Chapter 27: Games as the Play of Simulation

A video game usually mimics some real-life situation: rockets accelerating and moving in space, bouncing Ping-Pong balls, a kayak in river currents, the food-chain in an ecology. The game of Chess is an abstraction based on a battle between two small groups of warriors: similarly, video games imitate life. A video game is a simulation, a model, a metaphor.—Warren Robinett, Inventing the Adventure Game

Introducing Simulation

Games as the Play of Simulation is our third and final schema exploring the play of representation. In Games as the Play of Meaning, we examined how games become meaningful through the process of signification. In Games as Narrative Play, we unearthed the wealth of techniques by which games tell stories. For the purposes of this schema, we hone in tightly on the mechanics of play itself, and the way representations are constructed dynamically, through interaction with a game. How, for example, does the board game Diplomacy simulate the art of negotiation? How does the paper-based game Ace of Aces dynamically represent World War I air combat? How does the digital game Deus Ex depict action and intrigue through designed algorithms and rules? The concept of simulation lies at the intersection of representation and dynamic systems. As simulations, games create representations, but they do so in a very particular way: through the process of play itself.

We look for answers to questions regarding games and simulations by focusing on the representational mechanics of game systems. A game creates representations in many ways, from its instruction manual text and imaginative fictive world to the visual design of its spaces and the audio design of its soundtrack. At the center of all of these depictions is the game system itself. This system generates representations from a player's interaction with the game, out of the experience and logic of play. This special class of representations, experienced as procedures, sets of behaviors, or forms of interaction, is the raw material from which simulations are constructed. We call this form of depiction procedural representation. A simulation-based approach to representation in games, it is the central concept of this schema.

However, procedural representation is only part of what we study in this chapter. In addition to exploring the mechanisms of procedural representation, we also investigate the relationship of those representations to the world outside the game. We know something is a simulation, in part, because we are familiar with the thing that it is simulating. Diplomacy is a polit-ical simulation because it mimics processes of negotiation that are known and familiar in the real world. Yet even though Diplomacy faithfully models the art of negotiation, its representation is still in some measure artificial, contained within the game, separate from the real world. The
relationship between a game and the "reality" that it depicts is a fundamental aspect of considering games as simulations.

This is not our first mention of representation and "reality." Back in Games as the Play of Meaning we introduced the concept of the cognitive frame. A cognitive frame is a way of organizing or understanding the world, a framework that shapes interpretation and therefore what we take things to mean. Considering not only how a game simulates, but also what it simulates raises questions regarding the relationship between the artificial world of a game and the "real life" contexts it intersects. These questions will play an important role in our understanding of games as simulations, and will become increasingly important as we move into our primary schema on CULTURE.

Defining "Simulation"

A video game is an imaginary world: its inhabitants are nonexistent creatures that nevertheless the eye can see, and the hand can move. It is imaginary in the sense that there is no solid reality behind the picture. A bouncing ball may be faithfully simulated, but that moving blip of light has no real mass or elasticity. The ball's position, velocity, mass, and elasticity are just numbers stored in the computer that controls the video game; and the laws of physics that govern the ball's trajectory and its bounce are just mathematical equations stored in the computer's program.—Warren Robinett, Inventing the Adventure Game

In Inventing the Adventure Game, Warren Robinett, the game designer and programmer best known for the Atari 2600 game Adventure, looks at games through the lens of simulation. He is particularly interested in the way that digital games are "imaginary worlds," as he puts it, in which players experience blips of light and sound as a representation of some other real-life situation. His description of a simulated bouncing ball, in which the sensory components of position, velocity, mass, and elasticity are peeled back to reveal the underlying mechanisms of the programmed software, reminds us of the often hidden relationship between the formal structure of a game and the experience of that structure through play.

Robinett specifically addresses the way that representations in video games "mimic" real-world phenomena as diverse as bouncing balls and warring soldiers."A video game is a simulation, a model, a metaphor," writes Robinett. What exactly does he mean? What is a simulation? How are games simulations? Is every game a simulation? What is the relationship between a simulation, a model, and the real-world? We tackle these thorny questions in the pages to follow. But first, let us take a moment to define the concept of simulation. The educational game reference A Handbook of Game Design provides a good starting point:

A simulation can be defined as "an operating representation of central features of reality." This definition again identifies two central features that must both exist before an exercise can reasonably be described as a simulation. First, it must represent an actual situation of some sort—either a situation drawn directly from real life, or an imaginary situation that conceivably could be drawn from real life (invasion by extraterrestrial beings, for example). Second, it must be operational, i.e., must constitute an on-going process—a criterion that effectively excludes from the class of simulations static analogues such as photographs, maps, graphs, and circuit diagrams, but includes working models of all types.[1]

The authors Eddington, Addinall, and Percival identify two components that make a representation a simulation. First, a simulation represents something: an "actual situation," which is either a circumstance from real life or an imaginary situation that is conceivably real. This component points out the referential qualities
of a simulation: a simulation refers to something in the real world. It is significant that the authors use the phrase "central features of reality" rather than just "reality" when describing what a simulation represents. As we will see, a simulation cannot depict every aspect of something; it has to choose a very small subset of characteristics around which to build its representation.

The second component of the definition identifies the fact that a simulation is a very particular type of representation, what the authors call "operational." According to them, a simulation is a representation in the form of "an on-going process" instead of a static representation such as a diagram or flowchart. This component of the definition describes the systemic character of simulations. A simulation is a dynamic system: a set of parts that interrelate to form a whole. A simulation is therefore a procedural representation, one achieved through an ongoing process. In the case of games, the ongoing process is play.

Eddington, Addinall, and Percival's statement, "A simulation is an operating representation of central features of reality," offers quite an efficient little definition. In proposing our own definition, we would, however, like to make three small adjustments: first, in keeping with our system-based terminology, we replace the word "operational" with "procedural." Second, we generalize the idea of "central features" to "aspects" of reality. Third, we add quotation marks around the word reality. The result is the following definition of simulation:

A simulation is a procedural representation of aspects of reality.

Both components of this definition, the fact that simulations represent procedurally and that they depict elements of "reality," represent surprisingly complex concepts. In the pages that follow, we look closely at these two aspects of simulations, considering each in turn.


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**Game and Non-Game Simulations**

The general concept of a simulation is certainly not restricted to games. For example, economists and sociologists use simulations to study mathematical relationships among variables, often as a set of equations that process data. The data might be information from the U.S. Census—demographic information about income, housing, and voting patterns, for example—and the equations might spell out sets of relationships among data. Using this kind of simulation, a researcher would be able to speculate on changes in some of the variables, such as income and housing, input these changes into the simulation, and see how voting patterns would change as a result. This kind of simulation doesn't seem like much fun to "play" (it certainly is not a game), but it does fulfill the requirements of a simulation. There are real-world referents represented in the simulation (economic and political realities) and the simulation functions by processing data through a set of procedures. The process might be merely a mathematical equation, but it is a process just the same.

Economic simulations are rarely explicitly interactive. Usually, a researcher sets up data and then "runs" the simulation to process the data. However, some simulations are designed to be highly participatory, such as training simulations. These include computer-based simulations allowing airplane pilots to practice flying without leaving the ground, live role-playing simulations that allow salespeople to refine their social skills on difficult clients, underwater simulations where astronauts practice zero-G maneuvers in a swimming pool, and emergency simulations in which the residents of an apartment building hold fire drills. Each simulation takes its identity from a real-world situation: flying a real plane, pitching a real sale, attempting a real space walk, or escaping from a real fire. In every case, the representation the simulation creates is a process: the complex
machinery and interactivity of a flight simulator, the social and conversational process of role-playing, the physical simulation of being in outer space, and the flow of bodies down stairwells and along fire escapes.

What About Those Quotation Marks?

Well, what about them? Why did we alter Eddington, Addinall, and Percival's definition by putting the term "reality" in quotation marks? This adjustment was necessary because the relationship between so-called "reality" and representation is complex. Is reality a fixed and known quantity, or is it something constructed by our senses, cognition, or cultural understandings? Is reality something that exists outside of representation, or is it something that is constructed by the process of representation? Should representations themselves be included as part of "reality?" We don't have the space to tackle these long-debated philosophical questions here. But we ask that over the course of this chapter, you keep in mind the fact that the "reality" that simulations depict is not a simple given. Putting quotation marks around the word is just a little punctuational string-around-the-finger to remind us of this fact.

Clearly there are many simulations that are not games. But what about game simulations? In the digital game industry, there is a genre of games called simulations, or "sims" for short. Sim City, for example, is a complex depiction of the process of urban planning, city economics, and the evolution of a human community; it is a simulation game. Other game simulations depict historical processes, natural ecosystems, or military vehicles. Although sims, perhaps more than other games, explicitly fulfill both components of our definition (a procedural representation of aspects of "reality"), all games can in fact be considered simulations. Remember that a game design schema must be applicable to all games. Therefore in proposing the schema Games as the Play of Simulation, we are arguing that any game can be considered a simulation.

As abstract or fantastical as games may be, it is possible to see them as simulations of one kind or another. Chess and Tic-Tac-Toe, for example, can be framed as representations of territorial conflict, in which simulated units war for control of a stylized battlefield. Games that involve fantastic elements, such as Dungeons & Dragons, also simulate through their play. Detailed rules, for example, simulate the way that different weapons impact different kinds of armor. Even the spell-casting system in D&D is a simulation of sorts: it simulates an imaginative "reality," one rooted in myth, religion, and popular culture. As the example of extraterrestrial invasion in the quote from Eddington, Addinall, and Percival illustrates, aspects of "reality" can refer to things outside our lived experience.

Some games, such as Tetris, present more ambiguous referents, but that does not mean that they are not a kind of simulation. Tetris simulates the way objects can fall down, stack up, and even make noises when they slide into place next to each other. In this way, Tetris is a simple simulation of the forces of gravity. Then there is the fact that falling Tetris objects are called "bricks," and these bricks form an interlocking brick wall grid. These aspects of the game point to a different kind of depiction, perhaps a simulation of construction. Tetris may not be a particularly accurate or instructive simulation of gravity or construction, but accuracy and instructiveness are not necessarily what a game simulation is about. A game simulation, as any kind of game representation, can be geometrically minimal, outrageously whimsical, or even intentionally misleading. Unlike a simulation designed for scientific research purposes, a game simulation is not beholden to a notion of representing empirical truth. Pong is not meaningful to players because it is a scientifically accurate representation of Table Tennis; it is meaningful because as a simulation it provides a context for deep and engaging play.
Meaningful Play and Simulation

How does framing a game as a simulation assist in designing meaningful play? In considering the play of simulation, we are simply re-working fundamental game design concepts established in previous chapters. Although the emphasis here is on how games create representations, fundamental principles of the design of meaningful play remain the same. Whether a simulation allows players to experience the representation of something known and familiar or fantastically imaginative, it does so through the design of meaningful play.

In order to see this principle at work, we can take a close look at Ace of Aces, a game designed by history teacher Alfred Leonardi in 1980.

Ace of Aces simulates a dogfight between two World War I aircraft, using a complex formal system to represent the speed, maneuverability, visibility, weapons fire, and other aspects of two-plane air combat. The striking thing about Ace of Aces is that the game takes place not on a computer or even on a paper wargame map, but instead inside two paperback game books. Each player has his own book, and each of the more than 200 pages has an illustration of what the player sees from his or her airplane cockpit. The point-of-view illustration shows the enemy plane at a certain distance, location, and angle relative to the player's own plane. For example, if an illustration shows your opponent's plane coming towards you over your own tail, it means the other player is directly behind you!

Players interact within the simulation by navigating through their book (players cannot look into each other's books) and selecting maneuvers. At the bottom of each page is a list of the possible maneuvers a player can take, with a number assigned to each. Both players select a maneuver in secret and call out the corresponding number, which determines the next page each player turns to in their book. The elegant formal system of the game is amazingly effective at simulating a dogfight between two World War I airplanes.

Does this seem hard to believe? Consider the scenario we describe: your opponent positioned directly on your tail. You choose a maneuver to slow down and perform a weaving turn to the right, in which you shift your position to the side, ending up parallel to your previous position—something like a car changing lanes. Let's say your tailing opponent thought you were going to make a run for it and made a decision to move forward at top speed—this choice would cause your opponent's plane to zoom right by your decelerating plane. When you turn to the appropriate page in your book and see the outcome of last round's maneuvers, the illustration would show your opponent's plane ahead of you and to the left; and in your opponent's book your plane would be visible behind and to the right.
Ace of Aces simulates aspects of World War I air combat. It does not simulate every facet of the experience (there are no rules to handle different kinds of weather and their effect on flying, for example), but it does represent important aspects of its referent. Spatial logic, tactical maneuvers, weapon jams, and even an increase in skill over several combats are all aspects of World War I air combat the game depicts. Furthermore, these representations are made possible through a dynamic system—a process based on a multifaceted mathematical model of air combat. It is through this process that Ace of Aces simulates a World War I dogfight.

