Game Design Concepts

By Orin Bishop

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Thesis Abstract

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The term "game design" is not well defined; it is used to mean many different things which oftentimes are only peripherally related to the actual design process, and many books purportedly on the subject do not adequately cover the core concepts of game design proper. The purpose of this thesis is to explore the more formal aspects of game design separate from other aspects of games such as art, production, audio, and programming. My objective is to flesh out a set of guidelines that can be applied across all types and media including both digital and non-digital games, and touch upon various difficulties and challenges that a game designer is likely to face in each stage of the design process from initial concept to playtesting and tweaking. Along the way I provide specific examples of how formal gameplay might be altered by specific changes to internal logic and mathematics, and how this might affect the experience for the players. The focus is on games as formal, mathematical systems, and I examine games from their basic elements outwards, though I also explore such topics as the incorporation of theme and narrative into formal gameplay. Throughout the thesis I present a number of different ways of looking at and thinking about gameplay, with the hope that the reader may emerge with a clearer vision of the underlying formal systems of all games.

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- Section 1 -

What is Game Design?

Games have existed throughout all of human history, from ancient Egyptian roll-and-move race games, to Mesoamerican ball and hoop sports, up through modern first-person-shooters. Games have always been and always will be with us, but how they are created has and undoubtedly will change. Within the last few decades in particular, games have shifted from being things that evolved and passed from generation to generation, to things that are actively being created. A new profession has rapidly emerged and is steadily rising in prominence, that of the Game Designer.

So what exactly is this profession? What is game design? That is perhaps the main question that this book is attempting to answer. There are many disciplines that relate tangentially to game design: game theory, systems design, economic (microeconomics more so than macroeconomics), psychology, sociology, political science. The problem is that none of these fields teach anything that is particularly close or relevant to actual game design. Game theory and systems design might be the closest, but even they fall drastically short of imparting any sort of impression of what it is to design a game except perhaps inadvertently. The truth is that game designers can learn and draw inspiration from almost anything, but "game design" as a formal discipline is still in its infancy. With this book, I am attempting to paint a picture of what I see the game design as; not programming, not graphics or sound design, not marketing or production, but game design proper. Whether you are an aspiring designer or just an interested reader, I hope that I can in some way change or enhance your perception of what I see as a deep, noble and worthwhile pursuit.

Formal and Experiential

There are essentially two basic ways of looking at games, as physical or digital things that people play, or as mathematical systems. The first will be referred to as a game's "experiential" structure/gameplay, and the second will be referred to as a game's "formal" structure/gameplay. Ultimately, experiential gameplay is all that matters because that is what players will see and play, and at this experiential level the game must be fun or engaging in some way or else players will not want to play it. But a game designer cannot directly affect experiential gameplay; he or she cannot always be in the room with the players making sure they are having fun. The only thing the game designer has control over is the game's formal structure. This can be manipulated in any way the designer can imagine and engineer, and this will effect changes on the game's experiential structure. The problem is that it is almost always difficult to anticipate how the experiential structure will be affected by any given change.

Games are complex systems. If they are not sufficiently complex, they will fail to hold players' interests. To achieve a sufficient level of complexity, a game's different elements will be interlocked to a certain degree, affecting each other in subtle ways. Because of this complexity, the tweaks that one makes to a game's formal system are likely to result in complex changes to the entire system that are hard to predict. The problem is that talking about changes to games as formal systems is often meaningless, the changes and their ramifications only become evident when we try actually playing the game, and then any problems will only be seen and described in terms of experiential gameplay. A designer must learn to transition between these two levels, to learn and understand how the game's formal structure creates the experiential one, and then to translate the experiential problems back to formal ones and make appropriate changes.

The central way to learn what ramifications various changes might have is to play the game many, many times until you become familiar with it at both a formal and experiential level. This process is called "iterative" design, the notion that you make a change in the game's formal system, play the game (usually multiple times without further changes), and then use the feedback you got from other players, as well as your own impressions, to devise further changes. Wash, rinse, repeat. This idea of a cycle of

testing and changing is so essential to good game design that there is a section of this book devoted to it, but let us for now just say that this is central to what a game designer does to improve a game's experiential structure.

Uncertainty

So what should a game's experiential structure be like? There are many things one can strive for when making a game, but the first element that your game *must* have is some degree of "uncertainty." Without this basic ingredient, it isn't really a game at all. Katie Salen and Eric Zimmerman explain this well in their book *Rules of Play:*

> One way to understand why games need uncertainty is that if the outcome of the game is predetermined, the experience cannot provide meaningful play. If a game has no uncertainty – if the outcome of the game is completely predetermined – then any choices a player makes are meaningless, because they do not impact the way that the game plays out. Meaningful play arises from meaningful choices. If a player's choices have no meaning in the game, there really is no reason to play. There is an intrinsic connection between uncertainty and meaningful play.
>
> Uncertainty is usually thought of as something that disempowers players by removing a sense of choice and agency, yet paradoxically, it is the uncertain outcome of a game that allows players to feel like their decisions have an impact on the game.

So how does one make the outcome of a game more uncertain? There are many different methods, but they essentially fall into two categories: Things that make a game more random, and things that make it more complex. The outcome of a game of Chess is uncertain despite the fact that it has no random elements (ignoring the possible coin-flip at the start for White or Black) because it is sufficiently complex, not in the rules themselves, but in their ramifications (though the rules themselves do create these ramifications). It is not simply that the winner is uncertain; indeed, if one player is sufficiently more skilled it is very likely that they will win. But this may not matter because *how* they will win is not known to *either* player until the last few moves. The interactions between the limited elements in the game create a vast sea of emergent

complexity that will be nearly opaque to the beginner and still somewhat murky even to the master.

If we look at a completely different sort of game, *Snakes and Ladders*, we see that how this game will progress will also be uncertain. But *Snakes and Ladders* has a very low level of complexity. There may be more to the game than most of us have thought about, but as games go its formal structure creates a strikingly un-complex game. It achieves uncertainty with its high degree of chance; not only is each move determined by a simple roll-of-the-die, but each roll has the possibility of resulting in the activation of one of the game's titular Snakes or Ladders, resulting in wild swings of fortune.

When designing non-digital games, it is much easier to employ the second method than the first. It isn't too difficult to make a game more random, but to make it more complex is hard to do without making the rules long and difficult to understand, at which point the game also becomes difficult to test and make balanced. (More skilled designers learn how to design complexity into their games without needing to add more and more rules and game elements.)

Digital and Non-Digital

It may sound so far like we are talking only about non-digital games, but I promise that every statement in this book is intended to apply to all types of games unless otherwise stated. Most digital games achieve uncertainty through the first method, complexity. In *Pong*, the physics of the ball is sufficiently complex as to be somewhat hard to predict, and more recent games like *Call of Duty 4* also achieve complexity through the complex interactions of their parts, despite possible random elements such as random spawn locations. But digital games also have a very important edge; the majority of them have a time element. Sure, some non-digital games use timers, but the temporal element is central to most digital games. In fact, when you look at digital games without a temporal element, most of them could easily be made into boardgames with little or no alterations to their rules (though they might not work very well as boardgames without changes).

Let's try removing the time factor from *Super Mario Bros.* and re-imagining it as a turn-based game:

Stage 1, World 1. Three Marios (lives).

Turn 1: We start out on the left side of the screen and there is a Goomba and a few blocks off to our right. We cannot go left. Should we walk right, or jump? Well, jumping won't get us anywhere, so let's go right.

