ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

TRANSFORMING STRUCTURES INTO INTERACTIVE EXPERIENCES: GENERATIVE FRAMEWORKS

M.Sc. THESIS

Duygu NARDERELİ

Department of Game and Interaction Technologies

Game and Interaction Technologies Programme

JUNE 2024

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

TRANSFORMING STRUCTURES INTO INTERACTIVE EXPERIENCES: GENERATIVE FRAMEWORKS

M.Sc. THESIS

Duygu NARDERELİ
(529211005)

Department of Game and Interaction Technologies

Game and Interaction Technologies Programme

Thesis Advisor: Assoc. Prof. Dr. Sema ALAÇAM

JUNE 2024

ISTANBUL TEKNİK ÜNİVERSİTESİ ★ LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

YAPILARIN ETKİLEŞİMLİ DENEYİMLERE DÖNÜŞTÜRÜLMESİ: ÜRETKEN ÇERÇEVE ÇALIŞMALARI

YÜKSEK LİSANS TEZİ

Duygu NARDERELİ
(529211005)

Oyun ve Etkileşim Teknolojileri Anabilim Dalı

Oyun ve Etkileşim Teknolojileri Programı

Tez Danışmanı: Doç. Dr. Sema ALAÇAM

HAZİRAN 2024

Duygu Nardereli, a M.Sc. student of İTU Graduate School student ID 529211005, successfully defended the thesis/dissertation entitled “TRANSFORMING STRUCTURES INTO INTERACTIVE EXPERIENCES: GENERATIVE FRAMEWORKS”, which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

Thesis Advisor : **Assoc. Prof. Dr. Sema ALAÇAM** ....
İstanbul Technical University

Jury Members : **Prof. Dr. Leman Figen GÜL** ....
Istanbul Technical University

Assist. Prof. Dr. Emirhan COŞKUN ....
Haliç University

Date of Submission : 24 May 2024
Date of Defense : 27 June 2024

To my son, Devin, who brings endless joy and inspiration into my life,

FOREWORD

I want to express my deepest gratitude to Assoc. Prof. Dr. Sema Alaçam, my thesis advisor, for her invaluable guidance, support, and encouragement throughout the development of this thesis. Her insights and expertise have been instrumental in shaping the direction and execution of my research. I must also extend my thanks to my other half, Egemen, who believes in me and is willing to share his experiences in game design. He has enriched my work and guided me throughout this process. My sincere appreciation goes to my beloved parents and family, who have never let me feel alone. I am grateful to all my friends, especially Alisa, Ateş, Buse, Gamze, and Mert, who participated in the workshops and supported me with their opinions throughout this journey.

Lastly, I would like to thank my dear son, Devin, whose presence has not only brought joy to my life but has also transformed my mindset on life and motivated me to strive to be the best version of myself. I feel incredibly fortunate to have him in my life, and his influence on this thesis cannot be overstated.

May 2024

Duygu NARDERELİ
(Architect)

TABLE OF CONTENTS

Page

FOREWORD ..... **ix**
TABLE OF CONTENTS ..... **xi**
ABBREVIATIONS ..... **xiii**
LIST OF TABLES ..... **xv**
LIST OF FIGURES ..... **xvii**
SUMMARY ..... **xix**
ÖZET ..... **xxi**
1. INTRODUCTION **1**
1.1 Design and Game Design Ontologies 2
1.2 Scope and Motivation of the Thesis 3
1.3 Research Questions 4
2. THE ACT OF DESIGNING: THINKING WITH PROTOTYPES **5**
2.1 Game Design, Design, and Serious Game Frameworks 5
2.2 Redefining Game Components Based on MDA Framework 12
2.2.1 Mechanics 13
2.2.2 Dynamics 17
2.2.3 Aesthetics 20
3. METHODOLOGY **27**
3.1 Data Collection 28
3.2 Analyze Method 29
4. BUILDING A NEW GENERATIVE FRAMEWORK USING BOARD GAME MECHANICS AND MDA FRAMEWORK **31**
4.1 Selection and Classification of the BGG Mechanics 31
4.2 Understanding the Aesthetics Through Mechanics 36
4.2.1 Selection of board games 36
4.2.2 Relation of the aesthetic elements 42
4.3 Designing of the Game Exercises 44
4.3.1 Participants 47
4.3.2 Design workshop 48
4.3.3 Findings and outcomes 56
4.4 Applying the Generative Framework 61
5. CONCLUSIONS & RECOMMENDATIONS **61**
5.1 Constraints 64
5.2 Future Works 65
REFERENCES **67**
APPENDICES **69**
APPENDIX A 70
APPENDIX B 71
CURRICULUM VITAE **75**

ABBREVIATIONS

BGG	**:** BoardGameGeek.com
DDE	**:** Design, Dynamics, and Experience Framework
DPE	**:** Design, Play, and Experience Framework
FBS	**:** Function, Behaviour and Structure Framework
FPS	: First-Person Shooter Game
MDA	**:** Mechanics, Dynamics, and Aesthetics Framework
OOP	**:** Object Oriented Programming

LIST OF TABLES

Page

Table 2.1 : FBS Design Processes **6**
Table 2.2 : MDA Components Description **8**
Table 2.3 : Categorization of the term "Mechanics" according to earlier studies **17**
Table 2.4 : Categorization of the term "Dynamics" according to earlier studies **20**
Table 2.5 : 8 Kinds of Fun **21**
Table 2.6 : 4 Keys to Fun **22**
Table 2.7 : Categorization of the term "Fun" according to earlier studies................ **23**
Table 4.1 : Selected Board Games and Their Mechanics **40**
Table 4.2 : Survey About the Relationship Between Board Game Mechanics and Aesthetics **43**
Table 4.3 : Participants Profile **47**
Table 4.4 : List of Game Patterns Produced on Design Workshops **55**
Table 4.5 : Evaluation and Statistics Of Participants **57**
Table 4.6 : Survey Results of General Questions **58**
Table 4.7 : Survey Results of Questions Specific to Exercise 1 .... **59**
Table 4.8 : Survey Results of Questions Specific to Exercise 2 .... **59**
Table 4.9 : Survey Results of Comparison Between Exercises **60**
Table 4.10 : Survey Results of Practical Application **60**
Table B.1 : Post Workshop Evaluation Form **72**

LIST OF FIGURES

Page

Figure 2.1 : FBS Framework **5**
Figure 2.2 : Perspectives of Designer and Player **7**
Figure 2.3 : Game Elements.. **9**
Figure 2.4 : Elemental Tetrad **10**
Figure 2.5 : DPE Framework **11**
Figure 2.6 : Redefined Game Design Process Diagram **13**
Figure 2.7 : Understanding the Game Elements **25**
Figure 3.1 : Research Algorithm.. **30**
Figure 4.1 : Concepts in the BGG Ontology.. **32**
Figure 4.2 : Classification Diagram of the Selected Board Game Mechanics.......... **34**
Figure 4.3 : Comparison of Board Game Mechanics Through the Lens of Aesthetics **35**
Figure 4.4 : Generative Framework’s Deck... **44**
Figure 4.5 : Exercise-1 Algorithm **45**
Figure 4.6 : Exercise-2 Algorithm **46**
Figure 4.7 : Design Workshop with Participant EN **49**
Figure 4.8 : Design Workshop with Participants GK and AL **51**
Figure 4.9 : Design Workshop with Participants AT, BU, and MK **53**
Figure 4.10 : Design Patterns Found in Games that Produced in Workshops.......... **54**
Figure 4.11 : Stages of Generative Framework **62**
Figure A.1 : Generative Framework’s Game Cards **70**
Figure A.2 : Game Decks Created on Workshop **71**

TRANSFORMING STRUCTURES INTO EXPERIENCES: GENERATIVE FRAMEWORKS

SUMMARY

Understanding the complicated relationship between player experiences and game components is essential in the evolving game design landscape. This study explores this dynamic by offering practical and interactive game design exercises. These exercises, which are based on the Mechanics, Dynamics, and Aesthetics (MDA) framework, a key tool in game design, are designed to make them more accessible and actionable for game designers, emphasizing their crucial role in shaping player experiences.

Gathering feedback at specific thresholds is crucial in the intricate game design and development process. Today's novice learners favor various learning sources, rapid information access, clearly defined objectives, and the ability to use technology to visualize the consequences of their decisions. This study offers a structured yet adaptable game design approach catering to these diverse learning preferences.

The primary objective is to enhance the comprehensibility and practicality of the MDA framework for game designers by redefining its core components—mechanics, dynamics, and aesthetics. This endeavor is anticipated to establish a new language that will prove advantageous in workshops with individual and collaborative game designers. By introducing these concepts early in the game production, designers can understand the design perceptions necessary for crafting captivating games.

The MDA framework plays a crucial role in bridging game design, game development, and technical background, enhancing comprehension of the design process. According to MDA, one of the critical components, 'aesthetics,' was designed as a destination, much like a compass. It guides the gameplay dynamics and mechanics, helping us map out a route for the emotional responses we want to evoke in the player. Mechanics are the only aspect of the game that designers have complete control over when it comes to fulfilling its emotional purpose, or aesthetics, by creating dynamics. Understanding all these experiences is crucial: It shows where the team should focus their efforts and how it can impact the player's experience when interacting with the game. This study uses board game mechanics as a foundation to avoid confusion in defining mechanics and ensure that selected mechanics evoke specific dynamics.

The study began by examining the necessity of creating academic systems for creative processes, followed by an investigation into existing frameworks for design, game design, and serious game design. Secondly, common points and objectives are identified, allowing for a comprehensive analysis and redefinition of the foundational concepts of the MDA framework. The foundational concepts of the MDA framework—mechanics, dynamics, and aesthetics—were analyzed and reconsidered in conjunction with game design literature. This analysis helped to develop a theoretical foundation on how these frameworks could be utilized as content in game development processes. After establishing the theoretical foundation, board game mechanics were employed to transform MDA into a new generative experience. Using the BoardGameGeek (BGG) database and an academic study's classification, the definitions of BGG mechanics were revised. A scoring system was developed to determine the emotions a game mechanic could generate, creating a network of relationships visualized based on the "8 kinds of fun" in MDA.

The proposed framework follows a card game structure with 28 different board game mechanics and components. These elements evolve into exercises focusing on various design issues requiring an iterative design process. The mixed-method approach validates the framework, where six expert game designers participate in a design workshop to evaluate MDA exercises and applicability with several parameters.

This study aims to provide game designers with a half-structured tool for creating engaging and emotionally resonant games by redefining the MDA framework and employing board game mechanics. The innovative approach ensures that designers, whether novices or experts, can systematically explore and implement effective game design strategies. The next generation of game designers will produce breakthroughs in player experience, designing games with unique play mechanics and thinking beyond the existing parameters. This generative approach can help foster innovation and give game designers a solid process for exploring unusual questions about gameplay and player experience possibilities.

YAPILARIN ETKİLEŞİMLİ DENEYİMLERE DÖNÜŞTÜRÜLMESİ: ÜRETKEN ÇERÇEVE ÖNERİSİ

ÖZET

Oyuncu deneyimleri ile oyun bileşenleri arasındaki karmaşık ilişkiyi anlamak gelişen oyun tasarımı dünyasında son derece önemlidir. Bu çalışma, bu dinamiğe yönelik pratik ve interaktif oyun tasarımı egzersizleri sunarak derinlemesine bir inceleme yapmaktadır. Bu egzersizler, oyuncu deneyimlerini şekillendirmedeki kritik konseptleri vurgulayarak, Mechanics, Dynamics ve Aesthetics (MDA) çerçevesini daha erişilebilir ve uygulanabilir hale getirmeyi amaçlamaktadır.

İnsan bilişi, bireyleri hedeflerine ulaşmak için gereken eylemlere hazırlayan canlı zihinsel simülasyonlarla gelişir. Belirli eşiklerde geri bildirim toplamak, karmaşık oyun tasarımı ve geliştirme sürecinde kritik öneme sahiptir. Oyun geliştirme süreçlerini anlayabilmek için her biri başlı başına bir disiplin olan oyun tasarımı, oyun geliştirmesi ve teknik arka plan arasında bir köprü kurulması gerekmektedir. Bu köprünün kurulabilmesi ve sürecin daha iyi anlaşılabilmesi için yeni bir dil ve araç oluşturma çalışmalarından biri olan MDA tasarım çerçevesi oyun tasarımına yönelik derslerde ve oyun stüdyolarında yardımcı bir materyal olarak zaman zaman kullanılmaktadır. Günümüzün öğrenme heveslileri, çeşitli öğrenme kaynaklarını, hızlı bilgi erişimini, net tanımlanmış hedefleri ve kararlarının sonuçlarını görselleştirme yeteneğini tercih etmektedir. Bu çalışma kapsamında MDA'nın oyun geliştirme süreçleri üzerindeki kavramsal ve davranışsal etkisini gözlemleyebilmek için masaüstü oyun mekaniklerinden yardım alarak temelde yeni bir üretken çerçeve modeli kurgulanmıştır. Yapılandırılmış ancak esnek bir oyun tasarımı yaklaşımı sunulan bu araştırmada bu tercihler karşılanmaktadır.

Tezin amacı, tasarım çerçevelerinin üretken bir hale getirilerek oyun tasarımı sürecine dahil edilmesinin sonuçlarını analiz etmek ve oyun üretiminde deneyim tabanlı öğrenme modellerinin entegrasyonu adına bir yol göstermektir.

Bu çalışmanın motivasyonu MDA'nın ortaya koyduğu oyun geliştirme ve oyun analiz sürecine özgü tekrarlayan, dinamik, kompleks ve öngörülemeyen davranışları ortaya çıkarmak ve tartışmaktır. MDA'nın özellikle oyun tasarımı eğitimine yeni başlayan üniversite öğrencileri için yeni bir dil oluşturacağı, buna bağlı olarak oyun üretim sürecinde ilk kez karşılaştıkları kavramların tasarım algılarının gelişmesine yardımcı olacağı öngörülmüştür. Oyunun geliştirme sürecinin önemli noktalarından birisi tamamen kapalı bir kutu olan kod sistemi ile kompleks ve dinamik bir çıktı oluşturmaya çalışmaktır. Bu iki disiplin arasında iletişimsel bir köprünün kurulabilmesi ortaya çıkacak ürünün kalitesi ve içeriği bakımından oldukça önemlidir. Bu araştırma, çerçevenin vurguladığı bu kavramları temsil edecek şekilde kurgulanmıştır.

Çalışmanın temelini oluşturan araştırma soruları aşağıdaki gibi özetlenebilir:

- Oyun tasarımı ontolojileri etkileşimli bir hale dönüştürülebilir mi? Bu deneyim biçimi yardımıyla, akademik bir dilin oyun geliştirmeye entegre olması sağlanabilir mi?
- Oyun geliştirme eğitimine ve oyun üretimine yeni başlamış kişiler için ontolojilerden yararlanmak oyun tasarımı ile ilgili kavramların ve oyun geliştirmeye dair süreçlerin anlaşılmasında katkı sağlayabilir mı?

Çalışma kapsamında, öncelikle yaratıcı süreçlere ait akademik sistemlerin oluşturulmasına neden ihtiyaç olduğu incelendikten sonra tasarım, oyun tasarımı ve ciddi oyun tasarımı disiplinleri için oluşturulmuş olan çerçeveler araştırılmış, ortak noktaları ve amaçları belirlenmiştir. MDA çerçevesinin temelini oluşturan mekanikler, dinamikler ve estetikler kavramları incelenmiş ve oyun tasarımı literatürü ile birlikte yeniden ele alınmıştır. Böylece çerçevelerin oyun geliştirme eğitiminde nasıl içerik olarak kullanılabileceği üzerine bir teorik altyapı oluşturulmuştur. Araştırmanın teorik altyapısı hazırlandıktan sonra MDA'nın yeni bir üretken deneyim haline getirilmesi için masaüstü oyun mekaniklerinden yararlanılmıştır. BGG (BoardGameGeek) veritabanı ve bu veriler temel alınarak yapılmış bir akademik çalışmanın sınıflandırılmasından yararlanılmış ve mekaniklerin tanımları gözden geçirilerek söz konusu mekanikler veritabanı genişletilmiştir. Oyun mekaniğinin oyunda ne tür bir "duygu" yaratabileceğini belirlemek için masaüstü oyunları ve mekaniklerinin incelenmesi ile bir puanlama sistemi üzerinde çalışılmıştır. MDA'da yer alan "8 çeşit eğlence" (8 kinds of fun) tanımına göre alt başlıkların birbirleriyle olan benzerlikleri, zıtlıkları, özgüllükleri ve anlamsal ilişkileri dikkate alınarak bir ilişki ağı oluşturulmuştur ve görselleştirilmiştir.

MDA çerçevesi, oyun tasarımında en yaygın ve pratik olarak kabul edilen yöntemlerden biri olsa da çeşitli eleştirilerle de karşı karşıya kalmıştır. Bu eleştirilerden biri, çerçevenin mekanikler, dinamikler ve estetikler arasında doğrusal bir ilişki öne sürmesidir. Bu durum, mekanikleri oyunun en temel bileşeni olarak gösterir ve oynanış dinamiklerini destekler. Ancak, bu yaklaşım formalist düşünceyi güçlendirebilir ve oyun tasarımının yinelemeli doğasını tam olarak yansıtmaz. Dinamikler ve estetikler de mekanikleri etkileyebilir ve oyuncu yorumları, tasarımcıların öngörmediği şekillerde gerçekleşebilir. Tez kapsamında, bu eksiklikleri göz önünde bulundurarak yeniden tanımlanmış bir oyun tasarım süreci diyagramı geliştirmiştir.

MDA çerçevesinin teorik yönlerini pratik tasarım kararlarına dönüştürmek zor olabilir ve optimal dengeyi bulmak için kullanıcı testlerinden yararlanmak gereklidir. Bu sebeple, oyun tasarımcılarının oyun bileşenlerin etkileşimini ve oyuncuda hangi duyguları oluşturacağını anlamak için kullanılabilecek bir yarı strüktüre olmuş altlık çalışması geliştirilmiştir. Çalışmada, MDA'nın pratik uygulamasına yeni bir bakış açısı sunarak bu alıştırmaları sürekli olarak yeniden üretmek için yeni bir sistematik yaklaşım önermektedir.

Önerilen çerçeve, 28 farklı masa oyunu mekaniği ve bileşenine sahip bir masaüstü oyunu gibi oluşturulmuştur. Tekrarlanan bir tasarım süreci gerektiren 2 adımlı alıştırmalar, çeşitli tasarım sorunlarını içeren kavramsal bir çerçeve sunmuştur. Bu çalışma, 6 uzman oyun tasarımcısının katıldığı bir oyun tasarımı atölyesinde ve ardından çeşitli parametrelerle MDA'nın uygulanabilirliğini ve alıştırmaları değerlendireceği çok yöntemli bir yaklaşım kullanılarak doğrulanmıştır. Elde edilen veriler sonucunda çerçevelerin üretken bir deneyime dönüşmesi ve oyun tasarımı süreçlerine dahil olmasının gelecek çalışmalar için altyapı oluşturabileceği düşünülmektedir.

Bu çalışma, MDA çerçevesini yeniden tanımlayarak ve masa oyunu mekaniklerini kullanarak oyun tasarımcılarına ilgi çekici ve duygusal olarak etkileyici oyunlar oluşturmak için pratik bir araç sağlamayı amaçlamaktadır. Yapısal temel, oyun tasarım ilkelerini öğretmek için önemli bir araçtır ve teorik bilgiyi pratik uygulamayla birleştirir. Disiplinler arası ekipler arasında iletişimi artırır ve yapay zeka sistemlerine entegrasyon potansiyeli sunar. Bu, tasarım sürecinde verimlilik ve yenilik sağlar. Gelecek çalışmalar, uzun vadeli etkileri gözlemleyerek ve dijital araçlar geliştirerek bu tezin bulguları üzerine inşa edilebilir.

Yenilikçi yaklaşım, ister yeni başlayan ister uzman olsun, tasarımcıların etkili oyun tasarım stratejilerini sistematik olarak keşfetmelerini ve uygulamalarını sağlamaktadır. Gelecek nesil oyun tasarımcıları, benzersiz oyun mekanikleri ile oyuncu deneyiminde çığır açacak ve mevcut parametrelerin ötesinde düşünecek oyunlar tasarlayacaklardır. Bu üretken yaklaşım, yeniliği teşvik edebilir ve oyun tasarımcılarına oyun oynanışı ve oyuncu deneyimi ile ilgili sıra dışı soruları keşfetmek için sağlam bir süreç sağlayabilir.

1. INTRODUCTION

Several studies have examined how incorporating experiences has changed our ways of working, learning, and thinking. Researchers have shown that one of the most important factors in keeping new-generation learners interested in subjects is their capacity to engage with content in addition to traditional methods. Humans are most effective at thinking and comprehending when they can mentally recreate an experience that prepares them for the activities necessary to achieve their goals (Gee, 2007).

As specified by Gee (2013), “Real learning requires new experiences connected to goal-directed actions and to ways of properly assessing the results of our actions in terms of our goals” (p. 151). When they are merely consumers, they need help taking ownership of the content and engaging deeply with the subject. Since all individuals have different needs and interests, employing various learning styles yields better results for some people. Moreover, diversifying these styles encourages learners to contribute new perspectives to the content.

Design research, created within the context of design practice, enables the exploration of broader inquiries that extend beyond the constraints of a specific design issue. Integrating design research into the design process leads to new and unforeseen questions that emerge directly from designing (Zimmerman, 2003). The game design method is especially suitable for serving as a model for research through design.