Ace of Aces constructs this simulation by combining emergent and embedded elements. The drawings and pages themselves are fixed in print, and do not change as the game is played. In this sense, the book pages might be considered embedded narrative elements, pre-scripted narrative descriptors experienced by the player during play. However, the complexity of the underlying game rules incorporates these pages as elements within a truly emergent system. The Ace of Aces book pages are less like the pages of a Choose-Your-Own Adventure book and more like video frames from a real-time simulation display, snapshots of an ongoing battle. In creating a simulation, both emergent and embedded elements can be incorporated into the overall game. However, because of the way that simulations rely on dynamic systems, framing a game as a simulation tends to emphasize the emergent components of the game, the more purely systemic elements that interact in complex ways to generate unexpected results.

Ace of Aces not only provides a rich and coherent simulation of air-to-air combat, but also facilitates meaningful play. Because the pages of the two books contain all of the possible spatial relationships between planes (made possible by a set of rules), the players are literally navigating through the game’s space of possibility, experimenting with maneuvers, taking daring risks, and psyching each other out. Each decision they make is both discernable and integrated into the larger game experience, an experience made possible by the simulation. The representational mechanics of the simulation solidly support player decisions, establishing a taut and meaningful domain of interaction. The simulation creates a space of play that exists somewhere between the two printed books, the social interaction of the players, and the battle playing itself out in their overlapping imaginations.
Ace of Aces manages to engage players without illusionistic 3D graphics and sophisticated force-feed-back pilot controls. Playing Ace of Aces is radically different than flying a plane, yet it somehow still manages to function as a successful simulation. Simulations do not need to literally embody the material and sensual forms of the phenomena they are simulating. This is what Robinett means when he calls a game "a simulation, a model, a metaphor." As representations, simulations often represent metaphorically, meaning they can create representations in non-literal ways. Sometimes, game simulations try and replicate the actual experience of the thing they are simulating, as with VR displays that take over a player's entire field of vision. More often, however, simulations take on modes of representation that are not so literal. There is an underlying mathematical model that connects Ace of Aces to planes moving through space. But the activity of playing the game—turning pages and calling out numbers—is nothing like sitting in an actual cockpit. In fact, this metaphorical difference between the core mechanic of Ace of Aces and its simulated referent is one source of the game's pleasure.

Procedural Representation

Seen as simulations, games are dynamic systems that construct representation through play. Asteroids, for example, represents the feeling of vast space through the inertial drift of the player's ship. The game designers could have created any navigational scheme they wanted, such as a space ship that could start and stop instantly and turn on a dime even when in motion. Instead, the player must maneuver the ship retro rocket-style, taking into account acceleration and momentum. Through this designed activity, the game expressively depicts deep space. In the Lord of the Rings Board Game, the dark force of Sauron is represented as a figure on a track that moves steadily toward the players; his evil nature manifest in his terrifyingly inevitable advance as well as in the deadly ramifications of an encounter with him on the board. The board game Up the River playfully recreates the experience of a flowing river through the unusual format of its board, which is made out of horizontal strips. Each turn, a player takes the strip from the rear and places it in the front. In this way, the sailboats belonging to the players must battle the steadily flowing water current as they race to be the first to reach the dock.

In these three examples, formal and experiential elements of the game work to create a representation that emerges out of the procedures of game play. We call this form of depiction procedural representation. The term "procedural" is shorthand for all of the process-based ways that games can signify. A procedural representation might arise from the functioning of a computer program's AI; it might be an emergent result of players following the rules of a game; or it could be an expressive core mechanic that references a particular action outside the game.

A miniatures-based wargame is a representation of war partly because the pieces themselves resemble miniature soldiers and because the battlefield can be painted to look like a contested landscape. But these visual signs make up only one part of the game's larger representation. Wargame representation is also procedural, created through the rules of the game and player choices that the rules engender. For example, units in a wargame generally have a movement rating, representing the number of hexes or spaces through which the unit can move in a turn. In a typical wargame, a cavalry unit will have a higher movement rating than an infantry unit. This statistical difference between types of units is not only a formal distinction; it is a form of representation.

The fact that a cavalry unit moves more quickly in the game than an infantry unit is an act of signification that is fundamentally different than the visual aesthetics of the game token. Its representation is procedural, based on the unit's formal identity and its interactive capabilities within the game system. Of course, the units in wargames have many other kinds of formal statistics as well, from offensive and defensive abilities to
movement strengths and weaknesses on different types of terrain. All of these formal designations are based on the simulated characteristics of various battle units. As the game is played, these formal identities become systemic relationships that constitute a dynamic, procedural representation of war.

We can consider games as procedural representations on two levels. Borrowing concepts from *Games as the Play of Meaning*, we know that games are representations and also that they can represent. The idea that games are representations means that an entire game can serve to depict something. Considering procedural representation on this macro-level, a game represents as a whole. Pong is a procedural representation of Table Tennis; Tony Hawk's Pro Skater 3 is a procedural representation of skateboarding. The notion that games can represent means that games contain smaller, internal depictions. This also holds true when considering the procedural aspect of game representation. We can look at the structure of a game on a micro-level and identify the procedural representations that make up the whole, such as the movement rules for cavalry and infantry wargame units.

Macro- and micro-level procedural representations can be embedded in each other. A card game that depicts social life in an eighteenth century royal court is a game that as a whole simulates a particular historical moment. But within the game, we find several micro-procedural representations. There might be one set of rules to simulate swordfight dueling and another to simulate the current political climate of the court. Of course, these micro-procedural representations are linked together within the complete system of the game that constitutes the overall simulation. The same is true of digital games, where the code that simulates light falling on 3D objects is generally separate from the code that simulates the behavior of computer opponents. Although they simulate different aspects of the game's subject matter, these components are all contained within the larger macro-system of the game simulation.

Because procedural representations emerge out of the play of a game, the player's participation is crucial in bringing the signifying procedures to life. As with all game representations, however, procedural representations also grow directly from the rules of the game, gaining meaning as players interact with them through play. Following are three examples of games that make very different use of procedural representation. In each case, the representation is brought to life through both the formal rule structure and the experience of play.

**Diplomacy**

The board game Diplomacy is a complex representation of World War I political negotiation. The game takes place on a map of Europe and (depending on the particular edition of the game) the tokens used by players might resemble land-based and naval military units, or they might be abstract shapes. Each player assumes the role of a European military power, vying to occupy a number of key cities and conquer the continent.

The game is played in turns. Each turn, players negotiate in public and private for a limited amount of time (usually about 10 or 15 minutes). At the end of the negotiation period, players write down and simultaneously reveal their selected actions. The outcomes of their actions that turn are contingent on the decisions of other players. For example, during a turn one player moves an army into a territory occupied by another player. Support that the invading player has garnered from other players determines the success of the invasion. If the invasion pits one attacking unit against one occupying unit, the action is unsuccessful. However, if the invading player received support from another player with a unit in an adjacent region, the attack is successful: the strength of the invasion becomes two units acting against one. These rules make advancement of your armies on the board difficult, requiring players to make alliances and coordinate their actions.

The formal game mechanics of Diplomacy result in a dramatic procedural representation of negotiated alliances, uneasy agreements, and broken peace treaties: a representation, in other words, of diplomacy itself. Only one player can ultimately emerge as victor, and it is usually
just a matter of time before deceit festers and player alliances are broken, reshuffled, and reformed. Which of your allies are going to betray you—and how? In the game of Diplomacy, as in the diplomatic processes it depicts, social skills are at least as important as strategic thinking.

Diplomacy as a whole procedurally represents the subject matter of diplomacy, and it does so through a number of internal representations that combine to form the overall simulation. For example, although Diplomacy could take place on an abstract map and still maintain the same sense of diplomatic intrigue, the map is also used as a means of procedural representation. Switzerland, for instance, is a central but impassable neutral territory, mirroring its isolationist role in World War I. Each country's starting forces are a representation in miniature as well, appropriate to the time period: England has the strongest naval force but a weak army.

Diplomacy is a wonderfully engaging procedural representation of World War I political negotiation, but it only achieves status as a simulation because of careful design decisions. Procedures embodied in private player negotiations, simultaneous player action, contingent action > outcomes, the ability to support other players' actions, and procedural use of the map and tokens combine to create a complex representation of diplomacy. This representation is a product of the process of play: a representation that only gains meaning when it is experienced as a system of dynamic relationships driven by player interaction.

**Vampire**

Vampire is a game that relies on procedural representation as well. The game comes from the *New Games Book*, which lists the following rules:

To start, everyone closes their eyes (Vampires only roam at night) and begins to mill around. You can trust the Referee to keep you from colliding with anything but warm living flesh. However, you can't trust him to protect you from the consequences, for he is going to surreptitiously notify one of you that you are the vampire.

Like everyone else, the vampire keeps her eyes closed, but when she bumps into someone else, there's a difference. She snatches him and lets out a blood-curdling scream. He, no doubt, does the same….

If you are a victim of the vampire, you become a vampire as well. Once you've regained your composure, you too are on the prowl, seeking new victims. Now perhaps you are thinking that the game too quickly degenerates into an all-monster convention? Ah, but then you didn't know that when two vampires feast on each other, they transform back into bread-and-butter mortals.

Will the vampires neutralize each other before all mortals are tainted by the blood-sucking scourge? Why don't you try a little experiment and see? There's always hope, even in the midst of a blood-curdled crowd.¹²

The referent that Vampire simulates is quite different than the referent of Diplomacy. Whereas Diplomacy procedurally represents a real-world historical situation, Vampire comically evokes images of vampires ripped straight from the pages of pulp fiction. The way the game design achieves its procedural representation, however, is no less sophisticated.

Because Vampire requires no game materials (no map or game pieces), it relies entirely on the activity of the players' bodies to generate play: game representations emerge solely from the interaction between players. The initial limitation on the game, the fact that players must
keep their eyes closed for the duration of play, orchestrates a certain kind of representational experience. Enclosed in darkness, the player is taken out of the ordinary world and placed in the imagined world of the vampire night, a setting whose drama is amplified by the fact that players spend the entire game stumbling through an unfamiliar space, feeling around for each other.

This tension-filled core game mechanic makes every meeting between players a surprise. There are three different ways that an encounter can play out, from two non-vampires exchanging thankful sighs of relief to a screaming vampire attack, (or double-attack, if two vampires collide). As players wander aimlessly, the sound of shrill yells map the darkness surrounding the players, transforming their invisible game world into a screamingly theatrical sonic landscape. In addition to supporting the goofy-horror flavor of the game, the sound component allows players to "see" the larger playfield, signaling areas of action. Are those bloodcurdling yells coming from somewhere safely far away? Or perhaps from RIGHT BEHIND YOU! These simple procedures (wandering around with eyes closed, meaningful chance encounters, screams erupting in the darkness) together create a coherent and distinctive vampire experience for every player in the game.

Furthermore, as with many New Games games, Vampire plays with the conventions of winning and losing. Does an individual player win at Vampire? How? Do players try to become bitten? Or do they try and remain safe? As vampires, are players seeking new victims? Or a cure for their condition, in the form of another vampire? How will the game end? With a field full of vampires or with the group purged of their vampiric tendencies? The emergent representational system of the game, in which players collide like charged particles, takes on unpredictable patterns. The fact that the game can end in one of two states heightens the drama of the experience and gives the overall game play the suspense of a thriller.

Vampire creates a representation through a number of procedures, from the game's immediate core mechanics to the long-term trajectory of play. Vampire is successful as a representation because it is squarely focused on the player experience. From the outside, Vampire looks like a silly group activity. It is only inside the game that the procedural representation works its magic.

Illuminati

We first mentioned the board game Illuminati in Breaking the Rules. The game design is remarkable, among other reasons, because it offers a play variant that encourages rule-breaking within certain boundaries. Although Illuminati uses many means to simulate its subject matter, we focus here on how rule-breaking itself acts to create a procedural representation.

Illuminati is based on the Illuminatus books of Robert Anton Wilson, and the subculture of conspiracy theory associated with them. Players in Illuminati assume the roles of shadowy power brokers that manipulate world events and political structures to their own devious ends. There are groups that players can control and link in the game, from the FBI to Trekkies to the entire state of California. Each of these elements is represented in non-procedural ways (through illustrations and text descriptions), as well as in more procedural ways (each group is represented through a set of attributes, making California, for example, a much more lucrative group to control than the Trekkies).