Turn 2: The Goomba has walked forward and, combined with our rightward velocity, is now within jumping range, and the blocks are out of the way. Should we keep walking right and die, jump and kill the Goomba, or stop? Let's kill the Goomba…

Turn 3: Let's play something else…

From this example one begins to see the problem. But it could be that players are bad at estimating whether or not jumping will result in the Goomba's death even with the time element removed, and that the game remains uncertain and still fun. This highlights another advantage digital games have over non-digital ones. In *Pong*, it is not necessary that the players know where the ball is headed at all times, and it might even be playable as a turn-based game with no time pressure. But if *Pong* were a boardgame, the players would have to know where the ball was going to go or else they wouldn't be able to put it there on the next turn. In other words, without a computer to decide things for them, the players have to run the whole game by themselves (which will likely also be tedious). As a direct translation, *Pong* does not work as a boardgame because it lacks the crucial uncertainty of not being sure where the ball will end up. It works as ping pong of course, but in that case real-world gravity and physics are taking over the computer's job (though originally it was really the other way around). Instead of having the players perform the job of the physics engine, we could assign that job to a deck of cards in some way, and this would then achieve uncertainty through randomness rather than complexity. This

change would make the game playable, but so far there doesn't seem to be much of any skill involved, particularly when compared to its arcade brother.

These two advantages, the inclusion of complex temporal elements which test players reflex and time estimation skills, and the ability to have the computer know and keep track of large portions of the game and even parts of its rules that the players can be completely unaware of, make it much easier to create a digital game that is uncertain. The temporal aspect in particular makes it possible to let the player exercise a wide range of skills that they probably wouldn't need in a non-digital game. (There are a number of advantages that non-digital games have over digital ones, but we'll get to those.)

There is also a secret third way in which digital games can make a game more uncertain (I didn't mention it before because it was a secret), the game can start with some amount of its rules and content secret to the player, and then gradually reveal things as the player goes through the game such as new levels or abilities. (Introducing new parts of the game's story isn't relevant here unless this directly affects the gameplay somehow.)

One problem with this method is that once something is revealed, it is revealed. Once a player discovers all there is to know about a newly introduced element/rule, the thrill of discovery is gone. This is likely to hurt the game's replayability, but the first time through might be really interesting if the things a player learns really shake up his or her previous assumptions about the game. There are many "arty" games that make interesting use of not telling players off the bat how the game works, and playing off of their assumptions as gamers. (The downloadable computer game *Passage* is a good example of this, and if you haven't already played it go download it now without reading any descriptions; the same goes for the computer game *YHTBTR*.)

A distinction that is usually more important than digital or non-digital is whether a game is single-player or multiplayer. If the game is to be played against other people, this opens up a whole range of possibilities that are difficult to incorporate into a single-player game. Computers allow us to pour sounds, graphics, and real-time calculations into things that are essentially glorified solitaire. Depth is certainly possible in single-player games, but it often involves trying to make increasingly complex computer AIs

that attempt to act as opponents in some way and essentially simulate a multiplayer game. Because in the end, people are one of the most entertaining sources of uncertainty in existence.

So assuming we can get our game to the level of being uncertain, what is the next thing to shoot for? Well here's where it gets a little tricky. Once we have achieved some degree of uncertainty, we can officially label our creation a game, and at this point it becomes almost completely subjective which games are better than others in the same way that evaluating any art form is subjective. Rather than risk a philosophical argument about the value and nature of opinions, we'll simply say that a game is good if it meets the standards of its creator and (more important if you plan to make any money) if it appeals to its target market.

So basically it's up to you to decide what you want your game's experiential structure to be, and that's that. So what's the point of this book? Well, when we actually sit down and start coming up with rules and mechanics and crafting a formal structure, we realize as soon as we start playing it that the game is nothing like we envisioned. (This is usually true even for the best game designers in the world.) What's "fun" might be subjective, but the internal logic of a game's formal structure is anything but subjective. Formal game design is the art of designing, iterating and perfecting a formal structure that will generate the game you want to make. If you're happy with your game as it is and it's everything you hoped it would be, that's fine, but if you hoped it could be something more, keep reading…

- Section 2 -

Skill and Choice

Choice

We've brought up the idea of how games can demand skills of their players, and that digital games have the advantage of being able to demand the timing/reflex skills in much more extensive ways. These sorts of skills tend to require relatively little conscious thought on the part of the player, and are more something you get better at with practice. There are, however, a wide range of challenges that require a higher degree of mental participation, and these mostly have to do with choice. In fact, nearly every game has some elements of choice.

In *Pong*, when the ball is coming towards you, you could play very defensively and try as hard as possible to be where the ball is headed, or you could be very aggressive and try to hit the ball at an angle and send it back at the opponent at a weird trajectory, though this may make you more likely to miss the ball. Or you could do something in between. This is probably the central choice of *Pong*, and though you may make it subconsciously, it is probably more conscious to you than the raw estimations of distance and physics you are performing at all times. Many things may factor in to this choice: the skill and play-style of your opponent, your confidence in your own abilities, the score, what you think your opponent is expecting (what you did last time), etc. There is also the choice about which direction to hit the ball in, and the data you use to make this decision will probably also be quite detailed. How much of this thought process is conscious will depend on the player, but there is more to *Pong* than just having a good feel for its physics.

This choice of risk vs. reward is common among digital games, and gaming in general. In *Super Mario Bros*. you are likely to be more cautious if you are on your last life rather than trying to finish the level quickly, and in Poker you might decide to bluff if you think

your opponents are bad at reading people. But not every choice is one of risk vs. reward. In a first-person-shooter you might have to decide whether to reload now or attack and try to defeat the enemy with your remaining clip, and neither choice might feel "safer" to you, you're just not sure which one is more likely to keep you alive. In a real-time-strategy game you might have to decide from which direction you should attack the enemy's base. Maybe one side has more anti-air turrets but the other side is more of a choke point. This choice feels different than the choice of whether to reload or not. The main reason is that we are under considerably less time pressure to make it. It could be that the choice of whether or not to reload is completely obvious in retrospect, but that because we have to make it almost instantly it presents us with a challenge. Interestingly, in almost all non-digital games there is no element of time pressure at all. Sure there might be a social stigma against taking three hours to think out a move (and some players will do this anyway), but you won't get shot if you take too long (by the enemies in the game at least). Granted a few board and cardgames have a time limit mechanism, and games such as Chess are sometimes played with a chess clock. And it is true that there are inherent real-time elements in games that involve interpersonal diplomaticy or trading. But for the most part players are free to contemplate their moves at their leisure. This is also true of turn-based digital games.

As a consequence, each course of action that they are considering must seem viable or else the choice is obvious, and if players have all the time in the world to decide a move, they are much more capable of discovering that only one of the choices is viable. "What's five squared plus twelve" is a question that requires some skill if you are forced to answer within 1.7 seconds, but otherwise most adults will find it trivial. If one of the choices is strictly better, then players, particularly experienced ones, will realize this and choose that option often without even having to think about it.

An important aspect of most games is the choices that the player is forced to make. But if a choice is obvious, then it is not really a choice at all. A beginner might find the choice interesting because they do not understand the game yet, but as they improve, the game's formal structure will begin to reveal itself to them, and if an obvious choice is presented to them, they will find it trivial and boring. This is one of the central ideas of game

design, the idea of presenting choices to the player with at least two options that seem viable.

In game theory, there is the concept of a "saddle point." If the choice or strategy (set of choices) of each player will lead to a better outcome for them than if they unilaterally deviate, this outcome is called a "saddle point." *Rules of Play* elaborates on how this is relevant:

> The concept of saddle points is extremely important in game design. In general, you want to avoid them like the plague. […] Many fighting games are ruined, for example, because despite all of the special moves and combinations that are designed into the game, the best strategy to use against opponents is simply to use the same powerful attack again and again and again. Saddle point! Another common occurrence of saddle points involves the programming of computer opponents. In many real-time strategy games there are "holes" or weaknesses in the AI that allow for saddle points. If a player discovers that the computer opponent does not know how to defend well against a certain type of unit, he is likely to abandon all other game strategies and simply hammer on the AI's weakness over and over, regardless of how much care went into carefully designing missions that require different kinds of problem-solving. Saddle point!
>
> This type of play, based on exploiting a strategic saddle point, is called an exploit or degenerate strategy. A degenerate strategy is a way of playing a game that ensures victory every time. The negative connotations of the terms "exploit" and "degenerate" imply that the player is purposefully eschewing the designed experience in favor of the shortest route to victory.

