Fundamentals of
Game Design

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Edited by
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Preface

Game design is a fairly recent field. It deals with the creation of games by using the elements of design aesthetics. It is multidisciplinary, and uses the elements of optimization theory, probability, economics and artificial intelligence, etc. Different approaches, evaluations and methodologies on game design have been included in this book. Most of the topics introduced in it cover new techniques and the applications of this field. This textbook is meant for students who are looking for an elaborate reference text on game design.

To facilitate a deeper understanding of the contents of this book a short introduction of every chapter is written below:

Chapter 1- The designing and development of video and computer games for commercial and private use is known as game design. Game designers incorporate aesthetics, logic, strategy and popular culture into game designs to make them more appealing to the masses. Successful game franchises can run into several seasons and have earned their creators billions of dollars in sales revenue. This chapter provides a comprehensive overview of game design.

Chapter 2- When a video game design has been constructed by the designers, it is the programmers that convert the idea and images into the final game. This involves game programming which is the software side of game development. When the game is published internationally, it involves converting game language and content to the local language. Also, the gameplay content needs to be altered keeping in mind the sensitivities of the new target audience. This chapter deals with subjects like video game development, game programming, game testing, video game localization, game server, mod and independent video game development.

Chapter 3- The creation of a video game design requires input from designers and programmers. A video game starts from an idea that can be classified under one of the several genres. The whole game is planned out with consideration to game features, story, target audience, budget etc. This chapter illustrates the developmental course of a video game design from its inception till its final unveiling. The content informs the reader about topics like game mechanics, game art design, character creation, level design, field of view, dynamic game difficulty balancing etc.

Chapter 4- The earliest video games used text instead of vector graphics. This entailed players reading descriptions about the game setting, players and the actions that take place. But with the emergence of flash, vector graphics became popular. This was then replaced by 2D, 2.5D, 3D graphics and pixelated isometric graphics. In this chapter, the reader is introduced to the video game graphic styles chronologically to provide a timeline for the changing trends in video game graphic design.

Chapter 5- Based on the manner in which players interact with each other and the virtual environment through gameplay, video games are categorized into action, adventure, role-playing, simulation, strategy and massively multiplayer online video game. This chapter explains each type with suitable examples to aid in a better understanding of the different genres. A part of

the chapter focuses on strategy video game and its sub-types. Game design is best understood in confluence with the major topics listed in the following chapter.

Chapter 6- This chapter introduces the reader to game design jargon like nonlinear gameplay, virtual world, virtual economy, free-to-play, gold sink, time sink, gamification, game engine and gameplay micromanagement. Some concepts have been in use for many decades while challenging narration and story-arcs have led to the development of newer concepts of game design. The aspects elucidated in this chapter are of vital importance, and provide a better understanding of this field.

I owe the completion of this book to the never-ending support of my family, who supported me throughout the project.

Editor

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Introduction to Game Design

The designing and development of video and computer games for commercial and private use is known as game design. Game designers incorporate aesthetics, logic, strategy and popular culture into game designs to make them more appealing to the masses. Successful game franchises can run into several seasons and have earned their creators billions of dollars in sales revenue. This chapter provides a comprehensive overview of game design.

Game Design

Game design is the art of applying design and aesthetics to create a game to facilitate interaction between players for entertainment or for medical, educational, or experimental purposes. Game design can be applied both to games and, increasingly, to other interactions, particularly virtual ones.

Game design creates goals, rules, and challenges to define a sport, tabletop game, casino game, video game, role-playing game, or simulation that produces desirable interactions among its participants and, possibly, spectators.

Academically, game design is part of game studies, while game theory studies strategic decision making (primarily in non-game situations). Games have historically inspired seminal research in the fields of probability, artificial intelligence, economics, and optimization theory. Applying game design to itself is a current research topic in metadesign.

History

Sports, gambling, and board games are known, respectively, to have existed for at least ten thousand, six thousand, and five thousand years.

Folk Process

Tabletop games played today whose descent can be traced from ancient times include chess, go, pachisi, backgammon, mahjong, mancala, and pick-up sticks. The rules of these games were not codified until early modern times and their features gradually evolved and changed over time, through the folk process. Given this, these games are not considered to have had a designer or been the result of a design process in the modern sense.

