Playful Thinking

Jesper Juul, Geoffrey Long, and William Uricchio, editors

The Art of Failure: An Essay on the Pain of Playing Video Games, Jesper Juul, 2013

Uncertainty in Games, Greg Costikyan, 2013

Uncertainty in Games

Greg Costikyan

The MIT Press
Cambridge, Massachusetts
London, England

voices as artists, philosophers, or specialists in other industries or fields of study. These books will be bridge-builders, cross-pollinating both areas with new knowledge and new ways of thinking.

At its heart, this is what Playful Thinking is all about: new ways of thinking about games, and new ways of using games to think about the rest of the world.

1 Introduction

Uncertainty is not, in most circumstances, a good thing. We do not wish to be uncertain about whether we can pay our bills, uncertain of the affections of the people who matter to us, uncertain about our health, or uncertain about our job prospects. Businesses are always concerned about the management of risk; they seek ways to reduce uncertainty. At least in the developed world, people pay taxes mainly as a means of reducing uncertainty—the risk of invasion and conquest, the uncertainty of terrorism, the risks created by possible unemployment, by loss of income in old age, and by health crises. They top this off by devoting a portion of their income to insurance, pension plans, and savings, all attempts to reduce uncertainty in their lives.

Yet if the goal is a reduction in uncertainty, the reality is that we live in an uncertain and conditional universe. Even in apparently civilized countries, madmen may come to power and slaughter millions of their own citizens. Apparently sane leaders maintain arsenals capable of destroying whole cities at a blow. Despite the miracles of modern medicine, terrifying diseases can spring out of nowhere and devastate whole populations. Seemingly harmless practices—smoking, applying pesticides, drilling for undersea oil—can turn out to have devastating and

unexpected consequences. We may wind up cooking ourselves in our own industrial waste, or turning the oceans into sewers. For that matter, terrorists could get hold of a nuke, an asteroid impact could erase tetrapodal life from the planet, a nearby star could go supernova and subject us all to killing radiation, nanotechnology could turn us all into gray goo, and Jesus could return, smiting all sinners—and I can assure you that, by the standards of the people who think this last remotely possible, I certainly qualify as a sinner.

The world is in fact filled with terrifying uncertainty, and it is a tribute to the dauntless and objectively insane optimism of the human species that we, most of the time, are fairly cheerful about it.

But the reality is that we are faced with uncertainty throughout our lives—and that much of our effort is devoted to managing and ameliorating that uncertainty. Is it any wonder, then, that we have taken this aspect of our lives, and transformed it culturally, made a series of elaborate constructs that subject us to uncertainty—but in a fictive and nonthreatening way?

I'm talking about games, of course.

In the course of this book, I shall endeavor to persuade you that games require uncertainty to hold our interest, and that the struggle to master uncertainty is central to the appeal of games. I will explore the many sources of uncertainty in games of diverse sorts and come to some conclusions about how to categorize these different sources of uncertainty. Finally, I will suggest ways in which game designers who wish to design with intentionality, that is, to purposefully craft novel game experiences rather than implement a new skin for a well-understood game genre, can use an understanding of game uncertainty in its many forms to improve their designs.

2 Games and Culture

What humans *do* is create culture. Culture is what differentiates humans from other animals.

The most primitive life-forms—amoebas, for example—adapt to their environment almost exclusively through evolution. Only over generations of slow change can new behaviors be added to their repertoire of the possible. In other words, they store information only in the genes.

Somewhat more advanced species—like, say, reptiles—are capable of learning new behaviors; they can store information also in the memory, but have no means of transmitting that information to others.

Most mammals, and some birds, can indeed impart things they've learned to others; birdsong varies by region within a species, kittens need to learn the kill stroke from their mother (or as adults, they won't know what to do with a mouse). Memories can be shared, at least to a degree.

When animals that live in social groups have the ability to learn, you get the beginnings of culture, that is, the transmission of knowledge within a group. Von Schaik[1] describes how one group of orangutans knew to use a stick to get into the flesh of a spiny fruit, while another group living nearby did not have this

knowledge. In general, the great apes and elephants are known to have cultural practices that vary by group, and to transmit information within the group. In an anthropological sense, they have culture—not, obviously, in as elaborate a form as among humans, but culture nonetheless. They have the ability to store information not merely in the genes, or in the memories of individuals, but in the collective knowledge of the society.