But presenting the player with multiple viable options is difficult, particularly if you can't obscure them with a time limit. The game must be well balanced for it to allow a diverse range of strategies, or else one strategy will dominate and experienced players will only do that, and then the game will become boring and pointless once the optimal strategy is revealed. It comes back to the idea of uncertainty. If I'm following the winning strategy and you aren't, I'm presumably going to win, and if we are both using the optimal strategy, this too will likely cause the game to become repetitive and predictable, even if the outcome might be uncertain. If a player is to always have viable options, then there

must be many viable strategies and approaches to the game, and this requires the game to be well balanced. The primary approach to making a game more balanced, as with most design problems, is to iterate. Test, change and test again. Most balance problems can be fixed by tweaking variables such as increasing the cooldown time on a good ability, lowering the cost to play a mediocre card, or making a unit deal less damage. Occasionally though, balancing the game might require tampering with the game's actual rules and mechanics. We'll get back to all of this later.

Skill

It is difficult to try and categorize skills, but they tend to be either mostly automatic skills that are improved through practice, or they are skills of logical deduction or intuition that demand more conscious thought. Both of these types of skills are improved through learning a game's formal structure. We'll refer to the former type of challenge as "tests" and the second type of challenge as "choices." (By a "choice," we are assuming a meaningful choice that has multiple options that seem viable and that are formally different; otherwise it isn't really a choice at all.) This is a gross oversimplification, and there are obviously challenges that will somewhere in the middle, but it gives us a starting point for talking about skills in games. It is also interesting to note that both types of skills can generally be improved not just by playing a particular game, but also by playing other games that have similar formal structures. And as we will see, many games have very similar formal structures to other games in the same class or genre. (This is why if you've played *Doom*, you'll likely start off better at *Half Life 2* than someone who's never tried a first-person-shooter before. This is less true for non-digital games, which tend to be more distinct from one another in their formal structure.)

Real-time games tend to be mostly built around tests, the automatic or "twitch" skills, and turn-based games tend to be built more around choices, the skills involving conscious analysis. Real-time games can potentially utilize both types, but they tend to be fairly "mindless" and focus more on testing unconscious skills. *Guitar Hero*, for example, requires the player to have mastered the particular skill coordinating the beat of the music with the controls of the guitar and the notes on the screen, but there is only the

occasional conscious decision, such as when to use "star power." Indeed if players try to think too hard about what they are doing, they will get out of the "zone" and cease being able to play at a high level. This is true of many activities. You cannot play golf or tennis well if you are analyzing every element of your swing, you just have to train your muscles through practice (a.k.a. repetition) to do the job properly.

It is difficult to have tests in turn-based games without any temporal element, but real-time games, or games with real-time elements, can potentially utilize both types of skill. But real-time games tend to heavily emphasize tests over choices though, and this is primarily because it is difficult to balance a game to the point where interesting choices emerge, yet it is easy to have meaningful tests in a real-time game, even though they may be no fun to perform (though many skill tests do require careful balancing to really be interesting and avoid saddle points). There is nothing inherently wrong with utilizing tests, but they are mostly based on how well your brain has already learned a particular skill, and they largely fail at engaging players at a cognitive level. They are also more difficult to talk about formally and mathematically than choices are, though there is certainly math involved in their design, as Raph Koster makes clear in his book *A Theory of Fun:*

> We've evolved exquisite sensitivity to visceral challenges. A survey of games featuring jumping found that the games with the "best controls" all shared one important characteristic: when you hit the jump button, the character on screen spent almost exactly the same amount of time in the air. Games with "bad controls" violated this unspoken assumption. I'm pretty sure that if we went looking, we'd find that good jumping games have been unscientifically adhering to this rule for a couple of decades, without ever noticing its existence.

Tests

There are countless varieties of tests which can be thrown at a player, and they all challenge his or her proficiency with the game in one way or another. A test might be trying to dodge a barrage of fireballs, or perform a difficult combo, or skid around a turn.

Some tests are specifically designed and implemented, such as a quick-time event during a cutscene, and others are highly emergent, such as successfully blocking an opponent's attack in a fighting game, and there is a wide range between these two extremes. A player's own agency in triggering these tests can vary widely as well.

Some tests are more rooted in the digital world, i.e. successfully navigating a sequence of platforms, and some are more rooted in the physical, such as pressing the right combination of buttons with the correct timing. When it comes to fighting games, there are two schools of thought: Either figuring out and inputting the correct button combinations should be part of the challenge, or it shouldn't. Most versus fighting games (*Soul Caliber, Street Fighter, Mortal Kombat*) have lengthy lists of combos to be learned, whereas some games such as *Super Smash Bros*. (which some would argue is not a "proper" fighter) have all special moves mapped to the B-button, so that the most complicated sequence that the player will ever have to perform is simultaneously hitting B and a direction. One can argue upon the merits of both styles (and my belief is that 'as simple as possible' is always better when it comes to controls and rules), but what is certain is that the latter approach shifts the emphasis towards what's happening onscreen and towards one's opponent, and away from the controller.

On the other hand, a game like *Guitar Hero* largely hinges on the obtrusiveness of the controller; in this case, the game is largely about working the "guitar," and it becomes more about hitting scrolling dots on the screen only after the player has reached a certain level of competence. What sort of approach you should take, and what sorts challenges you ought to present to the player, will depend a great deal on what sort of game you are trying to make.

Clearly there is subtlety to how tests are designed, and as with any aspect of game design there should also be lots of testing and iteration involved. Technical aspects aside however, designing tests that will be playable is far easier than designing meaningful choices. As stated already, if a choice is to be meaningful, the game must be balanced enough that there are at least two options that seem appealing to the player. But it is more than just balance; the game also requires a sufficient degree of complexity. If a game is too simplistic, then it will become obvious to the player which choices is better, and if the

game is both simplistic and balanced, it could be that both choices really are equally good, at which point any concept of skill goes out the window.

As an illustration, let's say we have a game that lasts five rounds. On the first round, the player is given a choice between either scoring five points, or taking a card that gives the player one point at the end of every round. If the card does nothing else, and points only matter at the end, then both options are functionally identical. The game mechanic is balanced, but it is too simplistic to provide a meaningful choice. If we were to unbalance the game by perhaps saying that the card grants a point at the *start* of every round instead of at the *end*, it would then be worth four points on the first turn, and the obvious choice would then be to take the immediate five points instead; still no real choice yet. But let's now make things a little more complex. We don't necessarily need to add rules to this mechanic, we'll just change it a little so that its interactions with the rest of the game are more complex. Let's say that instead of points, we are trying to get money, and presumably sooner is better because we can use it to buy things sooner (though we won't go into detail about how the rest of the game might work). Now the choice is between keeping (getting) five million dollars on the first round, or building a factory (card) that makes us one million at the end of every round. Now the game seems unbalanced, since (depending on what you can spend it on) it is presumably better to have money sooner rather than later. So to balance it, we might need to lower the cost of the factory to, say, three million. Depending on how this new mechanic interacts with the rest of the game, it might present players with a tough and interesting choice on the first round of whether to invest in a factory or save their money. The mechanic itself is formally identical except that we have substituted a spendable resource for victory points, but the way it interacts with the rest of the game is more complex, which potentially makes the choice meaningful. Of course the game might still be too simple, and after a couple of plays it might become obvious that the optimal strategy is to not build a factory, and it could be that simply balancing (i.e. changing the numbers) doesn't fix the problem, so the game's structure might need to be altered further to make the choice meaningful. Sometimes it's enough to make a designer long for a simple reflex test…

There is a third important way in which choices can be made difficult: through variability. As I said, a player might play the previous game a couple of times and realize that it is optimal not to build a factory on the first round. If it took him or her that long to figure it out, the problem is likely not in the game's complexity, but in its variability.