In any design discipline, designers acquire knowledge most effectively by engaging in the design process and gaining direct experience with the creations they produce (Salen, Zimmerman, 2004). Creating a game involves integrating multiple disciplines and is highly challenging. A game designer must also decide what feelings they desire the player to have, as a game is consumed from the player's perspective. An ontology can assist by precisely outlining the game field's attributes, ideas, and classifications. Enhancing the understanding of this area and providing a systematic approach to game design would advance the developing digital gaming industry (Junior & Silva, 2021).

Schell (2008) points out, “A game is a problem-solving activity, approached with a playful attitude” (p.37). This allows for a very playful methodology to stimulate creativity while providing a practical framework to explore gameplay possibility space problems.

This study is focused on analyzing game components described in game design ontologies to realize how different game elements contribute to player experiences. After an overview of the game's main components, this research will also aim to create a more creative and productive game design with a new iterative generative framework firmly centered on designing a player experience.

1.1 Design and Game Design Ontologies

Gero (1990) stated, "The meta goal of design is to transform requirements of the purposes of the resulting artifact into design description" (p. 27). Design ontologies enable students and novice designers to understand the foundational concepts of design, relevant principles, and interdisciplinary connections. This knowledge allows them to fully comprehend design processes and apply this understanding effectively in their design work. Conceptual design is a method that involves identifying and adapting requirements as they emerge throughout the design activity, thus creating a dynamic context within which processes can operate (Gero & Kannengiesser, 2004).

Design ontologies structure knowledge about various areas and contexts of design. This structuring helps new designers better adapt their practices to real-world challenges and guide their solution processes more effectively. According to Gero (1990), "Design research has several goals, including a better understanding of design, the development of tools to aid human designers, and the potential for automation of some design tasks" (p. 28).

Most game designers consider the design process a creative activity requiring great skill, and they always deny that it can be organized within an organized framework. As the industry grows without any stop and with the increasing complexity of game technology, the tasks of game designing and development become a challenge. To consistently create high-quality games, organizations must enhance the efficiency and benefit of their development processes (Junior & Silva, 2021).

There is no single universally accepted game design ontology. Some studies have only reached the analysis stage, and others have not gained widespread acceptance due to their limited scope. For this quest, the Mechanics, Dynamics, and Aesthetics (MDA) framework, with its comprehensive components and its attempt to define the emotional aspect of gaming, stands out. Despite its limitations and some criticisms in certain areas, it has earned recognition in both the academic field and the game industry, underscoring its relevance and impact.

1.2 Scope and Motivation of the Thesis

In this thesis, we work on game design ontologies to turn past research into a method applicable to success in real game development processes. We have great expectations from the MDA framework and think about it as a way of enhancing a new language that will help game designers work alone or collaborate with others. This new language will serve as a guide, helping designers navigate the limits of creativity and new concepts during the game production process.

As described in the MDA framework linearly, mechanics generate dynamics, and dynamics, in turn, create aesthetics—the emotions intended to be elicited in the player. Development often starts with targeted emotions serving as a guiding compass. Publishers usually look to hire players with such emotions. However, recognizing—and effectively reproducing—these aesthetic elements is one of the challenging parts of game development. Mechanics, where designers can intervene explicitly, shape dynamics in the game by turning them into behavioral patterns. A key challenge is predicting which mechanics will lead to specific emotions that designers want to evoke. This issue is often addressed by incorporating successful game design patterns from well-received, creative games into new ones. The effectiveness of these patterns is tested with several playtesting processes, with decisions refined through an articulation process. Game design is inevitably a repeated, cyclical process, yet managing this cycle is essential to effectiveness.

The thesis focuses on developing a new generative framework model from a game designer's perspective. After examining the concepts of mechanics, dynamics, and aesthetics that constitute the MDA framework, the framework’s shortcomings will be discussed, and a new approach will be proposed. The generative framework module will explain, classify, and describe selected board game mechanics. The "8 kinds of fun" definitions of entertainment used in the original methodology will be discussed, and a network of relationships between these concepts will be established from a game designer's perspective. Additionally, various exercises are designed using mechanics from board games to establish the infrastructure of this framework.

We propose several practical and interactive game design exercises incorporating the MDA framework. The proposed framework will be constructed like a card game with 28 different board game mechanics and components that can evolve into exercises focusing on various design issues. Requiring an iterative design process, the game exercises will offer a conceptual framework for addressing design issues such as game creation, modification of existing games, and game analysis. This study will be validated using a mixed-method approach, where six expert game designers participate in a game design workshop and then evaluate the exercises and applicability of the MDA with various parameters. In the final section, an evaluation of the generative framework, including analyses and outcomes of the findings, will be presented.

1.3 Research Questions

Within the scope of this study, various questions about game design methodologies and game development processes have been investigated:

- Can utilizing ontologies help those new to game development and game production understand game design concepts and processes?
- Can this generative framework facilitate the integration of design research into game development and enhance the usability analysis in half-structured game design generation?
- How can the connection between game mechanics and the emotions intended to be elicited in the player be consciously constructed at the beginning of the game development phase?

2. THE ACT OF DESIGNING: THINKING WITH PROTOTYPES

2.1 Game Design, Design, and Serious Game Frameworks

When we look at the history of humanity, design has been an activity that has existed since 2000 BC. People have utilized design, and the artifacts created through design to better adapt to their environments. Understanding the underlying thought process of design, the tools used for designing, and the optimization of certain stages is one of the numerous goals of design research.

According to the Function-Behavior-Structure (FBS) approach, designers utilize artifacts that can provide the desired functions after deciding what they want to achieve. It provides a structured approach to dealing with complex design tasks, aiding in the clarity and effectiveness of the design process. FBS explains the basics of design, including its functions (what it is used for), behaviors (how it works), and structures (why it is formed). Functions define the objectives and requirements of the design; behaviors explain the functionality and performance of the design; structures indicate the organization of the design components and their interrelationships. (Figure 2.1).

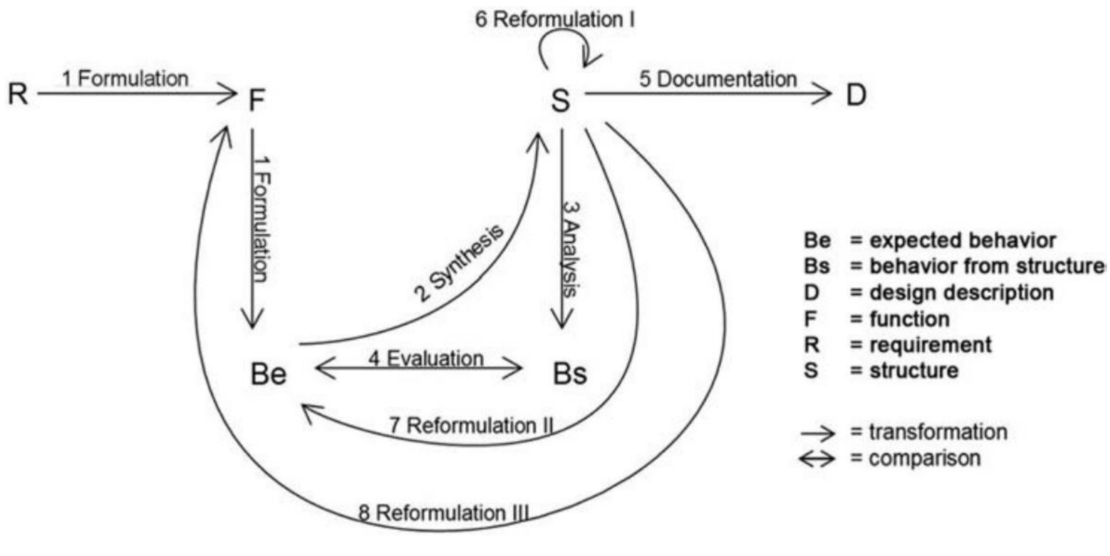


Figure 2.1 : FBS Framework (Gero & Kannengiesser, 2004)

A designer establishes relationships between a design object's functionality, behavior, and structure based on their expertise. More precisely, the designer attributes purpose to behavior and determines behavior from structure. However, a clear correlation between function and structure has not been found. (Gero & Kannengiesser, 2004). The FBS approach defines design by linking function, behavior, and structure components through different processes.

The definitions of the eight processes numbered in (Figure 2.1) are shown in the table below. (Table 2.1).

Table 2.1 : FBS Design Processes (Gero & Kannengiesser, 2004)

Formulation	Transforms design requirements into expected behaviors, expressed as function (F).
Synthesis	Transforms the expected behavior (Be) into a structural solution (S) designed to achieve the desired outcomes.
Analysis	The 'real' behavior (Bs) is transformed into the synthesized structure (S).
Evaluation	Determines whether the design solution satisfies the requirements by comparing the behavior emerging from the structure (Bs) with the intended behavior (Be).
Documentation	Creates the design description (D) needed for the product's assembly or construction.
Reformulation I	If the actual behavior is insufficient, consider changes in the structure variables or their value ranges.
Reformulation II	If the actual behavior is insufficient, consider changes in the behavior variables or their value ranges.
Reformulation III	If the actual behavior is insufficient, consider changes in the function variables or their value ranges.

The three stages of reformulation try to define the dynamic part of the design process. According to Gero and Kannengiesser (2004), designers create a memory during designing that incorporates what they learn and their previous experiences. This interaction has been termed "situatedness," which is cognitively summarized as "where you are when you do what you do matters" (p.376).

Gero et al. (2013) conducted an experimental study to test the applicability of the framework they developed. According to this research, they aimed to observe the impact of structural concept generation techniques on creativity in the design development process. Unstructured and intuitive concept-generating creativity strategies are designed to enhance the generation of intuitive ideas and promote divergent thinking. These techniques primarily prioritize the number of solution possibilities. The creativity strategies used in structured/logical concept generation involve analyzing functional requirements and generating solutions based on engineering principles and documented solutions from previous experiences (Gero et al., 2013). The research results with engineering students indicate that "as the structural approach increases, creativity focuses more on the causality of the problem." Designers who apply structured concept-generation techniques to enhance creativity are more likely to emphasize the problem-related parts of the process, including design goals and requirements. The results suggest that the level of structure in the concept generation methodology mainly impacts the first stages of the design process.

Another impressive application developed using FBS is a study on how the structural design approach affects creativity. Gero and Kannengiesser examine the role of creativity in the design process as the basis for prospective innovations that arise from that approach. Employing an ontological framework categorizes different stages in the design process. It identifies the areas where creativity can occur, regardless of whether human designers or artificial technologies show it. This study concentrates on creativity as the fundamental and antecedent of innovation. This is predicated on our proof that computer guidance in fostering innovative design focuses on developing ideas rather than solely on the subsequent stages of bringing those ideas to realization (Gero & Kannengiesser, 2008). This shows an ontological framework for creating, which identifies the source of creativity and expresses support for innovation.

When we look at the ontologies developed for game design, the MDA (Mechanics - Dynamics - Aesthetics) framework attempts to define the entertainment aspect of the game conceptually. It is also concerned with how the player and designer consume the game from different perspectives (Figure 2.2). According to LeBlanc (2004b), “Each component of the MDA framework can be thought of as a “lens” or a “view” of the game - separate, but causally linked.”

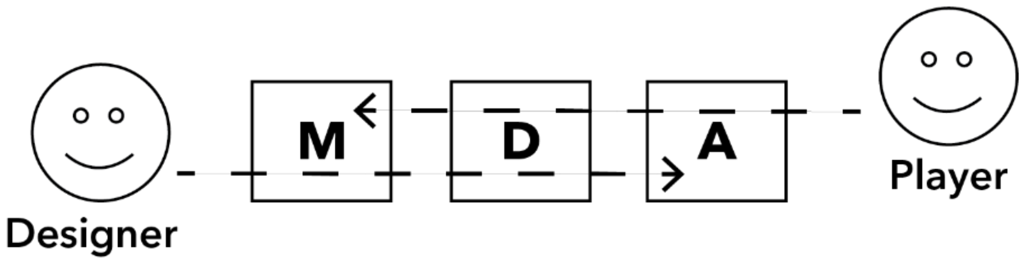


Figure 2.2 : Perspectives of Designer and Player (Hunicke et al., 2004)

The concept argues that video games are more artifacts than media. By this, we mean that the behavior of a game, rather than the media it creates for the player, is its content. It is easier to conceptualize games as systems that determine behavior through interaction when considering them as made objects. At every research and development stage, it makes possible more transparent design decisions and analysis possible. (Hunicke et al., 2004). Games are complex structures produced through a coding system, which forms a closed system that only the designer can modify. This results in an unpredictable dynamic behavior that the player will consume (Table 2.2).

Table 2.2 : MDA Components Description (Hunicke et al., 2004)

Mechanics	The components of the games are at the level of data representation and algorithms.
Dynamics	The run-time behavior of the mechanics, acting on player inputs and each other's outputs over time.
Aesthetics	Emotional responses are evoked in the players.

One of the critical components is the mechanics, which lays down the game's rule system, represented at the data level. On the other hand, dynamics are the immediate responses these rules made them possible to generate in reaction to players' behaviors. Finally, aesthetics are the emotions these interactions evoke in the player. The aesthetic component questions, "What emotions make games fun?" This focus on the player's perspective reminds us that their experience is a core aspect of the game design process. Thus, game design should be a collaboration between the designer and the player. In the framework, MDA defines game mechanics as the only component directly under the designer's control. This means that the designer needs to decide on the type of aesthetic the player needs to experience before working out the mechanics that will bring it about. The game balancing and playtesting enable the designer to adjust iteratively with the mechanics to realize a desired aesthetic effect over time (Winn, 2009).

While working on games, it is necessary to consider the perspectives of both the designer and the player simultaneously. This requires the designer to consider how even the slightest change can create a different emotional impact on the player (Figure 2.3). The game inherently supports a repetitive and cyclical design process and always requires balancing and fine-tuning. By considering the feelings we aim to elicit in players as a compass, designers can use this as a guide to ensure causality is achieved during the balancing process.

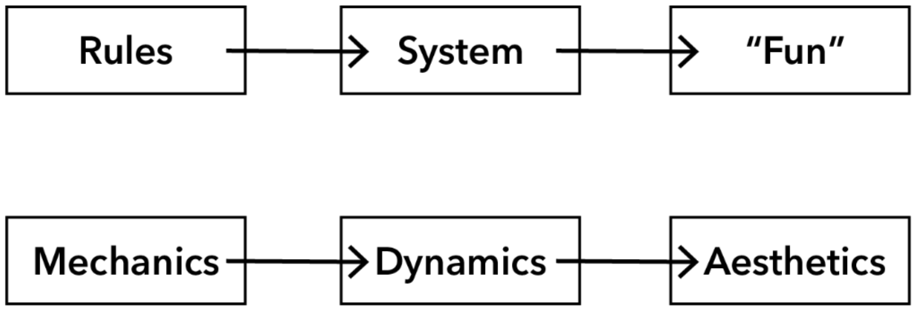


Figure 2.3 : Game Elements (Hunicke et al., 2004)

Although the MDA has proven to be a practical and widely accepted approach, it primarily focuses on game design and gameplay. It does not offer guidance on topics outside of gameplay, such as user interfaces, storytelling, and technology.

In one of the best-known studies that formed the foundations of game design, Schell described an approach that might be called an advanced version of the MDA: Elemental Tetrad. Like MDA, Elemental Tetrad has elements such as mechanics and aesthetics, but these elements hold different meanings for their relationships. The MDA approach achieves game design and balancing through a cyclic and iterative procedure. The game designer sets goals based on the aesthetic element and then explains the purpose of setting up such goals. Subsequently, the designer identifies the dynamics that will support these objectives and defines the mechanics that will generate these dynamics. The MDA framework suggests that the connection between mechanics and aesthetics is indirect, creating an abstract relationship.

In contrast, Schell's model proposes a direct link between mechanics and aesthetics (Figure 2.4). Additionally, it incorporates two new components: story and technology. Realizing that no element is more significant than any other is crucial. The tetrad is constructed here in a diamond shape rather than to highlight any relative importance but rather to help explain the "visibility gradient," which argues that technological features are often the least visible to most visible as aesthetics, with mechanics and story in the middle (Schell, 2008).

A distinctive point of the MDA framework is its reliance on mechanics to create aesthetics, a limitation that has inspired the development of new approaches. One such approach is DPE (Design – Play – Experience), which redefines the aesthetics component as "experience".

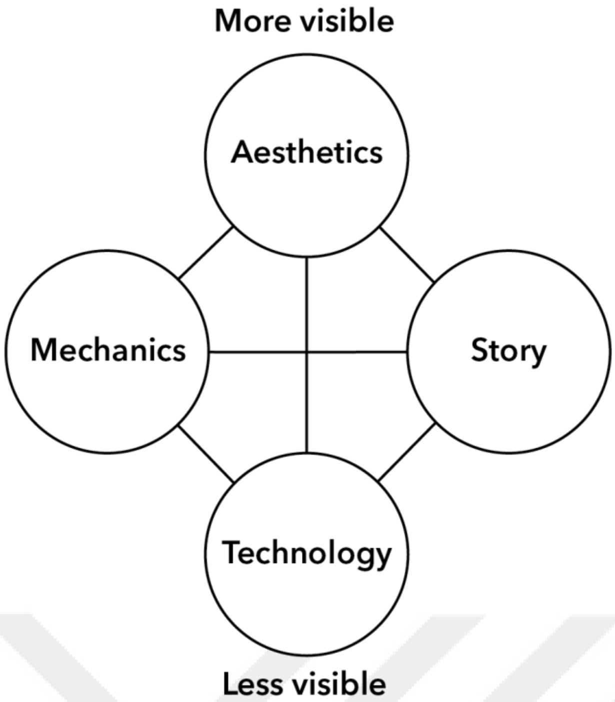


Figure 2.4 : Elemental Tetrad (Schell, 2008: 42)

Unlike MDA, DPE acknowledges that games can transcend entertainment to include educational layers, as in serious games. This approach also emphasizes the importance of interdisciplinary collaboration, providing a shared vocabulary for diverse teams to debate and evaluate game design. This vocabulary draws from the narrative, game design, education, instructional design, and user experience—disciplines integral to serious game design, highlighting the value of your diverse expertise.

The practice of serious game design can be understood only through the lens of diverse experience levels from team members. The diversity of these conceptual and material backgrounds enriches the design process, as well as a model that can provide interdisciplinary connections between different disciplinary vocabularies. For example, developers of exogenous educational games frequently modify existing game mechanisms and embed learning objectives within the established structures and rules governing those gameplays. These games are often concerned with repetition-based reinforcement of content (Halverson, 2005). Endogenous educational games intend to push students beyond rote learning to achieve better learning outcomes. These educational resources are fused into the game layout design from classic genres like RPG, Adventure, Board and Card, or even Puzzle games. In endogenous games, the design mirrors the philosophy of education by embedding educational goals within challenges in the gameplay. The game focuses on active problem-solving and learning goals particular to the context, where players must move along in a game environment and use knowledge to surmount challenges (Winn, 2009).

Designing serious games is challenging in various ways that the MDA framework does not address. While developing any good game is hard, designing a serious game is also hard. In addition to getting the most entertainment value or fun factor out of a game, designers should be able to guarantee that it is optimized for certain educational purposes. This is the dual optimization task, adding extra complexity to the design process for serious games, making it more difficult (Winn, 2009).

DPE adds a pedagogical learning layer to be grasped and mapped onto a network of relationships like MDA. It has organized its elements on a grid to add new elements beneath the main headings (Figure 2.5). At the learning layer, the designer must consider both content and pedagogy, seeking to facilitate the game to enable learning outcomes effectively. For example, in the MDA framework approach, the designer sets out certain goals rather than fun factors. However, whether these goals are achieved in serious games depends on integrating content and pedagogy toward a holistic learning experience.

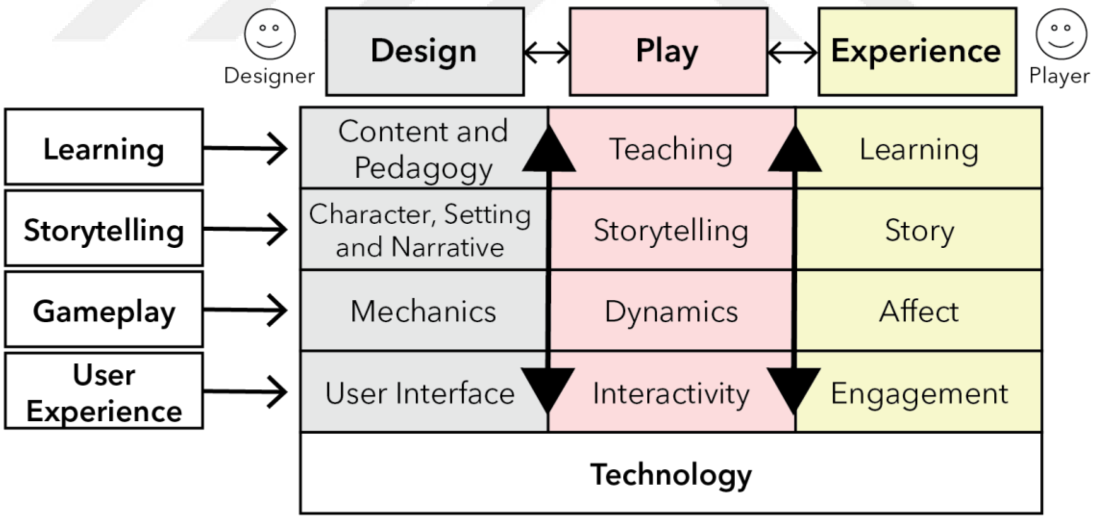


Figure 2.5 : The DPE Framework (Winn, 2009: 1015)

Understanding the parts of the MDA framework and how they connect is important. One might think of each part—Mechanics, Dynamics, and Aesthetics—as a separate "lens" through which we view and describe game design. For designers, the aesthetics they want to evoke come from how the game's system behaves, shaped by the mechanics. From the player's point of view, the aesthetic experience enabled by game dynamics is itself grasped as a product of mechanics. The interaction underlines deep levels within game design.