While some great apes have been taught rudimentary sign language, humans are largely unique in their ability to speak and, more generally, to use symbols and manipulate abstract concepts (both abilities that are implied by language). Thus, while apes and elephants have culture, humans have culture on steroids, because language allows us to transmit knowledge far more effectively. The invention of writing allows knowledge to be fixed in tangible form and transmitted through generations; the printing press made writing far more available throughout society; and the Internet makes all knowledge quickly and readily available to everyone (with a net connection, at least).

Our ability to create, manipulate, transmit, and understand culture is ultimately what makes us unique on the planet; and it is no surprise that we take *everything* we do and build elaborate cultural constructs about it.

Let us take cuisine as an example. All animals eat. Humans, however, create culture out of eating. Not simply content to ingest fuel to survive, we create rituals, techniques, and places for eating, and imbue the act of eating with cultural significance. We eat to cement family ties, to make business relationships, to explore friendships; we eat in chic Soho restaurants and fast food outlets and greasy spoons and around the family dining table; we braise, roast, stir-fry, and bake; we write and read books that explain how to create particularly tasty food. Only humans

take the simple act of ingesting nutrition and elaborate it in this complicated way. And it isn't just Western civilization that does so—every human culture assigns cultural meaning to food.

Or let us look at story. Language is natural to humans—indeed, language is what sets us apart from the animals. Given the existence of language, it is inevitable that we will want to describe past events to each other. Past events must be described in a way that gives a sense of context and the actors involved—the fundamental building blocks of story. Once we have learned to relate past events, it is inevitable that we will learn to lie about them—relating false past events—because humans are social animals, always striving for the acceptance and approval of others, and true events don't always give us that. Once we have learned to lie, it is a short jump from "lying for personal benefit" to "lying for entertainment value," and once that concept is understood, it's a short step to storytelling. But over the years, storytelling gets elaborated, until we have movies, noir novels, Noh drama, and limericks.

Animals eat; we eat arugula and goat cheese with lardons, toasted walnuts, and Dijon vinaigrette. All animals drink; we have Coca-Cola and the Schramsberg blanc de blanc. Mammals have sex; we have all-day weddings with elaborate ceremonies—and BDSM clubs. Apes will tap out a rhythm; we have the *Eroica* symphony, and *Rock Band*. Animals can see; we have the *Mona Lisa*. Beavers build dams and wasps build nests; we build Paris.

In other words, everything we do by nature, we complexify and reify and elaborate to an extreme degree through our culture—because culture, and the complex civilization it has enabled, is fundamental to our nature.

One of the things we do, of course, is play. Play is fundamental to all mammals; kittens tussle, dogs romp, dolphins swim

about each other in balletic displays. Play, it is said, is one of the ways that young animals learn survival skills—those kittens are hiding and pouncing, key skills for catching prey. But they're learning those skills in a nonthreatening environment; their siblings will not turn and bite viciously, the way an actual rat will. Play is earnest, yet not in earnest; it takes place in a protected space (as do games). Play is something that exists in every species that can learn, and for whom the skills they must learn are important to survival—but not among species whose behavior is dominated by genetics alone. Bugs do not play.

Play in the style of animals exists among young humans, too, of course—climbing and jumping, tussling and running. Even that we elaborate culturally by building playgrounds, by making toys. It isn't long before children *themselves* begin to elaborate their play—to imagine settings, to pretend that toys are characters, to negotiate rules and roles with other children.

The classic example, of course, is *Cops and Robbers*, a form of imaginative play in which two opposing teams have some sort of play fight. "Bang bang, you're dead." "No I'm not!"

Immediately, the need for a rule arises—and immediately, the children will negotiate one, whether implicit or explicit. A typical rule is that if the "shooter" has line of sight to his target, the target is dead, unless the target player can provide a narrative explanation of sufficient appeal for why he didn't die ("I dove for the ground, rolling and rolling and pulling out my gun!") That's an implicit rule, and a fuzzy one, but it's a rule nonetheless (and no fuzzier than the rules for, say, *Charades*, or any number of narrativist RPGs [role-playing games]).

Because they are social beasts, and language users, even very young humans do something that animals do not: they create culture out of play, elaborating an instinctive behavior

in an expressive and meaningful way. They create, in a word, games.