There is a subtle distinction between complexity and variability, and neither necessitates complex rules. If a game is designed so that its parts interlock and affect each other in interesting and unexpected ways, it allows for emergent complexity. A player might have a simple choice to make, but the list of things that could viably factor into their decision might be very large, because of the way that the game's parts interact (and an experienced player would likely have a better understanding of which factors to take into account when making a particular choice). Variability, on the other hand, simply means that the player is likely to encounter situations with which they are unfamiliar. A game could have variability because of its complexity. Go, for example, is likely to play out very differently every time. But complexity isn't necessarily required for a game to be variable.

Perhaps in the previous game there was originally a static market of things that one could buy that was the same from game to game. If we change it so that the items available in a game are randomly drawn from a deck and laid out face-up at the start of the game, this might make the game more variable, and it might be unclear, based on what has been drawn, whether or not it is optimal to build a factory. The gameplay probably isn't any more complex, but it might be more variable now, which may mean that a player has to play the game more than twice to have "solved" the factory choice.

So to summarize, in order to have a choice require skill, the game must have a sufficient degree of balance, complexity and variability. In contrast, designing a test that requires skill is a breeze. Tweaking the game so that either of these skills is actually fun to perform is a different kettle of fish, but having a game with meaningful choices is much more of an accomplishment than having a game with meaningful tests, and if a choice is meaningful, players are likely to find it more interesting than a meaningful but poorly constructed test.

There are skill aspects in some games that don't fall very neatly into either of these two categories. Trivia challenges, for example, are difficult to categorize. At first they would seem to fall into the category of choice, because the player often chooses from a selection of possible answers, but this would imply that trivia questions which don't have a list of answers to choose from are somehow fundamentally different from those that do. Although a player may be choosing between two or more answers, they are not weighing any other aspects of the game situation into their decision; they are merely trying to choose the right answer. If a game show gives the contestant the option to back out and take the money instead of guessing, this is a proper choice in a formal sense, and the player's money and perceived knowledge of the subject, etc., will likely weigh into this choice. But the actual selection of the correct answer isn't a choice in a game design sense; it is in fact closer to a test. The game is checking to see whether the player has a sufficient knowledge of the subject matter to succeed at the challenge. It is hard to call it a *skill* test however because although a player can be skilled at answering trivia questions, it is likely that their success will depend mostly on whether or not they happened to know the answer to the particular question being asked. This is why some game shows have a separate category of "skill testing question" wherein the contestant might be asked a math question, in which case their success will depend on their skill at math and not on whether they happen to know a fact. (A trivia game might also test a player's skill at hitting a buzzer faster.)

The truth is, all memory related challenges are difficult to categorize. On the one hand, like trivia challenges, they require that a player happen to know something they may have learned previously. But they are a bit different in that, if they are not trivia related, the thing(s) learned would have been in the context of the game. So the big question is, are memory tests and trivia based on the "skill" of memorizing and remembering things, or are they based on the luck of happening to know, or happening to have noticed/read, the thing(s) in question? To further complicate matters, it may well be that it requires a lot of skill to successfully memorize a list of state capitals, but if this is all done before the game even starts, does the knowledge of that information count as a skill in the context of the game itself? And what about strategic choices in a game that can be influenced by a player's memory of previous events, would this challenge then be

both a test and a choice? Ultimately I am inclined to file most memory-based challenges under the category of "tests" rather than "choices," but I will not attempt to resolve these issues here; the topic of how players can exercise skill in games is worthy of at least a book in and of itself.

The Central Choice

Sometimes when you are designing (or learning) a game, it is useful to think about what the most important type of choice in the game is or what you would like it to be. I call this game's "central choice," the balance that the player must maintain or else face defeat. It is quite common to talk about a game's central skill, such as passing aiming or jumping tests, but I find it much more useful from a design perspective to talk about a game's central choice, a balance that a player needs to maintain during gameplay through the choices made throughout the game.

For example, poker's central skill is bluffing, but its central choice is whether to stay or fold (as Kenny Rogers pointed out). *Pong*'s central skill is estimating geometry, but its central choice is between giving tricky returns or playing it safe. One could say that the central skill of many non-real-time games is estimating odds, but they present interesting challenges and gameplay largely through their central choice, whatever it may be, rather than through tests.

In many games, the central choice is between offense and defense. This is true of most team sports, at least at a macro level (though it might be different at the level of the individual players). This is the central choice in many war simulations as well; be too aggressive and you spread yourself too thin, be too defensive and you'll lose valuable opportunities. As with all choices, the games have to be fairly well designed and balanced to allow this "central choice" to emerge. Otherwise, a player's best option might always be to defend.

It is true that some games allow for really far-out strategies that eschew certain elements of the game. In the metagame of deck building for Magic: The Gathering, the central choice might be balancing between expensive, powerful cards and cheap, weaker cards, but a player might be able to win by building a deck that somehow uses only weak

cards. This doesn't mean that the central choice of Magic is not important, it's just that the game allows for a high degree of deviation from the norm as long as the deviating player does it well.

It is important to note that not everyone might agree on what the "central" choice of any given game might be, it is merely a concept you can use as a designer to help visualize and keep perspective on what you want your final game to be. You can check mechanics and aspects of your game against the desired central choice and decide if the are reinforcing it or degrading it, or you might decide to try and obscure it so that the player really has to learn the game before they discover what the heart of it is.

- Section 3 -

Constructing a Formal System

Every game, from tag to *Battlefield 1942*, has a formal system, an underlying internal logic that dictates how the elements in the game behave. It is the mathematical interaction between these elements that allows for interesting gameplay to emerge. In this section, we will talk about how to design a formal system that can be playtested and improved. But before we dive in and get our hands dirty, there are some terms I should define.

Player-Oriented Elements

All games have challenges and obstacles that the player is attempting to overcome, but perhaps more important are the tools a player is given to do so. I've split these player-oriented elements into four basic types, so before we move on, let's examine them:

-Resources. These are things that can be gained and spent. The player may have no choice about when and how they acquire the resource (they might just start the game with it), but they have some choice over how or when it is used. In the *Legend of Zelda* series, Link's bombs, arrows, rupees and hearts are resources. In Poker, a player's chips are the resource. In the board game *Power Grid*, coal, oil, garbage, uranium and money are the resources. In *Super Mario Bros*., lives and remaining time are resources. The economies of a game's resources are usually central to its formal structure.

-Powerups. These are things that a player start with or acquires which grant them powers and abilities. In *Zelda*, Link's bow, bomb bag (which allows him to carry and use bombs), sword and boomerang are powerups. In *Puerto Rico*, the buildings are powerups because they each let you break the rules in some way, or gain some bonus in a particular situation. In Power Grid, the power plants are powerups because they let you convert specific resources into power, and your houses are powerups because they let you convert

power into money (by being powered by your power plants). Guns are powerups because they let you use new types of ammo, or use ammo differently. This is a somewhat broad use of the term, but my intention is to differentiate these things a player cannot spend from resources. A player might lose a powerup, but they would have no control over when, so a weapon upgrade that lasts for a minute whether you use it or not would be a powerup, whereas a box of machine-gun ammo would be a resource.