As Hunicke, LeBlanc, and Zubek pointed out in 2004, the relevance of player experience to what the designer meant is crucial. Deconstructing these layers will make one realize how refined and interwoven game design is. This framework allows designers and players to realize the deep relationship between the mechanics driving the game and the resulting emotional experiences.

2.2 Redefining Game Components Based on MDA Framework

Though probably the most extended and practically accepted method of game design, the Mechanics, Dynamics, and Aesthetics framework recently came under attack due to several things that might be improved (Walk et al., 2017). One of the points brought up against it is the linearity of the progression suggested between mechanics, dynamics, and aesthetics by the framework.

While the "MDA" model and order might simplify a series of events, it also indicates a hierarchy where the formal qualities are ranked in their order of importance. The mechanics of a game provide the core basis upon which the entire support for the gameplay must count, making them the most crucial element within the entire system. The work might inherently insinuate formalist thinking, which incorrectly assumes a true ideal essence to a form, or attributes of a game being oversimplified and then categorized by utility (Polansky, 2015). This rigidity sometimes accurately reflects the iterative nature of game design, in which dynamics and aesthetics also influence mechanics.

Since the MDA framework mostly focuses on the designer's thoughts, the player's role in interpretation and emergent gameplay can be underestimated. It is common for players to use or even interact with game mechanics in ways that designers did not foresee, which can potentially cause experiences out of the scope of the MDA model. It leads to a narrow view of game design as much of its attention is paid to mechanics. Considering the deficiencies and the basic principles of MDA, a redefined game design process diagram is developed (Figure 2.6).

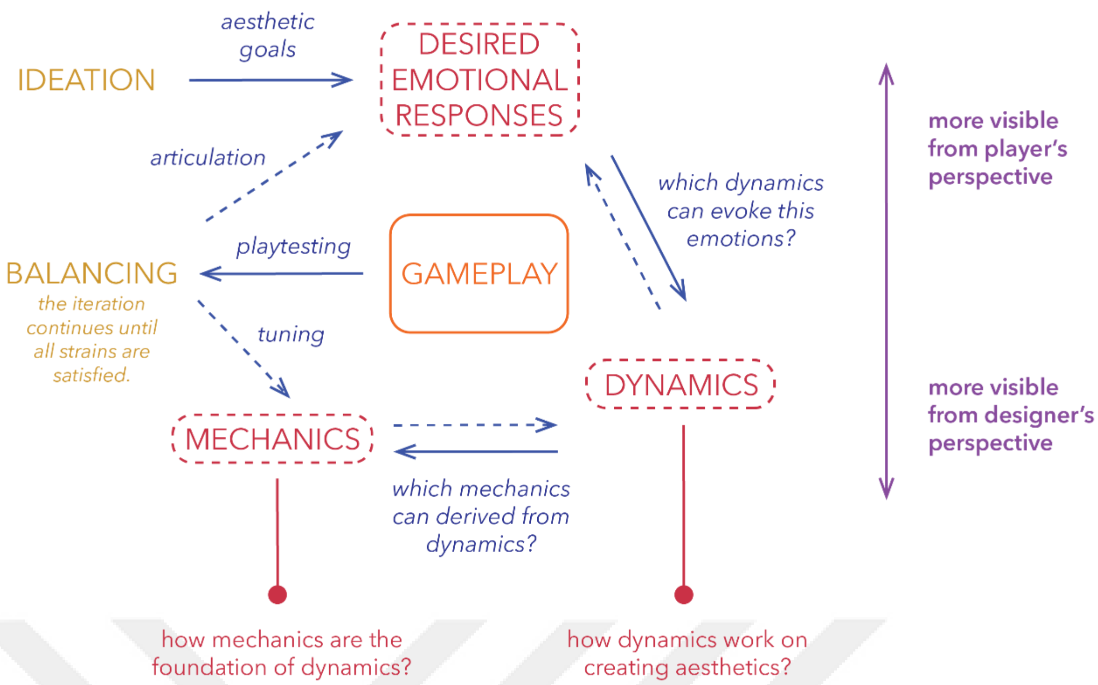


Figure 2.6 : Redefined Game Design Process Diagram

Translating the theoretical aspects of the MDA framework into practical design decisions can be challenging. Designers may need help deriving specific design strategies or solutions from the many principles described within the framework. Extensive user playtesting is often required to find the optimal balance where mechanics effectively lead to dynamics and desired aesthetic experiences, which can be resource-intensive. New game designers need training to effectively use the MDA and understand what each component entails and how they interact. This thesis proposes a novel systematic approach for consistently reproducing these exercises, offering a fresh perspective on the practical application of the MDA.

2.2.1 Mechanics

Researchers and game designers have tried to explain game mechanics in research comprehensively. Sicart (2008) addressed interesting, extensive research where he stressed that only consideration of the rules, obstacles, emotions, and experiences of players would not be able to clarify this concept fully. He then provided a very useful analytic tool: the game system, which is something that configures the game experience. Sicart went further in discovering how changes in game design can involve innovations and influence the gaming experience to take a chance to engage players in aesthetic experiences built out of game design.

Schell (2008) argues that game mechanics constitute the core of what a game truly is, maintaining that relationships and interactions remain when plot, technology, and aesthetics are stripped away. Similarly, Richard Rouse (2005) takes a more functional approach to mechanics to determine "what the players are able to do in the game world, how they do it, and how that leads to a compelling game experience" (p. 310). Järvinen (2008) also describes mechanics with a rule-based approach as methods designed to steer the player's behavior by limiting their range of possible actions to achieve goals.

In MDA, a more precise definition is provided. Accordingly, they stated, "mechanics describes the particular components of the game, at the level of data representation and algorithms" and "mechanics are the various actions, behaviors and control mechanisms afforded to the player within a game context" (Hunicke et al., 2004, pp. 2-3). This framework illuminates the links between the game's formal, algorithmic components and how players interact with and manipulate them. However, Sicart (2008) criticizes this framework for its inability to adequately define and analyze mechanics due to inconsistencies in its definition.

Sicart (2008) further defines "game mechanics are methods invoked by agents, designed for interaction with the game state," which reflects an object-oriented programming (OOP) approach. In OOP, mechanics are designed as methods and attributes. Players function as instruments; "methods" refers to procedures or functions that an object can use to retrieve or manipulate data stored in another object. A game mechanism, therefore, involves specific actions that a player or character performs to interact with the game's virtual environment within the rules set by the game. For instance, certain mechanisms are only activated when specific objects are present or at stages of the game, allowing the player to perform actions within the constraints established by the rules. (Sicart, 2008).

Junior and Silva (2021) have reinterpreted Sicart's approach within the MDA framework, describing mechanics as "Doing responsibilities of Entities, with a purpose to invoke Dynamics" (p. 6). The responsibilities in this context are categorized as "knowing" and "doing." This definition excludes camera controls, which could be considered mere user interface interactions, such as clicking or adjusting the camera's view, from being classified as game mechanics. A clear definition of mechanics is vital because it lets designers directly control them to generate dynamics that produce the intended emotional effects or aesthetics. Recognizing these mechanics is essential to the core of game design and should be approached promptly and effectively (Junior, Silva, 2021).

The game design terminology defines "core mechanics" as the primary activities a player repeatedly performs while playing the game. Conventionally, the core mechanic is said to refer to the important ingredients that dictate the player's experience in interacting with the product, manifested in the form of essential actions that are repetitive and executed throughout the game to establish consistent behavior patterns that lead to specific experiences for the players. Core mechanics are integral to gameplay; players make meaningful decisions and meaningfully interact with the game (Salen, Zimmerman, 2004).

Core mechanics are often strongly coupled to the genre of the game. For example, in First Person Shooter (FPS) games, the core mechanic is shooting, which typically forms a collection of related actions like moving, jumping, aiming, and pulling the trigger. Some definitions of game mechanics draw a clear distinction between what the game allows and what the player does; this line, however, is not always so clear. Game rules are considered a subcategory of game mechanics; it indicates how vital their role is in setting structure to gameplay. Rules define spaces, entities, actions, the outcomes of actions, the limits of actions, and objectives. Juul (2005) outlines how game rules function as follows:

- Rules specify what players can do and dictate what should happen in response to player's choices. They must be simple enough to be implemented without skill and clearly defined so players can agree on their use.
- The rules of a game create a "state machine" that responds to the player's actions.
- One could think of this "state machine" as a shifting landscape of possibility that changes throughout gameplay. To play a game amounts to manipulating this "state machine" and navigating the game tree.
- Since a game can have multiple outcomes, players must strive to achieve the most favorable outcome possible.
- The actual gameplay emerges from how players seek to transcend those challenges. Gameplay is an interaction of rules and the player's effort to play

the game the best.

- Games serve as learning experiences where players enhance their gaming skills. At any moment, a player possesses a repertoire of abilities and strategies to tackle the challenges within the game. A key aspect of a good game's appeal lies in its ability to continuously test the player's skill set, requiring the development of new skills.
- A game can vary in difficulty, emphasize specific challenges, and even serve as a social activity. This variation provides an enjoyable experience through the rules; different games can offer different experiences.

Schell (2008) notes that “the mechanics of gameplay, even for simple games, tend to be quite complex and very difficult to disentangle” (p. 130). The complexity of the topic makes it very common to have different opinions regarding how to define and approach game mechanics. Some mechanics definitions have eluded a useful and pragmatic definition that would benefit designers and opted for an immaculate analysis from an academic and philosophical point of view. (Table 2.3).

Defining the mechanics, which are the fundamental building blocks of a game, is as complex as defining the game itself. Despite efforts to create comprehensive new studies by examining older works, encompassing all elements without becoming overly complicated is challenging. Some studies combine mechanics with rules, while others focus on separating these concepts. Although mechanics are the first component of the MDA framework, Hunicke et al. have faced criticism for their definitions, which have been seen as insufficient and confusing. Using the term "action," which is generally associated with dynamics, to describe mechanics, they introduced ambiguity into their conceptual framework. Therefore, this study has tried to avoid using the term actions" when defining mechanics. Additionally, rules have been included in the definition as a subset of mechanics.

The mechanics are the only element in the game designer's hands that can use dynamics to elicit the desired emotional response. Therefore, it is essential to comprehend how mechanics affect the game. Game designers must consider how their choices will affect the player's experience. Because game design is a recurring process, there is constant engagement with the mechanics throughout the entire process.

Table 2.3 : Categorization of the term “Mechanics” according to earlier studies.

	Schell	Juul	Rouse	Järvinen	Sicart	Hunicke et al.	Salen & Zimmerman	Junior & Silva
Characteristic	+						+	
Rules		+	+	+	+			
Actions				+	+	+	+	
Constraints			+	+				
Behaviors				+		+	+	+
Interactions	+	+			+			
Decisions							+	
Algorithms					+	+		
Agents /		+			+			+
Methods					+			
Gameplay		+	+			+	+	
Goals				+				

2.2.2 Dynamics

Various definitions have been attempted in game design literature to describe the gap between the game and the player's interaction. Dynamics are described in MDA as the player's instantaneous behaviors, while Salen and Zimmerman use the term "interaction" for this area, and Schell opts for expressions like "action" and "act."

Games are distinct from other entertainment forms like literature, music, films, and plays because their consumption is unpredictable. The sequence of events that unfolds during gameplay and the subsequent outcomes will be determined once the game is completed (Hunicke et al., 2004). Designing games involves crafting scenarios that players will explore and interact with, which requires a deep understanding of how game mechanics and dynamics work together. Playing consists of engaging in interactive activities. To be more precise, playing a game involves making decisions inside a gaming system that is intentionally designed to facilitate actions and provide significant results (Salen, Zimmerman, 2004).

Designing this unpredictable aspect of games means designing what the player will experience with the game. Dynamics serve as the bridge between the designer and the player and represent the part where players can interact. Designers, in turn, can craft these dynamics through mechanics. According to Schell (2008), “Actions are the “verbs” of game mechanics.” (p. 140). Schell has likened games without actions to non-verb sentences, meaning nothing happens. Even the most minor changes when selecting actions can determine the difference between a great game and a boring one. Therefore, these choices must be made carefully, and learning to listen to both the player and the game while designing it is necessary. Game design is repetitive due to these unpredictable and complex actions (2008).

The game designer must methodically construct a gameplay system in which these activities are significant to enhance the gameplay experience without causing disruptions or distractions. However, the game designers are not directly responsible for designing the actual gameplay experience. Structures and circumstances of play have a direct influence on the actions of players. The term "space of possibility" refers to the potential range of future actions a game design suggests. The game space encompasses all potential behaviors and meanings from a game design (Salen, Zimmerman, 2004). The "space of possibility," as defined by Salen and Zimmerman, acts as a bridge that brings us back to the aggregate of behaviors created by dynamics. The fact that this is defined as a space is not coincidental but entirely meaningful. In this area, players perform the enabled actions, explore, have fun, compete, and collaborate.

In the MDA framework, dynamics are not directly controlled by the designer but are influenced by mechanics. In doing so, this approach requires that designers calculate how to create such target dynamics, guiding players into targeted emotional experiences. This thus reflects a sensitive design process in which each game element needs careful consideration concerning the player's perception and feelings. Dynamics are a source of aesthetic experiences. For example, challenges may result from pressure in time or strategic actions taken by opponents. Fellowship may arise from shared knowledge with some group members or from setting challenging goals that cannot easily be achieved in solitude, for example, capturing an enemy's base. The concept of expression arises from interactive mechanisms that foster the inclination of individual users to make their distinctive contributions. These mechanisms include systems for acquiring, producing, or obtaining game goods, designing, constructing, and modifying levels or virtual environments, and crafting personalized and one-of-a-kind characters. The dramatic tension arises from the blend of factors that gradually increase and are then suddenly released and resolved. Our descriptions of dynamics will have to be exact and concrete to fit with aesthetics. By developing predictive and descriptive models for gaming dynamics, we can avoid common design errors and thus make the gaming experience better (Hunicke et al., 2004).

Determining in advance which dynamics will create certain emotions is quite challenging for designers. There is no definitive prescription for this, but what results have been encountered in previous experiences is often considered. As mentioned in FBS, memory also adds to the outcomes learned from our previous experiences. Designing what consequences actions might produce requires a similar approach. Designers can draw on their memories of past experiences, or as each product is designed, this process unfolds anew; new actions generate new experiences, and the cyclical process of game design comes into play. How can a development team effectively achieve a game's visual and artistic goals if they do not actively engage with the underlying mechanics that evoke those goals? There are two prevalent approaches in the business to address this issue: one is to draw on the dynamics of past similar games, and the other is to create prototypes flexibly until the desired aesthetics are achieved (Junior, Silva, 2021).

Schell has argued that the frequent appearance of similar sets of actions in games of a similar type is also related to the originality of those games. The prevalence of similarities among various games can be attributed to their use of a shared repertoire of actions. Examine the games labeled as "derivative," and you will observe that they possess an identical repertoire of actions as older games. Examine games commonly referred to as "innovative," and you will see that they provide players with unique actions regarding how they are performed or the outcomes they produce (Schell, 2008, p. 143).

The term "dynamics," which defines an ambiguous area in game design literature, is indispensable in game design research (Table 2.4). Various related terms have collectively contributed to the definition of dynamics. Although each study approaches the term differently, all the terms are consistent with one another. The most common approach to defining this element is the inherent uncertainty and fluidity in player interactions and game mechanics. While some associated dynamics with movement, others approached it as a void and black matter, on the contrary. As we can say, dynamics is the human effect that stands directly opposite the algorithms.

Table 2.4 : Categorization of the term "Dynamics" according to earlier studies.

	Schell	Salen & Zimmerman	Hunicke et al.	Junior & Silva
Action	+	+		
Act	+			
Interaction		+		+
Run-time Behaviour		+	+	+
Gap			+	
Verbs	+			
Space of Possibility		+		
Unpredictable				+
Bridge			+	+

2.2.3 Aesthetics

"What makes a game fun?" Numerous opinions have been expressed on this question. While feeling good about something, we unconsciously experience multiple emotions. An assessment of a game as enjoyable or not is reasonable when coming from the player. However, expressing the fun component more sophisticatedly is crucial for the designer, who watches and directs the process. From this angle, the designer ought to break down enjoyment and comprehend the elements that go into giving players a pleasurable experience. For instance, we might feel good after winning a match. Finding what we thought we lost can sometimes be fulfilling. Similarly, watching a competitor experiencing difficulties like our own might lift our spirits.

Sensory pleasure in games can be realized through tactile, auditory, and visual. This can be facilitated by collecting objects, touching them, or moving them around, having sounds thoughtfully fitted with the gameplay or visually stunning graphics that mean something. It is essential not only to equate visual pleasure with the quality of game graphics. No matter how impressive a game's graphics may be, they alone are not enough motivation for a player to engage with the game. Having autonomic reactions is not fun by itself. Since you already know how to do them, your brain will only reward you for doing them when it gives you a mental task. Typing does not make you feel good. It happens when you type while thinking about what to say or when you play a typing game (Koster, 2005). There are too many feelings for the term "fun"; thus, various people have felt the need to redefine it in new ways. Marc LeBlanc's concept of "8 kinds of fun" is included in the MDA framework, which adds to the aesthetic definition (Table 2.5).

Table 2.5 : 8 Kinds of Fun (LeBlanc, 2004b)

Sensation	Game as a sense of pleasure
Fantasy	Game as make-believe
Narrative	Game as unfolding story
Challenge	Game as obstacle course
Fellowship	Game as social framework
Discovery	Game as uncharted territory
Expression	Game as self-discovery
Submission	Game as mindless pastime

- Sensation: This form of enjoyment appeals to the five senses. In tactile games, sensory delight may arise from manipulating physical components, such as handling game dice or repositioning items on a game board.
- Fantasy: This element involves an immersion into an imaginative world, often causing players to lose track of time. It necessitates the creation of a detailed and internally consistent set of rules governing the universe.
- Narrative: Game narrative elements engage players by weaving complex stories that capture their interest and encourage prolonged engagement.
- Challenge: Games designed around challenges should strike a balance in difficulty; they should be manageable enough to frustrate the player yet challenging enough to maintain their interest and encourage continued effort.
- Fellowship: In multiplayer scenarios, social interaction can foster community or belonging among players, enhancing the gaming experience.
- Discovery: Games focusing on discovery incentivize players to explore and uncover new aspects or features within the game environment, rewarding curiosity and investigation.
- Expression: Games centered on expression allow players to exert their creativity, enabling them to leave a personal imprint on the game world through customization and creative input.
- Submission: This type of fun derives from engaging in simple, repetitive tasks that can be performed regularly. It offers a form of escapism or relaxation through minimal cognitive demands.

Each of these elements contributes uniquely to the gaming experience, catering to different player preferences and enhancing the multifaceted nature of game design.

Known as the "Four Keys to Fun," Lazzaro (2004) examines how games can elicit strong emotions from players without depending on storylines. These four main categories of player experiences make games enjoyable. Fifty-five individuals (15 passionate players, 15 casual players, and 15 non-players) engaged in their preferred video games in several environments during the study. Data was gathered through video recordings, questionnaires, and emotional cue observations (Table 2.6).

Table 2.6 : 4 Keys to Fun (Lazarro, 2004)

Hard Fun	Focuses on overcoming obstacles and solving problems. Creates emotions like frustration and personal triumph (Fiero).
Easy Fun	Engages players through exploration and immersion. Evokes emotions of wonder, awe, and mystery.
Altered States	Changes players' internal states during gameplay. Emphasizes emotions like excitement and relief.
The People Factor	Enhances social experiences through competition and cooperation. Generates emotions such as amusement and schadenfreude (joy over some harm or misfortune suffered by another).

Regardless of the type of fun, it is essential to recognize that for fun to be present, there must be an obstacle, and the individual must want to overcome this challenge. As Koster (2005) stated, “Fun, as I define it, is the feedback the brain gives us when we are absorbing patterns for learning purposes…. The lesson here is that *fun is contextual*. The reason why we are engaging in an activity matter a lot.” (p. 96).

The 6-11 Framework (Dillon, 2011) addresses a new classification over LeBlanc’s taxonomy, 8 Kinds of Fun. This taxonomy offers a perceptive and captivating overview of the emotional state within the players' minds, although it only provides a broad description at a high level. Ultimately, it may prove challenging for novice game designers and students to establish a direct correlation between a given type of enjoyment and a particular in-game dynamics. It identifies six core emotions and eleven basic instincts that interact to create engaging game experiences. These elements are deeply rooted in psychology and are considered universal across human experiences.

Six Emotions: Fear, anger, joy/happiness, pride, sadness, and excitement.

Eleven Core Instincts: Survival—including fight or flight, self-identification, collecting, greed, protection/care/nurture, aggressiveness, revenge, competition, communication, exploration/curiosity, and color appreciation.

The network of emotions and instincts in Dillon's 6-11 Framework can be effectively connected to game dynamics by recognizing that the different emotions the game evokes naturally trigger different instincts in players. These instincts, in turn, compel players to interact with the game, thereby demonstrating how overall aesthetics are linked to gameplay and game mechanics (Dillon, 2011).

When we examine how the term "fun" is addressed in the literature, LeBlanc aimed to provide a more general categorization of the fun in games (Table 2.7). He argued that emotions such as excitement, happiness, and sadness do not necessarily contribute to the fun of games, as these emotions can be fleeting or temporary and might not provide sufficient reasons to play a game.

Table 2.7 : Categorization of the term "Fun" according to earlier studies.