Humanity has created games deep into its prehistory; from physical contests we created sports, from observations of random behavior we created luck games and the casting of lots; from these we created the earliest boardgames. We took the desire to create safe, temporary spaces for playful contests, and constructed elaborate rules for new games, which we imbued with social meaning. From carefree exploration of each other and the environment—the essence of animal play—we ultimately built elaborate cerebral artifacts; there's a direct line, as strange as it may be, between a litter of kittens tussling with each other and two people pondering a *Chess* board. They're both forms of play; but the former is unbounded, unscripted, and *simple* play, while the latter is the product of thousands of years of cultural refinement and elaboration. And playing *Chess* has social meaning, too; to say "I play *Chess*" is to make a claim to be regarded as a thinker, an intellectual of a sort, and perhaps one who prizes the pleasures of the mind over the pleasures of the body.

In a sense, "game" is merely the term we apply to a particular kind of play: play that has gone beyond the simple, and has been complexified and refined by human culture. Just as novels and movies are artistic forms that derive from the human impulse to tell stories, and music is the artistic form that derives from our pleasure in sound, so "the game" is the artistic form that derives from our impulse to play.

3 Uncertainty

Uncertainty, in fact, is a primary characteristic of all sorts of play, and not of games alone; if you think like a programmer, you might say that Game is a subclass of Play, and inherits from Play the characteristic of Uncertainty.

In *Les jeux et les hommes,*[1] the sociologist Roger Caillois says: "Play is . . . uncertain activity. Doubt must remain until the end, and hinges upon the denouement. . . . Every game of skill, by definition, involves the risk for the player of missing his stroke and the threat of defeat, without which the game would no longer be pleasing. In fact, the game is no longer pleasing to one who, because he is too well trained or skilful, wins effortlessly and infallibly."

Caillois calls simple play, unencumbered by rules, *paidia*, and rules-bound play *ludus*. As I prefer to eschew obscurantism, I believe "simple play" and "game" will suffice. Even in simple play, uncertainty is necessary; if, for instance, your older brother always beats you in a footrace, you will quickly lose interest in playing with him. If your friend Jessica always wants to be the princess and insists that you must belong to the supporting cast—prince, ogre, ugly stepsister—and particularly if she never permits a reversal in the story whereby her premier status is

overturned—you will want to find another way to play. Simple play is, in the ideal, joyful and inventive; if it becomes predictable, both the inventiveness and the joy are lost.

The need for uncertainty is, if anything, even truer in games; if our expectation is of predictability, we are unlikely to enjoy the game.

Consider, for example, the game of *Tic-Tac-Toe* (or *Noughts and Crosses*, as the Brits call it). Unless you have lived in a Skinner box from an early age, you know that the outcome of the game is utterly certain. Whoever goes first will take the central square, because occupying it is advantageous, and unless one player is naïve or stupid, players will prevent each other from winning by blocking any attempt to get three in a row. It is a solved game, and a trivial one, and no one beyond a certain age can play it with enjoyment, because no uncertainty about the game's path exists.

And yet the game survives, is taught to each new generation, and is played, by children, with every evidence of enjoyment. The explanation for this is simple: the naïve player has not yet learned, or figured out, that the game has an optimal strategy. To the child, the outcome seems uncertain—as it is, since two players, both playing without an understanding of the game's strategy, produce an uncertain outcome. Thus, a naïve player may experience fiero in winning *Tic-Tac-Toe*, or the fleeting sadness of loss upon losing. In other words, *Tic-Tac-Toe* can be experienced as enjoyable only by naïve players, because only for them is its outcome uncertain.

Caillois's discussion of uncertainty, however, implies that the *outcome* of a game must be uncertain for it to be enjoyable; in this, he is incorrect. The outcome of *Space Invaders* (Nishikado, 1978) for example, is certain: The player will lose. Sooner or

later, the player will be overwhelmed by the serried ranks of invading aliens, and the game will end in a loss. *Space Invaders*, like many of the early arcade games, has, curiously, no win state. But "win or lose" is, after all, merely a binary; *Space Invaders* has a numerical score, which increases with each alien slain, and with no theoretical upper bound to the score. Moreover, a player who achieves one of the top scores on the machine with which he engages may enter his name (or a few characters, anyway), with his score thereafter recorded for everyone to see for all time to come—or until the machine is reset, of course. The goal of *Space Invaders* is not to "win," for you cannot, but to achieve a high score—perhaps bettering your own previous score, perhaps achieving a place on the high score list, perhaps outdoing a friend, perhaps achieving the top slot on the list. The uncertainty of the game lies not in its ultimate outcome, but in the final score.

