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RULES

Game rules are paradoxical: Rules and enjoyment may sound like quite different things, but rules are the most consistent source of player enjoyment in games. We may associate rules with being barred from doing something we really want, but in games, we voluntarily submit to rules. Game rules are designed to be easy to learn, to work without requiring any ingenuity from the players, but they also provide challenges that *require* ingenuity to overcome. Finally, the rules of a game tend to add up to more than the sum of their parts: For most games, the strategies needed to play are more complex than the rules themselves.

Fixed rules are a core feature of games, but rules do not appear out of nowhere; they are created by players in folk games and by game designers in commercial games. Many games are played using either playing cards or computers, but the rules appear to *be the same*, even if it is the players that uphold the rules when played with cards, but the computer that upholds the rules in the video game version. As a game can move between different media, so can the rules that make up the game. But then what are rules made of and what function do game rules serve?

Let us assume that games are enjoyable in part because players *enjoy* the sense of accomplishment that solving a challenge gives them. In a multiplayer game, the enjoyment may also come from the interaction with other players, the contest or the teamwork involved in playing the game. These are not the only enjoyable aspects of games, but they are surely among the most universal ones.

In short, rules work like this.

1. *Rules* are designed to be above discussion in the sense that a specific rule should be sufficiently clear that players can agree about how to use it. Rules describe what players can and cannot do, and what should

happen in response to player actions. Rules should be implementable without any ingenuity.

2. The rules of the game construct a *state machine*, a "machine" that responds to player action (regardless of whether the game is played using computer power or not).

3. The state machine of the game can be visualized as a landscape of possibilities or a branching *game tree* of possibilities from moment to moment during the playing of the game. To play a game is to interact with the state machine and to explore the game tree.

4. Since a game has multiple outcomes, the player must expend effort trying to reach as positive an outcome as possible. It is usually harder to reach a positive outcome than a negative one—harder to win than to lose. If the player works toward the positive outcome, the player therefore faces a *challenge*.

5. The way the game is actually played when the player tries to overcome its challenges is its *gameplay*. The gameplay is an interaction between the rules and the player's attempt at playing the game as well as possible.

6. Games are learning experiences, where the player improves his or her skills at playing the game. At any given point, the player will have a specific *repertoire* of skills and methods for overcoming the challenges of the game. Part of the attraction of a good game is that it continually challenges and makes new demands on the player's repertoire.

7. Any specific game can be more or less challenging, emphasize specific types of challenges, or even serve as a pretext for a social event. This is a way in which rules can give players *enjoyable experiences*, and different games can give different experiences.

There are two extreme ways of creating challenges for players: that of *emergence* (rules combining to provide variation) and *progression* (challenges presented serially by way of special-case rules). Emergence games are the historically dominant game form. Progression games are a historically new game form where the game designer explicitly determines the possible ways in which the game can progress. Rules in games of emergence present a paradox contained in the sentence *easy to learn but difficult to master*. This is a common description of the type of game with nominally simple rules where it nevertheless requires immense amounts of effort to gain proficiency in playing the game. The apparent paradox here is that the simplicity of the rules of a game may lead to very complex gameplay. Emergence in games comes in many different forms, and it explains many interesting aspects of games such as the fact that a game can be played for hundreds of years without being exhausted; how the actual playing of a game can be unpredictable even to its designer. The element of surprise in emergent games is special in that it is an interaction between the rules of the game and the fuzzy ways in which humans understand games.

What makes an enjoyable challenge? Using a combination of Marcel Danesi's discussion of puzzles (2002) and discussions from the game development community about what Sid Meier has coined *interesting choices* (Rollings and Morris 2000, 38) I will examine what *kinds of* challenges games provide and how. Rules are not the only source of game enjoyment; I discuss the enjoyment of games as fictional worlds in chapter 4.

What Are Rules?

There is generally a clear-cut split between the fiction and rules of a game: The rules of chess govern the movement of the pieces; the representation fiction of chess is the shape and color of the pieces. No matter how the pieces are shaped, the rules, gameplay, and strategies remain identical.