-MacGuffins (or "McGuffins"). The term was coined by Alfred Hitchcock to refer to the object in a movie that the characters are seeking which drives the plot but has no other purpose. It might be a briefcase in a spy movie or a relic in an adventure flick. Digital games, particularly adventure games, often have items that the player has to acquire before they can get past a certain point. Sometimes acquiring the item is unavoidable, such as when it is given to you after you defeat a level's boss. If an item affects the game in no other way, such as not taking up space in your inventory or granting you any ability other than getting past a specific point, it is a true MacGuffin.

These are not resources because the player is forced to use them at a specific point and has no option to use them earlier or later. For example, the player cannot sell a MacGuffin before they are required to use it. MacGuffins often have little to do with formal gameplay and are there to make experiential gameplay more clear or thematic. In most cases, they could be replaced with a passcode or a switch without affecting the game's formal structure. They are often inserted to force the player to fully explore their environment, such as in the Atari 2600 game *Adventure*.

You could talk about the ball in a sport being the MacGuffin, though this is somewhat debatable since having the ball confers tangible new abilities on the bearer (such as the ability to pass the ball, or to tag a player).

-Collectables. These are things that a player does not need which also have little or nothing to do with formal gameplay. Examples are the coins in *Super Mario Bros*., which grant the player an extra life if they collect 100, but are largely irrelevant unless the player is going for a high score. If points are the only measure of one's success, such as

in most classic arcade games, then the things that confer them (such as the cherries in *Pac-Man*) might transcend mere 'collectable' status as it is defined here.

Some of the masks Link collects in *Majora's Mask* are collectables and do virtually nothing, whereas some grant Link new powers and would be classified as powerups, and some do nothing other than let you get past a certain point and are MacGuffins. In *Donkey Kong Country* for the Super Nintendo, the bananas function the same as the coins in *Super Mario Bros*. and are collectables, whereas in *Donkey Kong 64* they are required in order to challenge each level's boss, which makes them MacGuffins. In *Super Mario 64*, the coins function the same as in the NES version except that they also restore the player's health, so in some sense they are a resource rather than a collectable, as this healing power affects the game more than the extra life at 100. Collectables have virtually nothing to do with formal gameplay.

Macguffins and collectables are rarely found in non-digital games primarily due to the fact that, because there isn't a computer to keep track of everything, there is an economy on rules, and they are one more thing players have to learn, adding little to actual gameplay. It is a rule of good design in general that whether or not a given element should be included should come down to whether its advantages outweigh its costs. In game design, adding an element usually means adding rules, which means that the benefits of the element need to outweigh the costs of greater rules-complexity, though these costs will depend on what sort of game you are designing.

Also, the concept of exploring an unknown environment is more common in digital games, and MacGuffins and collectables encourage or force the player to do this. The gameplay is in how the player explores the game word though, so formally speaking the MacGuffins and collectables are basically just the carrots at the end of the stick.

Saying that MacGuffins and Collectables are mostly irrelevant to formal gameplay leaves the other two elements, Resources and Powerups, as the driving forces of gameplay. It is my contention that the strategic and choice-oriented elements in virtually every game emerge from the interplay of its various resources. In Checkers, you sacrifice pieces in order to deplete your opponent's. In *Doom*, you spend ammo to preserve your health.

Aiming and jumping skills aside, games can usually be cleanly boiled down to their basic system of resources, and this is something to consider when designing and conceptualizing your own formal system.

Getting Started

So where does one start when trying to design a formal system? Simplistically speaking, there are two ways to begin. One can start with a theme – a narrative, setting or emotion that one wants to evoke – and then design mechanics to try and evoke this theme; or one can start by thinking of interesting mechanics and then either find a theme that fits them to some degree, or simply having an abstract game with no strong theme.

It is difficult to point to an abstract game that is completely devoid of theme; Chess seems to be some sort of battlefield simulation or perhaps a metaphor for royal politics, and the music and backgrounds in some versions of Tetris seem to be in some way themed around Tsarist Russia. There are also many games, particularly many European boardgames, which claim to have a theme despite the fact that the gameplay seems completely abstract to many players. For the purposes of this section, we won't worry about how much of a theme players perceive your game to have (though this is an important factor to keep in mind). What we are concerned with right now is merely how you might use the theme when designing your game's mechanics. (*Tigris & Euphrates* has been accused of having a theme artificially pasted on, yet ironically its designer, Reiner Knizia, has stated that he designed the mechanics around the theme.)

Many things can inspire game designers. They might get game ideas from a movie, a documentary, a conversation, a history book, or a feeling they had when they looked at a butterfly in the park. (A game designer begins to think in this way about everything we encounter; it is in some sense both our gift and our curse.) In reality, there are as many viable methods for designing games as there are possible games.

Whether you have a theme or not, a good place to start is to decide what the players are trying to accomplish, and what the fundamental challenges are that stand in the way of that goal. Stated more simply, what will the players be doing?

We tend to see games as big, complex systems, but the fact is that most games can be cleanly boiled down to a small number of activities, and more importantly to a small number of choices. Many games have a central skill such as aiming or jumping, but unless the game is a brainless twitch-fest, or completely broken or unbalanced, it will also have a central choice (discussed in the previous section). One of the first things to consider when designing a game should be what balance the player should have to maintain. This is the heart of your game's strategic and tactical landscape, and most of the time it will be closely tied to your game's resources.

One of the most fundamental aspects of any game is its resources, and virtually every game has them in some form. In games with any sort of time pressure, time is a resource. Many things can be thought of in terms of a resource. If you give your opponent in badminton a couple of free points to make him overconfident, you are in some sense "spending" your score leeway and security in an attempt to purchase a psychological advantage. It isn't really important what might or might not count as a resource, but thinking about your game's structure in terms of resources can allow you to better understand it as a system, and if you have its desired strategic gameplay in mind, examining its economy of resources can help you understand what is and isn't working.

The first principle of economics is scarcity, i.e. there is not enough for everyone to have everything they want. Without this basic principle, there would be no market and no economy. The same logic applies to games. If everyone had as much as they would ever need, they would be guaranteed to succeed at everything and the game's uncertainty would be lost. Likewise, if players never had enough of anything ever, they would be assured to fail at the game, and once again uncertainty would go out the window. For a game to be uncertain and fun, the central resources need to be carefully tuned so that they are limited enough to be important to the gameplay, but not so limited as to stifle it.

Of course, just because something is a resource doesn't mean that it's central to gameplay. There is a timer in *Super Mario Bros*., but players are just as likely to move at

a spry pace by virtue of their own impatience, and not by the externally imposed timer. This is because as a resource the timer is fairly liberal, but if the time limit on every level were cut in half, time would suddenly become a precious commodity, and gameplay would be very different. In this "race" variant of *Super Mario Bros*., time is a central resource; in the regular game, it is not. The game's enjoyment lies with its central skill of jumping and avoiding danger and its strategic landscape is limited (as we saw in Section 1). This is because it lacks a complex interplay of its resources. Because the timer does not play a large part in the gameplay (assuming you are not attempting a speedrun), the important resources are primarily the lives and extra hits you are attempting to preserve., which does not give it any particularly meaningful strategic choices; *Super Mario Bros*. is thus predominantly a game of skill-tests and not a game of choices.

Skill versus Choice

Most digital games require that the player has achieved a certain level of competence with certain skills in order to proceed, such as jumping or aiming. Games with strategic choices require that the player understand the game's structure to some degree in order to make intelligent choices. Games with skill-tests usually require that the player understand the game's structure to some degree, but because most gamers are familiar with a vast array of games and are equipped with a vast palette of skills, they are prone to understand the game very quickly, master it, and become bored, unless the skill-test is especially novel. Good skill-oriented games either continually present new types of challenges that the player needs to learn how to overcome, or they ramp up the difficulty in such a way that it forces the player to approach the same types of challenges in new ways.