After the rise of commercial game publishing in the late 19th century, many games which had formerly evolved via folk processes became commercial properties, often with custom scoring pads or preprepared material. For example, the similar public domain games Generala, Yacht, and Yatzy led to the commercial game Yahtzee in the mid-1950s.

Today, many commercial games, such as Taboo, Balderdash, Pictionary, or Time's Up!, are de-

scended from traditional parlour games. Adapting traditional games to become commercial properties is an example of game design.

Similarly, many sports, such as soccer and baseball, are the result of folk processes, while others were designed, such as basketball, invented in 1891 by James Naismith.

New Media

Technological advances have provided new media for games throughout history. The printing press allowed packs of playing cards, adapted from Mahjong tiles, to be mass-produced, leading to many new card games. Accurate topographic maps produced as lithographs and provided free to Prussian officers helped popularize wargaming. Cheap bookbinding (printed labels wrapped around cardboard) led to mass-produced board games with custom boards. Inexpensive (hollow) lead figurine casting contributed to the development of miniature wargaming. Cheap custom dice led to poker dice. Flying discs led to disc golf and Ultimate. Personal computers contributed to the popularity of computer games, leading to the wide availability of video game consoles and video games. Smart phones have led to a proliferation of mobile games.

The first games in a new medium are frequently adaptations of older games. Pong, one of the first widely disseminated video games, adapted table tennis. Later games will often exploit distinctive properties of a new medium. Adapting older games and creating original games for new media are both examples of game design.

Theory

Game studies or gaming theory is a discipline that deals with the critical study of games, game design, players, and their role in society and culture. Prior to the late-twentieth century, the academic study of games was rare and limited to fields such as history and anthropology. As the video game revolution took off in the early 1980s, so did academic interest in games, resulting in a field that draws on diverse methodologies and schools of thought. These influences may be characterized broadly in three ways: the social science approach, the humanities approach, and the industry and engineering approach.

Broadly speaking, the social scientific approach has concerned itself with the question of "What do games do to people?" Using tools and methods such as surveys, controlled laboratory experiments, and ethnography researchers have investigated both the positive and negative impacts that playing games could have on people. More sociologically informed research has sought to move away from simplistic ideas of gaming as either 'negative' or 'positive', but rather seeking to understand its role and location in the complexities of everyday life.

In general terms, the humanities approach has concerned itself with the question of "What meanings are made through games?" Using tools and methods such as interviews, ethnographies and participant observation, researchers have investigated the various roles that videogames play in people's lives and activities together with the meaning they assign to their experiences.

From an industry perspective, a lot of game studies research can be seen as the academic response to the videogame industry's questions regarding the products it creates and sells. The main question this approach deals with can be summarized as "How can we create better games?" with the

accompanying "What makes a game good?" "Good" can be taken to mean many different things, including providing an entertaining and an engaging experience, being easy to learn and play, and being innovative and having novel experiences. Different approaches to studying this problem have included looking at describing how to design games and extracting guidelines and rules of thumb for making better games

Strategic Decision Making

Game theory is a study of strategic decision making. Specifically, it is "the study of mathematical models of conflict and cooperation between intelligent rational decision-makers". An alternative term suggested "as a more descriptive name for the discipline" is *interactive decision theory*. The subject first addressed zero-sum games, such that one person's gains exactly equal net losses of the other participant or participants. Today, however, game theory applies to a wide range of behavioral relations, and has developed into an umbrella term for the logical side of decision science.

The games studied in game theory are well-defined mathematical objects. To be fully defined, a game must specify the following elements: the *players* of the game, the *information* and *actions* available to each player at each decision point, and the *payoffs* for each outcome. (Rasmusen refers to these four "essential elements" by the acronym "PAPI".) A game theorist typically uses these elements, along with a solution concept of their choosing, to deduce a set of equilibrium strategies for each player such that, when these strategies are employed, no player can profit by unilaterally deviating from their strategy. These equilibrium strategies determine an equilibrium to the game—a stable state in which either one outcome occurs or a set of outcomes occur with known probability.

Design Elements

Games can be characterized by "what the player does." This is often referred to as gameplay. Major key elements identified in this context are tools and rules that define the overall context of game.