When players use the rule-breaking variant, a completely different kind of representational experience results. The premise of the game requires players to twist existing social structures and institutions to the mysterious—and often ridiculous—ends of the Illuminati. A player might arrange things, for example, so that Trekkies control the FBI, and the FBI in turn
controls California. Therefore, the idea of reworking existing power structures to devious
effect is already an important part of the overall representation of the game. But by breaking
the rules, players take the act of manipulation one step further. The game rules themselves
become a representation of the staid rules of society, which the players, as shadowy power
brokers, subvert. The action of breaking the rules is itself a procedure, representing the way
players turn the game world upsidedown in order to undo existing power structures and the
well-laid plans of other players.

This kind of game play takes players right to the edge of the magic circle, as they engage in
an experience that actively plays with the destruction of the game's authority. This is precisely
why it is such a powerful representational device, because breaking the rules allows players to
play with genuine power. The authority of the rules, the social contract of a game, the safety
and trust of play, all become radically undermined, as the game flirts with its own destruction.
Can you imagine a better way to represent the topsy-turvy world of the Illuminati?


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**Represented Conflict**

We are beginning to understand how procedural representations work to simulate phenomena through
dynamic depictions. But there is a question that precedes a discussion of how games create such
representations. It is the question of what phenomena a dynamic system can depict. Can a game designer pick
anything to simulate, or are there inherent limitations? Are there certain things that games are predisposed to
simulate, certain subjects that lend themselves naturally to games? Game designer Warren Robinett seems to
think that just about anything might be simulated:

Many provocatively complex phenomena await interpretation …trains and other vehicles
which move cargo through spaces, kayaks in swirling river currents, planets orbiting their
stars, competing creatures in evolving ecologies, visible melodies smeared upon harmonic
wallpaper, looping programs in throbbing execution, and human thought darting across a
tangled network of knowledge....

The real world offers a vast set of phenomena to simulate—animals behaving, plants
growing, structures buckling, traffic jamming, snowflakes forming. Any process is a
candidate. Every verb in the dictionary suggests an idea. [3]

Since Robinett originally penned this challenge, games have been designed to simulate some of the
phenomena he describes: Sim Life attempted to simulate evolving ecologies of creatures; the shareware game
Bridge Builder simulates structures buckling under the weight of a train. However, many of the phenomena on
his list are still waiting to find themselves in games. As Robinett points out, "every verb in the dictionary
suggests an idea" for a simulation. Why then, do games seem to focus on a narrow range of processes to
simulate? Why do we see the same genres of games over and over: fighting, racing, war, sports, and so on? Of
course, economic and business concerns greatly influence game content. But is there something else,
something deeper about the underlying structure of games that determines the kinds of processes they can and
cannot depict?

Our definition of a game describes them as systems in which players engage in an artificial conflict, defined
by rules, that results in a quantifiable outcome. The part of the definition relevant to our present discussion of
simulation and representation is conflict. Games are contests of power: they are systems of conflict. Conflict is not only a product of the game’s rules, but of its system of representation as well. Every game, on some level, dynamically represents conflict. The elements of a game—the players, the pieces, the rules—all have a role in generating the representation. The insight that games represent conflict through a dynamic process might help to explain the prevalence of certain content in games: perhaps some forms of conflict are simply easier to model than others. At the same time, understanding the kinds of conflict that games most often depict also helps us to strategize new kinds of subjects for games to simulate.

What are the forms of conflict we find dynamically represented in games? If the game has a strong narrative component, the conflict is easy to spot. The Lord of the Rings Board Game clearly simulates the struggle of the players, as the Fellowship hobbits, to reach Mount Doom at Mordor and destroy the One Ring. But in many games, it is more difficult to pin down the simulated conflict. What is the conflict in Baseball, Checkers, or Jeopardy? The key to comprehending the form of conflict simulated by a game is to figure out what is being contested. In what kind of arena is the conflict being held? Over what is the conflict being waged? How is the progress of the conflict measured? What aspects of the conflict are dynamically represented?

In order to answer these questions we distill the range of game conflict into three general categories: territorial conflict, economic conflict, and conflict over knowledge. These three categories are neither discrete nor mutually exclusive: many games incorporate two or all three of them at once within their design. Rather than a strict typology, they are instead conceptual frames for looking at the kinds of conflict that games can dynamically represent. Next, we explore each of these three categories in more detail.

**Conflict Over Territory**

Conflict over territory is perhaps the most intuitive of the three categories. Board games such as Chess, in which pieces are moved on a limited playing field, are a common game of this sort. In games of territorial conflict, players strategically position their units to capture enemies and gain ground. Conflicts of this kind are abstract representations of war: the pieces depict military units, and the play area dynamically represents the territory over which the battle is waged.

Go is another good example of a game focused on capturing territory. As players lay down their stones, their primary goal is to surround areas of the playfield to secure the captured space. At the end of the game, each player receives a point for each grid intersection secured (plus a point for each captured enemy piece). The game originated as a military simulation—in feudal Japan, Go was considered a martial art. As a territorial conflict, Go is a strikingly elegant representation.

There are many other games that simulate the process of territorial conflict. Tic-Tac-Toe is a simple territorial conflict where players attempt to strategically occupy territory in a pattern that will lead to victory. Ball-based sports such as Football and Soccer entail moving a team or a special marker across a stretch of terrain into the opponent’s end zone or goal: the enemy invaded. Tabletop games such as Warhammer offer incredibly complex representations of warfare dynamically enacted, with dozens of different kinds of units, large detailed maps, and thick rulebooks controlling the particulars of interaction. The U.S. military uses even more complex war games as training exercises, in which hundreds or even thousands of troops play vast games of laser tag in real and simulated environments.

**Economic Conflict**

Economic conflict is another common form of conflict in games. Within simulations of economic conflict, it is not terrain that is contested, but a unit of value. The word "economic" does not necessarily refer to money, but to any collection of pieces, parts, points, cards, or
other items that form a system through which the conflict takes place. In a pinball game, you
are trying to rack up a high score. In Magic: The Gathering, you are trying to reduce your
opponent's life to zero. In these game economies, the rules give each unit a value, and
progress through the game is measured according to the values assigned by this economy.

An economy in a game is generally a **limited economy**. This means that the units that make up
the economy are finite, and usually the players know the composition of the economy. In
Poker, it is crucial that all players understand the limited economy of a deck of playing cards.
Knowledge about which cards appear in the deck allows them to understand which hands are
more difficult to build. Four-of-a-kind is harder to build than a pair; a straight flush harder
still. The other economy of Poker—the betting money—might or might not be a limited
economy. Each player might start with the same amount of chips, in which case all players
know the parameters of the chip economy. If players can use money in their pockets or other
valuables for betting, the players don't know the full extent of the economy—although the
economy is ultimately limited by the capital each player possesses outside the magic circle.
On the other hand, if players are not betting "real money" but are instead playing for fun
using an endless supply of chips, the normally limited betting economy becomes unlimited.

Because economic conflict is generally reducible to numbers and points, and games are
intrinsically mathematical, we can frame almost any game in this way. For example, a race
game, in which players roll a die and move a marker down a track, might at first seem to be a
territorial conflict.

However, the same game could also be played by throwing dice and adding up the points that
players receive each turn, making the game more of an economic conflict. Since the two
games would have similar constitutive rules, the operational rules would help determine
what kind of conflict the game represents. Yet some games combine categories: Is Quake a
territorial conflict or an economic one? It is clearly a hybrid. The play takes place within the
representation of a space, in which relative position at each moment is quite important.
However, much of the game consists of managing economies of resources such as health,
armor, ammo, weapons, and kills.

Even the strongly territorial games of Chess and Go can be seen as procedural representations
of economic conflict. In Chess, the pieces represent an economy, and the use-value of each
piece is derived from the total set of relationships on the board. Of course, one unit—the
King—has a special value, which determines the winner of the game. Similarly, at the end of
a game of Go, territory is translated into points, and as with the race game example, Go could
be interpreted as an economy—of contested points. Remember that the three kinds of conflict
are not hard and fast categories; they are merely frames we use to understand the kinds of
conflict that games traditionally simulate.

**Conflict Over Knowledge**

Conflict over knowledge offers a different model for understanding the way games simulate
conflict. In Trivial Pursuit, for example, it is true that pieces move about on the spatial
territory of a board. It is also true that the players acquire a set of colored plastic pieces within
an economy of parts in order to win the game. But these ways of framing Trivial Pursuit seem
to leave out the key component of the game conflict: the process of asking and answering
trivia questions.

In Trivial Pursuit, as with many other games in which information itself forms the arena of
conflict, the contested "terrain" of the game is knowledge. Game shows such as Hollywood
Squares, computer trivia games such as You Don't Know Jack, and even games about
translation of information from one form to another such as Charades, can all be understood
as games in which the conflict is one of knowledge. Conflicts over knowledge are inherently cultural, because the game conflict itself engages with a cultural space that lies outside the game. In a game of conflict over knowledge, the outcome of a game action is dependent on whether or not the player knows the right answer to a question of some kind. This is quite different than representation of territorial or economic conflict: the process being simulated is the conflict of acquiring and sharing cultural knowledge. Games designed with factual knowledge as part of the system of conflict cross over the border of the magic circle, creating a game contingent on information brought into the game from external sources.

Games represent conflict as acquisition of and contestation over territory, economy, and knowledge. These three rather abstract categories don't tell us exactly what games are capable of simulating, but describe the general sorts of processes that games most often simulate. Identifying these three categories also helps explain why we see the same kinds of conflict being modeled over and over in games. For example, why is it that video games often seem to focus on simulating military conflict: fighting, shooting, and conquering? Or that so many games overflow with collectable item economies: magic coins, money, or other precious objects? Like it or not, the tendency toward military and economic representation in games has a long history, directly linked to the processes of territorial and economic conflict intrinsic to most games.

There is a relatively clear line of descent, for example, from Go and Chess to Kriegspiel, wargaming miniatures, and role-playing games, and from these non-digital games to today's RPGs, FPSs, and RTSS (role-playing games, first-person shooters, and real-time strategy games). A tremendous amount of design thinking regarding wargaming, military simulation, and other forms of territorial conflict has accumulated over the centuries. Simulating the difference between mounted units and infantry units; between melee and ranged weapons; between attacks that spread damage and attacks that penetrate; between size and maneuverability, strength and speed, and so on, have become well-worn design problems of game representation over the years. In this sense, today's highly detailed military games are the inheritors of millennia of design thinking.

Happily, this long history in no way limits what it is possible to simulate in games, even when it comes to forms of conflict. An important question for today's game designer is: What other kinds of conflict can games simulate? For example, what about Robinett's wish list? How could a game be designed to simulate social conflict, psychological conflict, or interpersonal conflict? These are truly tough design challenges. As we will see in the following pages, part of the challenge lies in the fact that simulations require radical simplification and stylization. Sid Meier's Civilization series are wonderful strategy games that tackle the Herculean task of simulating cultural development. But because cultural knowledge in the game is necessarily stylized into abstract units ("Do you trade Monotheism for Iron Working?") the game never comes close to representing the subtlety of its subject matter.

The history of games contains many robust examples for simulating military and economic conflict. A design lexicon for simulating social or cultural conflict may take generations to develop. Of course, these unsolved challenges are part of what makes game design as a field so remarkable. Despite the fact that games are a truly ancient phenomenon, there are still countless avenues for representational innovation—as long as you are ready to question long-standing assumptions about what games are and what they can be.

Procedural Characters

Conflict is an abstract, elemental way of thinking about the kinds of processes that games simulate. But it is not the only way to frame games as simulations. What about simulation and storytelling? Any of the game narratives discussed in the previous chapter could be thought of as a simulation, providing it was represented through a dynamic process. Combining narrative and simulation is a powerful way of thinking about games as a representational medium, because it forces a truly experiential approach to participating with a story. As Reiner Knizia wrote in his earlier essay for this book, his hope for the Lord of the Rings Board Game was that it would "not just re-tell Tolkien's plot, but more importantly it would make the players feel the emotional circumstances of the story."

Following are four examples of just one part of the storytelling equation, the element of character. The four examples each examine a very different strategy for procedurally creating narrative experience via character (here we are using a general concept of "character" that refers to a fictional persona contained within a game representation). Some of the examples are characters under the direct control of a player, whereas others remain outside of player control. In all cases, rules and interaction are used to procedurally construct a character, while also weaving the character into the larger fabric of the game representation.