	LeBlanc	Koster	Lazarro	Dillon
Sensory pleasure	+	+		+
Imaginative world	+			
Storytelling	+			
Overcoming obstacles	+	+	+	+
Social interaction	+		+	+
Exploration	+	+	+	+
Self-representation	+			+
Repetitive tasks	+			+
Immersion		+	+	+
Solving problems		+	+	+
Excitement			+	+
Engaging with content		+		

Similarly, Koster suggested that, instead of focusing on emotions, the essence of fun lies in engaging with the content, which should intrigue the player and encourage them to overcome challenges, regardless of the form it takes. Dillon's approach, which attempts to define fun through emotions and instincts, helps identify transient pleasures but presents a complex categorization for determining the overall fun factor of games. In contrast, Lazzaro remained equidistant to all studies by trying to identify the factors that cause changes in emotions. Although all these studies contribute significantly to understanding what makes a game fun, LeBlanc’s "8 Kinds of Fun," suggested alongside the MDA framework, is considered the most comprehensive work in this field.

Fullerton (2008) advises “a very high level about what is interesting and engaging about your game to players while they are playing and what experiences they will describe to their friends later to communicate the high points of the game” (p. 11). In line with the MDA framework's concept of “aesthetic models,” we can establish game frameworks using refined terminology to delineate the dynamics and mechanics of gameplay. For example, it is crucial to encourage competitive gameplay and provide explicit feedback regarding the winner. A game becomes significantly less engaging if the player does not perceive a clear and achievable goal for winning or feels it is impossible to achieve victory (Hunicke et al., 2004). By understanding these interactions, designers can create games that resonate more deeply with players, ensuring that the mechanics and dynamics work together to evoke the desired emotional responses Figure (2.7).

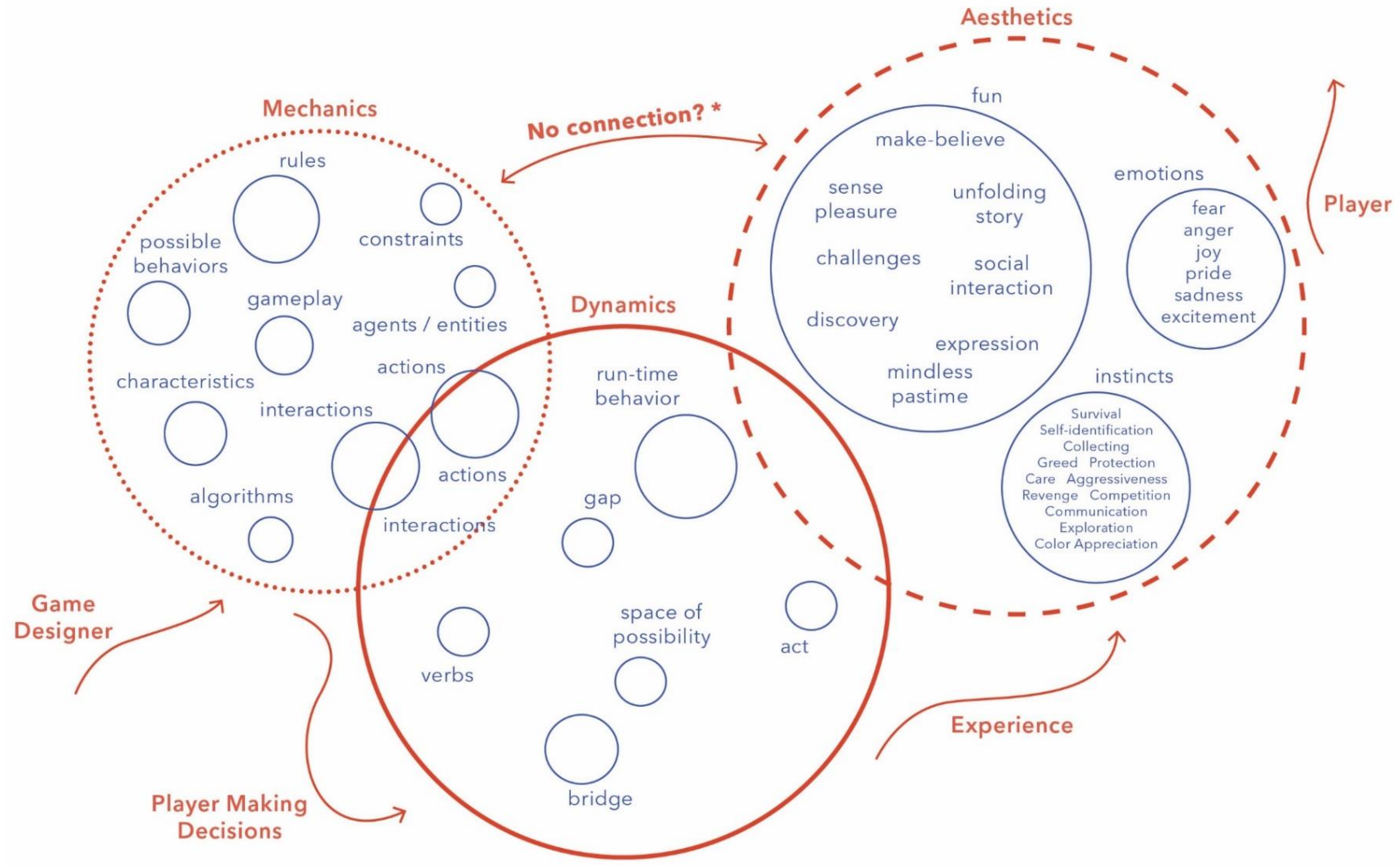


Figure 2.7 : Understanding the Game Elements

3. METHODOLOGY

In this thesis, following the literature review, a comprehensive theoretical framework is presented, discussing how these design frameworks can be used as content for game development. This step involves a detailed re-evaluation of the MDA concepts in the context of existing game design literature, ensuring a thorough understanding and application of the framework.

In this research process, we utilize board game mechanics, classifying these mechanics based on existing academic work and expanding this classification by revising the definitions of mechanics used within the study. This theoretical framework is inspired by the structure of a card game in which 28 different board game mechanics and components represent different facets of game design. Based on this framework design, relevant practical and iterative game exercises have been developed. The exercises are theoretical, practical, and iterative, allowing progressive refinement and adaptation considering feedback and evaluation. Each exercise delivered a thorough and inspiring approach to the understanding and application of the general principles regarding game mechanics, dynamics, and aesthetics within a diversity of contexts.

A mixed-method approach will be employed to validate the effectiveness and applicability of the proposed framework and accompanying exercises. This phase of the methodology involves conducting a game design workshop facilitated by and for expert game designers. Participants were chosen based on their knowledge and experience levels and their interests in game design. Game design workshops are appropriate research tools for several reasons. The practice involved is targeted and cost-effective, accommodating the participation of many people. The data that can be generated from such workshops may be very large in quantity, thus turning them into empirical instruments for the study of game design creation. Additionally, they can facilitate the development of new designs, as demonstrated in our case. Compared with other approaches, such as observing game designers in their workplace, studying game design workshops is relatively easy (Sintoris, 2015). During this workshop, six expert game designers actively used the exercises, providing evaluations that were recorded in video and audio. Experts later evaluated these exercises through a questionnaire based on various parameters that checked their effectiveness and the applicability of the MDA framework. The analyses would be about integrating MDA principles in exercises and their influence on enhancing the understanding of game design processes.

3.1 Data Collection

When selecting board games, specific criteria were considered to observe what types of fun the games evoke. Firstly, efforts were made to ensure that the selected games were popular within specific board game genres, as the group scoring them had access to these games in their office; therefore, the majority needed to be widely recognized games. Since core mechanics differ in the chosen games, this was considered an important aspect relating mechanics to emotions.

However, since many games deploy numerous mechanics, and some mechanics can also be repetitive in a game itself, the focus was reduced only to those core mechanics that defined each game's most unique representative gameplay mechanisms. Additionally, new mechanics added to the BoardGameGeek database since 2017 were incorporated to ensure the study reflected current trends and innovations in game design. This selection was made to avoid mechanics with confusing explanations or overly niche appeals to provide clarity and relevance for the participants. Considering these criteria, participants were asked to evaluate 25 games based on the "8 kinds of fun" components. This allowed for a comprehensive analysis of how different game mechanics contribute to various types of fun and player enjoyment.

Data collection for the case study consisted of two major exercises. One exercise asked participants to design games using given random game mechanics to create a particular type of fun. The second exercise asked participants to design mechanisms and dynamics based on a previously given fun factor goal. Active discussions, different types of questions, and a think-aloud method were employed during the exercises with the participants.

3.2 Analyze Method

Several empirical techniques are employed in design studies to validate frameworks. Two proven methods were chosen to meet this study's validation goals:

- Comparative analysis of aesthetic elements
- Design workshop and expert group interviews

One can establish structures to highlight strengths, weaknesses, and improvements by comparing the new framework with the existing ones. Experts can provide feedback on how well the framework aligns with industry standards, its comprehensiveness in covering necessary concepts, and its clarity in definition and structure. One of the main objectives of a design experiment is to refine the original idea through hypothesis testing and revision based on continuous learning environment analysis (Cobb et al., 2003).

This methodology outlines a comprehensive approach to exploring and enhancing the application of the MDA framework in game design through a practical, hands-on, and evaluative process, ensuring that the findings are grounded in actual designer experiences and feedback (Figure 3.1). Engaging with a game is a deliberate sort of "delight" when playing the game is an aim in and of itself rather than a means to a goal outside of it. Games are excellent case studies for design research because of this peculiar aspect of the design process. A game establishes and redefines its form and the experiences it may offer players as it develops (through the iterative process). New questions can arise from the iterative play of design itself (Zimmerman, 2003). The analysis will help identify strengths and weaknesses for improvement, providing a pathway for future enhancements to the framework and its application in game design education or game development.

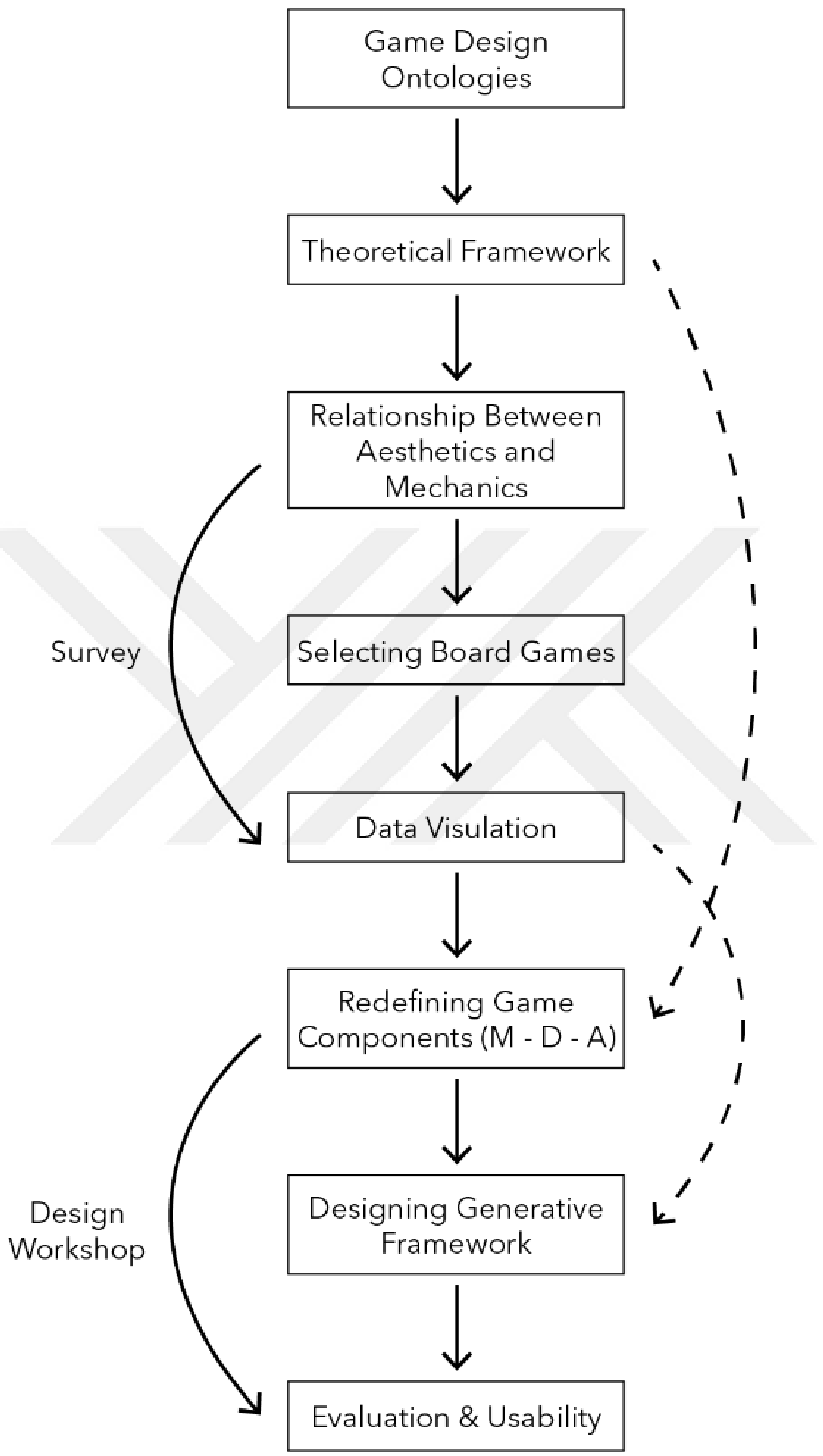


Figure 3.1 : Research Algorithm

4. BUILDING A NEW GENERATIVE FRAMEWORK USING BOARD GAME MECHANICS AND MDA FRAMEWORK

This section will detail the process of designing the generative framework model and its application in a design workshop to create a case study. It begins with an overview of the purpose and source of the board game mechanics used, how they were classified, and the criteria for their selection and inclusion in the study. Additionally, a survey was conducted to examine the fun factors these selected mechanics produced in user experiences. The survey results were visualized and categorized to show the relationship between mechanics and aesthetics.

In this study, a card game form is presented that defines 28 unique board game mechanics within its scope. These mechanics become exercises oriented at diverse design problems requiring an iterative design process. Six professional game designers participated in a workshop to evaluate these exercises and the applicability of MDA with different parameters as part of a mixed-method validation approach.

The framework will help develop an overarching perspective on how different game mechanics can evoke emotions and underline the requirement of iterative design for fine-tuning game elements. Exercises might make participants track and understand their progress, proving that the framework will help guide further learning. Moreover, this framework can facilitate communication and cooperation among the multidisciplinary team through its very structured nature, with a common language and a set of concepts usable by all team members.

4.1 Selection and Classification of the BGG Mechanics

BoardGameGeek (BGG) is a hub for board game enthusiasts and a vital academic resource offering an extensive game information database. Content contribution by website users is possible through reviews, ratings, images, videos, and questions about rules. Board games listed on BGG are ranked based on user ratings. These ratings influence the game's overall ranking in the global BGG list, a widely referenced indicator of a game's popularity and critical reception. In most of the BBG databases, collaboration among users is possible. However, mechanics cannot be directly attributed; instead, the site operators gradually incorporate them over time (Kritz et al., 2017).

This thesis utilizes the classification system Kritz, Mangeli, and Xexéo (2017) developed to categorize board game mechanics from BGG systematically. This classification forms the foundational framework for analyzing game mechanics within the Mechanics-Dynamics-Aesthetics (MDA) framework. The adopted classification is pivotal for exploring the dynamics and aesthetics these mechanics can induce in board games.

The BGG ontology (Kritz et al., 2017) has created a taxonomy tree based on four principles:

Similarity: Subclasses must handle the same things their parent does.
Specificity: Any subclass should always show clear differences from its parent.
Opposition: The subclasses should not overlap in features.
Unique Semantic Axis: Each subclass must differ from the parent class along some common property.

The primary structure of the ontology includes two large categories directly borrowed from the MDA framework: 'Algorithm' and 'Data Representation'. These categories help us understand how game mechanics influence player interactions and flow. (Figure 4.1)

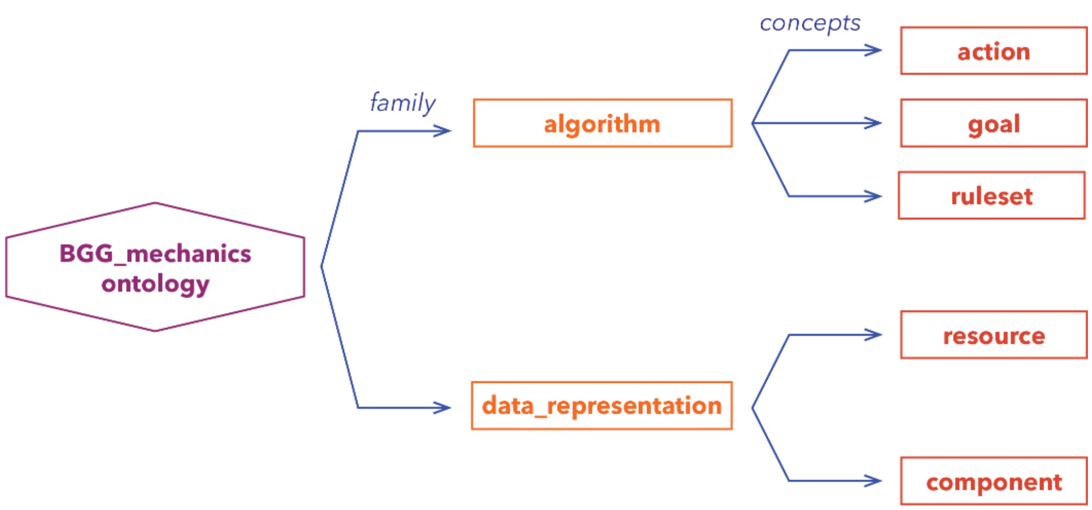


Figure 4.1 : Concepts in the BGG Ontology (Kritz et al., 2017: 184)

In the BGG ontology article, 48 mechanics taken from the database are explained and classified. Modifications were made based on their relevance and clarity in refining the mechanics for this thesis. This was done considering which mechanics might create dynamics and, thus, what emotions they might evoke. Additionally, attention was paid to the fact that the mechanics do not have confusing explanations for the participants using the framework.

In the "Action" section, mechanics such as Trick-Taking, Betting, Singing, Action_Programming, Simultaneous_Action_Selection, Secret_Unit_Deployment, Tile_Placement, Chit-Pull, Stock_Holding, Grid_Movement, and Press_Your_Luck have been removed. In their place, mechanics like Stacking_and_Balancing, Drawing, End_Game_Bonuses, Variable_Player_Powers, and Negotiation have been added. In the “Goal” section, mechanics such as Pick_Up_and_Delivery, Memory, and Area_Closure have been removed. Scenario_Mission and Clue_Finding have been added. In the “Ruleset” section, Solo_Game and 1_vs_1 have been added.

Although the "Teams" section does not generate dynamics, it was retained for its emotional impact on gameplay. Conversely, the "Component" section was removed due to its lack of generating dynamics. The "Resource" section has been included exactly as it is. The current setup of mechanics to be used in this research is illustrated in (Figure 4.2) below.

When selecting the mechanics marked in dark red, care was taken to ensure they came from different sub-concepts within various categories. These mechanics are intended to form the foundation for innovative game patterns that participants can create. Additionally, many of these mechanics are familiar to players and were avoided by some mechanics to maintain the framework's general applicability. Especially considering board games, these mechanics provide sufficient guidelines to create various games across different genres and categories.

Knowing what motivates different player types can help design appropriate progression and reward structures that keep players engaged with a game for a long time. That approach would keep these games engaging and satisfying for other types of players. According to Bartle's player typologies (1996), four-player types, achievers, explorers, socializers, and killers, can expected to adapt to games developed using these mechanics (Figure 4.3).