Tools of Play

Games are often classified by the components required to play them (e.g. miniatures, a ball, cards, a board and pieces, or a computer). In places where the use of leather is well established, the ball has been a popular game piece throughout recorded history, resulting in a worldwide popularity of ball games such as rugby, basketball, football, cricket, tennis, and volleyball. Other tools are more idiosyncratic to a certain region. Many countries in Europe, for instance, have unique standard decks of playing cards. Other games such as chess may be traced primarily through the development and evolution of its game pieces.

Many game tools are tokens, meant to represent other things. A token may be a pawn on a board, play money, or an intangible item such as a point scored.

Games such as hide-and-seek or tag do not utilise any obvious tool; rather, their interactivity is defined by the environment. Games with the same or similar rules may have different gameplay if the environment is altered. For example, hide-and-seek in a school building differs from the same game in a park; an auto race can be radically different depending on the track or street course, even with the same cars.

Rule Development

Whereas games are often characterized by their tools, they are often defined by their rules. While rules are subject to variations and changes, enough change in the rules usually results in a "new" game. There are exceptions to this in that some games deliberately involve the changing of their own rules, but even then there are often immutable meta-rules.

Rules generally determine turn order, the rights and responsibilities of the players, and each player's goals. Player rights may include when they may spend resources or move tokens.

Victory Conditions

Common win conditions are being first to amass a certain quota of points or tokens (as in Settlers of Catan), having the greatest number of tokens at the end of the game (as in Monopoly), or some relationship of one's game tokens to those of one's opponent (as in chess's checkmate).

Single or Multiplayer

Most games require multiple players. However, single-player games are unique in respect to the type of challenges a player faces. Many games described as "single-player" may be termed actually puzzles or recreations. Unlike a game with multiple players competing with or against each other to reach the game's goal, a one-player game is a battle solely against an element of the environment (an artificial opponent), against one's own skills, against time, or against chance.

Storyline and Plot

Stories told in games may focus on narrative elements that can be communicated through the use of mechanics and player choice. Narrative plots in games generally have a clearly defined and simplistic structure. Mechanical choices on the part of the designer(s) often drastically effect narrative elements in the game. However, due to a lack of unified and standardized teaching and understanding of narrative elements in games, individual interpretations, methods, and terminology vary wildly. Because of this, most narrative elements in games are created unconsciously and intuitively. However, as a general rule, game narratives increase in complexity and scale as player choice or game mechanics increase in complexity and scale. One example of this is removing a players ability to directly affect the plot for a limited time. This lack of player choice necessitates an increase in mechanical complexity, and could be used as a metaphor to symbolize depression that is felt by a character in the narrative.

Luck and Strategy

A game's tools and rules will result in its requiring skill, strategy, luck, or a combination thereof, and are classified accordingly.

Games of skill include games of physical skill, such as wrestling, tug of war, hopscotch, target shooting, and stake, and games of mental skill such as checkers and chess. Games of strategy include checkers, chess, go, arimaa, and tic-tac-toe, and often require special equipment to play them. Games of chance include gambling games (blackjack, mah-jongg, roulette, etc.), as well as snakes and ladders and rock, paper, scissors; most require equipment such as cards or dice.

Most games contain two or all three of these elements. For example, American football and baseball involve both physical skill and strategy while tiddlywinks, poker, and Monopoly combine strategy and chance. Many card and board games combine all three; most trick-taking games involve mental skill, strategy, and an element of chance, as do many strategic board games such as Risk, Settlers of Catan, and Carcassonne.

Use as Educational Tool

By learning through play children can develop social and cognitive skills, mature emotionally, and gain the self-confidence required to engage in new experiences and environments. Key ways that young children learn include playing, being with other people, being active, exploring and new experiences, talking to themselves, communication with others, meeting physical and mental challenges, being shown how to do new things, practicing and repeating skills and having fun.

Play develops children's content knowledge and provides children the opportunity to develop social skills, competences and disposition to learn. Play-based learning is based on a Vygotskian model of scaffolding where the teacher pays attention on specific elements of the play activity and provides encouragement and feedback on children's learning. When children engage in real-life and imaginary activities, play can be challenging in children's thinking. To extend the learning process, sensitive intervention can be provided with adult support when necessary during play-based learning.

