer-Ballester, and Xun He (2018) “Flow and immersion in video games: The aftermath of a conceptual challenge,” *Frontiers in psychology*, Vol. 9, p. 1682.
- Milman, Daisy and Devin Mills (2023) “The relationship between parasocial friendship quality with non-playable video game characters, gaming motivations, and obsessive vs harmonious passion,” *Telematics and Informatics Reports*, Vol. 10, p. 100057.
- Mora-Cantallos, M. (2018) “MOBA games: A literature review,” *Entrainment Computing*, Vol. 26, pp. 128–138.
- Murray, Janet H. (1997) *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*, Cambridge, MA: MIT Press.
- Nacke, Lennart and Craig A Lindley (2008) “Flow and immersion in first-person shooters: measuring the player’s gameplay experience,” in *Proceedings of the 2008 conference on future play: Research, play, share*, pp. 81–88.
- Naul, Emily and Min Liu (2020) “Why story matters: A review of narrative in serious games,” *Journal of Educational Computing Research*, Vol. 58, No. 3, pp. 687–707.
- Nielsen (2018) *U.S. Games 360 Report: 2018*, US: Nielsen.
- Nordin, Denisova A. Cairns P., A.I. (2014) “Too many questionnaires: measuring player experience whilst playing digital games,” p. 69–74.
- O’ Brien, H. (2008) “What is user engagement? A conceptual framework for defining user engagement with technology.”
- Oliver, Richard L (1999) “Whence consumer loyalty?” *Journal of marketing*, Vol. 63, No. 4_suppl1, pp. 33–44.

- Orji, Rita and Karyn Moffatt (2018) “Persuasive technology for health and wellness: State-of-the-art and emerging trends,” *Health informatics journal*, Vol. 24, No. 1, pp. 66–91.
- Park, Hyemin and Gapyuel Seo (2019) “A study on game character design based on mythical motif-focused on league of legends,” *Journal of Digital Contents Society*, Vol. 20, No. 12, pp. 2329–2340.
- Parsons, T. (2019) *Ethical Challenges in Digital Psychology and Cyberpsychology*, UK: Cambridge University Press.
- Polger, Thomas W. (2012) “Functionalism as a philosophical theory of the cognitive sciences,” *Wires cognitive science*, Vol. 3(3).
- Polster, Erving and Miriam Polster (1973) *Gestalt therapy integrated: Contours of theory and practice*, New York, USA: Brunner/Mazel.
- Poropat, A. (2009) “A meta-analysis of the five-factor model of personality and academic performance,” *Psychological Bulletin*, Vol. 135(2), pp. 322–338.
- Qiu, H., J. Jiao, and M. Wan (2023) “Analysis of the game ”Sheep a Sheep” in the context of the theory of mind flow,” *Youth Journalist*, Vol. 8, pp. 62–64.
- Reinecke, Hartmann T., L. and A. Eden (2014) “The Guilty Couch Potato: The Role of Ego Depletion in Reducing Recovery Through Media Use,” *Journal of Communication*, Vol. 64(4), pp. 569–589.
- Roccas, S. et al. (2002) “The big five personality factors and personal values,” *Personality and Social Psychology Bulletin*, Vol. 28(6), pp. 789–801.
- Rocha, Andreia (2023a) “Analyzing the impact of character animations on gameplay styles and player perception.”
- Rocha, Andreia (2023b) “Analyzing the impact of character animations on gameplay styles and player perception,” *Turku University of Applied Sciences*.

- Rogers, Katja, Sukran Karaosmanoglu, Maximilian Altmeyer, Ally Suarez, and Lennart E Nacke (2022) “Much realistic, such wow! a systematic literature review of realism in digital games,” in *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*, pp. 1–21.
- Rogers, Scott (2014) *Level Up! The guide to great video game design*: John Wiley & Sons.
- Rothmund. T., Bender. J., Gollwitzer. M. and Klimmt. C. (2015) “Short- and Long-Term Effects of Video Game Violence on Interpersonal Trust,” *Media Psychology*, Vol. 18(1), pp. 106–133.
- Rubin, Alan M and Elizabeth M Perse (1987) “Audience activity and soap opera involvement a uses and effects investigation,” *Human communication research*, Vol. 14, No. 2, pp. 246–268.
- Rubin, Alan M, Elizabeth M Perse, and Robert A Powell (1985) “Loneliness, parasocial interaction, and local television news viewing,” *Human communication research*, Vol. 12, No. 2, pp. 155–180.
- Salen Tekinbas, Katie and Eric Zimmerman (2003) *Rules of play: Game design fundamentals*: MIT Press.
- Schell, Jesse (2008) *The Art of Game Design: A book of lenses*: CRC press.
- Schroeder, Axelsson A., R. (2006) “Avatars at Work and Play: Collaboration and Interaction in Shared Virtual Environments,” *The Psychology of MMORPGs: Emotional Investment, Motivations, Relationship Formation, and Problematic Usage*, pp. 187–207.
- Sherry, J. (2004) “Flow and media enjoyment,” *Communication Theory*, Vol. 38, pp. 217–231.
- e Silva, Adriana de Souza and Ragan Glover-Rijkse (2020) *Hybrid play: Crossing boundaries in game design, players identities and play spaces*: Routledge.
- Slater, Mel, Angus Antley, Adam Davison, David Swapp, Christoph Guger, Chris Barker, Nancy Pistrang, and Maria V Sanchez-Vives (2006) “A virtual