Based on this, you could argue that Caillois was wrong only in failing to see that the outcome of a game can be more than a binary "win" or "loss" state—that it can be expressed numerically, with a wider range of possibilities. But actually, there's a deeper problem here; not all games have outcomes.

This is a problem not only for Caillois, but also for Salen and Zimmerman, authors of the landmark game studies volume, *Rules of Play*. They define a game as follows: "A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome."[2]

There's a fair bit to unpack there, and I don't propose to critique the definition word by word; I'm concerned only with "quantifiable outcome," here. Certainly, both win/loss and a score are "quantifiable outcomes"; but what is the "quantifiable outcome" of a game of *Dungeons & Dragons* (Gygax and Arneson,

1974)? *Dungeons & Dragons* has numbers, of course: experience points, player levels, hit points, and so on. It quantifies a great deal. And while the game offers players the implicit goal of improving their character and its capabilities by earning experience points and thereby increasing in level, this is not a competition among the players, who are instead expected to cooperate rather than oppose one another. Nobody "wins." A single session of *Dungeons & Dragons* may come to an outcome—a logical break point in the story is reached, or the players get tired and go home—but unless the gamemaster chooses, for his own reasons, to impose some arbitrary stopping point to the game, it can go on, in principle, forever. Indeed, some games have gone on for decades, with a degree of continuity in terms of the players, their characters, and the setting.

In short, a game of *Dungeons & Dragons* can end, and, if tied to a story, there may be some narrative outcome; and much of the game is quantified. But no outcome is necessary, and quantification is irrelevant to the outcome, if any; outcomes are narrative in nature, not imposed by the game system.

Dungeons & Dragons is far from unique in this regard; *World of Warcraft* (Metzen, Pardo, and Adham, 2004) is the same. There are lots of numbers, and characters work to increase them, but there is no leaderboard, no end of game, no wins or losses or competitive ranking. If *World of Warcraft* ever has an "outcome," it will be because Blizzard tires of the game, or its player base erodes over time to render it unprofitable, and someday the operators close it down. It has no outcome in any meaningful sense.

World of Warcraft is, of course, ultimately derivative of *Dungeons & Dragons*; but the same characteristic pervades today's most popular and commercially successful game form, the

so-called social game. *CityVille* (uncredited, 2010) and *Mobsters* (uncredited, 2008) have no "outcomes"; like *Dungeons & Dragons* and *World of Warcraft*, they are "games neverending."

Certainly these games contain uncertainty; if they were entirely predictable, people would long ago have stopped playing them. The uncertainty is not in the *outcome*, however, because there *is* no outcome. The uncertainty is in the path the game follows, in how players manage problems, in the surprises they hold.

Caillois is correct, therefore, in his assertion that uncertainty is a key element of play, and by extension all games, and incorrect only in his suggestion that uncertainty of *outcome* is essential; uncertainty can be found almost anywhere, as we will see when we begin to analyze individual games.

What Caillois and I call uncertainty, the cultural anthropologist Thomas Malaby[3] calls "contingency." Interestingly, he claims that the main reason games are compelling is that our experience of the real world is "contingent"—the world is unpredictable—and that grappling with the same kind of unpredictability in the more constrained context of the game appeals to our fundamental nature. In other words, he's making essentially the same claim I made at the beginning of this book; that part of the reason games appeal is because they allow us to explore uncertainty, a fundamental problem we grapple with every day, in a nonthreatening way.

I don't have any greater use for the term "contingency" than I do for Caillois's "paidia" and "ludus," however; it obscures rather than reveals. Contingency merely implies that one thing depends on another. The statement "If A, then B" is contingent; the truth of B is contingent on the truth, or falsity, of A. But it

is also perfectly certain; if we know the state of A, we know with certainty the state of B.