What are rules? One school of thought describes rules as primarily being *limitations*. In the previous chapter, I rejected Bernard Suits's definition of games as being based on allowing the player to reach a goal by only using the *less efficient means* available (1978, 34). In Suits's view, games limit the options of a player: in high jump, using a ladder is disallowed; in a track race, the player may not run across the midfield. My objection was that it made some sense in the choice of examples, but that it is not a general feature of games. In sports, we generally have the option of finding a more efficient way of reaching the game goal. On a basic level, this is because the human body and the laws of physics exist *before* the game, but in a game, they are appropriated for the game's purposes, and some limitations are added to how they can be used. This is similar to my racing game mentioned in the preface, where the movement of the cursor on a terminal was an existing system that was used to signify the movement of a car; the game then imposed additional rules on that system, disallowing the movement of the cursor into the characters that signified the racetrack. Likewise, Katie Salen and Eric Zimmerman describe rules as *limiting player action* with the following argument: "**Rules limit player action.** The chief way that rules operate is to limit the activities of the player. If you are playing the game Yatzee, think of all the things you could do with the dice in that game: you could light them on fire, eat them, juggle them, or make jewelry out of them.... Rules are 'sets of instructions,' and following those instructions means doing what the rules require and not doing something else instead" (2004, 122). This is technically true, but the limitation view of rules only paints half the picture: you *could* make jewelry of the dice, but it would be meaningless within the Yatzee game. The rules of a game also *set up potential actions*, actions that are meaningful inside the game but meaningless outside. It is the rules of chess that allow the player to perform a checkmate—without the rules, there is no checkmate, only meaningless moving of pieces across a board. Rules specify *limitations* and *affordances*. They prohibit players from performing actions such as making jewelry out of dice, but they also add meaning to the allowed actions and this *affords* players meaningful actions that were not otherwise available; rules give games *structure*. The board game needs rules that let the players move their pieces as well as preventing them from making illegal moves; the video game needs rules that let the characters move as well as rules that prevent the character from reaching the goal immediately.

Sports and other physical games require an extra note here: Though the explicit rules of soccer only state the dimensions of the playing field, the ball's specifications, what the players can and cannot do, and the conditions for winning, the game of soccer is also governed by the laws of physics—the air resistance of the ball, gravity, the condition of the grass, and the limits of human anatomy. If we compare the physical sport of soccer with a video game version of soccer such as *FIFA 2002*, the video game adaptation requires that the laws of physics and the human anatomy be explicitly implemented in the programming *on the same level as the explicit rules of the game:* A computer-based soccer game needs to implement the physics of the players and the soccer pitch as well as the rules of the game. Gravity existed prior to the invention of soccer, and the human body existed prior to the invention of the foot race, so including them in a game is a choice that the creators of the game make. It therefore makes sense to see the laws of physics on the same level as the conventional rules in soccer: The main difference between the rules of a video game and the rules of a sport is that sports use the preexisting systems of the physical world in the game.