Development Process

Game Artist

A game artist is an artist who creates art for one or more types of games. Game artists are responsible for all of the aspects of game development that call for visual art. Game artists are often noted in role-playing games, collectible card games and video games.

Testing

Game testing, a subset of game development, is a software testing process for quality control of video games. The primary function of game testing is the discovery and documentation of software defects (aka bugs). Interactive entertainment software testing is a highly technical field requiring computing expertise, analytic competence, critical evaluation skills, and endurance. In recent years the field of game testing has come under fire for being excessively strenuous and unrewarding, both financially and emotionally.

Strategies

Board Games

Board game design is the development of rules and presentational aspects of a board game. When a player takes part in a game, it is the player's self-subjection to the rules that creates a sense of purpose for the duration of the game. Maintaining the players' interest throughout the gameplay

experience is the goal of board game design. To achieve this, board game designers emphasize different aspects such as social interaction, strategy, and competition, and target players of differing needs by providing for short versus long-play, and luck versus skill. Beyond this, board game design reflects the culture in which the board game is produced.
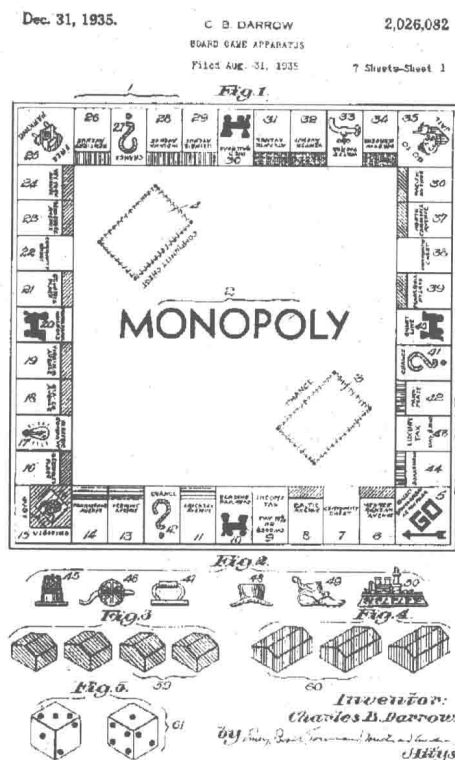
Charles Darrow's 1935 patent for *Monopoly* includes specific design elements developed during the prototype phase. Prototypes are very common in the later stages of board game design, and "prototype circles" in many cities today provide an opportunity for designers to play and critique each other's games.

The most ancient board games known today are over 5000 years old. They are frequently abstract in character and their design is primarily focused on a core set of simple rules. Of those that are still played today, games like go (c.400BC), mancala (c.700AD), and chess (c.600AD) have gone through many presentational and/or rule variations. In the case of chess, for example, new variants are developed constantly, to focus on certain aspects of the game, or just for variation's sake.

Traditional board games date from the nineteenth and early twentieth century. Whereas ancient board game design was primarily focused on rules alone, traditional board games were often influenced by Victorian mores. Academic (e.g. history and geography) and moral didacticism were important design features for traditional games, and Puritan associations between dice and the Devil meant that early American game designers eschewed their use in board games entirely. Even traditional games that did use dice, like *Monopoly* (based on the 1906 *The Landlord's Game*), were rooted in educational efforts to explain political concepts to the masses. By the 1930s and 1940s, board game design began to emphasize amusement over education, and characters from comic strips, radio programmes, and (in the 1950s) television shows began to be featured in board game adaptations.

Recent developments in modern board game design can be traced to the 1980s in Germany, and

have led to increased popularity of "German-style board games" (also known as "Eurogames" or "designer games"). The design emphasis of these board games is to give players meaningful choices. This is manifested by eliminating elements like randomness and luck to be replaced by skill, strategy, and resource competition, by removing the potential for players to fall irreversibly behind in the early stages of a game, and by reducing the number of rules and possible player options to produce what Alan R. Moon has described as "elegant game design". The concept of elegant game design has been identified by *The Boston Globe*'s Leon Neyfakh as related to Mihaly Csikszentmihalyi's concept of "flow" from his 1990 book, "Flow: The Psychology of Optimal Experience".