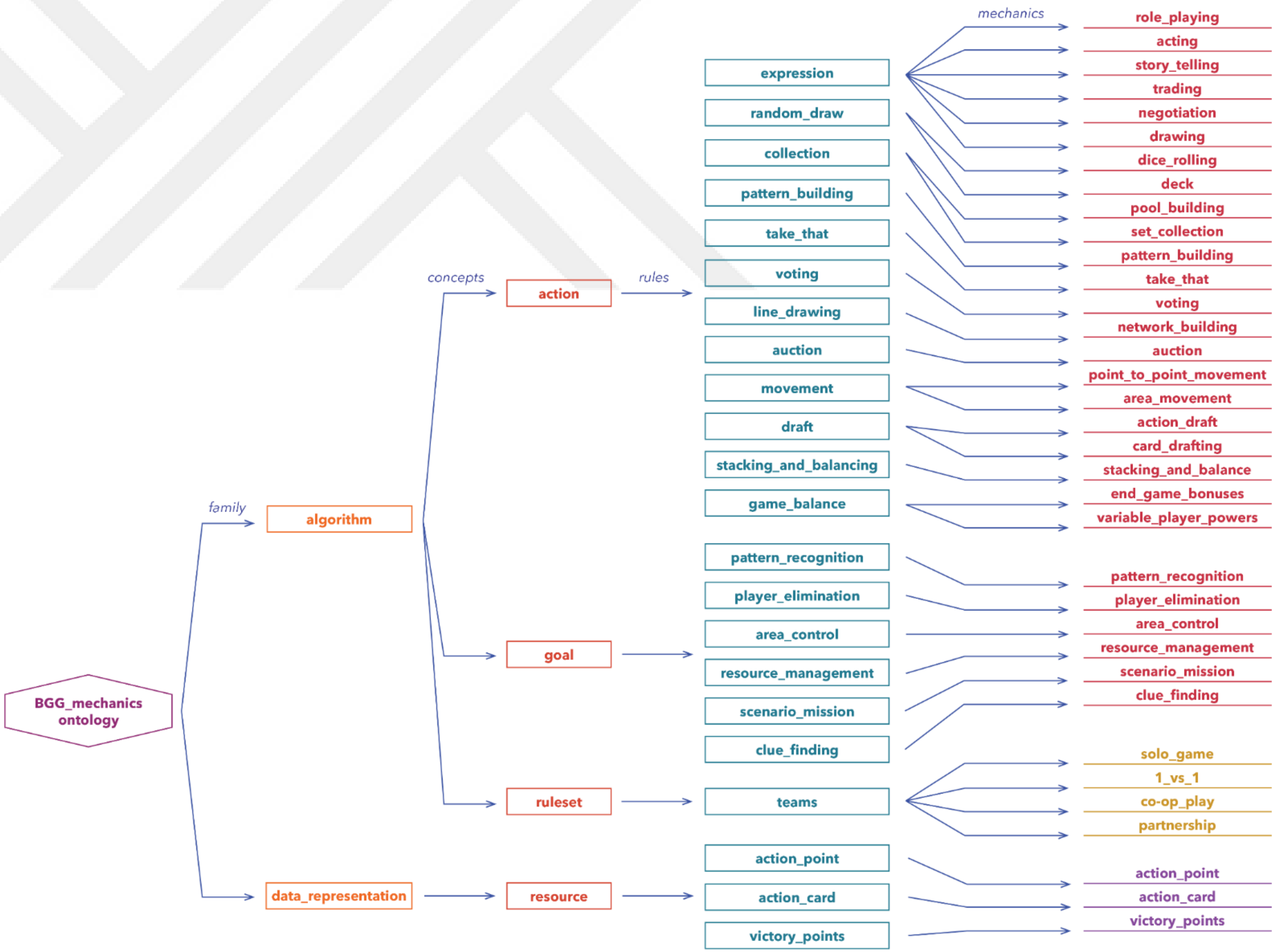


Figure 4.2: Classification Diagram of the Selected Board Game Mechanics

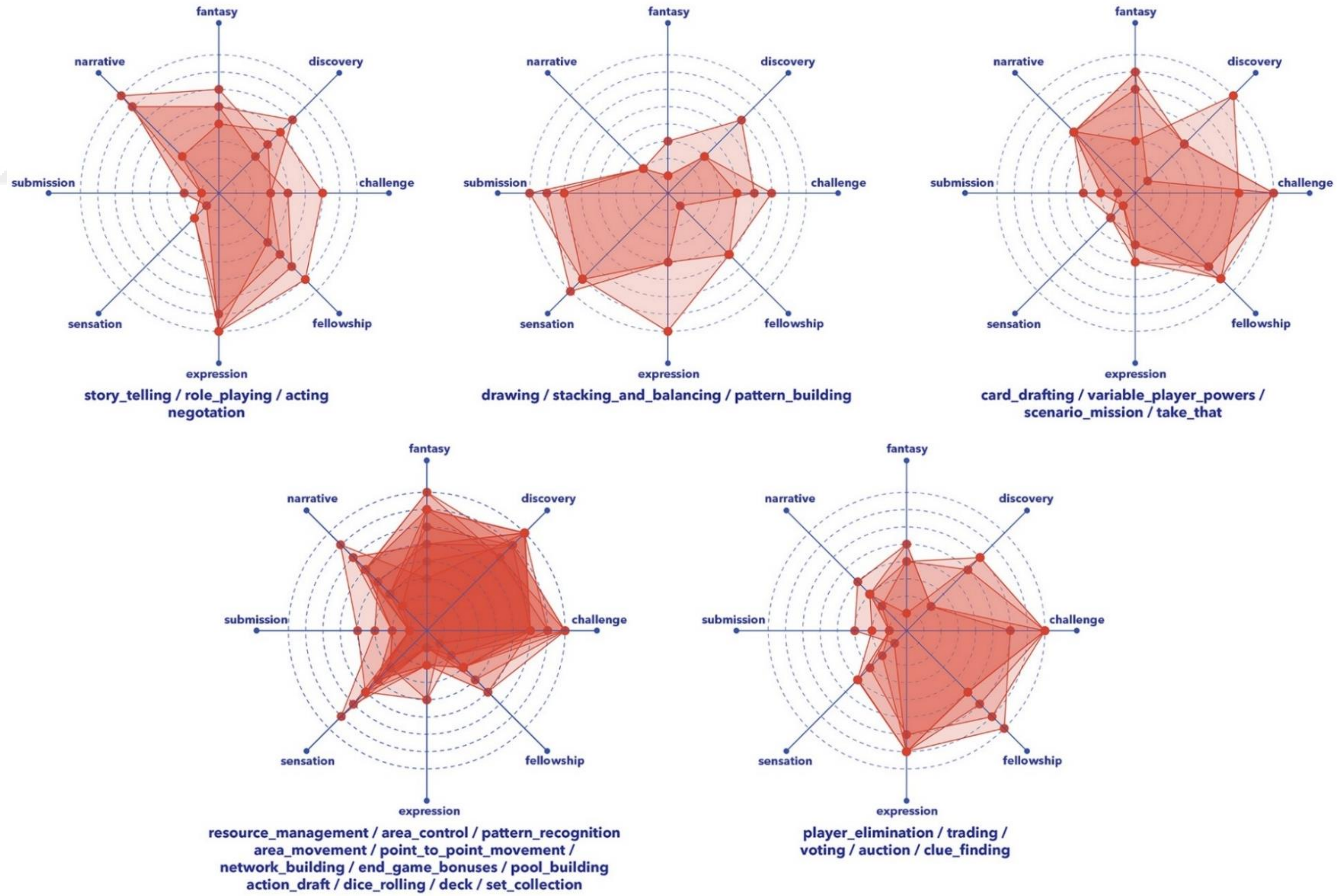


Figure 4.3: Comparison of Board Game Mechanics Through the Lens of Aesthetics

This classification scheme effectively organizes the mechanics and their potential impacts on both the dynamics of gameplay and the aesthetics experienced by the player. Each element, from family to component, shapes the overall experience, aligning well with the MDA framework's goal of linking mechanics to emotional responses.

4.2 Understanding the Aesthetics Through Mechanics

In the competitive world of game design, knowledge of how different mechanics impact player emotion is critical to creating engaging and memorable experiences. This aspect will be further investigated by surveying ten board game enthusiasts working in the game industry. The objective was to investigate the relationship between board game mechanics and aesthetics, categorized under the eight kinds of fun: Sensation, Fantasy, Narrative, Challenge, Fellowship, Discovery, Expression, and Submission. Collecting gamer's insights aimed to uncover which mechanics are more helpful in creating specific emotional responses.

This study analyzed board game mechanics to determine which mechanics will evoke specific aesthetics and visualize these relationships. It also aimed to determine whether the results would provide good supporting data for a generative framework being designed.

4.2.1 Selection of the board games

Each of the 25 selected board games features innovative characteristics in terms of mechanics, gameplay, story, and interactivity. As seen in Table 4.1, the games vary in their core mechanics (marked in red as the core mechanics of the games). Since a game can have multiple mechanics, it was considered that these mechanics would also be evaluated in the survey. In the survey, when the games are rated from 1 to 8 based on their proximity to the respective types of fun, it is believed that the core mechanics will predominantly influence these emotional responses.

1. Captain Sonar: It is a teamwork game that enables a unique and exciting experience of communication and team play. The simultaneous play and real-time strategy make for a thrilling experience.
2. Monikers: A party game that evolves through three rounds, becoming

progressively more challenging and hilarious. Players love the game for its creative humor, which sets it apart from many party games.

3. Dixit: This game is known for its beautiful and abstract artwork. It encourages imaginative storytelling and interpretation. Players have enjoyed the creativity this inspired, setting it apart from many more structured and rule-heavy games.
4. Chinatown: This negotiating and trading game is described as resembling the rapid movement and ruthlessness found in real estate deals. It is polymorphic in player interaction and deal-making, setting it apart from more passive economic games.
5. Catan: A timeless resource management and trading classic that will appeal due to its strategic depth and replayability. Considered to be one of the players' favorites because of its well-balanced aspect of luck and strategy, it is also rich in engaging trading mechanics.
6. Pax Pamir: This historical game offers deep strategy, complex player interactions, and intricate gameplay to provide a rich, narrative-driven experience that differs from typical strategy games.
7. Telestrations: It is an endless drawing and guessing game that creates endless laughter. Its ability to create hilarious miscommunications makes this indeed a standout party game.
8. Wingspan: It has beautiful art and an educational theme—players comment that it has relaxed yet strategic gameplay with accessibility and reward.
9. Dominion: As a pioneer of the deck-building genre, it yields many strategic opportunities and variations due to the huge number of possible card combinations within the deck. Innovation and high replayability make it a favorite of many.
10. Quarriors: This dice-building game introduces a unique twist on the deck-building genre with dynamic and fast-paced gameplay. Players like this combination of skill and luck.
11. Sushi-Go: This quick card drafting game with sets of cards worth different point totals is loved for its simplicity. The goal is to predict the cards your rivals want and spoil their plans while you trying to score points.
12. Carcassone: This tile-placement game is praised for its strategic depth. Players enjoy creating landscapes by placing tiles to build cities and roads and the tactical

decisions involved in strategically placing tiles and their followers.

13. Werewolf: This is a social deduction game that works in player interaction and bluffing as the game unfolds, full of energy and tension.

14. Ticket to Ride: This is a game that combines route-building with strategic planning, making it deeply engaging. Players appreciate its straightforward rules and the satisfaction of completing routes.

15. Monopoly: A classic game of real estate and strategy is well-known for its enduring appeal and competitive gameplay. Despite its length, players enjoy the negotiation and economic management it involves.

16. Friedrich: A historical war game that combines strategic thinking with asymmetric gameplay. Players move their armies along pre-defined points on the map. Each move must follow the connecting lines between these points, requiring players to think carefully about where to move their armies to control critical locations and anticipate enemy movements.

17. Tokaido: It's a calmer journey where one goes linearly along a set path, focusing on the beauty of the journey rather than the destination. Players plan their spending according to available points, but they will need them in later actions.

18. Risk: This game is loved for its strategic planning and player alliances. Once players lose all their territories, they are out of the game. Players must balance the risks of attacking with the rewards of gaining new territories. Aggressive expansion can leave territories vulnerable to counterattacks, requiring careful planning and resource management.

19. Lost Ruins of Arnak: This game combines deck-building with action drafting and offers a rich, thematic adventure. Players enjoy its strategic depth and exploration elements.

20. 7 Wonders: A drafting game with several ways to win different techniques and multiple paths to victory. The tactical game requires players to know what other players are doing.

21. Jenga: A dexterity game that is simple yet nerve-wracking. Players love the physical challenge and the tension.

22. Ogre: An asymmetric tactical war game where one player controls a powerful tank

(the Ogre), and the other controls an army trying to stop it.

23. Battleship: A classic deduction game involves discovering and sinking the opponent's ships.
24. King of Tokyo: A dice-rolling game of monster battles is praised for its fast-paced and chaotic fun. The game offers two paths to victory: accumulating victory points or eliminating all other players. This dual victory condition provides strategy flexibility and keeps the game engaging and unpredictable.
25. Pandemic: Players must become a team to contain disease outbreaks worldwide in this cooperative game. It is a game of teamwork, strategy, and missions based on scenarios that add new challenges and story elements to the game—pandemic, providing new challenges and enhancing replayability.

The selected games stand out from their peers due to their distinctive features. They have found wide acceptance in literature for board games and have reached a broad audience: Games like Captain Sonar and Pandemic bring intense communication and collaboration. In games like Catan, Wingspan, and Risk, deep strategic planning can be found. Dominion and 7 Wonders offer numerous replays of strategies and ways to victory. Jenga and King of Tokyo tense the body and mind, as players are on edge. Others bring elements that refresh the concepts of board games; for example, Captain Sonar adds real-time strategy, while Dominion does deck-building and Quarriors does dice-building. Furthermore, the beautiful visuals of some, such as Dixit and Wingspan, form large portions of their appeal.

Additionally, a distribution was created to test various game mechanics extensively. As shown in the table, the selected games feature numerous diverse core mechanics that make them stand out. Core mechanics are the base mechanisms that are repeated most often in the game, setting it apart from others. The separation also concerns how those mechanics evolve into dynamics and affect gameplay through the player's experiences.

Table 4.1 : Selected Board Games and Their Mechanics

Mechanics	Captain Sonar	Monikers	Dixit	Chinatown	Catan	Pax Pamir	Telestrations	Wingspan	Dominion	Quarriors	Sushi Go	Carcassonne	Werewolf	Ticket to Ride	Monopoly	Friedrich	Tokaido	Risk	Lost Ruins of Arnak	7 Wonders	Jenga	Ogre	Battleship	King of Tokyo	Pandemic
Role_Playing	x												x												
Acting		x	x																						
Story_telling		x	x																						
Trading				x	x										x										
Negotiation				x	x	x							x												
Drawing							x																		
Dice_Rolling					x			x		x								x				x		x	
Deck									x																
Pool_Building									x	x															
Set_Collection				x		x		x	x		x			x	x	x	x	x		x					x
Pattern_Building												x													
Take_That	x								x																
Voting			x										x												
Network_Building					x							x		x								x			
Auction															x										
Point_to_Point_Movement																x	x								x
Area_Movement	x					x						x						x							
Action_Draft											x								x	x					
Card_Drafting		x						x	x	x	x			x						x				x	
Stacking_and_Balancing																					x				
End_Game_Bonuses								x			x			x			x								
Variable_Player_Powers													x				x			x		x			

Table 4.1 (continued) : Selected Board Games and Their Mechanics

Mechanics	Captain Sonar	Monikers	Dixit	Chinatown	Catan	Pax Pamir	Telestrations	Wingspan	Dominion	Quarriors	Sushi Go	Carcassonne	Werewolf	Ticket to Ride	Monopoly	Friedrich	Tokaido	Risk	Lost Ruins of Arnak	7 Wonders	Jenga	Ogre	Battleship	King of Tokyo	Pandemic
Pattern_Recognition																							x		
Player_Elimination															x			x						x	
Area_Control																x									
Resource_Management					x												x		x						
Scenario_Mission																x						x			x
Clue_Finding			x																						
Solo_Game								x											x		x				
1_vs_1							x														x		x		
Co-op_Play																									x
Partnership	x	x											x												

4.2.2 Relation of the aesthetic elements

After the survey, a graphical analysis was undertaken to interpret the results in a way that could be used within the generative framework. The survey results, representing the average scores given by 10 participants, are shown in Table 4.2. The table is structured like a heat map and contains numbers ranging from 1 to 8. In this context, a score of 8 indicates that the mechanic is highly conducive to generating the specified fun factor, while a score of 1 signifies that it is the least conducive.

This analysis aimed to explore potential similarities among aesthetic elements, considering which aesthetics are more likely to be used together, which are more frequently employed, and which, due to their rarity, can create unique game experiences. The survey results were visualized in a pie chart to understand these questions better. The emotions of Narrative – Fantasy – Discovery, Expression – Fellowship – Challenge, and Submission – Sensation frequently occur together in games. The results of each mechanic were visualized by positioning these types of fun close to each other in the circular graph. Subsequently, the emerging patterns were grouped according to their similarities. Based on this grouping, five different mechanic-aesthetic relationships can be discussed.

Mechanics such as Storytelling, Role-playing, Acting, and Negotiation are likely to evoke the fun elements of Expression, Narrative, and Fellowship. Drawing, Stacking and Balancing, and Pattern Building are likely to evoke the fun elements of Submission, Sensation, and Expression. Card Drafting, Variable Player Powers, Scenario Mission, and Take That are likely to evoke the fun elements of Challenge, Fellowship, and Fantasy. Resource Management, Area Control, Pattern Recognition, Area Movement, Point-to-Point Movement, Network Building, End Game Bonuses, Pool Building, Action Draft, Dice Rolling, Deck Building, and Set Collection are likely to evoke the fun elements of Challenge, Discovery, and Fantasy. Player Elimination, Trading, Voting, Auction, and Clue Finding are likely to evoke the fun elements of Challenge, Fellowship, and Expression.

These relationships provide valuable insight into how different game mechanics can influence the kinds of fun players experience and aid in making more engaging and rounded games. This subtle understanding makes a huge difference in the design process, helping to meet the game's emotional and experiential aims

Table 4.2 : Survey About the Relationship Between Board Game Mechanics and Aesthetics

Family	Concepts	Rules	Mechanics	Sensation	Fantasy	Narrative	Challenge	Fellowship	Discovery	Expression	Submission
Algorithm	Action	Expression	Role_Playing	1	5	7	3	4	6	8	2
Algorithm	Action	Expression	Acting	1	5	7	4	6	3	8	2
Algorithm	Action	Expression	Story_telling	2	6	8	3	5	4	7	1
Algorithm	Action	Expression	Trading	2	4	3	8	5	6	7	1
Algorithm	Action	Expression	Negotiation	2	4	3	6	7	5	8	1
Algorithm	Action	Expression	Drawing	7	1	2	4	5	3	8	6
Algorithm	Action	Random_Draw	Dice_Rolling	4	7	5	8	3	6	1	2
Algorithm	Action	Random_Draw	Deck	4	8	5	7	3	6	1	2
Algorithm	Action	Collection	Pool_Building	5	6	3	8	2	7	4	1
Algorithm	Action	Collection	Set_Collection	5	7	2	6	4	8	3	1
Algorithm	Action	Pattern_Building	Pattern_Building	7	3	2	5	1	6	4	8
Algorithm	Action	Take_That	Take_That	1	6	5	8	7	4	3	2
Algorithm	Action	Voting	Voting	1	5	4	6	8	2	7	3
Algorithm	Action	Line_Drawing	Network_Building	7	5	4	6	2	8	1	3
Algorithm	Action	Auction	Auction	3	4	2	8	7	5	6	1
Algorithm	Action	Movement	Point_to_Point_Movement	4	7	5	6	3	8	2	1
Algorithm	Action	Movement	Area_Movement	4	7	3	6	5	8	2	1
Algorithm	Action	Draft	Action_Draft	3	8	5	6	1	7	4	2
Algorithm	Action	Draft	Card_Drafting	2	7	5	8	6	1	4	3
Algorithm	Action	Stacking_and_Balan	Stacking_and_Balancing	8	1	2	6	5	3	4	7
Algorithm	Action	Game_Balance	End_Game_Bonuses	5	3	7	6	2	8	1	4
Algorithm	Action	Game_Balance	Variable_Player_Powers	2	7	5	8	6	4	3	1
Algorithm	Goal	Pattern_Recognition	Pattern_Recognition	6	4	3	8	5	7	2	1
Algorithm	Goal	Player_Elimination	Player_Elimination	4	5	3	8	6	2	7	1
Algorithm	Goal	Area_Control	Area_Control	4	5	6	7	3	8	2	1
Algorithm	Goal	Resource_Manage	Resource_Management	3	5	6	8	4	7	1	2
Algorithm	Goal	Scenario_Mission	Scenario_Mission	1	3	5	6	7	8	4	2
Algorithm	Goal	Clue_Finding	Clue_Finding	4	1	3	8	5	6	7	2

4.3 Designing of the Game Exercises

Linus Pauling, a respected American scientist and Nobel Prize winner, once said, “The best way to get a good idea is to get many ideas and throw the bad ones away.” How should we decide which ideas are ordinary? Is generating a lot of ideas as easy as it seems? These two questions contain essential building blocks for the game design process. When designing game exercises, the goal was to help designers avoid potential pitfalls and provide a new way of thinking.

The game exercises are played using a deck. (Figure 4.4) The mechanics, actions, resources, and teams in this deck can be seen as elements that provide input for the game. The 28 board game mechanics selected in the previous section were designed as game cards and included in the exercises. Graphs showing the relationships between mechanics and aesthetics and tables indicating how specific mechanics could create actions (dynamics) were prepared to assist the participants.

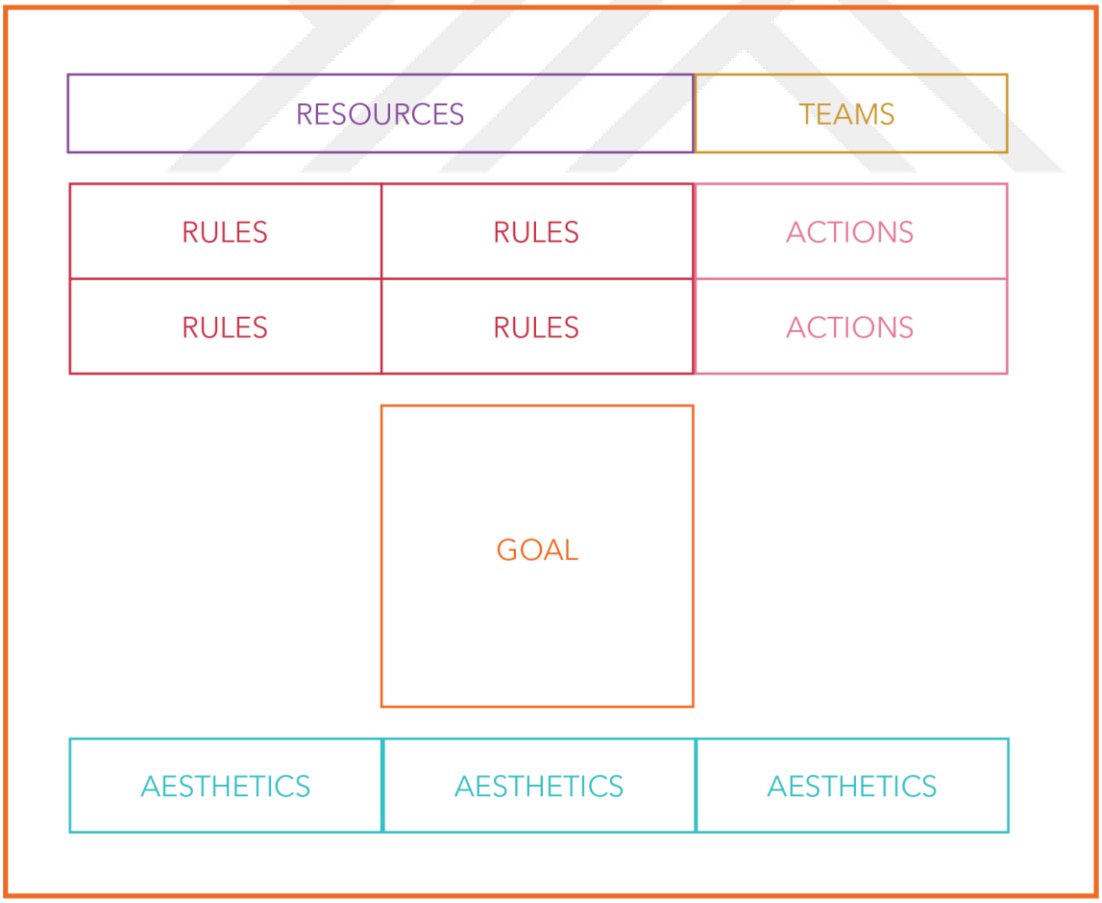


Figure 4.4 : Generative Framework’s Deck

According to the rules of the game, in the first exercise (Figure 4.5):

Participants draw four mechanic cards and define the game rules with the mechanics in their hands.