Choices are a little different. In Section 2, we said that for something to be a proper choice, it must have at least two viable-seeming options. One of them can be better than the others (and indeed should be, or the choice is effectively meaningless), but if it is immediately obvious what the right choice is, it isn't really a choice. The choice can also be more obvious if there is more time pressure, and indeed you could look at the strategic landscape of *Super Mario Bros*. as a series of obvious choices decided very quickly (there's a Goomba walking towards me, should I jump on it or stand still?!).

Making certain types of choices also means learning various skills as well and, as with skill-tests, experience with one game can help us make better choices in another. But if the games' underlying systems are sufficiently different, this gained knowledge from one game can backfire in another, even if the games' rules appear similar. Consider this comparison from *Half-Real*:

> [T]he two games, of *Quake III Arena* and *Counter-Strike* have mostly similar rules, but are considered very different gameplay experiences: "*Counter-Strike* is a game of kill or be killed. But unlike *Quake III Arena* or *Unreal Tournament*, it's not a mindless action game that involves nothing more than twitch-shooting" (Ajami and Camparano 2001). It is a general trait of emergent systems that a small change can have big ramifications throughout the system, and this is also the case with games: *Quake III Arena* is a fast-paced first-person shooter. When a player dies, they respawn within a few seconds. Even when playing multiplayer team games, the games tend to be fairly individual.
>
> Unlike *Quake III Arena*, *Counter-Strike* Is famous for its team-oriented gameplay, but since there are no rules in *Counter-Strike* that tell the players to "play team-oriented," the question is, what makes *Counter-Strike* a team-oriented game? *Counter-Strike* only adds a few variations on the team-based modes of *Quake III Arena*: Players do not respawn during a round, there are goals that can win an entire round for a team, and players move more slowly and are much more vulnerable. As it turns out, these variations completely change the game to be more oriented toward team play. Since the player only has one life per round, death becomes something to be avoided at all costs. This makes it very important for players to work together. In even a simple skirmish, being in a group is much better than being alone. Having your back covered becomes important. Communication therefore becomes important. In this way, very simple rule changes can completely change the gameplay of a game. This is how *Counter-Strike* can be team oriented even though it does not say so anywhere in the rules.

Two important lessons can be gleaned from this. The first is that, while both games require the same basic skill repertoire (i.e. navigating a 3D map, locating players and objects, aiming, strafing an enemy, hiding behind cover, coordinating/timing assaults),

they also require them in very different amounts. The skill elements are largely (though not completely) the same, but the strategies of *when* to employ each skill are extremely different. For the most part, players can transfer their basic palette of skills from *Quake III Arena* over to *Counter-Strike* without too much modification. But to become at all competent at the latter, the player must completely reorient their choice selection process, and this requires learning the game's underlying formal structure. If a game's formal structure takes a long time to learn, the game is said to have "depth." This is not the same as simply practicing a skill, it means reorienting and conditioning your strategic framework to fit the game's mechanics. This is not to say that trying to come up with creative new skill-tests is not a worthwhile endeavor, and a few games (*Guitar Hero*) can stand up to repeated play with little or no elements of choice. However, most games could benefit from a higher number of more interesting choices, and this is because they are very tricky to design.

The second thing to learn is that small changes to a game can have extremely large (and often unexpected) consequences on its gameplay. This is why, as a designer, you should carefully consider every element of your game without taking anything for granted. As an example, many board and cardgames are played with turn order passing clockwise, but many also have the turn order decided in a slightly or completely different manner. This usually has a fairly profound effect on gameplay, and is anything but random. Every mechanic in your game, no matter how ordinary or unimportant it appears to the layman, should be the way it is for a good reason.

Resources

Earlier on, I said that a basic part of most games is their economy of resources. In simple terms, these resources are what give rise to the game's choices, by forcing the player to trade one resource for another in an attempt to improve their overall position and make the most of whatever they have at any given time. Resource here is a very broad term, encompassing things such as life-points, remaining turns, cards in hand, ammunition, secret or public information, or anything else that the player can gain or spend in some way. (In non-formal terms, a player's patience could be considered a resource that the

player is spending to do a boring but lucrative task.) Let's look at some games and examine their economies of resources:

-In the boardgame *The Settlers of Catan (Die Siedler von Catan*), the players receive and spend the five resources lumber, wheat, wool, ore and clay. Other resources include remaining turns before someone else reaches 10 points and wins (which is usually an indeterminate amount), development (action) cards, remaining settlement and city pieces (though once they are placed on the map, they don't really function as resources because they are permanent), real-world seconds before a trade concludes (also not determinable), and (non-formally) the goodwill of other players.

-In *Monopoly*, resources include money, properties, houses and hotels, and (non-formally) the goodwill of other players. In this case, game-time isn't really a resource because you have virtually no control over the game's pacing, and there is no predetermined endpoint other than you or your final opponent going bankrupt, which is the same as running out of the money resource. On the other hand, failing to purchase properties in the early game and allowing other players to do so first implies a squandering of turns, so in this sense time *is* a resource, but only if the players are playing poorly.

In *Warcraft 3*, there are the explicit resources of lumber and gold. Other resources include time, units, buildings (because they can be destroyed if not defended), individual units' remaining health energy, items, information, secrecy, and player attention (micromanagement).

In *Doom (1993)*, resources include ammo, time, health, and armor.

Poker has basically one resource: chips.

Doom's resources are fairly limited, as is their interaction with one another (ammo conserves health and armor, etc.), and gameplay arises primarily from skill-tests

involving aiming and navigation (and occasionally platforming and dodging). Choices are fairly limited and obvious, such as when to reload and which weapon to use. By contrast, the choices in *Warcraft 3* are deep and multilayered, and this is primarily a consequence of its more complex resource system. However, the sheer number of different resource types is not as important as how they interact with one-another. Resources are spent to buy units to gather resources to buy units to defend buildings that allow units to gather resources that allow you to build units… Resources are a good place to start; by designing elegant and novel resource economies, you can create a game that has strategic depth and interesting choices, and if your rules are simple enough that beginners are able to gain a basic operational understanding of the game's structure, they can lower themselves into the game's depth at whatever pace they choose, assuming, of course, that the game is balanced…

Balance

In game design, balance is a two-sided coin. By presenting a series of choices to the player, you are in essence requiring them to maintain some sort of balance to avoid failure. Conversely, to create this requirement, you yourself must balance the game so that the un-fun or degenerate strategies *un*balance it. Savvy?

Let's put it another way. You want the player to do certain things that are fun, and not do other things that aren't fun (either for them, or because it makes the game un-fun for others). Players want to do fun things, but demonstrably they'd rather win as easily as possible than have fun, thus you need to make sure that the fun activities are also the best ways of winning.

You can't just have one winning strategy though, because this becomes un-fun. Literally speaking, a strategy is a specific series of choices that leads to an outcome, so as long as players still have to think about each choice, it's okay if they follow the same general strategic plan. However, it's nice when a game allows for a diverse range of strategies, and if this is your goal, then the more difficult (harder-to-pull-off) strategies should tend to be more lucrative (likely to succeed) than easier strategies (though possibly only slightly) to encourage the players to keep exploring the gamespace.

If the choices are well designed, then the player will need to maintain some sort of equilibrium. Why? In the simplest terms, if you walk into a multiple-choice exam and know you can get every question right by choosing "A," then you are not being presented with meaningful choices. The test must force the "player" to choose "A" only when it is appropriate. Not too much, not too little. If the right answer is always "A," then the test is in some sense unbalanced. If I can win by spending money on properties whenever I get the chance, then whether or not to buy a property isn't really a choice because the game is unbalanced, and so the need for me to maintain the balance goes out the window. To use a somewhat forced metaphor, it's as though game designer is standing below with a game on his head, and the player is standing on the game. The player is ideally required to hold their balance so as not to topple to the ground, but if the game and the game designer are not doing their part, then the player's keeping balance becomes irrelevant.