Strategies and State Machines

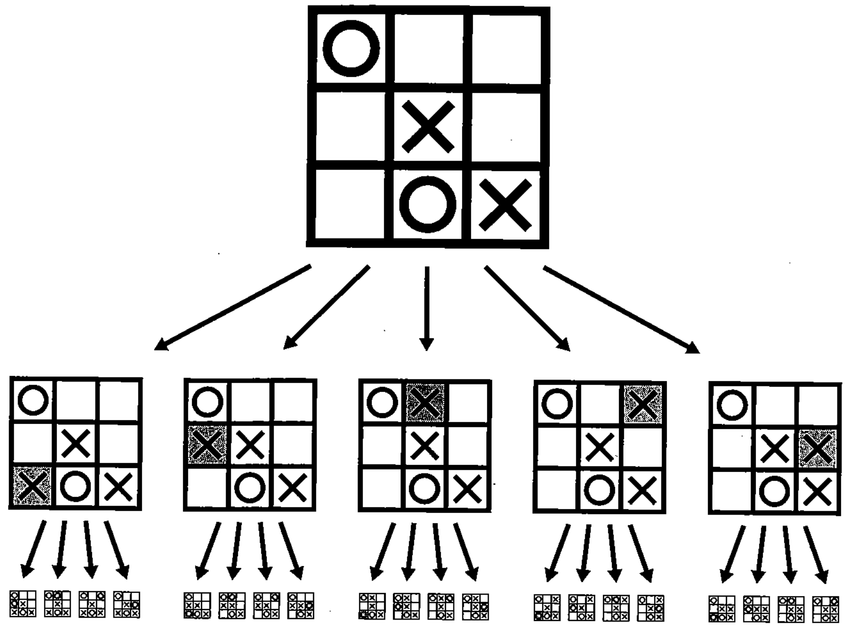
As explained in *game theory* by Neumann and Morgenstern, there is an important distinction between rules and strategies: "Finally, the *rules* of the game should not be confused with the *strategies* of the players.... Each player selects his strategy—i.e. the general principles governing his choices—freely. While any particular strategy may be good or bad—provided that these concepts can be interpreted in an exact sense—it is within the player's discretion to use or to reject it. The rules of the game, however, are absolute commands" (1953, 49). In game theory, a strategy is an overall plan for how to act in the variety of different states that the game may be in. A *complete strategy* is one that specifies unambiguously what the player should do for every possible game state. In actuality, humans tend to play games with incomplete and loosely defined strategies: A player may have a strategy that applies to only a small subset of the possible ways in which the game can be played, and will subsequently have to invent a new strategy if the game turns out differently than expected.[1] Actual strategies tend to group many possible game states into clusters in order to reduce the large number of potential game states to a manageable set of more generalized situations (Holland 1998, 41). A *dominant strategy* is one that is always better than all other strategies, regardless of the actions of any opponent.[2] A given game allows for any number of different strategies, some of which will be more effective than others. While the strategies of a game are different from the rules of the game, the relative effectiveness of a potential strategy is *a consequence* of the game rules.

Game theory also distinguishes between games of *perfect information* and games of *imperfect information:* In the former case, all players have complete knowledge of the game state at any given moment (Neumann and Morgenstern 1953, 30). In the latter case, players only have partial knowledge of the game state. Games of perfect information include many traditional board games and a few video games such as *Space Invaders* (Taito 1977), *Tetris* (Pazhitnov 1985), *ChuChu Rocket* (Sonic Team 2000), and *Tekken 3 Tag Tournament.*[3] Games of imperfect information include most card games (since the hands of the other players are hidden) and the majority of video games including all three-dimensional games (3-D graphics hide things from the player's view).

To borrow from computer science, the rules of a game provide a *state machine*. Briefly stated, a state machine is a machine that has an *initial state*, accepts a specific amount of *input events*, changes state in response to inputs using a *state transition function* (i.e., rules), and produces specific outputs using an *output function.*[4] In a literal sense, a game is a state machine: A game is a machine that can be in different states, it responds differently to the same input at different times, it contains input and output functions and definitions of what state and what input will lead to what following state (e.g., the piece can move from E2 to E4, but not to E5; if you are hit with the rocket launcher, you lose energy; if your base is taken, you have lost). When you play a game, you are interacting with the state machine that is the game. In a board game, this state is stored in the position of the pieces on the board; in sports, the game state is the score *and* the players; in computer-based games, the state is stored in memory and then represented on screen. Henceforth, I will be referring to the state of a game as the *game state*. If you cannot influence the game state in any way (as opposed to being unable to influence the game state in the *right* way), you are not playing a game.[5]

The game state only refers to the game, and not to the minds of the players. For example, in a game of perfect information, the players will not know in any detail the plans and thoughts of opponents; these are considered external to the game state. What happens in the mind of the players will be discussed later in the chapter. We can visualize the state machine of the game as a *game tree* where each game state can lead to a number of other game states, which can lead to other game states, until the game ends. Figure 3.1 is a small part of the game tree of tic-tac-toe.