- reprise of the Stanley Milgram obedience experiments,” *PloS one*, Vol. 1, No. 1, p. e39.
- Song, W. and J. Fox (2015) “Playing for Love in a Romantic Video Game: Avatar Identification, Parasocial Relationships, and Chinese Women’s Romantic Beliefs,” *Mass Communication and Society*, Vol. 19(2), pp. 197–215.
- Spielberger, C.D. (1988) *Manual for the State-Trait Anger Expression Inventory*, Odessa, FL, US: Psychological Assessment Resources.
- Spielberger, Gorsuch R. Lushene R. Vagg P. Jacobs G., C. (1983) *Manual for the State-Trait Anxiety Inventory*, Palo Alto, CA, US: Consulting Psychologists Press.
- Stanley, J. B. and Dennis K. D. (2015) *Mass Communication Theory: Foundations, Ferment, and Future.*: Oxford University Press.
- Sternberg, K., J. Sternberg (1973) *Cognitive Psychology (6th ed.)*, Belmont, CA, USA: Cengage Learning.
- Sutcliffe, A. (2010) *Designing for user engagement: Aesthetic and attractive user interfaces*, San Rafael, CA, US: Morgan & Claypool Publishers.
- Swink, Steve (2009) *Game Feel: A Game Designer’s Guide to Virtual Sensation*, Burlington, MA: CRC Press / Morgan Kaufmann.
- Sylvester, C. (2013) “Experiencing the end and afterlives of International Relations/Theory,” *European Journal of International Relations*, Vol. 19(3), pp. 609–626.
- Takatalo, Kawai T. Kaistinen J. Nyman G., J. and J. Häkkinen (2011) “User Experience in 3D Stereoscopic Games,” *Media Psychology*, Vol. 14(4), pp. 387–414.
- Tompkins, Jessica E and Nicole Martins (2022) “Masculine pleasures as normalized practices: Character design in the video game industry,” *Games and Culture*, Vol. 17, No. 3, pp. 399–420.

- Tukachinsky, Riva and Robert S Tokunaga (2013) “10 The effects of engagement with entertainment,” *Annals of the International Communication Association*, Vol. 37, No. 1, pp. 287–322.
- del Valle-Canencia, Marta, Carlos Moreno Martínez, Rosa-María Rodríguez-Jiménez, and Ana Corrales-Paredes (2022) “The emotions effect on a virtual characters design—A student perspective analysis,” *Frontiers in Computer Science*, Vol. 4, p. 892597.
- Vandewalle, Alexander, Steven Malliet, and Kristoffel Demoen (2024) “Playing with character: a framework of characterization in video games,” *Games and Culture*, Vol. 19, No. 6, pp. 722–742.
- Voimala, Jesse (2023) “Creating a Video Game Character Design Workflow: a literature review on the theories and methods used by professionals in video game character design.”
- Wang, Chih-Mei, Jon-Chao Hong, Jian-Hong Ye, and Jhen-Ni Ye (2022) “The relationship among gameplay self-efficacy, competition anxiety, and the performance of eSports players,” *Entertainment Computing*, Vol. 42, p. 100489.
- Wilhelmsson, Ulf, Wei Wang, Ran Zhang, and Marcus Toftedahl (2022) “Shift from game-as-a-product to game-as-a-service research trends,” *Service Oriented Computing and Applications*, Vol. 16, No. 2, pp. 79–81.
- Williams, D. (2006) “Groups and Goblins: The Social and Civic Impact of an Online Game,” *Journal of Broadcasting & Electronic Media*, Vol. 50(4), pp. 651–670.
- Wirth, Hartmann-T., W. (2007) “A Process Model of the Formation of Spatial Presence Experiences,” *Media Psychology*, Vol. 9(3), pp. 493–525.
- Woods, Orlando (2022) “The economy of time, the rationalisation of resources: Discipline, desire and deferred value in the playing of gacha games,” *Games and Culture*, Vol. 17, No. 7-8, pp. 1075–1092.