Indeed, the distinction between contingency and uncertainty is illustrative of the distinction between games and puzzles. Puzzles are full of contingencies; the solution to one clue in the crossword is contingent on the letters revealed by a cross. The solution to a logic puzzle is contingent on the clues provided. The solution to Sudoku is contingent on the arrangement of the prefilled squares. The only uncertainty involved is in the solver's ability to sort through the contingencies; or to put it another way, a puzzle is static. It is not a state machine. It does not respond to input. It is not uncertain; and it is not interactive.

All games are interactive—nondigital games just as much as digital ones. To be "interactive" means that there are two (or more) parties to a phenomenon, and the actions of one meaningfully affects the state of the other, and vice versa. Conversation is a form of interaction. So, for that matter, is using a light switch; the user's flick causes a change in the state machine that is your house's electrical system, which produces a stream of electricity to a light bulb, which casts illumination on you.

Consider the game of *Chess* as an interaction between two players. The game itself is a state machine whose state is recorded in the positions of the pieces on the board. The players impose a culturally agreed-upon set of algorithms to determine how and under what circumstances the state of the game may be modified, which involves each player responding to the actions of the other sequentially, until a particular state, known as "checkmate," is reached. The fact that the gamestate is represented in physical form, and that the algorithms used to modify its state

are applied by live people rather than a computing device, does not alter the fact that, at its core, the game is interactive.

What would a "noninteractive game" be like? Games by nature either involve multiple players, who interact with each other in some fashion—or a single player attempting to deal with a system that poses some kind of challenge, whether that be 'beating' a level-based videogame or applying the rules of *Klondike Solitaire* to move all cards legally from the tableau to piles sorted by value and suit. In short, even soloplay games are "interactive," albeit in this case the interaction is between a single player and some algorithmic system that responds to the player's actions.

If you took the pieces of a *Chess* set and nailed them to the board, you might have a "noninteractive game," in some sense, but it would no longer be playable.

So all games are interactive. Of course, many other things are interactive as well—the light switch we alluded to, the word processor on which I am composing this book, Google, eBay, and the American political system, for instance. None of these things are games.

To say *why* these things are not games would require us to define "the game"; while trying to do so is an enjoyable pastime in its own right, one in which I have indulged elsewhere, it could produce a book in its own right, and not this one. But it's worth noting one major distinction between games and just about every other form of interaction; games thrive on uncertainty, whereas other interactive entities do their best to minimize it.

Indeed, in the realm of interactive applications, whole disciplines—information architecture, human–computer interaction (HCI), and user-centered design (UCD)—have been invented

precisely to help people create *less* uncertain interactions. If we are shopping online or operating an air conditioner, or for that matter electing a congressman, uncertainty and challenge are the *last* things we want. Rather, we prefer simplicity, surety, and consistency.

You often hear people saying that they want to make their applications or websites more "gamelike." They do not, in fact, mean it. I could make Microsoft Word more gamelike; let us say that in order to make text boldface consistently, I need to be a level 12 Word user. Before I get to that level, every time I try to boldface something, the application does a check, rolling against my level, in effect. If I fail the check, it applies a random font effect instead of boldface. This would not be "more entertaining"; it would be infuriating.

In short, in designing most interactive products, the elimination of uncertainty is desirable. In designing games, a degree of uncertainty is essential. This is why people who try to apply, say, the theories of HCI expert Jakob Nielsen to games often err; interface clarity may still be desirable, but eliminating challenge and uncertainty is not. Games are *supposed* to be, in some sense, "hard to use," or at least, nontrivial to win.

4 Analyzing Games

I've said that uncertainty is a key element of games, and that uncertainty can be found in games in many ways. To gain a better understanding of how games exploit uncertainty, and how they generate it, let us examine a series of games in search of their sources of uncertainty. Once we have done so, we will perhaps be better equipped to categorize the types of uncertainty in games, to identify uncertainty in new games, and perhaps even to understand how and why some games succeed and others fail.[1]

Super Mario Bros.

Super Mario Bros. (Miyamoto, 1985) seems a good place to start, both because of its importance to the field and its huge influence on a whole generation of game designers—and because, at first glance, you might be hard put to find any source of uncertainty in the game.

When you begin the game, you see a small figure—Mario—standing under a sky. Attempting to move to the left does nothing. Moving to the right scrolls the world. There is no uncertainty about where to go; indeed, throughout the game, there is none.