It is often impractical to draw the complete game tree of a game, so the game tree is most useful as a way of understanding the large number of possibilities that a few simple rules can establish. In fact, a tic-tac-toe program I have written shows that there are 211,568 possible tic-tac-toe games—211,568 paths through the game tree of this simple game. The game tree visualizes the dynamic possibilities of a game as a map that players travel through when playing the game.



| **Figure 3.1** |
A partial game tree of tic-tac-toe.

► To see the complete listing of possible tic-tac-toe games, visit the book's Web site at http://www.half-real.net/tictactoe.

Even though it is easier to illustrate the game tree of a turn-based game, action games can also be seen as game trees, but with a much larger number of branches from moment to moment.

Algorithmic Rules

Is there anything special about game rules? Rules are limitations as well as affordances, but is there a limit to what can be a rule in a game? The rules in games are designed to be above discussion, not in the sense that it is above discussion *what* rules to use, nor in the sense that rules are never subject to disagreement, but in the sense that the *application* of a specific rule *should* be above discussion. If we think exclusively in terms of games played using computers, the question of what kinds of rules can be implemented in a computer program has already been specified in computer science with the concept of an *algorithm*. In Donald Knuth's classic computer science textbook, *The Art of Computer Programming*, he lists five important features for an algorithm:

1. **Finiteness.** An algorithm must always terminate after a finite number of steps. . . .
2. **Definiteness.** Each step of an algorithm must be precisely defined; the actions to be carried out must be rigorously and unambiguously specified for each case. . . .
3. **Input.** An algorithm has zero or more inputs . . .
4. **Output.** An algorithm has one or more outputs . . .
5. **Effectiveness.** An algorithm is also generally expected to be *effective*. This means that all of the operations to be performed in the algorithm must be sufficiently basic that they can in principle be done exactly and in a finite length of time. (Knuth 1968, 4–6)

For our purposes, *definiteness* corresponds to the description of rules as being unambiguous; *finiteness* and *effectiveness* imply that the rules of a game have to be practically usable; *input* and *output* relate to the input and output of the state machine described earlier. Knuth explains how a cookbook recipe *does not* qualify as an algorithm:

Let us try to compare the concept of an algorithm with that of a cookbook recipe: A recipe presumably has the qualities of finiteness (although it is said that a watched pot never boils), input (eggs, flour, etc.) and output (TV dinner, etc.) but notoriously lacks definiteness. There are frequent cases in which the definiteness is missing, e.g., "Add a dash of salt." A "dash" is defined as "less than $\frac{1}{8}$ teaspoon"; salt is perhaps well enough defined; but where should the salt be added (on top, side, etc.)? Instructions like "toss lightly until mixture is crumbly," "warm cognac in small saucepan," etc., are quite adequate as explanations to a trained cook, perhaps, but an algorithm must be specified to such a degree that even a computer can follow the directions. (Knuth 1968, 6)

Students of contemporary literary theory may find the demand for *definiteness* daring since it is well known that any piece of text or information can potentially be understood in any number of ways, but in actuality, algorithms can be definite because of the way they are constructed. In the recipe example, Knuth points to the fact that the recipe can be understood by a trained cook, but not by someone who has not cooked before. The recipe presupposes knowledge about the problem domain—in this case cooking. For something to be an algorithm, it has to be usable *without an understanding* of the domain. As such, what can qualify as an algorithm—and therefore what can be made a rule in a game—hinges on a *decontextualization:* an algorithm can work *because* it requires no understanding of the domain and because it only reacts to very selected aspects of the world—the state of the system; the well defined inputs; but generally *not* the weather,[6] the color of the computer case, the personality of the computer operators, or the current political climate.

This leads back to Goffman's notion of *rules of irrelevance:* playing a game involves ignoring many aspects of the current context: "any apparent interest in the aesthetic, sentimental, or monetary value of the equipment employed" (1972, 19). As such, *all game rules relate only to selected parts of the context in which they are played.* In state machine terms, this is because a game has a predefined number of *input events*—the state of the game does not change because the sky becomes overcast or because someone coughs; it only changes when someone performs a permissible move: *Game rules relate to selected and easily measurable aspects of the game context.* To rephrase Goffman's description, every game rule also has a *rule of relevance:* A rule includes a specification of what aspects of the game and game context are relevant to the rule. The rules of relevance are a place where rules and fiction meet in that learning a game also means learning to ignore the purely decorative aspects of that game. This is part of the process of *information reduction,* discussed later.