**Zelda: Link's Awakening**

In this adventure game for the Game Boy, players control a character named Link, moving him about the fictional world of the game, exploring new spaces, acquiring objects, and defeating enemies. The game is rich with characters—in addition to Link, many personalities populate the world of the game, including a witch character that players encounter early in the game.

The character of the witch signifies the idea of "witch" in many different ways. The character looks like a witch (she wears a tall pointed hat), sits next to a cauldron, cackles as she talks, and possesses other stereotypical trappings of a cartoon witch. In addition to these non-procedural representations, depiction of the witch occurs procedurally as well: the witch character has a number of systemic qualities that allow her to signify in ways that a non-procedural character could not.

For example, like many characters encountered in Zelda: Link's Awakening, the witch's character lives in her own house. Most houses are found in villages, where many of them are clumped together. As a result, they are easy to locate. But the witch's house lies deep in the heart of a dangerous wood. In order to reach it, the player must overcome obstacles as he or she searches through the maze-like forest. Not only is the witch represented in the space of the game as living a life isolated from the villagers, but her very separation from society makes her character more difficult to find. Both of these attributes (isolated and dangerous to visit) are very "witchy" characteristics. In the game, these characteristics are a function of the position of the witch's house relative to other elements on the game-grid of the imaginary world; they are procedural, growing from the formal characteristics of the game and the player's own game interactions.

When a player reaches the witch, she informs Link (via onscreen text) to bring her a mushroom. If the player goes back out into the forest, collects a mushroom, and then brings it back to the witch, she will take the mushroom, stir her cauldron, and produce a magical powder for the player. The witch enacts a procedure that transforms the mushroom, changing its properties within the game. As a liminal character living outside the bounds of society, the witch has the ability to convert natural objects to useful technologies. This kind of procedural characteristic is common in adventure games (take object A to character X and receive object B). Yet in the case of the witch, it works very well to depict her character. The procedural elements constituting her representation (her location in the world, her ability to convert...
objects) are truly witch-like and serve to create an effective and memorable character.

One last note of clarification: imagine a witch character in a book similar to the witch in Zelda: Link's Awakening. The book's story would describe how the witch lives in the woods, makes magical potions, and so on. What would be the difference between the two witches? Aren't they basically the same character? Perhaps, but the form of their representation is radically different. Although both witches might have the same "literary" characteristics, the witch in the book would not possess these traits as procedural qualities, which are triggered as part of an activity of meaningful play. In fact, the witch in the story is exactly the kind of witch that the game witch references. Actively exploiting the witch's witch-like qualities, not just by reading about them but also by playing with them, is what makes her representation so powerful to experience in the context of the game.

**Virtua Fighter 4**

The fighting game Virtua Fighter 4 integrates procedural representation into the narrative play of the game by tying the formal characteristics of the fighting characters to their appearance, personality, and embedded backstory. Every character is designed with explicit strengths and weaknesses, which are procedurally represented through character attributes. For example, Pai Chan has incredible speed but lacks power and hard-hitting moves. Kage-Maru has complex combinations and special moves, but they take time to execute, leaving him vulnerable to attacks from his opponent. Jeffry McWild has great power, but is large and heavy, and therefore less agile. Each character's strengths are countered by logical weaknesses, adding up to a fighting "personality" that plays itself out during each match.

In a well-designed fighting game these procedural representations have strong ties to the fictive world and narrative of the game. How a character fights is usually an external representation of internal qualities, and fighting styles are mirrored in the narrative histories provided for each character, as well as more mundane information such as height and weight, profession, gender, and country of birth. All of these non-procedural narrative descriptors may seem superficial to the gameplay, but they help create an integrated character in which procedural and non-procedural elements are brought together in a character representation that players experience on many levels.

For example, Virtua Fighter 4's Pai Chan is an action film star whose hobby is dancing. She is small and light and favors a fighting style that uses combos and quick reverses. Her father, Lau, bested her in a previous tournament, and in VF4 Pai is determined to defeat him and prove herself a worthy successor to her father's legacy. Each component of this narrative offers players insight into the strengths and weaknesses of the character. Pai Chan's background as an action hero and dancer make her quick and agile. Her preferred style of fighting favors rapid combinations that often leave her defenseless if her attacks are blocked. Because of her intense desire to defeat her father, Pai Chan is driven by emotion, not logic. As a result, her fighting style is visceral and immediate. She reacts quickly, but rarely plans for the long fight.

This character sketch not only describes Pai Chan herself, but also the playing style that her procedural characteristics engender. By "playing" Pai Chan in a match, the player participates in her representation, bringing her procedural characteristics to life. The play becomes a meaningful representation because of the well-designed synergy between her formal characteristics, appearance, backstory, and emergent personality. This kind of richly layered simulation is a fantastic example of the unique ways that games signify through an integrated suite of representational mechanisms.

**Deus Ex**
Deus Ex is a role-playing game designed for both computer and console platforms. A strong feature of the game is the computer-generated characters, which respond to game events in surprisingly subtle and expressive ways. These characters follow a series of AI algorithms that determine how they behave in any given situation. In *Swords and Circuitry*, Hallford and Hallford reprint a section of the Deus Ex design document that outlines how different character types act in certain circumstances. This fascinating document reveals the designed mechanisms by which the game's characters are procedurally represented. Here is a brief excerpt from the document:

**Civilian:**
- Does not harm civilians
- Ignores unidentified sounds
- Aware of alarms
- Issues warning before attacking
- Flees when wounded below X% (where X is high)
- Tends to protect self
- Ground-based movement, normal

**Thug:**
- No concern for safety of civilians
- Investigates unidentified sounds
- Aware of alarms
- Attacks without warning
- Flees when wounded below X% (where X is low)
- Ground-based movement, normal

**Military:**
- Does not harm civilians
- Investigates unidentified sounds (if possible without abandoning post)
- Aware of alarms
- Issues warning before attacking
- Never flees when wounded
- Ground-based movement, fast

These character descriptions are quite high level—they do not formally specify exactly how each character will behave. For example, the speed of each character is only defined as "normal" and "fast" rather than numerically. However, as an abstract character sketch, these descriptions offer a snapshot of the sort of design decisions the game's designers made as they developed the characters' behaviors. Compare the thug character and the military character. Whereas the more cowardly thug will flee when his health is low, the brave military character will never abandon his post and will fight it out to the bitter end. The unscrupulous thug will attack without warning, but the honorable military character will issue a warning before attacking. In this way, the programmed characteristics of the characters take on a simulated personality, becoming expressive by virtue of their procedural differences. By adding different types of characters defined along a number of parameters, an entire cast of procedurally generated actors could be developed.

To appreciate the sophistication of these strategies for representation, compare the Deus Ex characters to the witch in Zelda. The witch behavior is fairly simple and wholly predictable (if: receive mushroom, then: create powder). In contrast, several Deus Ex characters encountering each other in the game create a scene rife with emergent drama.

Imagine, for example, the following situation: A thug approaches a civilian. The civilian (who ignores unidentified sounds) pays no heed to the footsteps of the approaching thug, who begins to mercilessly beat the civilian (attacks without warning; no concern for safety of civilians). After the thug strikes a single blow, the civilian starts to flee (flees when wounded below X%, where X is high), pursued by the thug (both characters move at normal speed).
The pair of them run by a military character who takes notice of them (investigates unidentified sounds) and takes up the chase herself, quickly catching up to them (moving at fast speed). The military character ignores the civilian but catches up to the thug and begins to issue a warning… How will the scene play out? Does the thug pause when warned, giving the civilian time to flee? Do the military character and the thug battle to the finish? Or does the entire scene disperse as characters each go their separate ways?

This sequence of actions is not pre-scripted, but instead emerges from the simulated behaviors of the characters. Each character has a very distinct personality. Of course each character also has a different visual appearance, style of movement, tone of voice, and so on. These nonprocedural traits are certainly important to their overall representation. But it is through the procedural representation of the characters, representation emerging from behavioral characteristics, that they take on active roles in the dramatic events of the game.

**Blob**

Procedurally represented characters are not exclusive to the domain of digital games. Our final example of a procedural character comes from a non-digital game, a New Games tag variant called Blob.

If you're addicted to late-night TV monster movies, here's a sure way to kick the habit and break out into the light of day…

The Blob begins innocently enough as a mere individual playing a game of tag. As soon as she catches someone, she joins hands with him. Now he's part of the Blob too, and they both set out, hand-in-hand, in search of victims. Everyone the Blob catches (only the outside hand on either end of the Blob can snatch at players) joins hands with it and becomes part of the lengthening protoplasmic chain. And thus the insidious Blob keeps growing.

Unlike your run-of-the-mill, mad scientist-created Blobs, this one is not content to merely ooze along, seeking its prey. It gallops around the field, cornering stray runners and forcing them to join up…

Moreover (horrors), the Blob can split itself into parts and, with its superior communal intelligence, organize raiding parties on the lone few who have managed to escape. The thrilling climax occurs when there's only one player left to put up a heroic last-ditch stand on behalf of humanity. But alas, there is no defense against the Blob, and humanity succumbs. (If that seems unfair, well, that's the plot.)

The moral of our story could well be, "You become what you fear." If you have the heart to destroy humanity again, you can have the last person caught start the Blob for the next game.[5]

The game of Blob is centrally focused on the procedural representation of a single character: the Blob. The form that the character takes, a mass of moving bodies, is quite different than the characters in Zelda: Link's Awakening, Virtua Fighter 4, and Deus Ex, which are experienced as visual images and audio. Yet, like these characters, the Blob is generated out of a set of representational procedures.

The Blob parodies a B-grade movie monster: a humongous, horrifying, pudding-like creature. The rules of the game cleverly bring this character to life through a set of behavioral procedures for representation. The fact that the rest of the players try to avoid the Blob immediately creates an environment of fear. The slow-moving Blob scatters players before it, lumbering through the playfield. The touch of the Blob is deadly, and when a player is
brushed Designing the mechanisms of that system presents many challenges, one of the edges of the Blob, that player is ingested. In *Inventing the Blob*, designing decisions for a game designer. Inventing the Blob incorporates into the body of the character.

As the Blob grows, it tends to move more slowly while covering a wider area; it can also fragment and recombine. Given a phenomena to simulate, the problem is to decide what are a very protoplasmic way. The size of the Blob is an inverse function of the number of players running loose around the edge, and what the relationships are that let these parts affect one another. The dwindling non-Blob players become another community of hard-nosed survivors. Oh no! Don't tell me it got Sharyn too! At the game's climax, the Blob symbolically ingests the entire world, becoming synonymous with the group of players as they reach a competitively and cooperatively achieved endpoint. The game's narrative may only have one ending, but as the rules point out, there is a moral to the story.

Just as the witch in *Zelda: Link's Awakening* was represented, the Blob possesses procedural character traits (fearful, steadily growing, nomenon you want to depict in your game is most likely ingests players, fragments and recombines, inevitably wins) overflowing with layers of detail. But as with all forms of that are exceedingly Blob-like. An elegantly designed game representational media, you will never be able to fully persona, the Blob generates a character through excep-represent every facet of your subject.


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**Designing Simulations**

Procedural representations clearly can provide meaningful play for game players. But designing simulations is challenging. Once you decide what it is you want your game to simulate, how do you put the pieces together to arrive at the kind of simulation that you want? A simulation, as a representational process, is more than a series of independent procedures producing a result. A simulation arises from the operation of a system in which every element contributes in an integrated way to the larger representation. *Adventure Game*, Warren Robinett outlines some of the key design issues involved in creating a simulation:

Given a phenomena to simulate, the problem is to decide what are its parts, how these parts can be represented with numerical values, and what the relationships are that let these parts affect one another.

Making a simulation is a process of abstracting—of selecting which entities and which properties from a complex real phenomena to use in the simulation program. For example, to simulate a bouncing ball, the ball's position is important but its melting point probably isn't. Any model has limitations, and is not a complete representation of reality. [6]

In these few sentences, Robinett makes a number of very important points about the design of simulations, including: sented through procedures that created distinctively "witchy" characteristics, the character of the Blob possesses

• **Simulations are abstractions.** The real or imagined pheprocedural character traits (fearful, steadily growing, nomenon you want to depict in your game is most likely ingests players, fragments and recombines, inevitably wins) overflowing with layers of detail. But as with all forms of that are exceedingly Blob-like. An elegantly designed game representational media, you will never be able to fully persona, the Blob generates a character through excep-represent every facet of your subject.
Thus your simulated tionally effective procedural means—and completely representation, as Robinett points out, is an abstraction. without digital technology! Chess is a highly abstracted representation of war. Sim City is a very stylized version of government and city planning. D&D even abstracts people—into the characteristics of Strength, Intelligence, Wisdom, Dexterity, Constitution, and Charisma. A simulation does not attempt to simulate every aspect of its referent, but instead focuses on those elements necessary to the game. Virtua Fighter 4 simulates the fighting capabilities of its characters; it does not simulate their biological immune systems or taste in classical music, since these are not relevant to the play of the game. Being able to select which components of your subject to ignore and which to retain and abstract is an absolutely critical game design skill.