Design question: What interesting rule variations can we consider? What actions might these rules create? After a brief discussion, the relevant actions should be added to the deck using post-it notes.

Design question: What are the aesthetics of this game? Participants can use the graphs to answer this question. Do the resulting aesthetics match the desired ones? If not, what model can be created by adding or removing some aesthetics?

Design question: What are the game's resources? How will these resources be gained and spent? Again, they should be added to the deck using post-it notes. At this stage, do any rules need to be changed?

Design question: How many players will the game have? Can the maximum number of players and game duration be decided? The gameplay strategy of the game should be considered.

Design question: Is there any change in the game's aesthetics at this stage?

Design question: Can a genre and narrative layer be added to the game?

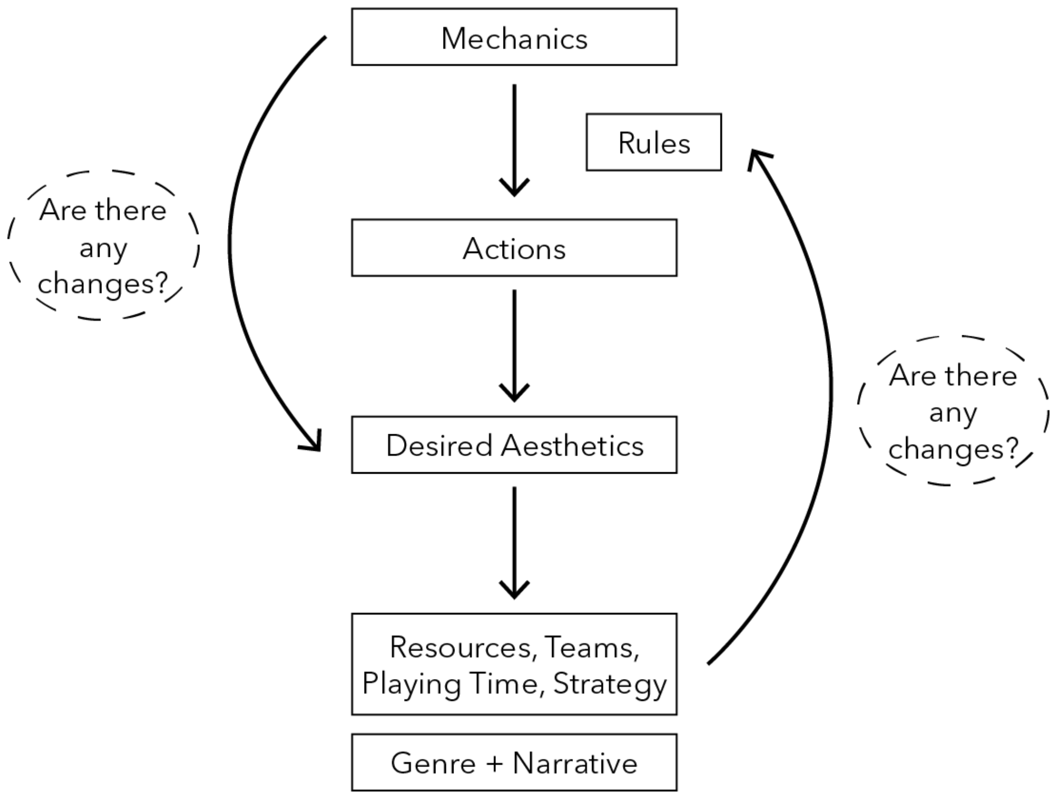


Figure 4.5 : Exercise-1 Algorithm

According to the rules of the game, in the second exercise (Figure 4.6):

Before designing the game, the desired aesthetics are written on the game deck. Two mechanics cards that are considered suitable for this aesthetics are drawn. Additionally, two cards are drawn face-down and added as a surprise.

Design question: What interesting rule variations can we consider? The game rules are determined by discussing them together with the aesthetics.

Design question: Which actions that emerge from these mechanics will help achieve the intended aesthetics? The decided ones are added to the deck using post-it notes.

Design question: What are the game's resources? How will these resources be gained and spent? Again, they should be added to the deck using post-it notes. At this stage, do any rules need to be changed?

Design question: How many players will the game have? Can the maximum number of players and game duration be decided? The gameplay strategy of the game should be considered.

Design question: Is there any change in the game's aesthetics at this stage?

Design question: Can a genre and narrative layer be added to the game?

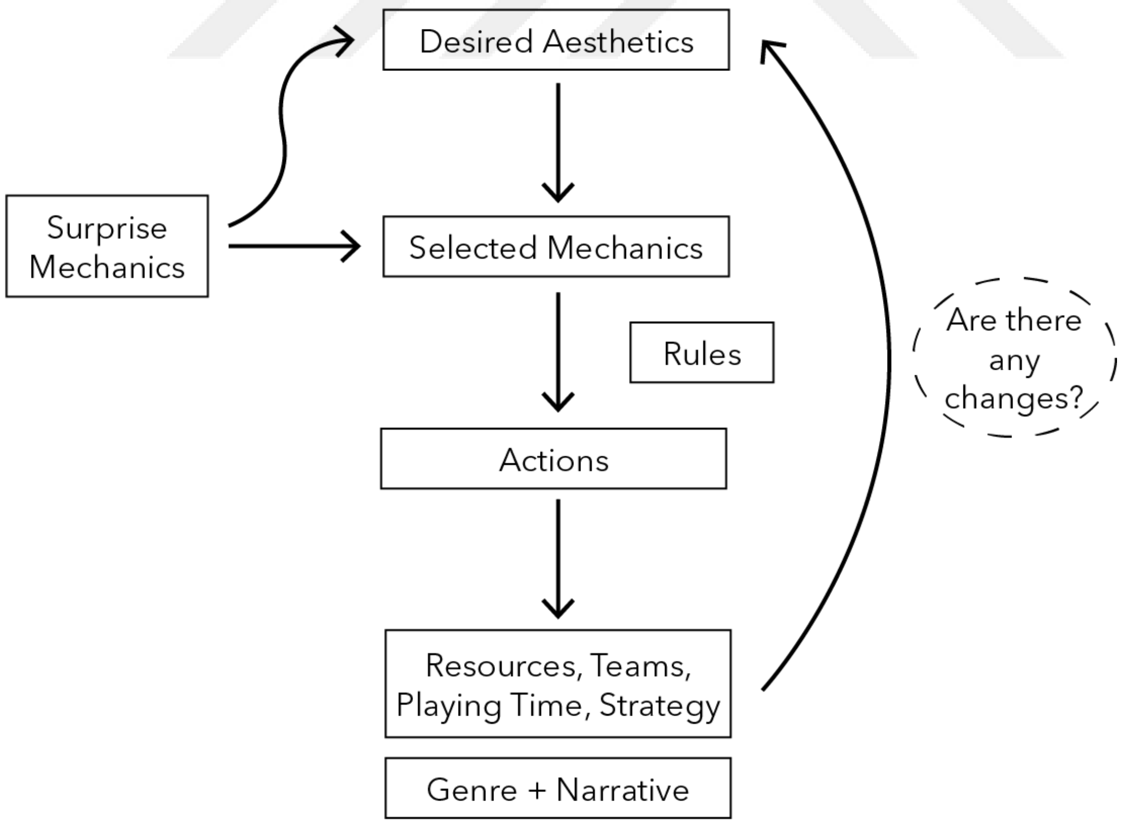


Figure 4.6 : Exercise-2 Algorithm

In the first exercise, we aim to identify the fun factor we want to create for the player using randomly selected game mechanics from the cards. This process involves balancing different aspects, such as the weight of the mechanics, their impact on dynamics (actions), and rule-setting. In the second exercise, the desired fun factor is set as the target, and participants select suitable mechanics and dynamics to achieve it. When the rules are determined, checking for any changes in the targeted aesthetics is necessary. After participants complete both games, a discussion can be held on which game is more innovative. The purpose of the game exercises is to prepare for the iterative processes of game design and to experience how the outcome can change depending on where the design started.

4.3.1 Participants

The participant profile is significant within social sciences as it is crucial for effective data analysis. In this study, a total of six participants were involved: three males and three females, indicating a balanced gender representation. The participants' ages range from 23 to 35, suggesting a mix of young professionals and those with more experience in the independent game industry. There are two game designers (EN and AT) and one participant involved in both game design and marketing (MK). This highlights a strong focus on game design expertise. Participants GK and AL are involved in product and growth management, respectively, indicating crucial roles in game projects' strategic development and scaling. One participant (BU) is a game artist, emphasizing the importance of visual and creative aspects in game development.

The work experience ranges from 2 to 7 years, while a few of the participants have a high amount of experience, with the majority having only 2 to 3 years. As such, the mix offers seasoned insights with fresh perspectives (Table 4.3).

Table 4.3 : Participants' Profile

Code	Gender	Age	Birthplace	Profession	Work Experience
EN	Male	35	Istanbul, Türkiye	Game Designer	7 years
GK	Female	26	Istanbul, Türkiye	Product Manager	3 years
AL	Female	23	Istanbul, Türkiye	Growth Manager	3 years
AT	Male	25	Istanbul, Türkiye	Game Designer	3 years
BU	Female	26	Istanbul, Türkiye	Game Artist	2 years
MK	Male	34	Istanbul, Türkiye	Game Design & Marketing	7 years

4.3.2 Design workshop

The design workshop was divided into three sessions according to the participants' schedules. The first session was conducted with EN, followed by a second one with AL and GK, and finally with AT, BU, and MK. At the very beginning of each workshop session, the objectives of the workshop and the game design approach focused on were presented. This was followed by an explanation of the MDA framework and its components. Board game mechanics applied in the workshop were also explained. This introductory part lasted around 10 minutes for each session. Participants' questions were answered at that time, and information was provided about the methods and differences between exercises. The average time to implement the first exercise was 35 minutes per session. The second exercises were shorter, lasting about 15 minutes on average.

In the workshop with participant EN, the first exercise created a game where the player could collect items such as antiques, jewelry, books, or old electronics. Various rules were defined to balance the resources of money and items in the game. For instance, using trade and auction mechanics, players could convert unused items into money and acquire valuable items. The fun factors of the game were identified as challenge and expression (determining which type of item to collect). However, to increase the challenge factor and balance the power dynamics in the game, the participant decided to add a theft mechanic. It was decided that players would lose money at the start of each turn if they held onto items that other players found useful. The introduction of the theft mechanic added fellowship as a fun factor by balancing the resources.

In the second exercise with the same participant, the desired fun factors were fantasy, challenge, and submission. Here, as the participants became more familiar with the concepts and approaches from the first exercise, they chose to challenge themselves and started with goals that were not commonly used together. With the selected and drawn mechanics, a storybook game was created. The player's goal in the game was to complete the book without dying by making choices. If the player's health or money reached zero, they had to restart the game. There was no change in the initially chosen aesthetic goals, and the game rules were aligned with these goals (Figure 4.7).

In the second session with AL and GK, Since participants were eager learners of game design, more time was spent on the theoretical background in this session.

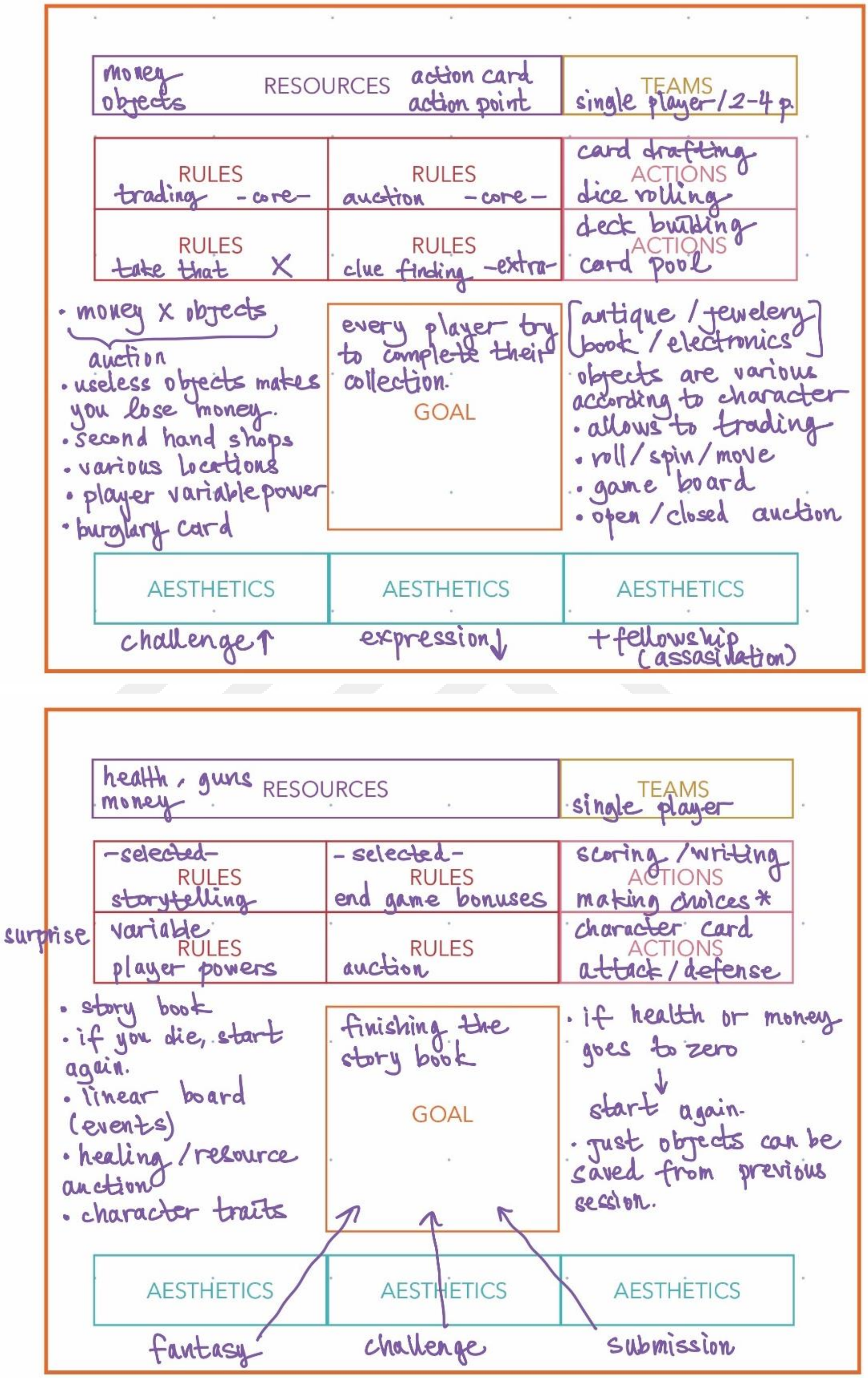


Figure 4.7 : Design Workshop with Participant EN

Before completing the exercises, participants asked a wide range of questions and often engaged in lengthy discussions about how the mechanics could work, ensuring that all participants agreed. They conceptualized the first game where players had to catch a criminal using hidden roles and finding clues in their hunt. A core scenario mechanic was identified, and the rules were written around that. To add replayability, they came up with a design by which, in each game run, clues would be randomly placed so that players could find or buy them with resources to form a collection. The game was designed with narrative, challenge, and discovery as its core aesthetics. For the team aspect, they considered playing by forming alliances and discussed adding voting and player elimination mechanics to enhance the sense of fellowship.

In the second exercise of this session, a collaborative effort led to the selection of challenge and fantasy as the target aesthetics. Using the chosen and drawn mechanics, a game was designed where players, based on different character traits, move and fight enemies by rolling dice to find an object. They designed a deck like Monopoly, where players roll dice to advance through locations. If a player completed a turn without dying, they would receive a bonus and move on to the next turn. After establishing these mechanics and rules, they discussed incorporating discovery and submission aesthetics into the game. Players could repeat the game as often as they wanted after completing the turn alive, serving as a time-passing element (Figure 4.8).

In the third workshop group, participants AT, BU, and MK worked on designing a skill-based battle game whose core mechanics are stacking and balancing for the first exercise. The aim of the game should be to have the highest but most stable tower, requiring players to strategize their moves. A game deck was designed to manage the acquisition of blocks, which were a primary resource mechanics. Players could roll dice to advance and purchase blocks or attack neighboring players to damage their towers. The target aesthetics for this game were sensation, fellowship, and challenge. One also mentioned making a narrative layer that would give more motivation and strategy options for stealing or using blocks so that they are working toward some greater goal.

The second exercise of the workshop shifted towards creating a game centered on expression and fantasy. The participants, armed with the drawn mechanics, designed a guessing game with RPG elements. This game was unique in its incorporation of negotiation, which is a surprise element, and role-playing mechanics, pushing beyond the boundaries of conventional role-playing games. After formulating the game rules, it was anticipated that discovery, challenge, and fellowship would also be evident alongside the primary fun factors.