Compare two different possible versions of the checkmate rule in chess:

1. A player is in checkmate when his or her king is in a hopeless position.
2. A player is in checkmate when the king is checked [can be captured in the next move] and he or she is unable to bring the king into an unchecked position in one move.

The actual rule for checkmate is of course the second one, and it works because the aspects of the game situation that are relevant to the rule are well defined—only the positions of the pieces. Rule #1 would immediately lead to long discussions about what constituted a hopeless position; whether a position was hopeless would depend on how skilled the player was, which could then be subject to discussion and so on. Rule #1 fails to work because it does not specify what aspects of the context are relevant—in Knuth's terms, it lacks *definiteness*. Rule #2 works because it does specify what is relevant. Furthermore, even when the relevant aspects of the context are specified, rules still need to be specified in such a way that we can easily decide whether a condition is met or not. Imagine two rules in soccer:

1. The ball is out of play when it is far away.
2. The ball is out of play when it crosses the white line drawn on the grass.

Both rules specify what aspect of the game context is relevant—in this case the position of the ball—but the first one fails to specify it in sufficient detail to be of any use. Again, rule #1 would likely lead to much discussion because it is not easily decidable.[7] In a video game, the distinction is more likely to be between what *can* be an enforceable rule (since the computer keeps track of the game state, everything in the game is already measured) and what players find to be an *acceptable* rule (players tend to become frustrated if they cannot tell exactly what happened).

Making Rules, Changing Rules

How are the rules of a game determined? In a video game, the rules are explicitly designed by the game developers, and usually developed through play-testing. In a folk game, the rules of a game are developed, passed on, and changed by thousands or even millions of independent players. In the 1894 report "Mancala, the National Game of Africa" (Culin [1894] 1971), the American anthropologist Stewart Culin examined the diffusion and variations of the game of mancala (also known as kalaha) around Africa and the Middle East, and found considerable variations in the way the game was played. Given the historical and geographical spread of the game, this makes sense. Perhaps more surprising is that a game can undergo a considerable amount of development and variation within a confined area and time period. Jean Piaget has offered a more local and detailed description of the negotiations about the rules of a "folk" game among children, a marble game called "the square game":

> As we had occasion to verify, the rules of the Square game are not the same in four of the communes of Neuchâtel situated at two to three kilometers from each other. They are not the same in Geneva or Neuchâtel. They differ, on certain points, from one district to another, from one school to another in the same town. In addition to this, as through our collaborator's kindness we were able to establish, variations occur from one generation to another. A student of twenty assured us that in his village the game is no longer played as it was 'in his days'. These variations according to time and place are important, because children are often aware of their existence.
>
> Finally, and clearly as a result of the convergence of these local or historical currents, it will happen that one and the same game (like the Square game) played in the playground of one and the same school admits on certain points of several different rules. Children of 11 to 13 are familiar with these variants, and they generally agree before or during the game to choose a given usage to the exclusion of others. (Piaget 1976, 414–415)

This suggests that it is a common experience to discuss the variations in the rules of a game, changing them at will, and being aware of a number of different variations. Piaget documents that children are well versed in the art of discussing the rules of games, and he confirms what I postulated in chapter 2, that games generally require that the rules be agreed upon *before* the game starts.

The Joy of Arguing about Rules

The description of rules having to be defined before a game starts makes it sounds like disagreement about rules is *always* a problem, something that stands in the way of the enjoyment of playing a game. But any aspect of the enjoyment of games can potentially be placed in the background in favor of something else that was previously considered a dull obstacle, and discussing rules can in fact be enjoyable: In her article "Sex Differences in the Games Children Play," Janet Lever compared the play of some eight hundred children and concluded that the boys *enjoyed* discussing the rules of a game: "During the course of this study, boys were seen quarrelling all the time, but not once was a game terminated because