- Yang, P. (2014) "Identifying Patterns in Combat that are Predictive of Success in MOBA Games," *Proceedings of the Foundations of Digital Games 2014 Conference*.
- Yee, Nick (2006) "Motivations for play in online games," *CyberPsychology & behavior*, Vol. 9, No. 6, pp. 772–775.
- Yerkes, Robert M, John D Dodson et al. (1908) "The relation of strength of stimulus to rapidity of habit-formation," *Journal of comparative neurology and psychology*, Vol. 18, No. 5, pp. 459–482.
- Yu, F. and W. Xue (2018) "Study on buying intention of virtual props in mobile online games," *Modern Communication*, Vol. 22, pp. 114–116.
- Zhang, C. (2016) "Loving Boys Twice as Much: Chinese Women's Paradoxical Fandom of "Boys' Love" Fiction," *Women's Studies in Communication*, Vol. 39, pp. 249–267.
- Zhao, Y. (2011) "Controversy in Negative Effects of Video Games," *Advances in Psychological Science*, Vol. 19, No. 12, pp. 1788–1797.
- Zheng, R. and M.K. Gardner (2017) *Handbook of Research on Serious Games for educational applications*, Hershey, PA: Information Science Reference.
- Zheng, Robert and Michael K Gardner (2016) *Handbook of research on serious games for educational applications*: IGI Global.
- Zufri, Tubagus, Dodi Hilman, Octavianus Frans et al. (2022) "Research on the application of pixel art in game character design," *Journal of Games, Game Art, and Gamification*, Vol. 7, No. 1, pp. 27–31.
- Zung, W. K. (1971) "A rating instrument for anxiety disorders," *Psychosomatics*.

Appendices

A. Semi-Structure Interview Outline for Pre-tests

1. How do you know this game?
2. What's your motivation to play this game?
3. How do you feel about the quality of this game? Please rate this game on a scale, 1 for the lowest and 10 for the highest.
4. What difficulties did you encounter during the game? (e.g. problems stemming from the game itself, unpleasant experiences between players in the game)
5. How do you think and feel about these experiences?
6. What did you do when you face these difficulties/dilemmas/unpleasant experience? Why?
7. Here is your personality test result. Is there any differences between your personality in the game world and your personality in the real world? Please describe with details.
8. What do you think is the cause of this phenomenon?
9. Do you think other people's impression of you is biased from your own description?
10. What do you think is the reason?
11. When you have a bad experience in a game, does it affect your real life?
12. Have you ever given someone an unpleasant experience in the game? What is the reason for this?

B. Measurement Questionnaire

B.1 Game Engagement

Cognition Engagement

1. My attention is always highly concentrated when playing game.
2. I experience the highest enjoyment when playing game.
3. Time goes by very quickly when playing game
4. I tend to forget where I am when playing game.
5. I thirst for more information about game.

Affective Engagement

6. This game is my first choice.
7. I will continue to play this game.
8. I am willing to say positive things about this game to others.
9. If others want to play a mobile game, I will recommend this game.
10. I will encourage friends and relatives to play this game.
11. I find this media figure to be attractive.
12. The media figure makes me feel comfortable, as if I am with a friend.
13. I see this media figure as a natural, down-to-earth person.
14. I would like to meet this media figure in person.
15. I look forward to seeing this media figure in the new game episodes.
16. If this media figure appeared in another game, I would play that game.
17. If I saw a story about this media figure in a newspaper, magazine, or social network services I would read it.
18. This media figure seems to understand the kinds of things I want to know.
19. I miss seeing the media figure when he or she is absent.

Behavioral Engagement

20. I intend to continue purchasing game or in-game items.
21. I strongly recommend others to purchase game or in-game items.
22. I find purchasing game or in-game items to be worthwhile.
23. In future, I am likely to frequently purchase game or in-game items.

24. In future, I plan to spend more on game or in-game items.

B.2 Anxiety

While playing this game...

1. I felt calm.(R)
2. I felt secure.(R)
3. I felt tense.
4. I feel strained.
5. I felt at ease.(R)
6. I felt upset.
7. I was presently worrying over possible misfortunes.
8. I felt satisfied.(R)
9. I felt frightened.
10. I felt uncomfortable.
11. I felt self confident.(R)
12. I felt nervous.
13. I felt jittery.
14. I felt indecisive.
15. I was relaxed.(R)
16. I felt content.(R)
17. I was worried.
18. I felt confused.
19. I felt steady.(R)
20. I felt pleasant.(R)

B.3 Personality Preference

1. You regularly make new friends.
2. You find the idea of networking or promoting yourself to strangers very daunting.(R)
3. You feel comfortable just walking up to someone you find interesting and striking up a conversation.
4. You enjoy participating in team-based activities.