Guidelines

The following is a list of general tips that may be useful when first fleshing out a design, or when faced with a difficult choice or problem.

-A game should ideally be as simple as possible, but no simpler. Often it seems necessary to add new rules to fix problems or adhere more closely to the theme, but these things can usually be solved with more elegant solutions like tweaking variables or changing or combining existing rules. It is the way in which elements of the game intersect and interact with each other which creates emergent complexity, and not the sheer number of elements. A sign of a good game is often one where the rules sound completely logical and obvious in retrospect, but ironically it usually takes longer to get a game to this state. The confusion may stem from the ambiguous use of the word "complexity" since rules complexity and emergent complexity (e.g. depth) are two separate concepts, and "gameplay complexity" is frequently used to refer to both of them.

-You can have clever ideas without them making it into the final product. Don't use a mechanic or feature just because it seems neat or innovative, but because it fits with the game and actually improves it in some way.

- Instead of looking at what other games do well, try looking at what they do poorly and figure out how you might fix it. Admiring and learning from good mechanics, and figuring out why they work well, is very useful, but often even more can be learned from games that are *almost* good. If you focus too much on what has been done well, you might create a game that does those familiar thing well or even better, but if you focus on what has been done badly, you could just end up with something entirely new.

-Three important things to decide early on are: what will players be doing, what will the teams and victory conditions be, and what will the game's resources be? Resources are the foundations for choice. Design an economy of resources early on, but be open to changing it many times over the development process.

-Take plenty of notes. Write down ideas as they come to you, and keep writing down new ideas as the project evolves. Don't throw away old notes; keep track of the project's evolution and why various changes were made or what solutions failed in the past. That said, don't get bogged down in bureaucracy, and find a note-taking style that works for you. There's no quality standard or minimum length for a note provided you can understand it later (though writing design documents for a team is a different story).

-Think objectively and clearly, and try to stay mentally detached. Keep in mind what each game mechanic is meant to do; you test these hypotheses with playtesting, but you should always have them in mind. When you run into problems, reflect calmly on what the problems are that you're trying to address, and in what ways this might be done. Frequently think about what your goals are, and what sorts of emotions, situation, and player dynamics your game is meant to evoke.

-If your game is meant to bring the player into a theme, figure out what sorts of important choices the characters in your imagined or historical narrative would be making, and try to design and balance the game so that the player is forced to make those same sorts of choices. Interesting choices that make sense within the narrative context can do a lot more for immersion than just presenting the theme through cutscenes, event cards or quick-time events.

-A game based around a theme can never encompass all the relevant aspects and details, but there is an art to abstraction. Figure out what the important aspects and choices of the setting are, and strip away the ancillary details until your game emphasizes those things. Unnecessary thematic details don't need to be ignored or removed if they can be implied by or factored into other mechanics. For example, there is no explicit mechanic in *Axis & Allies* for a bomber's bay doors jamming, but that is one of many possible thematic rationales encompassed by rolling poorly in a bombing attempt.

-Work out as much of the game in your head and in notes as you can. A vital skill to cultivate is imagining in your head how certain mechanics will play out, and usually your imaginary game will play wildly differently than the actual game once you start prototyping and playtesting it, but fleshing it out in your head as best you can, and catching obvious problems and loopholes early, will save you countless hours of labor. There is nothing wrong with just playing around with some game bits or some code without having any idea of what you're trying to make (and in fact this can give you lots of ideas by itself), but what you want to avoid is having a blinding inspiration for a game, and then making an elaborate prototype before realizing that the game won't work at all in its current form. Notes are much easier to make and modify than cards or code, and ideas are even easier.

-That being said, the best way to design games is to go out and do it! With a pencil and some cardstock, you have the materials to make and sell (to a publisher, at least) fantastic complete games, so the fact that you don't have a team of programmers or artists at your

beck and call is no excuse. Like everything else, all it takes is practice, so get to it already! … Out of pencils? Then read on instead.

There are many viable game design methods, and many approaches to constructing a game's formal system, but there are a few specific aspects of that system that are central. What you want the players to do are important considerations, as are the orientation of the teams and victory conditions. Every element that has an impact on the way that the system behaves must be properly evaluated, but a game's resources in particular are often central to the game's strategic landscape.

But creating a system is only the very first step. The next is to subject it to rigorous playtesting, all the while maintaining and objective and detached perspective. An iterative design process is necessary to allow your game's formal system to function the way you intend it to.

- Section 4 -

Victory and Game Over

> When playing a game the goal is to win, but it is the goal that is important, not the winning.
>
> – Reiner Knizia

Victory Conditions

What players are trying to do in a game is as important as what they *can* do, and the way that players behave in a game will hinge largely upon the different end conditions and how they are achieved. In old arcade games, or games that involve betting real money, there tends to be a scale of outcomes, and players will walk away with some amount of points, money and possibly debt. In most games however, a player is either declared a winner or a loser, or occasionally neither in the case of a tie or something similar. This mostly binary system of ordering outcomes, coupled with the commonly used mechanic of having only one winner, tends to have particular consequences on a player's behavior during the game. If a player achieves the best possible outcome (i.e. winning) simply by doing better than all opponents, then trying to hinder a player who is doing well can be just as effective as trying to better one's own position. Trying to bring down a winning opponent in non-tournament poker is a pointless strategy if the aim is to make the most money, but in most games the goal is to come out on top of the pack in some way rather than simply achieving a particular score or state of affairs. As a game designer, it is important to understand how a game's victory and ending conditions define how people play it. They are as much a part of the game as any other element, and sometimes tweaking or reevaluating them can improve the game in ways that simply changing the core mechanics cannot. The following is a list of some of the common victory conditions found in games (and some games use multiple of these):

-The first player to fulfill an objective wins. A player might be required to control a set number of territories at the end (or start) of their turn in a war game, or "frag" a set number of opponents in a first-person-shooter. These sorts of victory conditions tend to fall into two types in that the player either has to accumulate or accomplish something that cannot be lost or reversed, or they have to accumulate or accomplish something that *can* be lost or reversed. Both can be viable, and lead to very different game styles. If the thing can be lost or reversed, this will usually cause the game to swing back and forth as players team up to bring a leader down (possibly going on indefinitely if there is not some other factor that causes the game to come to an end). If the victory objects cannot be lost, then the other players will have to destroy or prevent all means of a leading player getting more of them, which will likely make for a very different sort of game if a player's progress towards victory can never be reduced but their means of attaining it can.

-Most points when the game ends wins. With this sort of victory condition, there is something else that triggers the game to end (such as a player getting eliminated, a card being drawn, a time limit expiring, or the victory point supply running out), and then the player who has the most points wins. Alternatively, the goal might be to have the *least* points at the end (and in many card games the thing that triggers the end is a player going above a certain score, thereby causing another player to win). Sometimes things such as money or territory serve as "points" at endgame (though they may not be referred to as points in the rulebook). If points can somehow be stolen, then the game can potentially be zero-sum, with the player with the largest slice of the pie at the game's end winning. Most games with point scoring tend not to be zero-sum however, and involve players simply trying to accumulate more point than their opponents. (A game can also have a zero-sum scoring system without all aspects of it being zero-sum.)