- **Simulations are systems.** A simulation is a whole made up of smaller, interrelated parts. As with any complex system, meaning emerges from the interaction of the parts. Brainstorming a list of attributes or effects that you want to include in a simulation is not enough. You must conceive of a system that incorporates them all. You might want a fighting game that can simulate the difference between a fast but weak character and a slow but strong character. But what does "fast,""slow,""strong," and "weak" mean in your system? How do they interrelate? How do these attributes affect the decisions and outcomes a player makes? All games are systems, but when we frame them as simulations, the systemic aspect of the game is harnessed directly for representational effect.

- **Simulations are numerical.** Not only are simulations abstracted, systemic representations, but they are also reducible to a formal, numerical structure. We know this already about games: at some level games are composed of rules, and at their most formal level, all rules are logical, mathematical, constitutive rules. The six D&D statistics listed previously are represented in the game as numerical digits between three and eighteen. Complex physics simulations in computer games are based on mathematical modeling. The behavior of artificial characters, whether on a Magic: The Gathering card or inside Deus Ex, can be reduced to their formal identity. The fact that simulations must reduce their subjects to formal, numerical values is exactly why it is so challenging to procedurally depict social, psychological, and other experientially complex phenomena in a game.

- **Simulations are limited.** Because simulations are numerical abstractions, they are intrinsically limited. As Robinett points out, "every model has its limitations and is not a complete representation of reality." We emphasize this aspect of simulations because of prevalent ideas in the computer game industry that more complex simulations automatically guarantee meaningful play. In fact, on a digital platform even a supposedly "realistic" simulation only depicts a tiny slice of any real world or imagined phenomenon. But this doesn't mean that simulations can't provide meaningful play. The inventive shareware game Bridge Builder simulates its subject, but it chooses a very narrow aspect of bridge building—the engineering challenges of the support structure. This design leaves out thousands of other possible characteristics that might be simulated, from the aesthetics of the building materials to the effect of the bridge construction on the surrounding ecosystem. But that's OK. The game turns the intrinsically limited nature of simulation into an asset, by focusing player activity on a fun and educational aspect of building bridges.

Design involves choice: to create a simulation, you need to decide what to simulate and how. Every choice you make as a game designer opens some possibilities and closes others. What is meaningful in the context of a particular simulation? Is it meaningful to blow wind into the face of the player as she is piloting a hang glider? Is it meaningful to provide a full-body harness in which the player can lie as she interacts with the simulation? Is it meaningful to simulate the insurance and legal procedures by which a player purchases or rents a hang glider? Pilotwings for the Nintendo Entertainment System, a popular game simulation of hang gliding, includes none of these features.

In digital games, much of this decision-making process involves the scope and depth of a simulation. If a racing game is composed of a single car on a single track, it can be extremely detailed. It might include a complex set of physics models, simulations of the internal suspension of the car, or wear on tire treads as they are used over time. Given the same design resources, the addition of more cars and more tracks means that fewer characteristics can be simulated in an equally detailed way. If even more elements are added—such as cars that can transform into jets and fly around the track—the focus of the simulation shifts once more. If a character can get out of the vehicle, walk around, and interact with other people, that casts the net even wider...
and the "depth" of the simulation decreases accordingly.

In designing a simulation, you must decide exactly what kinds of procedural representations you want to provide for players. In a fighting game series such as Tekken, a detailed (if fancifully cinematic) fighting simulation, the characters don't also get into cars and drive around a track. On the other hand, in an ambitiously open-ended game such as Shenmue, a player's character can have simple conversations with many other characters in the environment, examine, carry, and utilize a wide array of objects, and explore a large detailed space. As a result of the range of activities simulated, the fighting system in Shenmue is much more stylized and limited in scope than that of Tekken.

Why is it that games can't simulate everything with a high degree of detail? Why can't a game simulation be both wide and deep? There are several reasons. Limited development resources require that game designers decide where those resources will be spent. But the limitations of time and budget are not the only things affecting the scope of simulations. There are game design factors as well. Meaningful play stems from the ability of players to make meaningful choices from a limited set of knowable options. If a player has trouble recognizing everything that is being simulated, an understanding of knowable options decreases.

In an essay by game designer Harvey Smith on simulation and games,[7] he uses the fictional example of a vehicle-based game with terrain simulation so exacting that the geometry of a player-driven truck can get stuck on a tiny bump on the ground. In this case, the designer chose the wrong element of the game to simulate in detail. Smith's example also points out the problem of thinking that a simulation is anything but an abstraction. The "reality" of a game is determined by the meanings it creates within the magic circle. The terrain simulation in Smith's fictional example might be based on scientifically accurate mathematical models, but the only thing the player will experience is the frustrating, "unrealistic" experience of being unable to drive on what looks like relatively smooth terrain.

The proper scope of detail for a simulation is largely determined by expectations set by the broader context of the game. In Gran Turismo, a game that deeply simulates real-world car physics, players come to expect a finely grained driving experience. However, driving is clearly the focus of the game. No player expects to exit their car, wander up into the stands, and interact with spectators. A game such as Shenmue, on the other hand, has been criticized for disappointing players. If players can interact with many different kinds of objects in the game, why can they enter only some of the buildings and not others? Player expectations are raised to unrealistic levels: the implied breadth of the simulation is far greater than what the game actually delivers.

Given that simulations are abstract and limited, as a game designer you must choose your battles wisely. The elements you select to depict through the procedural representation of a simulation determine the experiential focus of your game. Another of Harvey Smith's thought experiments is to take a typical driving game and give it additional depth by having computer opponents take note of their fuel consumption and try to drive directly behind other cars, strategically using wind shear to conserve fuel. He contrasts this to a driving game with emotional simulation, in which one of the computer opponents might drive recklessly during a race because he had just ended a relationship with a girlfriend.[8]

Whereas Smith prefers the fuel consumption adjustment to the driving game, we find both of the game ideas equally interesting. Each of the two scenarios points to a very different game experience. Both driving games—one a hardcore strategic sim and the other a romance set on a race course—would require simulating different kinds of phenomena. These procedural representations would be part of the larger game system and would determine what the game could represent and what the player would experience. You most likely wouldn't want both the fuel consumption simulation and the romance simulation in the same game. Why? Because each pull the space of possibility and the focus of the play in opposite directions. The fuel consumption feature implies an entire system of detailed car simulation mechanics that would be the central focus of the game. The heartbroken driver implies a game system that would focus on simulating dating, emotions, and stylized romance. As you craft representations in your game system, you simultaneously create the meanings that players will experience.
The key is to remember that just because a simulation is limited in scope doesn't mean that it is impoverished in what it can provide players. The abstract play of Go contains an infinite number of strategic options. The fine-grained driving focus of Gran Turismo supports meaningful exploration because the simulation rewards players for learning about and taking advantage of its subtleties. And the broad-but-shallow world simulation of Shenmue lets players focus on the rich narrative surface of the world without getting tripped up in interactive complexities that would not be appropriate to the game. The creation of a simulation is the creation of a space of possibility. By defining the exact nature of your game's simulation, you are sculpting the shape of your game's meaningful play.


[8] Ibid.

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**Learning from Wargames**

Working within the intrinsic limitations of simulations is one of the key challenges of game design. What are you going to simulate in your game? How are you going to abstract it? Which features of the phenomena will you include and which will you ignore? How deep and how broad can your simulation be? How do you tie each aspect of your simulation to the larger player experience? To understand these kinds of design decisions more fully, we look in detail at a particular genre of game, the historical wargame.

Historical wargames are complex strategy games that use cardboard chits or metal figures on a map to simulate a battle. We have already noted that game simulations are not universally beholden to "realism" or "accuracy." But historical wargaming is a genre of game design where both realism and accuracy are important. Historical wargame designers base their troop composition, map layouts, and game rules on historical research, a numerical approach to military history that wargame designer James Dunnigan calls "analytic history." In the game design subdiscipline of historical wargaming, part of the design ethos is that a game accurately simulates historical circumstances.

History, in a very general sense, represents a fixed series of events. But a historical wargame is a *game*, which means that uncertainty, risk, and unpredictable outcomes play a role. What a historical wargame really simulates are the starting conditions of a conflict. The way that the conflict plays out is what makes the game interesting as a game experience. Will history repeat itself? Was the historical outcome inevitable? How much can masterful strategy affect the outcome? These are all questions that wargame designers and players seek to answer through the creation and play of their games. The meaningful play of a historical wargame derives not only from the strategic complexities of military decision making, but also from the fidelity of the game to its historical referent.

As we know, a simulation can never contain every possible aspect of the phenomena being simulated. Historical wargaming has been wrestling with this challenge for at least a century, making it a wonderful case study for the design of simulations. We have already touched on one aspect of wargame design, the abstraction of unit characteristics. The pieces in a war-game are far more complex than in a game like Chess. When a wargame unit "attacks" an enemy piece, the outcome of the simulated combat is not simply to remove the attacked unit (as in Chess); instead, a variety of factors determine the outcome. Resolving an attack might involve some or all of the following:
offensive strength of the attacking unit
• defensive strength of the defending unit
• whether or not either unit has already been wounded in battle
• terrain that might give advantages and disadvantages to either unit
• nearby units that can lend support
• the nearby presence or absence of a General or other leader
• the morale of a unit or of its team
• a random dice roll (to simulate the uncertainty of actual combat)

Generally, players tally these factors and consult an appropriate table that lists the outcome of the encounter. The complexity of the simulation doesn't end there, however, because the result of an attack can also take a variety of forms, including:

• one or both units is eliminated
• one or both units is reduced in strength
• one or both units is forced to retreat
• one unit displaces the other's position

A rich procedural representation emerges out of the factors going into and coming out of an encounter between wargame units. By tweaking the formal characteristics of units and the overall resolution system of a game, game designers can arrive at highly specific procedural representations of a historical battle. Depending on the particular game, the simulation might be a World War II tank division encountering enemy infantry, or a troop of horse-mounted archers fighting a phalanx of spearmen in the ancient Middle East.

Wargames are incredibly detailed. At the same time, everything about the representation of units in a wargame is highly stylized: a simple cardboard chit or metal figure "stands in" for a military unit, with each piece representing a whole group of soldiers or vehicles that move as a single block; the straightline or grid-based movement of the units; the reduction of combat to simple numerical factors; a single human player directing the entire battle from a birds-eye view. These are only a few examples of the many ways historical wargames radically abstract their subject matter. However, if you accept these limitations, if you take on the conventions of the game genre, within them there is room for endless play, both for the player exploring permutations of history and for the game designer constructing the systems that make the historical simulation possible.

The Field of Battle

In addition to characteristics of the units and the rules for their interaction, the design of the field of play presents its own challenges. A historical wargame has to function as both a playable game and an accurate simulation of history, two concerns that can often be at odds with each other. Wargame designer James Dunnigan writes about some of the design concerns in creating a game map:

There are two primary things to keep in mind when examining a geographical game map. First, it often has a grid, most often a hexagonal grid, superimposed over it.…. The second point is that in most historical situations, only very large ("gross") terrain features have any significant effect on operations. Thus, a great deal of detail on a map will often get in the way of providing an accurate simulation. The designer usually feels obliged to justify all of this detail. Often the gamer will be equally expectant that all of this detail be put to some use or otherwise why bother him with it. There is an unspoken assumption that only that which is
essential is displayed. It is normally considered a bad design if information is included in the
game that does not contribute to one's understanding of what is going on. [9]

The real world is infinitely rich, and cartographers—including game map-makers—are faced with the
representational challenge of simplifying geography in a way that is meaningful for the intended use of the
map. In a map for a historical wargame, designers must decide what to include and what to leave out, how to
abstract and structure the information to fit in the larger game system. As Dunnigan puts it, too much detail in
the terrain can get in the way of a player's understanding; only "gross" terrain features have a real impact on
military operations. Abstraction emphasizes the features critical to understanding the terrain, while
minimizing the "noise" created by less important elements.