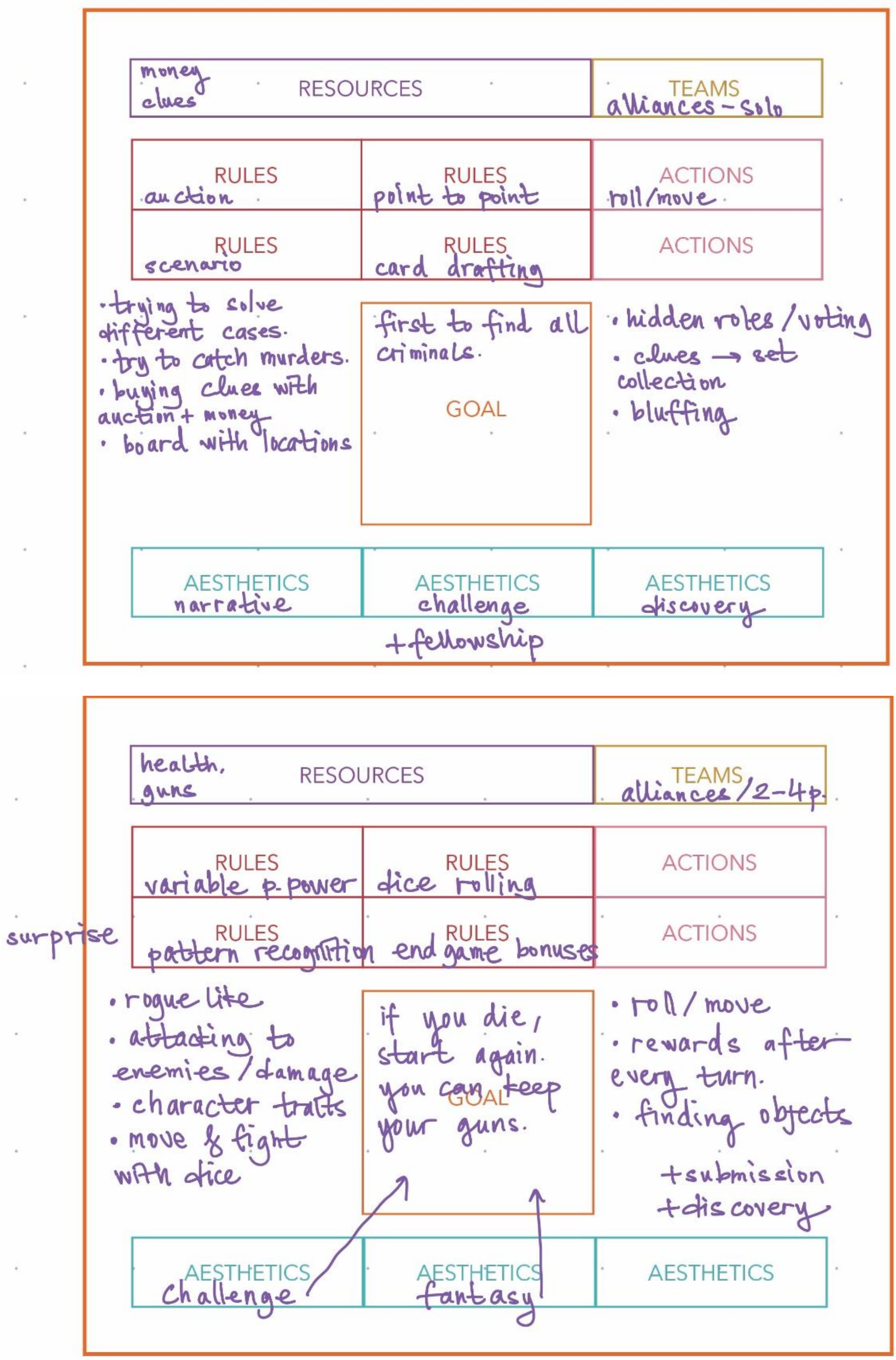
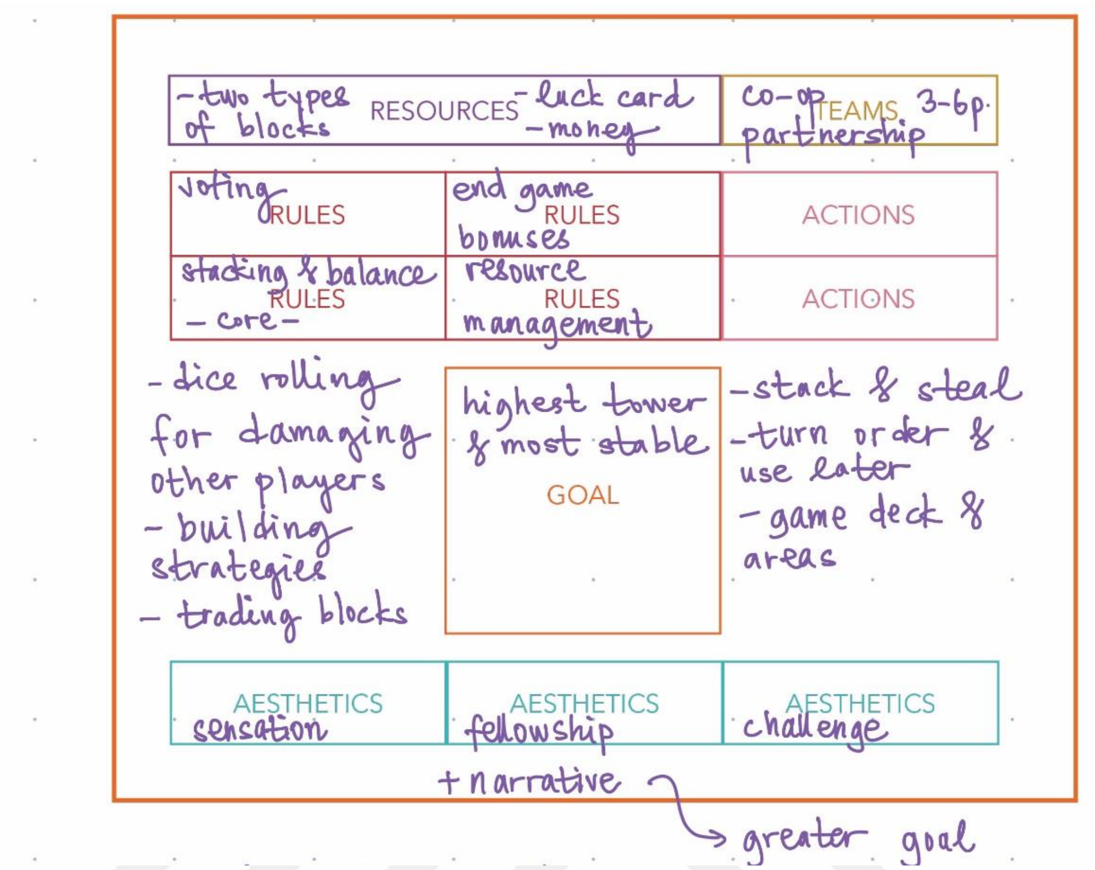


Figure 4.8 : Design Workshop with Participants GK and AL

Participants appeared to be concentrated and entertained throughout. In the second session, with less game design experience, the participants initially tried to treat all mechanics equally. As they gained a deeper understanding of game concepts and relationships, they could concentrate more on the fun aspect of the games. The participants noted that if they were to repeat the workshop, their approach might change, and they might be more willing to take risks. In contrast, the sessions with more experienced game designers focused more on making the games captivating. These game designers set out to design games that they personally would enjoy playing. They chose challenging rules and concentrated on their balance. Following the exercises' methods, they abandoned some decisions or added new perspectives while the process progressed (Figure 4.9).

To analyze and compare the products that emerged from the design workshop, Sintoris' (2015) study on game patterns was utilized. This study was prepared with data obtained from six different design workshops. Using the concepts from the study, the patterns found in the games produced within the scope of this thesis are marked in the table below. Table 4.4 helps comprehensively analyze the game patterns observed in the design workshops. Each game pattern is categorized under specific headings such as "Interaction between the players," "Challenge," "Narrative," "Players," "Game," and "Learning dimension," with further sub-categories for detailed insights. Analyzing game patterns is valuable for understanding how game mechanics and dynamics are employed across various design choices. It offers insights into the design process and creates engaging game experiences.

Game design patterns identified during the workshop range from strategic planning to resource management, from narrative engagement to player interaction (Figure 4.10). Common patterns deal with competition, exploration, and motivation, merging into dynamic narratives that assure a full and engaging experience. Although less frequent, such rare patterns as team forming, bluffing, sabotage, and stealing add special elements that might further discriminate a game and pose new challenges for players. The diversity of game design patterns that emerged, even within a short design workshop, shows how structured guidance can help develop various game mechanics and dynamics. Moreover, all elements under the eight kinds of fun enveloped the games developed in three workshop sessions (Figure 4.10).



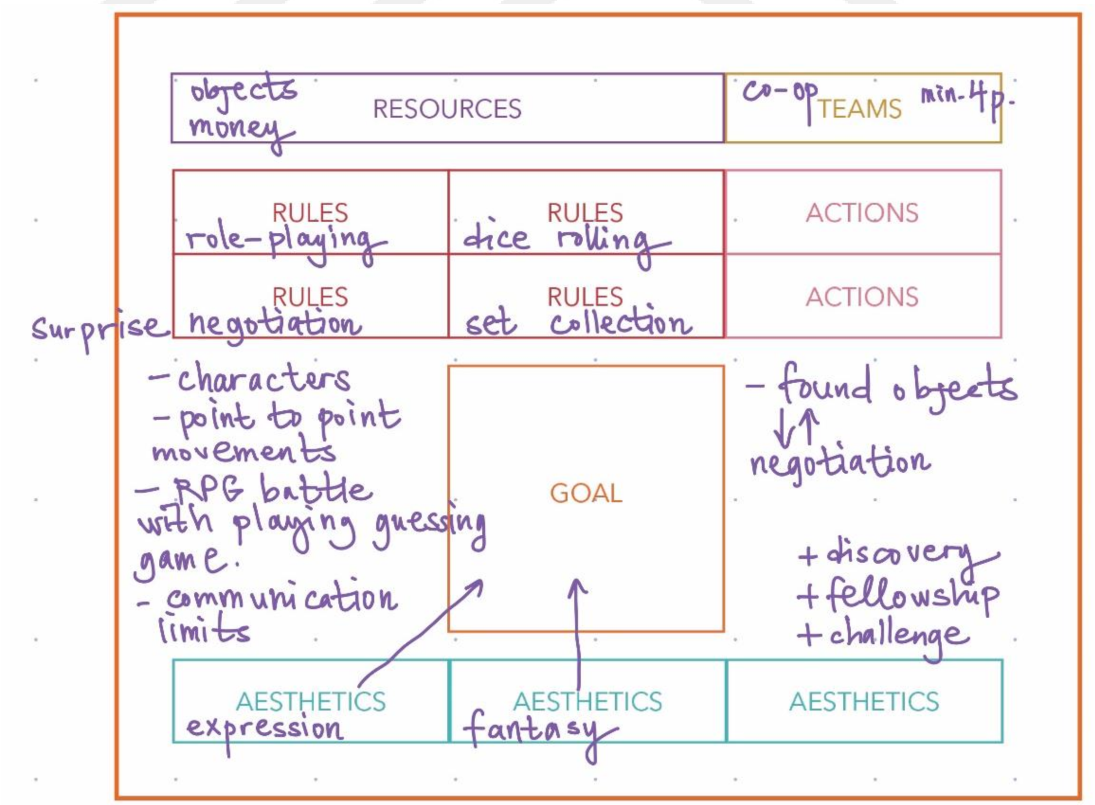


Figure 4.9 : Design Workshop with Participants AT, BU, and MK

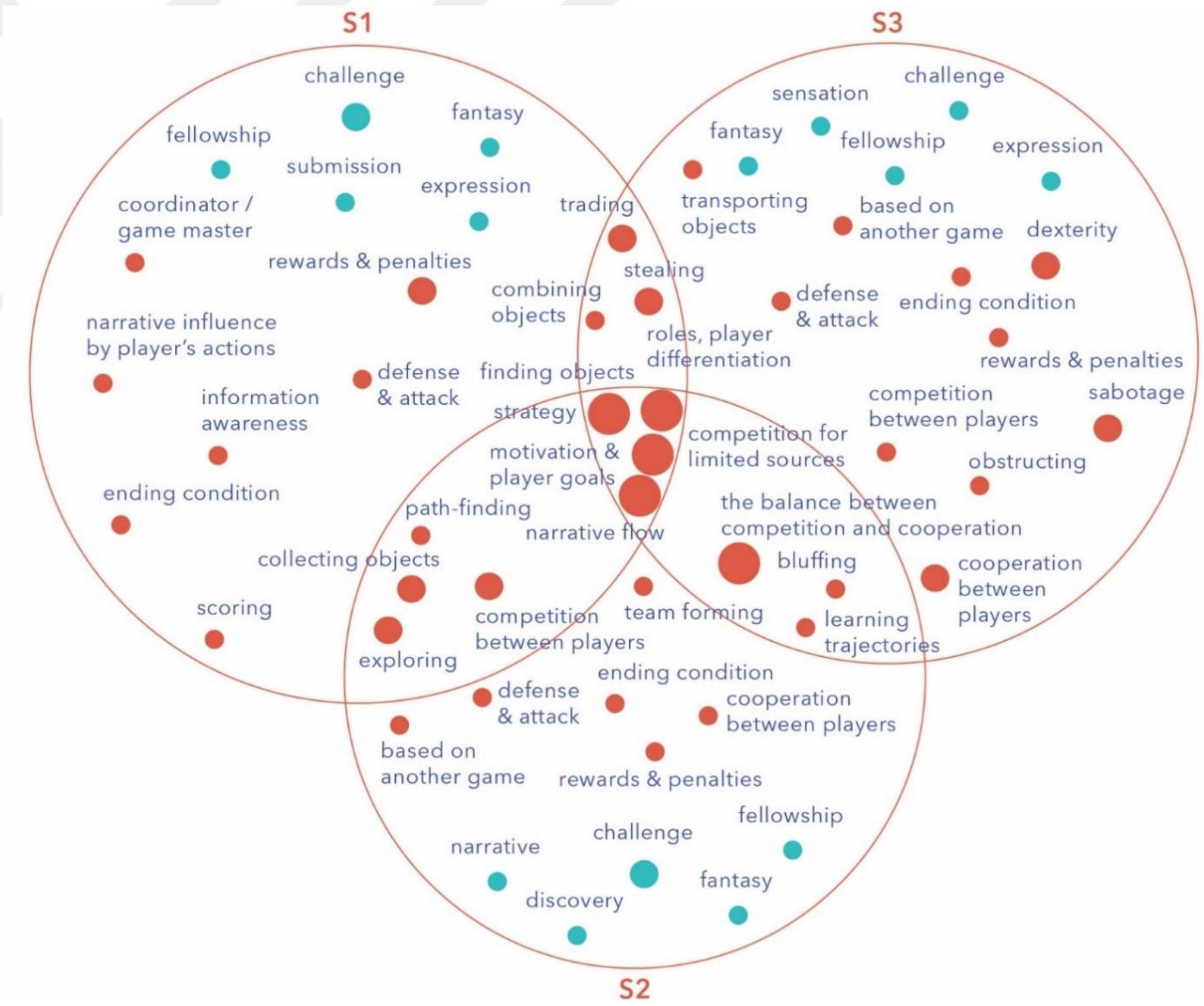


Figure 4.10 : Design Patterns Found in Games that Produced in Workshops

Table 4.4 : List of Game Patterns Produced on Design Workshops

		S1		S2		S3	
	Pattern Title	E1	E2	E1	E2	E1	E2
P1	*Interaction between the players*						
P1.1	The balance between competition and cooperation			+	+	+	+
P1.2	Competition for limited resources	+		+	+	+	+
P1.3	Competition between players or groups of players	+		+		+	+
P1.4	Roles, player differentiation	+			+		+
P1.5	Cooperation between players or groups of players			+		+	+
P1.6	Team forming			+			
P3	*Challenge*						
P3.3	Finding objects	+	+	+	+		+
P3.4	Exploring	+	+	+			
P3.5	Information awareness		+				
P3.6	Dexterity					+	+
P3.7	Path-finding		+		+		
P3.9	Territory defense-attack		+		+	+	
P3.10	Stealing	+				+	
P3.11	Transporting objects					+	
P3.12	Bluffing			+			+
P3.14	Sabotage					+	+
P3.15	Scoring		+				
P3.17	Collecting objects	+	+	+			
P3.19	Trading information or objects	+	+			+	+
P3.20	Combining collected objects	+				+	
P3.21	Obstructing (physically)					+	
P4	*Narrative*						
P4.1	Narrative flow	+	+	+	+		+
P4.3	The narrative is influenced by player actions		+				
P5	*Players*						
P5.1	Rewards/Penalties	+	+		+	+	
P5.2	Motivation	+	+	+	+	+	+
P5.4	Player goals	+	+	+		+	+
P7	*Game*						
P7.4	Based on another game or concept				+		+
P7.5	Ending condition		+	+		+	
P7.6	Coordinator/game master		+				
P7.7	Temporal structure					+	
P8	*Learning dimension*						
P8.1	Strategy	+		+		+	+
P8.2	Learning trajectories					+	+

4.3.3 Finding and outcomes

With a high average rating of 4.67, participants generally had a positive experience with the workshop. The exercises were well-received, with participants appreciating the balance between theory and practice, the clarity of the goals, and the workshop's overall engaging and educational nature. However, there is room for improvement in certain areas, such as using graphs and ensuring that exercises remain appropriately challenging without being too complicated.

Based on participant comments during the workshop, both exercises were beneficial in understanding the MDA concepts and their relationships. Exercise 2 was perceived as easier to grasp, thus being more motivating. On the other hand, exercise 1 was seen as closer to real-world game design approaches. Consequently, while exercise 2 provided a different perspective and was deemed more enlightening for future work, it highlighted the importance of defining player experiences as a design goal. This agrees with the MDA framework, in which making player experiences a design target greatly enhances the creative input of game designers within the process.

A more elaborate analysis of the results involves the statistical measures of mean, median, mode, and standard deviations in the survey data on the Likert scale, which conveys deeper insights and leads to informed decisions. The mean value gives a general average of the response, which provides a quick snapshot of data regarding the central tendency; it projects the general feeling of the surveyed population. The median provides the middle value, which helps understand central tendency when the data may consist of outliers. As such, it typifies the normal response more than the mean in skewed distributions. The mode indicates what most of the participants feel or think, as it is the most frequent response. Finally, the standard deviation measures the dispersion of responses around the mean. It indicates the degree to which the respondents agree or disagree.

The statistics can be analyzed for trends and patterns in the data (Table 4.5). Two questions have a high standard deviation above 1.00, which means the answers among the participants are not compromised. Apart from that, the results are mostly balanced, which allows for interpretation of the workshop's intentions.

Table 4.5 : Evaluation and Statistics Of Participants

Questions		EN	GK	AL	AT	BU	MK	Mean	Median	Mode	Standard Deviation
General Questions	1	5	4	4	5	5	5	4,67	5	5	0,52
	2	5	5	4	4	4	5	4,50	4,5	4 and 5	0,55
	3	5	5	4	4	3	4	4,17	4	4	0,75
	4	4	4	4	5	5	5	4,50	4,5	4 and 5	0,55
	5	4	5	5	5	5	4	4,67	5	5	0,52
	6	5	4	5	5	4	4	4,50	4,5	4 and 5	0,55
	7	4	4	5	5	5	5	4,67	5	5	0,52
	8	5	4	5	5	5	5	4,83	5	5	0,41
	9	2	4	4	5	5	5	4,17	4,5	5	1,17
	10	3	4	5	4	4	3	3,83	4	4	0,75
Questions Specific to Exercise 1	1	5	5	4	5	4	4	4,50	4,5	4 and 5	0,55
	2	5	4	5	5	5	3	4,50	5	5	0,84
	3	3	3	4	3	5	3	3,50	3	3	0,84
Questions Specific to Exercise 2	1	5	5	4	4	5	4	4,50	4,5	4 and 5	0,55
	2	5	5	5	5	5	3	4,67	5	5	0,82
	3	2	5	4	5	5	5	4,33	5	5	1,21
Comparison Between Exercises	1	Exercise 2	Exercise 2	Exercise 2	Exercise 1	Exercise 1	Exercise 1				
	2	Exercise 1	Exercise 2	Exercise 2	Exercise 2	Exercise 2	Exercise 1				
	3	Exercise 1	Exercise 2	Exercise 2	Exercise 2	Exercise 2	Exercise 1				
	4	Exercise 1	Exercise 2	Exercise 2	Exercise 1	Exercise 2	Exercise 1				
	5	Exercise 2	Exercise 2	Exercise 2	Exercise 2	Exercise 1	Exercise 2				
Practical Application	1	5	4	3	5	5	4	4,33	5	5	0,82
	2	5	5	4	4	5	4	4,50	4,5	4 and 5	0,55
	3	4	4	4	5	5	3	4,17	4	4	0,75
	4	5	4	4	4	5	4	4,33	4	4	0,52
	5	5	4	5	5	5	4	4,67	5	5	0,52
	6	3	4	5	5	4	4	4,17	4	4	0,75
	7	5	4	5	4	4	5	4,50	4,5	4 and 5	0,55
	8	4	4	3	5	5	5	4,33	4,5	5	0,82
	9	5	4	5	4	4	4	4,33	4	4	0,52
	10	5	4	5	5	5	3	4,50	5	5	0,84
	11	5	3	5	5	4	4	4,33	4,5	5	0,82
	12	4	4	4	5	5	4	4,33	4	4	0,52
	13	4	4	4	5	5	4	4,33	4	4	0,52
	14	3	5	5	5	5	4	4,50	5	5	0,84

General questions were answered on a 5-point Likert scale, where “1” represented "poor" and “5” represented "excellent". As shown in Table 4.6, the workshop experience was an evident success, enjoyable, and motivating experience. Theoretical background was found to be too dense, and the balance between theory and practice was weak sometimes. One workshop participant could not identify what the workshop was trying to achieve and that the goals should be more clearly stated. Also, on the challenging nature of the workshop, although this was generally perceived as positive, a few thought this challenge could sometimes be demotivating.

Table 4.6 : Survey Results of General Questions

		1 2 3 4 5
1	How would you rate your overall experience with the workshop?	4,67
2	The theoretical knowledge explained before the workshop was effectively applied during the exercises.	4,50
3	The workshop maintained a good balance between theoretical and practical activities.	4,17
4	The goals of the exercises were clear and understandable.	4,50
5	The exercises were challenging and productive.	4,67
6	The difficulty level was appropriate for my skill level.	4,50
7	The exercises were enjoyable and engaging.	4,67
8	I found the workshop to be both fun and educational.	4,83
9	The games successfully achieved the intended objectives.	4,17
10	Did you find the exercises challenging enough to keep you engaged but not too difficult?	3,83

Based on the questions specific to the first exercise, it can be inferred that participants agreed that the exercise quickly provided a foundational framework for determining game mechanics that aligned with the exercise's design goals (Table 4.7). Discussions held while defining the game's rules also contributed to generating game dynamics. Figure 4.3, produced within the scope of the thesis, was used as an auxiliary material for this exercise. Some participants found this material useful, while others did not see any benefit. A deeper analysis revealed that experienced game designers did not feel the need to utilize this visual, whereas beginners indicated that they benefited from the graphic. This material would be helpful for individuals who are not yet familiar with game design concepts or have not practiced how game mechanics work.

Table 4.7 : Survey Results of Questions Specific to Exercise 1

		1 2 3 4 5	
1	Did the exercises help you understand how to define and use game mechanics effectively?		**4,50**
2	Were the discussions on rule variations helpful in exploring different game dynamics?		**4,50**
3	Were the graphs useful in determining and adjusting the game's aesthetics?		**3,50**

Regarding the questions focused on the second exercise, it can be concluded that the goal of integrating the targeted aesthetic into the game was successfully achieved according to how the exercise was implemented (Table 4.8). Additionally, the mechanic randomly drawn and added to the game board, along with the mechanics chosen by the players, was highly beneficial to the game and received high ratings. Considering the structure of this exercise, the discussions about game rules had a more limited impact on game dynamics than the other one.

Table 4.8 : Survey Results of Questions Specific to Exercise 2

		1 2 3 4 5	
1	Did the exercise effectively help you integrate desired aesthetics into the game design?		**4,50**
2	Was selecting mechanics and adding surprise elements useful for game design?		**4,67**
3	Did the discussions on rule variations in this exercise help you explore different game dynamics?		**4,33**

The table above shows the total votes for each exercise preferred by the participants (Table 4.9). According to the results, no single exercise stood out in terms of helping understand game concepts, indicating that both approaches contributed to the study and the participants. The second exercise was more engaging and more accessible for the participants to participate in, suggesting that it might benefit future game development projects. Both exercises are valid since the participants had no significant consensus, favoring one approach over the other.