5. You enjoy solitary hobbies or activities more than group ones.(R)
6. You usually wait for others to introduce themselves first at social gatherings.(R)
7. You usually prefer to be around others rather than on your own.(R)
8. Your friends would describe you as lively and outgoing.
9. You avoid making phone calls.(R)
10. You can easily connect with people you have just met.
11. You feel more drawn to busy, bustling atmospheres than to quiet, intimate places.
12. You would love a job that requires you to work alone most of the time.(R)

C. Cyan Bird Narrative Design

Narrative Background

Humanity once violated a forbidden law and was granted the eternity it so long desired. But only when death ceased to be the end did people come to despairingly realize that—even when the body decays into dust—each soul blessed with immortality is doomed to merely “exist.” Sensory perception gradually faded. Consciousness spiraled into madness within the void of endless life, until it became numb to all things, trapped in eternal longevity.

Those whose bodies had yet to decay feared such a future. In an effort to undo the curse of immortality, they injected reversal factors into experimental subjects known as “Cyan Birds.” Yet, there is no life without cost, and no death without price.

The Cyan Birds were given eternal bodies—but with them came infinitely heightened senses. Their fragile souls could not withstand the overwhelming onslaught of sensation, and one generation after another of Cyan Birds perished swiftly. Humans could not endure loneliness, nor bear the pain of forgetting. No one could accept that their yearning would be lost to nothing. So those who had lost their loved ones in eternity constructed the **Quanxin Tree**—a cybernetic monument that recorded everything about the Cyan Birds.

Glossary

Cyan Bird Humans who became experimental subjects. Historical records indicate that Cyan Birds lived approximately one-tenth the lifespan of ordinary humans. Their bodies were flawless and immortal, but their minds and souls were incredibly fragile. After a short period of brilliance, they would be tormented by overstimulation of the senses and perish as their consciousness faded. Within the Quanxin Tree system, they are symbolized as fluttering blue birds.

Quanxin Tree The tomb—and homecoming place—of the Cyan Birds. A cybernetic monument forged from the soul of an immortal who willingly sacrificed their own consciousness. It replicated the memories of all experimental subjects, becoming their eternal resting place. People believe that as long as the Quanxin Tree endures, the Cyan Birds will never truly disappear—even if it takes countless epochs, they will one day be reunited with their eternal loved ones. It is called “the world tree where Cyan Bird souls may rest.”

Game Scene

In the end, humanity failed to find a perfect path to eternal life. As all physical bodies decayed, the replicated Cyan Birds remained imprisoned within the Quanxin Tree. No consciousness could touch another. They drifted endlessly in silence, repeating their longing for loved ones over and over—without pause, even beyond the destruction of the world.

To this day, Cyan Birds still beat their wings and soar, Still seeking, still searching— Searching for the path toward true **existence**.

Chapter: “To the Pioneer”

That birdlike young man came again. It was near the end of a long spring when the gardener saw him once more. The young man held a small bouquet of flowers, nodding politely in greeting. The gardener, struggling to move joints that had grown increasingly stiff, tried to speak with fiber-worn vocal cords—but the young man passed by, as if unaware. His steps always carried a light bounce, radiant with vitality. In this world worn down by age and fatigue, his every glance sparkled like the morning star at dawn. He stood beneath the shadow of lush leaves and

whistled quietly. Sunlight filtered through the branches, illuminating his shoulders and hair with an amber glow.

The little birds descended from the trees, singing as they settled in his shadow. Whenever he came, he was never alone—always surrounded by birds. Of all who came to the Quanxin Tree, he brought the most offerings. Others who visited were worn and numb, their inorganic eyes filled with dried-up tears. They collapsed under the tree, kneeling in silent prayer—sometimes with more sincerity than even the holiest rituals. They bowed their heads again and again, violently striking the ground until it was stained with thin blood. The gardener had seen many who seemed desperate to destroy their already decaying bodies. Pain was something long forgotten. The balance of life without death was shattered—they were all sliding toward the abyss of unconsciousness.

From the branches descended a shimmer of blue—a metallic bird with a faint song that could never drown out the mournful weeping of those who once loved. But the young man never cried. He only smiled—always beautifully, always completely. Like all Cyan Birds, he was stunning.

Before leaving, he would always tear the flowers apart petal by petal, scattering them into the pond. The gardener recalled how things had changed over the years. The world had grown older and more brittle. The young man came less often—but each time, more and more birds accompanied him.

This was the largest gathering yet. The Cyan Birds overlapped in the dim light, but their songs faltered, rising and falling only to be broken. Each note sank like a stone into water, disappearing without echo.

The world was dying, slowly and unevenly—trying to catch up to those who had already left. But there is no exit from life. The pioneers could not find it. Those who stayed behind are no different.

The young man remained silent. His steps grew lighter, like a dance, instinctively responding to songs he could no longer hear. The shadows multiplied, crying in sorrow, smiling in pity. The Cyan Birds flapped their wings and soared—fluttering and scattering, like flocks of glowing crimson butterflies in the wind.