The grid of the map is one important consideration. Units in a grid-based wargame move only within the
hexagons or squares superimposed on the map. Because of this, there is a very specific relationship between
the grid and the terrain. The game designer not only needs to select the relevant terrain features, but also
decides how those features fit into the grid. Because terrain can affect movement, simply laying a grid over
topographically correct terrain creates formal ambiguity. For example, in a particular game, units might not be
able to cross rivers. If a river flows through the middle of a map hex, does it mean that players can enter the
hex but not exit out the other side, or that they cannot enter the hex in the first place? A common solution in
wargame map design is to stylize the shape of rivers so that they are located only on the edges of hexes. This
solution makes the movement-blocking role of rivers in the game completely clear. Designing the terrain to
accommodate the game grid lessens the geographic accuracy of the map: there are no naturally occurring
rivers that can be plotted exactly along a hexagonal grid. But for game design purposes, abstraction that
eliminates formal ambiguity is essential.

Questions about rivers and wargame map design do not end there. If one purpose of a historical wargame is
fidelity to the real battlefield, which rivers should be included? When does a tributary or stream become too
small to be indicated on the map? Which rivers should have an impact on the play of the game? As Dunnigan
points out, if something is prominent on the map, a player will expect it to impact game play: a visible feature
that does not contribute to the functioning of the rules is bad design.

In designing a wargame map, in deciding which features to include and how to represent them within the
larger simulation, you are doing more than just creating a map. You are constructing a space of meaning. If
your game simulates combat between individual soldiers, the terrain elements you include make a
representational statement about which type of terrain affects a certain kind of combat. The meaning of a
wargame map arises not just from its geographic or pictorial features: the meaning derives from the role the
map plays in the larger game experience. The formal qualities of the map make certain player actions
possible, actions that constitute the ongoing moments of game play.

Not all wargames use a grid. Some miniatures games measure unit movement in inches, and in some digital
wargames, unit movement is free-form and highly granular. In these cases, the principles of abstraction and
meaningful play still hold. Are the map elements communicating their meaning to the player? Do they affect
game play in ways that make sense within the experience of the game emerges. In this way, the play of
simu-lation brings us back to the most fundamental questions of game design.
Simulation in Context

Historical wargaming provides a terrific context for better understanding issues of representation and simulation because the premise of the genre is that a game accurately depicts a real-world historical referent. Most kinds of games do not have such an orthodox view of how accurately they simulate “reality.” However, a related set of issues has increasingly come to prominence within digital games. Exactly how does a computer or video game procedurally represents its subject? At stake are the same core concerns we explored in historical wargames: how it is that a game simulation can create meaningful play.

The steadily increasing power of computer technology to simulate and manage complex systems has opened up new possibilities for game design in the digital realm. Incredibly detailed simulations of light, sound, physics, agent behavior, and other phenomena are becoming commonplace within games. Many recent writings from digital game designers focus on this feature of digital media and suggest strategies for game designers to use in their work. Let’s compare three such examples:

• In Swords & Circuitry, Hallford and Hallford discuss simulation design in games using the example of a grenade destroying a door. One approach to simulating this effect would be to specify the relationship between each grenade and each door in the game. In this case, every possible instance of a grenade effect in the game would have to be explicitly spelled out in the program. In contrast, in a more flexible system, grenades would belong to a general category of objects that cause damage, and doors would larger system of the game? Is the simulation creating a coher-belong to a general category of objects that break when ent representation? Are the outcomes of the player’s choices they receive damage. Hallford and Hallford strongly prefer meaningful? As play unfolds moment by moment, the total this latter approach to simulation design.[10]

• In Game Design: Theory and Practice, Richard Rouse III discusses a related set of ideas through the example of a dungeon puzzle, in which players open a secret door by dropping objects on a pressure plate trigger. One design approach would be to hard-code relationships between every object and the pressure plate, so that objects defined as “heavy” trigger the plate. Rouse advocates the creation of a generalized weight system instead, in which every object in the game has a numeric weight rating; if the weight value of the objects on the pressure plate reaches a certain number, the plate is triggered.[11]

• In “The Future of Game Design,” Harvey Smith shows a similar preference in an example involving bird behavior. Bird behavior could be modeled so that when a player moves within a certain radius of a simulated bird, the bird flies into the air. However, Smith would rather see a more detailed
simulation in which the bird's behavior could be triggered by the perception of light, sound, motion, or other modeled stimuli that would be more tightly integrated into the system of the game as a whole.[12]

All three of these examples make a similar point: there is a difference between a simple, *case-based* structure for a simulation and a more complex *generalized* structure that relies on integrated, systemic relationships. Although both approaches create procedural representations, the authors show a clear preference for one approach over the other. In their work, they cite a number of reasons why a generalized strategy is better for designing simulations:

- **It decreases work time:** When a game system is large, generalized systems allow for much more flexible design. In the grenade example, specifying every possible interaction between every possible weapon and every possible object in the game would be a major programming task. Making adjustments to these relationships once they are established (such as reverse-engineering metal doors to be immune to grenade damage) means going back into the code and modifying every affected instance. By creating classes of objects as Hallford and Hallford suggest, categories of objects can be moved in and out of different effect classes, so that game designers can quickly try out different combinations of relationships in the game.

- **It increases emergence:** More flexible game simulations lead to a greater degree of emergence in the game as a whole. In Smith's example, having a more detailed behavioral simulation for the birds creates more varied roles for the birds to play in the game. If the birds react to sound and not just to proximity, a game moment in which gunshots ring out and the flock of birds dramatically takes to the sky becomes possible. This is not necessarily something designed directly into the game, but it is an emergent effect of the simple rules governing bird behavior. With more detailed simulations, the space of possibility is enlarged and complexified.

- **It increases play options:** More generalized simulation systems give players more choices and more ways to solve problems. In Rouse's example of the dungeon pressure plate, a player that had no object to drop might create a magical snowstorm that created enough weight on the floor to affect the plate. Idiosyncratic play styles are encouraged, rewarding players for exploring the increased space of possibility. This leads to more distinct styles of play and more avenues for meaning. If a group of Smith's birds were present in a deathmatch game, for example, a smart player might strategically position himself, fire a shot to scatter the flock, and then use the motion of the birds as visual cover for an assault on the enemy.


[12] Harvey Smith, "The Future of Game Design"

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**A Balanced Approach**

Hallford and Hallford, Rouse, and Smith strongly advocate the use of generalized simulation design techniques as opposed to a case-based approach. But is it really possible to integrate every aspect of a game within a generalized system? One eloquent thinker on this topic is game designer Marc LeBlanc:
By "simulation" I mean game systems that are rich, many-faceted analog models, whereas by "emulation" I mean coarse, case-based game systems. An example of "simulation" might be the physics system in a shooter or the damage model in an RPG. The rules of the system create a space for exploration, allow for emergent complexity, and so forth. An example of "emulation" might be, in either game, a button that opens a door. There is no physical simulation of the electro-mechanical process of opening the door. It's just a single rule: "if button pushed, then door opens." The button is more of a semantic object than a physical object; in some sense it exists only on a functional level. Emulation is the smoke-and-mirror approach.

LeBlanc brings to light a point we made at the start of this chapter: simulations can be embedded. Even though an entire game can be considered as a single representation, it is important to be able to identify the smaller procedural representations that make up the larger whole. Although LeBlanc shares a preference for generalized simulation design strategies, he takes a measured approach and ultimately suggests a balance of case-based and generalized techniques. No game can rely entirely on rich, open-ended, emergent simulation. Nor should it. To demonstrate this balancing act, LeBlanc takes an example from a title he helped create, the computer game Thief, in which players can use water to put out a torch:

This is an emulated game system; there's a single rule that says water puts out fire 100 percent of the time. There's no simulation; no chance of using too little water and just getting steam, and no chance of drowning the torch so that it can never be relit. However, the other systems that interact with that system are simulations; you typically douse a torch by tossing a "water balloon" at it, the motion of which is physically simulated. The way the light from the torch affects your vision, and more relevantly, the vision of the opponents you want to stay hidden from, is also simulated.

(Remember that LeBlanc is using his own terminology—for example, he is using the term "simulation" to mean a generalized design approach, which is only one part of what we identify as the larger issue of simulation in games.)

LeBlanc's example contains intersecting systems of representation, some case-based and some generalized. In Thief, water puts out fire 100 percent of the time. Rather than a complex physics simulation with a variety of possible results, there is a predictable and consistent outcome: water extinguishes fire. But this case-based approach interacts with more complex structures. Tossing a water balloon at the torch involves the generalized simulation of motion; the diminished visibility from the extinguished torch results from a generalized simulation of light. The whole of the game representation emerges from the complex relationships of these parts.

In fact, most games use an approach that combines case-based and generalized representations. The Deux Ex characters of thug, civilian, and military agent were designed with generalized heuristics that produce emergent behavior. But other characters in the game were designed with simple, case-based behavior, such as a character that activates a cinematic cut-scene when encountered. Even simple board games such as Candyland combine a generalized movement system with a number of case-based special spaces on which players can land.

If Rouse, Smith, and Hallford and Hallford are correct, if a generalized approach saves time, increases emergence, and provides players with richer play, why would a digital game designer (or any game designer) use a case-based approach for structuring a procedural representation? One answer is that a truly generalized system could easily become overly complex to implement and might not save work time in the end. Another answer is that although case-based approaches can sometimes become simple and flatfooted, the opposite danger is true of generalized strategies. Taken too far, generalized simulation design can become fuzzy and ambiguous. If you are playing a game and you see a group of birds that suddenly takes to the air for no reason, their behavior will seem random and meaningless. It might be that their behavior is simulated in such detail that their internal clocks told them it was time to leave the scene and migrate south for the winter.
Unfortunately, the accuracy of the simulation would be lost on the player, who has no way of knowing how the meaning of the birds’ actions fit into the larger game experience.

Neither case-based nor generalized design strategies guarantee a successful game experience. The goal of game design is the creation of meaningful play, which should guide the selection of representational strategies in a game. In the example of the Zelda witch, a compelling character was created out of a central case-based procedure: if the player brings a mushroom to the witch, she will turn it into magic powder. This procedural representation was well-integrated into the other more generalized representational strategies of the game (the witch's hut is isolated, difficult to find, and dangerous to reach; mushrooms are hidden in the forest; magic powder has special effects in the game). Thus the meaning of the witch gained its power from the total game context in which it was experienced.

The fact that rich meanings can emerge from a representational context not based on software complexities offers an important insight into game design and simulation. As we’ve mentioned, games currently suffer from a narrow range of simulated subject matter. Although there are important historical reasons for the prevalence of military and economic conflict in games, other forms of conflict, such as social, cultural, or emotional conflict, can and should be represented as well. Some presume that an increase in technological complexity will make such representations possible. For example, a widely published quote from an executive at a major console manufacturer not too long ago looked forward to the day when the faces of game characters could represent emotion. According to the executive, on that day, games would become a mature and sophisticated form of cultural production. Clearly, media such as literature, theater, and comics have been capable of sophisticated representation for centuries without relying on high-resolution animation. Furthermore, even within the history of animation, many animated tears have already rolled down numerous animated cheeks. That fact alone is no guarantee that the story was meaningful to its viewers. In the case of computer games, although animated elements do play a part, the systemic and interactive qualities of the form have to be taken into account when envisioning future directions for the medium.

The procedural representation of new kinds of game content is within our grasp, but new content can only be discovered by paying attention to the fundamental principles of game design and meaningful play. Game designers need to cultivate a deeper understanding of the form in which they work. This is especially true in considering games as simulations. More than just choosing a representational design strategy, there is a complex interplay between a simulation and its simulated subject. It is to this relationship that our attention now turns.


[14] Ibid.

The Value of Reality

We have come to a turning point in this chapter. Up to now, our primary focus in considering the play of simulation has been on how simulations operate: the mechanisms that generate procedural representation, the abstraction necessary when game designers simulate a particular subject, the selection of case-based and generalized strategies for structuring simulations. But there is a very different aspect of simulations for us to consider. Recall our definition: a simulation is a procedural representation of aspects of “reality.” So far, our emphasis has been on the procedural component of simulations. But now we turn to the equally important and immensely complicated set of questions regarding simulations and "reality."
What is the relationship between the simulated content of a game and its real-world or imagined referent? At the 1998 Game Developers Conference, game designer Steve Jackson shared a fascinating anecdote about creating a driving combat computer game based on his classic paper game Car Wars. Using real-world physics and car data, the development team created an unusually detailed driving simulation that incorporated minute details of driving physics and a detailed simulation of the car engine. They also created a track based precisely on the geometry of an existing speedway. But when they test-drove their simulated car, using a steering wheel and pedal interface, they weren't able to reach the top speeds of the car on which the simulation was based. One day a professional race car driver visited the company. He sat down at the game prototype and immediately drove the simulated car around the track at breakneck speed, completing it close to the real-world speed record.