Modern technological advances have had a democratizing effect on board game design, with services like Kickstarter providing designers with essential startup capital and tools like 3D printers facilitating the production of game pieces and board game prototypes. A modern adaptation of figure games are miniature wargames like *Warhammer 40,000*.

Card Games

The design of card games is constricted by the type of the deck of cards, like Tarot or the four-suited Latin decks. Card games can be played for fun, like Go Fish, or for profit like Poker.

In Asian cultures, special sets of tiles can serve the same function as cards, as in mahjong, a game similar to (and thought to be the distant ancestor of) the Western card game rummy. Western dominoes games are believed to have developed from Asian tile games in the 18th century.

Magic: The Gathering was the first collectible card game (or "trading card game") in 1993.[1]

The line between card and board games is not clear-cut, as many card games, such as solitaire, involve playing cards to form a "tableau", a spatial layout or board. Many board games, in turn, uses specialized decks of cards as randomization devices, such as a sub-type of wargames called card-driven wargames.

Dice Games
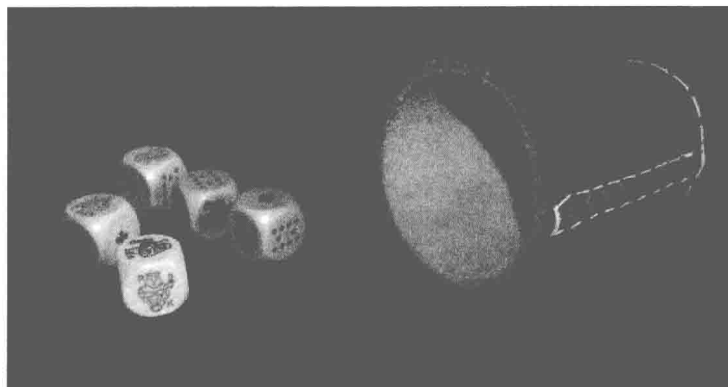
A set of poker dice and a dice cup

Dice games are among the oldest known games and have often been associated with gambling. The oldest known dice game is a backgammon set that was discovered by archaeologists excavating the site of the Burnt City, which was abandoned in 2100 BC. Non-gambling dice games, such as Yatzy, Poker dice, or Yahtzee became popular in the mid-20th century.

The line between dice and board games is not clear-cut, as dice are often used as randomization devices in board games, such as Monopoly or Risk, while serving as the central drivers of play in games such as Backgammon or Pachisi.

Casino Games

All casino games are designed to mathematically favor the house.
The house edge for a slot machine can range widely between 2 and 15 percent.

Casino game design can entail the creation of an entirely new casino game, the creation of a variation on an existing casino game, or the creation of a new side bet on an existing casino game. Casino game mathematician, Michael Shackleford has noted that it is much more common for casino game designers today to make successful variations than entirely new casino games. Gambling columnist John Grochowski points to the emergence of community-style slot machines in the mid-1990s, for example, as a successful variation on an existing casino game type. Unlike the majority of other games which are designed primarily in the interest of the player, one of the central aims of casino game design is to optimise the house advantage and maximise revenue from gamblers. Successful casino game design works to provide entertainment for the player and revenue for the gambling house. To maximise player entertainment, casino games are designed with simple easy-to-learn rules that emphasize winning (i.e. whose rules enumerate many victory conditions and few loss conditions), and that provide players with a variety of different gameplay postures (e.g. card hands). Player entertainment value is also enhanced by providing gamblers with familiar gaming elements (e.g. dice and cards) in new casino games. To maximise success for the gambling house, casino games are designed to be easy for croupiers to operate and for pit managers to oversee. The two most fundamental rules of casino game design is that the games must be non-fraudable (including being as nearly as possible immune from advantage gambling), and that they must mathematically favor the house winning. Shackleford suggests that the optimum casino game design should give the house an edge of smaller than 5%.

Role-playing Games

The design of role-playing games requires the establishment of setting, characters, and basic gameplay rules or mechanics. After a role-playing game is produced, additional design elements are often devised by the players themselves. In many instances, for example, character creation is left to the players. Likewise, the progression of a role-playing game is determined in large part by the gamemaster whose individual campaign design may be directed by one of several role-playing game theories.