The workshop was successful in helping participants see how game mechanics elicit emotional responses, indicating a strong connection between theory and practical application (Table 4.10). Exercises guided ongoing learning well; participants could track and understand their progress. The high recommendation rate (4.67) indicates a strong overall satisfaction with the workshop, highlighting its effectiveness in integrating academic language into game development and supporting the intentional design of fun elements in games. The feedback is positive in general terms; this means that the workshop was very effective in its objectives and was well received by its participants. The constraints provided were seen as beneficial for guiding the exercises without stifling creativity, though there is slight room for improvement. Moreover, minor adjustments could be included to explain better complex concepts and approaches to participants unfamiliar with game design.

Table 4.9 : Survey Results of Comparison Between Exercises

		Ex. 1	Ex. 2
1	Which exercise did you find more beneficial for understanding game design concepts?	**3**	**3**
2	Which exercise was easier to follow and implement?	**2**	**4**
3	Which exercise kept you more engaged and motivated?	**2**	**4**
4	Which exercise had clearer instructions and objectives?	**3**	**3**
5	Which exercise will be more useful in your future game design projects?	**1**	**5**

Table 4.10 : Survey Results of Practical Application

		1 2 3 4 5	
1	The workshop helped me understand the core concepts and processes of game design better.		**4,33**
2	The workshop helped me construct connections between game mechanics and the emotions they elicit		**4,50**
3	The constraints (rules) helped guide the exercises without limiting creativity.		**4,17**
4	The materials provided in the workshop can be used in professional activities.		**4,33**
5	I recommend this workshop to my colleagues.		**4,67**
6	The workshop is valuable for professionals in the field.		**4,17**
7	The exercises provided quick and helpful feedback.		**4,50**
8	The workshop helped me understand my game design progress.		**4,33**
9	The workshop's innovative approach was practical.		**4,33**
10	This form of experience helps integrate an academic language into game development.		**4,50**
11	Ontologies contribute to beginners' understanding of game design concepts and development processes.		**4,33**
12	The developed framework is practical and applicable in real-world game design.		**4,33**
13	The developed framework effectively supports the intentional design of fun elements in games.		**4,33**
14	I think the framework and exercises benefit individuals new to game development.		**4,50**

The workshop was successful in helping participants see how game mechanics elicit emotional responses, indicating a strong connection between theory and practical application (Table 4.10). Exercises guided ongoing learning well; participants could track and understand their progress. The high recommendation rate (4.67) indicates a strong overall satisfaction with the workshop, highlighting its effectiveness in integrating academic language into game development and supporting the intentional design of fun elements in games. The feedback is positive in general terms; this means that the workshop was very effective in its objectives and was well received by its participants. The constraints provided were seen as beneficial for guiding the exercises without stifling creativity, though there is slight room for improvement. Moreover, minor adjustments could be included to explain better complex concepts and approaches to participants unfamiliar with game design.

4.4 Applying the Generative Framework

The framework formalizes the design process, providing a structured guide and ensuring all steps involved are well-defined and followed properly. Many problems that crop up due to less organized and spontaneous approaches to game design could be avoided by a design team that defines experience goals, creates prototype designs for play-testing, and refines through iteration. Applying this systematic procedure ensures that the design focuses on the intended experience goals from the beginning. In other words, it reduces the risk of deviation during the design phase and aids in keeping the direction very crystal clear. At the prototyping stage, designers get to create early versions of the game for testing to collect feedback and find bugs. The game can be balanced and optimized through iterative testing and refinement cycles, ultimately enhancing the player experience and satisfaction.

The application of the framework can be divided into six stages. The first stage, Preparation, involves informing participants about the materials and concepts used within the framework. Depending on the participants' knowledge of game design, this preparation phase may include theoretical information about design principles. Additionally, the preparation stage should cover the game components and terminology that form the basis of the framework.

During this stage, the designer should prepare the game cards and any design briefs that will be used. This phase may also involve inviting potential users, experts, or consultants to the subject. This ensures that participants are well-equipped and prepared with adequate information to advance the design process. The second step, Exploration, is where the briefs are reviewed. If an exact player audience has been targeted or a favorite genre or game type is preferred, it should be noted at this stage. At the Motivation stage, the emotional responses expected to be triggered by the game are identified. Using the aesthetics from the MDA (Mechanics-Dynamics-Aesthetics) framework for this terminology is recommended. In the Core Design phase, game elements are defined and necessary for the identified design goals of the game. Details of the game's mechanics, dynamics, rules, teams, resource mechanics, story, rewards, and end conditions are defined. During the Translation stage, it is checked how mechanics and dynamics are influenced by initially set rules. This Elaboration phase consists of iterative balancing and tuning, with the feedback from playtesting back into the core design. The process continues until the game is complete (Figure 4.11).

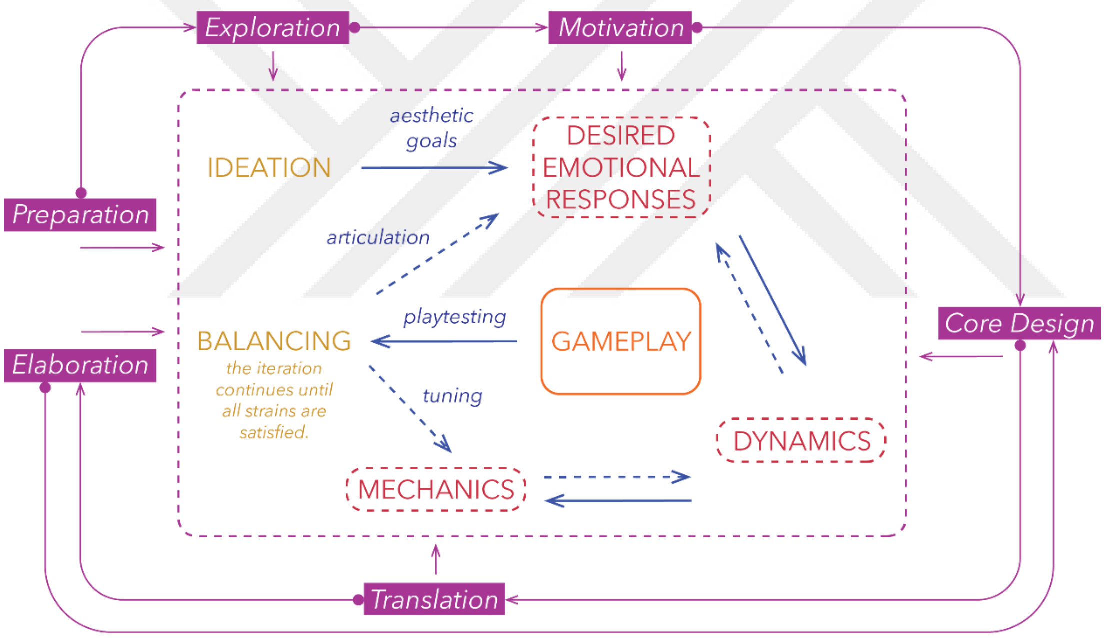


Figure 4.11 : Stages of Generative Framework

Moreover, the systematic process enhances the spirit of collaboration and good communication among the design team. Every person understands better and can contribute to the project at hand, thus saving on misunderstandings that might drag on during development. This is contrary to the ad hoc design, which is normally chaotic and always has inconsistent results and problems that are not fixed. Finally, this strict, systematic framework enables designers to create a balanced and fun game, allowing them to be much more effective and efficient in the design process.

5. CONCLUSIONS & RECOMMENDATIONS

This thesis explores the potential of applying structured design ontologies like the Mechanics, Dynamics, and Aesthetics (MDA) framework suggested by Hunicke et al. (2004) in game design through practical exercises. The primary objective was to enhance the game design ontologies' comprehensibility and applicability for game designers, fostering a deeper understanding of how game elements contribute to player experiences. The MDA framework effectively structured game design processes, providing a clear pathway from mechanics to player experiences. As the framework indicates, when carefully selected and designed, game mechanics directly influence game dynamics and, subsequently, the players' emotional responses (aesthetics). According to the study's findings, the interaction does not have to be one-way. Moreover, merely designing mechanics and indirectly designing dynamics does not provide definitive information about whether the desired player responses will be achieved. Game development is a complex and iterative process involving continuous testing and refinement.

The study's most significant benefits lie in empowering participants, enhancing the method in design research, and showing that a structured foundation can light up many creative alternatives in a short time: ideation. The structured approach empowers designers to ideate faster and generate ideas of better quality because of the clarity in the framework within which creativity thrives. It enhances systems thinking and thus provides a designer with an in-depth understanding of how the different game elements are related and affect player experiences, providing confidence in design decisions.

The theoretical contribution of this study lies in systematically applying the framework in a series of workshops and analyzing the resulting games; the study provides empirical evidence on the efficacy of structured design processes in creating engaging and innovative games. The research also underscores striking a balance between theory and practice and gives insight into how a game design framework may be iteratively refined for different levels of expertise. Developing a generative framework based on game mechanics presented a pragmatic approach to game design by revealing processes like simulation for game designers. The framework offers a structured approach with a collection of techniques at each stage of the design process. This thorough process allows designers to address all crucial elements of design. The material of this tool covers a range of inquiries, from fundamental queries like "Where should I start?" to more complex ones like "Which element of content should I target for the game?". The framework's structure, designed like a board game, allowed for flexibility and adaptability in various design scenarios, making it a valuable guide for novice and experienced designers.

A design workshop was conducted within the research topics presented in the thesis. Participants found the exercises engaging and beneficial in understanding MDA’s game concepts and their progress in game design. The practical application of these concepts through hands-on exercises helped solidify theoretical knowledge. The generative framework developed here serves as a great base for developing engaging, innovative, and emotionally significant games; it thus supports the continuous evolution of the game design scene. More than that, this emphasis on the understanding of player experiences being introduced as a design goal follows the emergent trends of user-centered design, which enables the production of innovative, engaging, and meaningful games for players. This focus on the player's experience could make for much more immersive and satisfying games, raising the quality of overall game design.

5.1 Constraints

This study was conducted from a subjective perspective, which introduces certain limitations. The findings and interpretations are influenced by the personal biases and experiences of the participants and the author, which may affect the objectivity of the results. Additionally, some participants expressed that the application was challenging because it needed significant theoretical knowledge. Therefore, the framework may not be suitable for beginners. Additionally, while the framework can produce numerous unique and innovative games, it was mentioned that these games might remain limited to the board game domain in a professional context. It was recommended that the study be extended to include areas such as video games. Additionally, a significant limitation of this study is that the games created were not subjected to playtesting. As a result, player feedback on the games is lacking.

5.2 Future Works

The structured foundation teaches even advanced principles in game design. It allows new designers to fill it in with their ideas and learn how the game's mechanics, dynamics, and aesthetics work, dramatically closing the gap between theory and practice. This could also allow for enhanced communication between multidisciplinary teams because the approach provides a common language and set of concepts that all parties can understand and utilize with effects. Game design lecturers can use this framework as a guide to develop their curriculum and tasks. Game design students might use it as a point of reference for their assignments. Long-term studies into applying the MDA framework in game design education and practice will provide insight into its effectiveness and areas for improvement.

Another significant benefit could be that this structured approach may be implemented within AI systems. Clearly defining the parameters and processes allows for the creation of semi-automated design tools to help designers generate and further develop ideas. Addressing these constraints and following the recommendations made will allow further work to build off the findings of this thesis to continue improving upon the practice and understanding of game design.

This can help develop digital tools and platforms that further increase accessibility and usability, allowing designers to experiment and iterate much more quickly. Also, the fact that this framework lends itself to different contexts while producing similar results makes it an extremely versatile tool in the changing landscape of game design.

REFERENCES

Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit MUDs. *Journal of MUD Research, 1*(1), 1–19.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design Experiments in Educational Research. *Educational Researcher, 32*(1), 9–13. http://www.jstor.org/stable/3699928

Dillon, R. (2011). The 6-11 framework: A new methodology for game analysis and design. In *Proceedings of the Game-On Asia Conference* (pp. 25-29). Singapore.

Fullerton, T. (2008). Game Design workshop. A Playcentric Approach to Creating Innovative Games. In *CRC Press eBooks.* https://doi.org/10.1201/b13172

Gee, J. P. (2007). *Good video games and good learning: Collected essays on video games, learning and literacy*. Peter Lang.

Gee, J. P. (2013). *The anti-education era: Creating smarter students through digital learning*. Palgrave Macmillan.

Gero, J. S. (1990). Design prototypes: A knowledge representation schema for design. *AI Magazine, 11*(4), 26–36.

Gero, J. S., & Kannengiesser, U. (2004). The situated function–behaviour–structure framework. *Design Studies, 25*, 373–391.

Gero, J. S., & Kannengiesser, U. (2008). Locating creativity in a framework of designing for innovation. In *Springer eBooks* (pp. 57–66). https://doi.org/10.1007/978-0-387-75456-7_6

Gero, J. S., Jiang, H., & Williams, C. B. (2013). Design cognition differences when using unstructured, partially structured, and structured concept generation creativity techniques. *International Journal of Design Creativity and Innovation, 1*(4), 196–214. https://doi.org/10.1080/21650349.2013.801760

Halverson R. (2005). What can K-12 school leaders learn from video games and gaming? *Innovate Journal of Online Education, 1*(6).

Hunicke, R., Leblanc, M. G., & Zubek, R. (2004, July 25-29). MDA: A formal approach to game design and game research. In *Proceedings of the AAAI Workshop on Challenges in Game AI*, San Jose, CA, USA.

Järvinen, A. (2008). *Games without frontiers: Theories and methods for game studies and design*. Tampere: Tampere University Press.

Juul, J. (2005). *Half-real: Video games between real rules and fictional worlds***.** Cambridge, MA: The MIT Press.

Junior, R., & Silva, F. (2021). Redefining the MDA framework—The pursuit of a game design ontology. *Information, 12* (395). https://doi.org/10.3390/info12100395

Koster, R. (2005). *A theory of fun for game design*. Scottsdale, Arizona: Paraglyph Press.

Kritz, J., Mangeli, E., & Xexéo, G. (2017). Building an ontology of boardgame mechanics based on the BoardGameGeek database and the MDA framework.

Lazzaro, N. (2004). *Why We Play Games: Four Keys to More Emotion without Story.* XEODesign, Inc., Oakland, CA.

LeBlanc, M. (n.d.). 8 kinds of fun. Retrieved from http://algorithmancy.8kindsoffun.com/

Polansky, L. (2015). On Genre and the Ludic Device. Available from http://sufficientlyhuman.com/archives/1008

Rouse III, R. (2005). *Game design theory and practice*. Plano, Texas: Wordware Publishing Inc.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals***.** Massachusetts: The MIT Press.

Schell, J. (2008). *The art of game design: A book of lenses*. Morgan Kaufmann.

Sicart, M. (2008). Defining game mechanics. *Game Studies*, *8*(1–14).

Sintoris, C. (2015). Extracting game design patterns from game design workshops. *International Journal of Intelligent Engineering Informatics*, *3*(2/3), 166. https://doi.org/10.1504/ijiei.2015.069878

Walk, W., Görlich, D., & Barrett, M. (2017). Design, dynamics, experience (DDE): An advancement of the MDA framework for game design. *Game Dynamics, 27–45*. https://doi.org/10.1007/978-3-319-53088-8_3

Winn, B. M. (2009). The design, play, and experience framework. In R. E. Ferdig (Ed.), *Handbook of research on effective electronic gaming in education* (Vol. III, Ch. LVIII). Kent: Kent State University.

Zimmerman, E. (2003). *Play as Research: The Iterative Design Process*.

Url-1 *<https://boardgamegeek.com/browse/boardgamemechanic>*, (accessed: 17.05.2024).

APPENDICES

APPENDIX A: Workshop Materials
APPENDIX B: Evaluation Form

APPENDIX A: Workshop Materials

Figure A.1 : Generative Framework's Game Cards

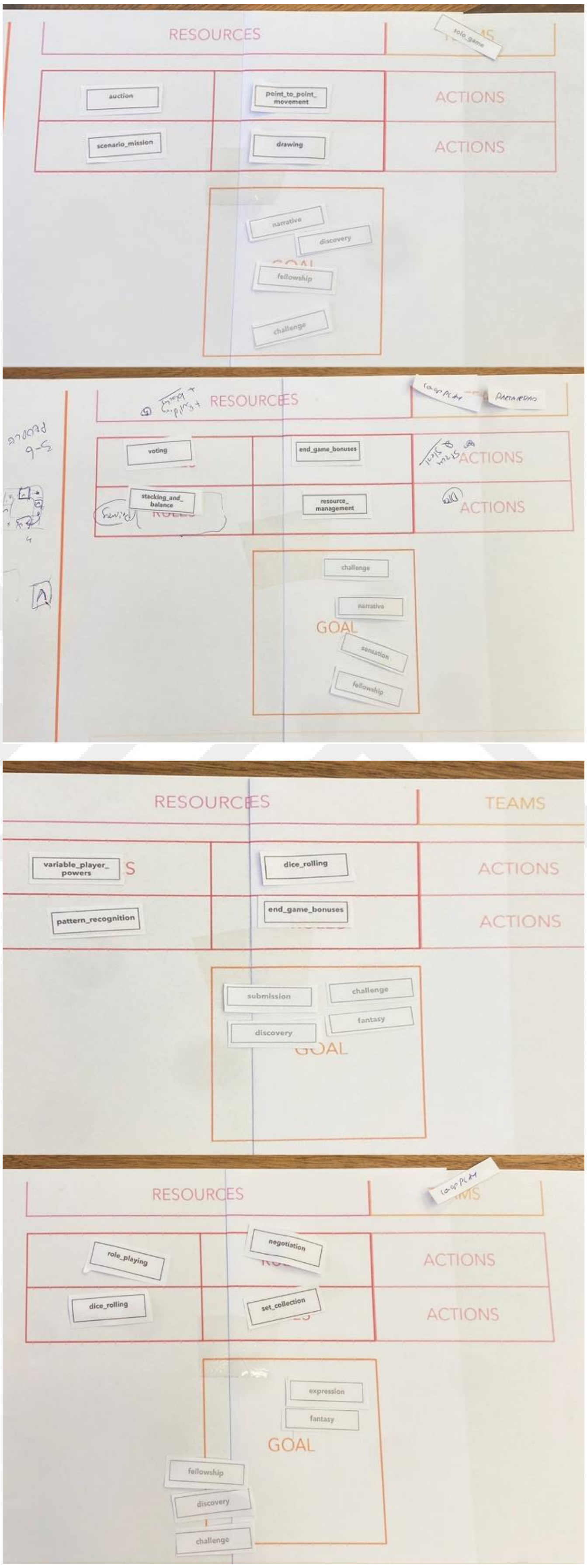


Figure A.2 : Game Decks Created on Workshop

APPENDIX B: Evaluation Form

Table B.1 : Post Workshop Evaluation Form

	General Questions	Evaluation 1-5
1	How would you rate your overall experience with the workshop?	
2	The theoretical knowledge explained before the workshop was effectively applied during the exercises.	
3	The workshop maintained a good balance between theoretical and practical activities.	
4	The goals of the exercises were clear and understandable.	
5	The exercises were challenging and productive.	
6	The difficulty level was appropriate for my skill level.	
7	The exercises were enjoyable and engaging.	
8	I found the workshop to be both fun and educational.	
9	The games successfully achieved the intended objectives.	
10	Did you find the exercises challenging enough to keep you engaged but not too difficult?	
	Questions Specific to Exercise 1	Evaluation 1-5
1	Did the exercises help you understand how to define and use game mechanics effectively?	
2	Were the discussions on rule variations helpful in exploring different game dynamics?	
3	Were the graphs useful in determining and adjusting the game's aesthetics?	
	Questions Specific to Exercise 2	Evaluation 1-5
1	Did the exercise effectively help you integrate desired aesthetics into the game design?	
2	Was selecting mechanics and adding surprise elements useful for game design?	
3	Did the discussions on rule variations in this exercise help you explore different game dynamics?	
	Comparison Between Exercises	Evaluation (Exercise 1 or Exercise 2)
1	Which exercise did you find more beneficial for understanding game design concepts?	
2	Which exercise was easier to follow and implement?	
3	Which exercise kept you more engaged and motivated?	
4	Which exercise had clearer instructions and objectives?	
5	Which exercise will be more useful in your future game design projects?	

Table B.1 (continued) : Post Workshop Evaluation Form

	Practical Application	Evaluation 1-5
1	The workshop helped me understand the core concepts and processes of game design better.	
2	The workshop helped me construct connections between game mechanics and the emotions they elicit in players.	
3	The constraints (rules) helped guide the exercises without limiting creativity.	
4	The materials provided in the workshop can be used in professional activities.	
5	I recommend this workshop to my colleagues.	
6	The workshop is valuable for professionals in the field.	
7	The exercises provided quick and helpful feedback.	
8	The workshop helped me understand my game design progress.	
9	The workshop's innovative approach was practical.	
10	This form of experience helps integrate an academic language into game development.	
11	Ontologies contribute to beginners' understanding of game design concepts and development processes.	
12	The developed framework is practical and applicable in real-world game design.	
13	The developed framework effectively supports the intentional design of fun elements in games.	
14	I think the framework and exercises benefit individuals new to game development.	

CURRICULUM VITAE

Name Surname **:** Duygu Nardereli

EDUCATION **:**

- **B.Sc.** **:** 2014, Istanbul Technical University, Faculty of Architecture, Architecture

PROFESSIONAL EXPERIENCE AND REWARDS:

- 2014-2022 Practiced Architecture as Architect at Erginoğlu & Çalışlar

PUBLICATIONS, PRESENTATIONS AND PATENTS ON THE THESIS:

- **Nardereli D.,** Alaçam S. 2024: Transforming Structures into Interactive Experiences: Generative Frameworks. International Graduate Research Symposium – IGRS'2024, May 08-10, 2024, Istanbul, Turkey.