The simulation was so "accurate" that it required expert manipulation in order to resemble the real-world phenomena it had been designed to replicate. What's the lesson? Don't forget the player. The designers of the game had assumed that simulation design meant only formally recreating a mathematical model of the car and the track. In fact, a game simulation not only includes the formal mechanisms of the system, but also the ways that those mechanisms engender and permit player action. The rules never solely determine the play of a game. The rules are always set into motion within an experiential context that includes particular players with their own levels of desire, skill, and expectation. The Car Wars designers had created a certain space of possibility with their design, but it took the right kind of player to navigate that space in the way it was meant to be explored.

The Car Wars anecdote reminds us that questions regarding the "reality" of a representation are never as simple as they seem at first glance. Was the car simulation "accurate"? Or was it only accurate in the hands of a professional race car driver? Is sitting in front of a computer monitor anything like driving a car? Would the race car driver have been able to reach top speeds playing with a standard console controller? Does the fact that the experience was "only a game" impact the answers to these questions?

When players interact with a simulation, they are never playing with the real thing. If they were, it couldn't be called a "simulation." At the same time, a simulation does reference its depicted subject through images, sound, and procedures. But how do these representations relate to their referents? In language, we know that the letters C-O-W don't resemble a cow in any way. But a photograph of a cow does bear some similarity to our own perception of a cow in the real world. How do games relate to their depicted subject matter? To answer these important questions, we return to the concept of metacommunication.

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**Framing the Simulation**

.Children know that they are manipulating their thoughts about reality, not reality itself; and they know that their play self is not the same as their everyday self.—Brian Sutton-Smith.

The Ambiguity of Play

In *Games as the Play of Meaning*, we introduced Gregory Bateson's concept of metacommunication, the unique form of communication that takes place in the context of play. To use Bateson's own example, when a dog nips another dog, the nip signals two things. On the one hand, the nip signifies a bite; it is a stand-in for the action of a real bite. On the other hand, the nip signifies just the opposite of a bite: it signals the fact that the two dogs are playing and not actually fighting. This kind of metacommunication—communication about communicative—is present not just in informal play but in games as well. It is a significant part of the complex mechanisms games use to construct meanings for their players.
Why is the concept of metacommunication so important, especially in the context of simulation? Metacommunication makes it clear that to play a game is to take part in a kind of double-consciousness. Game actions refer to actions in the real world, but because they are taking place in a game, they are simultaneously quite separate and distinct from the real world actions they reference. A kiss in Spin the Bottle or a frag in a Quake deathmatch refer to kissing and killing, but at the same time are actions that communicate I'm not kissing or killing you. I'm just playing. The magic circle is the space within which such paradoxical signals become meaningful.

In "A Theory of Play and Fantasy," Bateson uses the following diagram to illustrate the paradoxical state of mind embodied in play:[13]

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All statements within this frame are untrue.
I love you.
I hate you.
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This schematic is a riff on Epimenides' Paradox, also known as the Liar Paradox. The Liar Paradox is the philosophical problem of someone asserting "I am lying." If the speaker is a liar, then he is telling the truth, and vice versa: the liar's statement is a logical paradox. In the diagram, the first sentence, *All statements within this frame are untrue*, echoes this classical logic problem. But significantly, it locates the statement within a frame, a limited context within which the paradoxical sentence asserts its meaning.

For Bateson the frame is a psychological and philosophical construct that delimits the peculiar space of play. For game designers, Bateson's frame offers another way of understanding the magic circle of a game. It is a boundary that makes the paradoxical meanings of play possible. At the same time, the frame is only sustained by virtue of the continued metacommunicative assertions of play. In Bateson's illustration, the frame enables the statement's meaning, even as the frame's own meaning comes directly from the statement itself.

The magic circle is both a prerequisite and an effect of play. It is a robust context for the exhilarating experiences of game play. But it is similarly fragile, and vanishes quickly when a game ends. Bateson's diagram is a schematic of the cognitive frame of play, a visual retelling of the state of mind of a player in the midst of a play context. As a way of understanding what happens when a player enters into the magic circle and plays with a game simulation, it is a subtle and powerful illustration.

What about the other two statements, *I love you* and *I hate you*? These statements are also part of the paradoxical meanings captured within the frame. The two sentences address a larger point Bateson makes about set theory, and whether some or all of the statements within the frame could be considered true or untrue. For our present purposes, we will sidestep his larger argument to make a point of our own. Bateson could have included any two contradictory sentences in the frame. But he chose emotional statements about love and hate, statements seemingly addressed to someone else outside the frame.

These two little sentences, signals of pure emotion, remind us that the questions of play and meaning, of metacommunication and paradox, are not just abstract philosophical chatter. In understanding how games construct meaning, we are addressing the deeply felt ways that players engage with games and the emotional and social realities games reflect and construct. The metacommunicative state of mind is deeply intertwined with the unique pleasures and experiences of play.
The Immersive Fallacy

*All forms of entertainment strive to create suspension of disbelief, a state in which the player’s mind forgets that it is being subjected to entertainment and instead accepts what it perceives as reality.* — François Dominic Laramée, "Immersion"

We will return to Bateson’s ideas about metacommunication and meaning in just a moment. But for now, let’s bring the discussion back to the play of simulation, specifically the relationship between a game and the “reality” upon which it is based. The preceding quote is from a book on game design, appearing in an essay on “Immersion.” Game designer and programmer François Dominic Laramée argues for a particular relationship between a game player and a game, between the player’s state of mind and the perceived reality of the experience. He asserts that a game should strive to create an experience in which the player forgets that he or she is experiencing designed entertainment and instead believes that playing the game is experiencing reality firsthand. In fact, Laramée states that “all forms of entertainment” function in this way. This is a point of view very much at odds with our own.

We don’t mean to unfairly single out Laramée. His ideas about how a player experiences the “reality” of a game are extremely common in the digital game industry, the game press, and even in the public at large. Game designer Frank Lantz has called these kinds of ideas about immersion “widely held but seldom examined” beliefs. We wholeheartedly agree, and in the pages that follow we refute these beliefs, referring to them as the immersive fallacy. The immersive fallacy is the idea that the pleasure of a media experience lies in its ability to sensually transport the participant into an illusory, simulated reality.

According to the immersive fallacy, this reality is so complete that ideally the frame falls away so that the player truly believes that he or she is part of an imaginary world.

Although the immersive fallacy has taken hold in many fields, it is particularly prevalent in the digital game industry. Common within the discourse of the immersive fallacy is the idea that entertainment technology is inevitably leading to the development of more and more powerful systems of simulation. These technologies will be able to create fully illusionistic experiences that are indistinguishable from the real world. In an online discussion about the future of gaming, game designer Warren Spector speculated on this topic:

> Is the Star Trek Holodeck an inevitable end result of games as simulacra? The history of media (mass and otherwise) seems pretty clearly a march toward ever more faithful approximations of reality —from the development of the illusion of perspective in paintings to photography to moving pictures to color moving pictures with sound to color moving pictures with sound beamed directly into your home via television to today’s immersive reality games like Quake and System Shock. Is this progression inevitable and will it continue or have we reached the end of the line, realism-wise? [17]

To be fair, Spector self-consciously exaggerated his views in order to spark discussion. But in the debate that followed, it was clear that many participants take for granted the propositions that Spector articulated.

Spector’s selective history of entertainment technologies offers one reading of the development of media. But there are others. History rarely provides such a linear progression, and in regard to immersion, cultural
developments tend to be cyclical. As theorist Marie-Laure Ryan puts it, "The history of Western art has seen the rise and fall of immersive ideals." According to Ryan, immersion as a representational goal has gone through a number of stylistic cycles over the centuries. In the last several decades, she asserts, immersion has in fact become less prominent and respected in fields like art and literature. Ryan may be correct in regard to larger cultural movements, but within the digital game industry, belief in the immersive fallacy remains alive and well.


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**Metacommunicative**

Media The immersive fallacy is symptomatic of contradictory ideas about technology. On one hand, there is a technological fetishism that sees the evolutionary development of new technology as the saving grace of experience design. On the other hand, there is a desire to erase the technology, to make it invisible so that all frames around the experience fall away and disappear. Nowhere are these contradictory ideals more clearly expressed than in the concept of the holodeck, a fictional technology that first appeared in the television show *Star Trek: The Next Generation*. The holodeck is the dream of the immersive fallacy, a room in which matter and energy are manipulated to create a simulated environment of sight, sound, touch, smell, and taste that is a representation completely indistinguishable from lived reality.

What is wrong with this picture, and how does it relate to games? On one level, the immersive fallacy actually does make intuitive sense. When we play a game, we feel engaged and engrossed, and play seems to take on its own "reality." This is all certainly true. But the way that a game achieves these effects does not happen in the manner the immersive fallacy implies. A game player does become engrossed in the game, yes. But it is an engagement that occurs through play itself. As we know, play is a process of metacommunication, a double-conscious-ness in which the player is well aware of the artificiality of the play situation.

During the same online conversation in which Spector posted his intentionally provocative question, film studies scholar Elena Gorfinkel responded:

> Immersion is not a property of a game or media text but is an effect that a text produces. What I mean is that immersion is an experience that happens between a game and its player, and is not something intrinsic to the aesthetics of a game. The confusion in this conversation has emerged because representational strategies are conflated with the effect of immersion. Immersion itself is not tied to a replication or mimesis of reality. For example, one can get immersed in Tetris. Therefore, immersion into game play seems at least as important as immersion into a game's representational space. It seems that these components need to be separated to do justice and better understand how immersion, as a category of experience and perception, works.

Gorfinkel makes a number of critical points. First, with her example of Tetris she points out that there are plenty of examples of games in which "immersion" is not tied to a sensory replication of reality. In fact, there are countless examples of art and entertainment media, from techno music to comic books to expressionist
painting, which are clearly not premised on a simple suspension of disbelief. As Gorfinkel states, mistaken ideas about immersion can be framed as confusion between the intrinsic qualities of a media object and the effects that object produces. Gorfinkel argues that to understand the subtleties of "immersion," we need to look not just at the attributes of games (such as how detailed the graphics are), but at the way games function in relation to the experience of the player.

In the case of play, we know that metacommunication is always in operation. A teen kissing another teen in Spin the Bottle or a Gran Turismo player driving a virtual race car each understands that their play references other realities. But the very thing that makes their activity play is that they also know they are participating within a constructed reality, and are consciously taking on the artificial meanings of the magic circle. It is possible to say that the players of a game are "immersed"—immersed in meaning. To play a game is to take part in a complex interplay of meaning. But this kind of immersion is quite different from the sensory transport promised by the immersive fallacy.


Remediating Games

In some sense, the layered, metacommunicative state of play is similar to our experience of all media. In their book Remediation, theorists Jay David Bolter and Richard Grusin analyze the mechanisms by which media function, arguing that media operate according to a double logic. On one hand, media participate in what Bolter and Grusin call immediacy, the ability to authentically reproduce the world and create an alternative reality. At the same time, media also remind their audiences that they are constructed and artificial, a characteristic that Bolter and Grusin call hypermediacy.

Like other media since the Renaissance—in particular, perspective painting, photography, film, and television—new digital media oscillate between immediacy and hypermediacy, between transparency and opacity. Although each medium promises to reform its predecessors by offering a more immediate or authentic experience, the promise of reform inevitably leads us to become aware of the medium as a medium. Thus, immediacy leads to hypermediacy. [20]

For example, as Bolter and Grusin point out, a web cam promises immediacy though authentic, real-time access to another part of the world. But the fact that users have to view the web cam on a computer, in an operating system, in a browser, inside an interface, reminds them that they are not transparently experiencing the locale where the web cam exists, but are instead interacting with a highly artificial media construct. The main argument made by Bolter and Grusin is that all media combine these two processes into what they term remediation, an experience of media in which immediacy and hypermediacy co-exist.

We can also analyze games within this model. The double consciousness of play finds a strong parallel in the process of remediation, which mixes transparent immediacy with a hyper-mediated awareness of the constructed nature of play. In Cops and Robbers, players willingly take on the theatrical roles of criminals and police, even as they infuse those playful representations with meaning through their actions. In a first-person shooter such as Halo, part of the experience is the sensual vertigo of navigating a coherent, imaginary 3D space. But playing the game also involves an awareness of the game interface, the strategic use of the frame-breaking options, the use of text-based chat, fluctuating server speeds, and the sharing of tips with friends in the larger social context of play. These frame-related aspects of the Halo experience remind the
player that the game is a constructed, hypermediated experience.

The value of Bolter and Grusin's model is that it doesn't do away with illusionistic immersion, but includes it as one element within a more complex process. There is no doubt that the immediacy of sensory engagement is part of the pleasure of playing a game, particularly digital games with detailed representations that respond in real-time to player action. The immersive fallacy grossly overemphasizes these forms of pleasure, and in so doing, misrepresents the diverse palette of experiences games offer.


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The Character of Character

The danger of the immersive fallacy is that it misrepresents how play functions—and game design can suffer as a result. If game designers fail to recognize the way games create meaning for players—as something separate from, but connected to the real world—they will have difficulty creating truly meaningful play. To highlight these complexities, we now take a detailed look at just one aspect of a game's representation, character, to see how an understanding of metacommunication can impact the game design process.

We have already looked at character once in this schema, examining the way that procedural representations construct fictional personas in Zelda: Link's Awakening, Virtua Fighter 4, Deus Ex, and The Blob. Now we'll take aim at the other part of the simulation equation, pointing out the way that character representation relates to the "reality" outside the game. Two key questions arise: How does the player relate to a character in a game? And how can this relationship be understood in terms of the "reality" of the represented world? Just to keep things focused, we will limit our analysis to protagonist characters that a player directly controls, such as Mario in Super Mario World or Pai Chan in Virtual Fighter 4.

The immersive fallacy would assert that a player has an "immersive" relationship with the character, that to play the character is to become the character. In the immersive fallacy's ideal game, the player would identify completely with the character, the game's frame would drop away, and the player would lose him or herself totally within the game character.

These ideas have some validity, but they represent only one element of a much larger and more complicated process. A player's relationship to a game character he or she directly controls is not a simple matter of direct identification. Instead, a player relates to a game character through the double-con-sciousness of play. A protagonist character is a persona through which a player exerts him or herself into an imaginary world; this relationship can be intense and emotionally "immersive." However, at the very same time, the character is a tool, a puppet, an object for the player to manipulate according to the rules of the game. In this sense, the player is fully aware of the character as an artificial construct.

This double-consciousness is what makes character-based game play such a rich and multi-layered experience. In playing the role of Cloud in Final Fantasy VII, the player has a portal into the complex narrative world of the game. Through Cloud, the player encounters the settings, characters, and events of the game world; many players report a strong emotional attachment to their digital counterpart. At the same time, Final Fantasy VII is a complex role-playing game. The play experience occurs by watching cutscenes, navigating Cloud and his comrades through virtual spaces, managing a detailed inventory of weapons, items, and magic, taking part in constant strategic battles, and engaging with the game's intricate spreadsheet-like interface. Through these diverse activities, the performance of play acknowledges and celebrates its own
hypermediated construction.

The psychologist Gary Alan Fine, in his excellent book Shared Fantasies, offers a model for understanding the complex relationship between player and character. Shared Fantasies is an ethnographic study of tabletop role-playing game communities. Borrowing from psychologist Erving Goffman's theories of Frame Analysis, Fine identifies three "levels of meaning" within which the player/character game experience takes place:

First, gaming, like all activity, is grounded in the "primary framework," the commonsense understandings that people have of the real world. This is action without laminations. It is a framework that does not depend on other frameworks but on the ultimate reality of events.

Second, players must deal with the game context; they are players whose actions are governed by a complicated set of rules and constraints. They manipulate their characters, having knowledge of the structure of the game, and having approximately the same knowledge that other players have.

Finally, this gaming world is keyed in that the players not only manipulate characters; they are characters. The character identity is separate from the player identity. [21]

This three-fold framing of player consciousness—as a character in a simulated world, as a player in a game, and as a person in a larger social setting—elegantly sketches out the experience of play. The player and character frames both take place within the magic circle, whereas the person frame gains its primary meaning from the cultural context outside the immediate space of play. Fine makes the important point that movement among these frames is fluid and constant, and that it is possible to switch between them several times in the course of a single verbal statement or game action.

In digital games, the same multi-layered phenomena occurs. Imagine a player, holding a joystick-like controller, looking at a glass screen. The player is deeply engrossed in a game activity, sweating and anxious, focused completely on the space in front of him, leaning his body in synch with the visceral rhythms of the game, smiling and grimacing as he battles opponents and his actions play out in the world on the other side of the glass. What game is he playing? Try on both of these answers for size:

**He is playing Tomb Raider.** Our hypothetical player is looking at a television screen and manipulating a console controller. In one sense, our player immerses himself in the game's narrative world, taking on the identity of Lara Croft with her requisite strengths and weaknesses (I feel lost... I can't believe I survived that trap!). Simultaneously, he views her exaggerated anatomy from behind, pushing buttons and manipulating her like a puppet on his quest to find power-ups, overcome obstacles, and unlock doors to reach the next level (What was that cheat code again? This cutscene sucks.). He is both character and player. In addition, the larger social and cultural context in which he plays constitutes Fine's category of the player as person. Maybe he is trying to impress a friend with his skillful play. Or perhaps he is taking mental notes for a lecture he is going to give at an academic conference. In any case, the player is always present as a person connected to and situated in the real world.

**He is competing in Comedy Central's BattleBots.** In this case, the player's character is a battling, remote-controlled robot moving about the real world, the pane of glass not a television screen but a large sheet of plexi that protects the players and audience from flying scraps of metal. The BattleBots player is immersed in his activity too, and like the Tomb Raider player he is always aware that his actions are governed by the rules of the game. During game play, he might switch between the character/player/person frames many times, moving between emotional identification with his robot character (Ouch! I just got slammed!) and his role as player in the game contest (Let's see if I can get my bot out of the corner). He might even break the frame of player to wave to a friend in the crowd or to offer a sound bite to the television host.
Fine's three-layer model is an extension of the double-con-sciousness of play. Players always know that they are playing, and in that knowledge are free to move among the roles of person, player, and character. Players of a game freely embrace the flexibility of this movement, coming in and out of moments of immersion, breaking the player and character frames, yet all the while maintaining the magic circle.

This model applies even when players are not directly controlling a game protagonist. In any game, players move constantly between cognitive frames, shifting from a deep immersion with the game's representation to a deep engagement with the game's strategic mechanisms to an acknowledgement of the space outside the magic circle. Devotees of the immersive fallacy tend to see this hybrid consciousness as a regrettable state of affairs that will only evolve to its true state of pure immersion when the technology arrives. Play tells us otherwise. The many-layered state of mind that occurs during play is something to be celebrated, not repressed—it is responsible for some of the unique pleasures that emerge from a game.


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### Hacking the Holodeck

The questions surrounding games as simulations are always more complex than they first appear. There is no simple relationship between player and character, or player and game, or game and outside world. This is one reason why the immersive fallacy continues to colonize most design thinking about the future of games and the role of technology in creating compelling experiences: it is simply an easier position to take.

But the immersive fallacy is more than an idea. It is also a stumbling block to advances in game design, as it represents an overly romantic and antiquated model for how media operate. As long as game designers are caught up in a desire for the technology of the holodeck, they lack the vision to appreciate the potential for game innovation today. What if game designers focused their efforts on actively playing with the double-consciousness of play, rather than pining for immersion?

Imagine the kinds of games that could result: games that encourage players to constantly shift the frame of the game, questioning what is inside or outside the game; games that play with the lamination between player and character, pushing and pulling against the connection through inventive forms of narrative play; games that emphasize metagaming, or that connect the magic circle so closely with external contexts that the game appears synchronous with everyday life. Innovation is only bound by a failure to see the fundamental principles of play.

A common complaint among game developers is that games are not recognized as a significant form of culture, and that they lack a diverse mass audience. Instead, games seem to be relegated to the backwaters of culture. A sea change in cultural status will only occur when game designers acquire a more sophisticated understanding of how their media operates. Robust forms of contemporary pop culture are not premised on naïve ideas of immersion. Just take a look at the explicit self-consciousness of hip-hop, fashion, and Animal. These forms of popular culture have a deep understanding of the way media cultivates immersion while making explicit the mechanisms through which the representation is experienced.

This, of course, brings us back to simulation. Even though simulations are premised on the notion of fidelity to their referent, the very fact that they are dynamic systems means they allow for the exploration of alternate permutations. Simulations allow players to explore a space of representational possibility through the very act of play. Certainly there are a great many game designers driven by a desire to tell stories and provide narrative worlds for players. Framing games as simulations, as dynamic systems of procedural representation, unlocks
the potential of games as a powerful representational and narrative medium. But games have only just scratched at the surface. Questions remain: What can games represent? How can games engage players through meaningful play? And how can games challenge, critique, and contribute to the world outside the magic circle?


### Further Reading

**Narrative as Virtual Reality: Immersion and Interactivity in Literature and Electronic Media**, by Marie-Laure Ryan

An eloquent articulation of the relationships between literary theory, hypertext, and VR, *Narrative as Virtual Reality* focuses on what Ryan sees as the competing interests of immersion and interactivity. Although Ryan's sophisticated approach elevates her above the usual pitfalls of the immersive fallacy, she is an apologist for immersion, and her discussions of interactive design suffers as a result. That said, for the topics that this thick volume covers, it is essential reading.

*Recommended:*

- Part II: The Poetics of Immersion
- Part III: The Poetics of Interactivity


Bolter and Grusin introduce the concept of remediation, the process in which new media forms define themselves by borrowing from and refashioning old media. This process also works in reverse: older media forms borrow from new media forms, such as television remediating the windowed world of computing. The book's most useful concepts for game designers are *immediacy*, and *hypermediacy*, which refer to the way media forms can both authentically reproduce the world while simultaneously reminding the audience that the reproduction is both constructed and artificial.

*Recommended:*

- Introduction: The Double Logic of Remediation
- Chapter 1: Immediacy, Hypermediacy, and Remediation
- Chapter 2: Mediation and Remediation
- Chapter 4: Computer Games

**Shared Fantasy**, by Gary Alan Fine (see page 417)

*Recommended:*

- Chapter 1: FRP
Summary

- A simulation is a procedural representation of aspects of "reality." Simulations represent procedurally and they have a special relationship to the "reality" that they represent.
- There are many kinds of simulations that are not games. However, all games can be understood as simulations, even very abstract games or games that simulate phenomena not found in the real world.
- Game simulations usually operate metaphorically: they do not literally recreate a representation of their subject matter. The difference between a game simulation and its referent can be a source of pleasure for players.
- A procedural representation is a process-based, dynamic form of depiction. Procedural representation is how simulations simulate their subject matter. These forms of representation emerge from the combination of the formal system of a game and the interaction of a player with the game.
- An entire game can be considered a procedural representation of a particular subject. In addition, games include smaller procedural representations that make up the larger depiction.
- The subject matter of game representations is linked to the kinds of conflict that a game can represent. Games typically represent territorial conflict, economic conflict, or conflict over knowledge. Most games combine two or all three of these categories. It is possible to represent other forms of conflict as well.
- Simulations are a powerful way of thinking about narrative because procedural representation is an approach to storytelling that directly emphasizes the player's experience.
- Simulations are abstract, numerical, limited, and systemic. A simulation cannot be both broad and deep. Because designing a simulation means radically reducing the simulation's subject matter, a game designer must carefully select which aspects of a phenomenon to depict and how to embody them within the system of the game.
- Simulations, especially in digital games, can be structured according to a case-based logic, in which relationships between every element of a system are specified in advance, or a more generalized logic in which system elements share a set of general attributes. Generalized structures can save work time and lead to more emergent games where players have greater options for action. However, a balance between the two kinds of structures is usually necessary in any given game.
- The phenomenon of metacommunication implies that game players are aware of the frame of a game and that a player's state of mind embodies a kind of double-consciousness that both accepts and refutes that frame.
- The immersive fallacy is the belief that the pleasure of a media experience is the ability of that experience to sensually transport a player into an illusory reality. Although the immersive fallacy is prevalent in the digital game industry, it does not take into account the metacommunicative nature of play.
- Media theorists Bolter and Grusin argue that all media operate through the process of remediation. The two opposing elements of remediation are immediacy, which promises true and authentic representation, and hypermediacy, which emphasizes the constructed nature of media representation.
Psychologist Gary Allen Fine identifies three layers of game player consciousness: direct identification with the game character, engagement with the game procedures as a player, and existence in larger social contexts as a person.