-Last remaining player wins. This implies that the game has some form of player elimination. Many card and dice games are played such that in each round there is a loser who goes out, and the last remaining player is declared the winner (and traditionally wins the pot if it is a gambling game). In "classic" boardgames such as *Monopoly* and *Risk*, the

victory and ending condition is that a player be the last player still in the game, which can take an extremely long time and means that some players won't even be playing for much of the game if they are eliminated early. Player elimination tends to be frowned upon by today's boardgamers for these reasons, but there are viable ways to implement it that don't need to involve players sitting out for long periods. We'll get back to it in the section on common design problems.

I use the word "points" a lot even though many games have nothing in them called points. The word "points" generally means an abstract measurement of one's progress towards victory, but most games use something less abstract, either because it has a different name (i.e. "kills"), or because it serves another purpose in the games besides simply denoting victory (i.e. "money," "territory"). I talk about points or score simply for simplicity's sake, but I mean these terms to apply to any measure of victory wherein the things being counted could be counted as points at the end with no change to formal gameplay. Saying the player with the most territory wins is functionally the same as saying that every piece of territory is worth one point, and the player with the most points wins, though not every victory condition will transfer over to points so easily. (A game's theme might well be strengthened by something less abstract than "points," but formally the term will apply perfectly in many cases.)

It's also worth noting that in some games, players' scores are hidden or obscured in some way. It may be possible to track a player's score with a perfect memory, but when designing a game you can assume that players will not have perfect memories. It must be decided when designing a game which aspects of the game will be public, particularly in non-digital games where not deciding could lead to ambiguity in the rules. For example, is money public in *Monopoly*? It may say in some editions of the rules, but I'd guess many people haven't thought about it, and they don't need to think about it until it becomes important for whatever reason, at which point it ought to be in the rulebook somewhere. This isn't quite so crucial in digital games because the game just is how it is, unless of course there is missing information within the code itself, but what information is public to whom at what times *will* have some effect on gameplay. Maybe you are designing a first-person-shooter. Can the player look at everyone's scores by holding tab?

Are they completely hidden until the game announces that a player is only three frags from winning? Can you see your own score? All of these things should be decided upon at some point. They may change through iteration, but be aware that they do have an impact on gameplay and the overall experience.

Competition and Cooperation

Most games revolve around the idea of competition. Abstract strategy games like Go or Backgammon tend to be one player versus another, most sports are one team versus another, and multiplayer digital and non-digital games tend to be everyone against each other. But these common structures do not always apply. Many sports, such as fencing, are one versus one. Many multiplayer games have teams, such as "Capture the Flag" in a first-person-shooter, or the "police" players being pitted against the "Mr. X" player in *Scotland Yard*. And some abstract strategy games are multiplayer, such as Chinese Checkers or Three Player Chess. There are even some multiplayer digital and no-digital games in which all players are cooperating against the system, such as *Battletoads* for the NES, or Reiner Knizia's *Lord of the Rings*.

Some games feel like they have teams, such as the alliances that can form in *Risk*, but are really everyone for themselves. In many cases, these feelings of cooperation or competition are created by the operational structure of the game, yet the actual reality (everyone against one another) is due to the victory and ending conditions. The short-term goals of a game (conquering territory, staying alive, keeping down a leader) might encourage cooperation, but the long-term goals (controlling every territory) might necessitate selfish mercilessness. In *The Legend of Zelda: The Four Swords*, this common dichotomy is reversed. Players are constantly clamoring for rupees to be the player with the most at the end, and squabbling over the powerful and fun-to-use items, but they must cooperate to solve the puzzles and defeat the end boss, and when things look dire and defeat looks imminent, players will forsake collecting rupees and band together.

Games are largely defined by their victory conditions, yet it is a bit odd that so many games are built around the idea of competition either with everyone against one-another

or with teams. In game theory, by far the more interesting games are those in which everyone is looking out for their own interests and trying to maximize their own utility (score/happiness), with no regard for anyone else's. In a two-player game, if my objective is to try and defeat you, I have no incentive to do anything other than try and hurt your chances of winning in any way that I can (directly or indirectly). If we share an objective, then I have no incentive to do anything other than cooperate with you as well as I can. But if I just want to maximize my own utility, then our interactions can potentially be much more diverse and interesting.

Consider the classic game theory game *Prisoners' Dilemma*, devised in 1950 by Merrill Flood and Melvin Dresher. In it, two criminals have been arrested but the police have insufficient evidence to convict them. They are each separately given the option to confess to the crime and rat out their partner, or remain silent. If one confesses and the other doesn't, the one who confessed will get off with a one-month sentence, and the other will spend ten years in prison; If both confess, they will both spend two years in prison; and if both remain silent, they will both receive a six-month sentence for a minor charge. Neither prisoner is allowed to consult with the other.

The optimal collective outcome for this game is that both players remain silent and both only spend six months in prison, and if the players were allowed to consult (or were allowed to see each others' moves), this would quite likely be the outcome. The catch is that the optimal strategy, regardless of what the other player does, is to confess, because it minimizes a player's sentence either way: if I confess, you should confess and get two years instead of ten, and if I don't, you should still confess and get one month instead of six. Of course this is assuming that utility is completely based (inversely) on the length of the sentences, but if seeing me not get ten years in prison makes you happier, then your utility for that outcome should be set to reflect that.

Compare this to the game Rock-Paper-Scissors, a competitive zero-sum game in which each player is simply trying to guess what strategy the other will pick. If we play this game exactly once, then I have nothing to go on except perhaps your affinity for geology.

If we play multiple times, the psychology involved may become more interesting, but Prisoners' Dilemma also takes on new dimensions if played multiple times against the same opponent. The interesting game theory games used in social experiments are all of a partly-competitive and partly-cooperative structure, whereas there tends to be much less to say about purely-competitive or purely-cooperative game until they reach a fairly high degree of mathematical complexity.

So why are almost all of the games we play competitive? It may be primarily due to the fact that competitive games are simply easier to design. We talked earlier about how uncertainty is a crucial element of all games. The primary difficulty with games that have individual objectives is that if I know or am fairly certain before the game is over that I have completed my objective, I will lose interest in the game. For example, if each player is trying to get at least ten points by the end of the game, I might be able to kick back and relax for the rest of the game as soon as I hit ten. Things might be different if I can lose points or if the game is zero-sum and other players can steal my points, but it is inherently harder to balance partly because there will be no reason for players to band together against a leader if they aren't specifically trying to exceed the leader's score, so a leader is more apt to feel that their victory is certain.

It may be possible to keep a player's score hidden even from them, such as having players put many chips into a piggy-bank throughout the game hoping to have enough by the end. One might even consider keeping the victory conditions themselves hidden in some way, such as having it be unclear how many points each player needs to win, but if it is done too obviously, such as drawing a card at the end with a necessary score on it, this will probably seem unfair ("I would have won if you hadn't drawn the one which said I needed *twelve* points"). If we assume an elimination condition, wherein a player simply needs to remain in the game until the end, this gets around the problems above as long as elimination always seems like a possibility, but it has the problems of any elimination game (i.e. an eliminated player has to sit out until the game ends, however long this may be). Another possibility is a game that eliminates one or more players at the end who have done the worst in certain areas compared to the other players, so that the

players are partially competing to avoid this fate, while autonomously pursuing their own goal. There are other variations on this.

The reason these problems don't come up in game theory is because instead of the standard binary or ternary set of outcomes (win, tie or lose), there is a large or infinite scale of outcomes. Ten utility is better than nine which is better than eight which is better than seven… No matter how much utility I have, I am engaged because I want to make sure I end up with as much as possible. Think about it in real-life terms. If I am a millionaire, I can probably still improve my life in some way, and I want to avoid it getting worse. But if my objective is to finish the "game" with at least 500,000 dollars, then I really have no reason to keep playing unless I am actively being assaulted by thieves and taxmen.

This dichotomy between game theory and regular games isn't entirely comprehensive though because there are a number of games without defined win-loss conditions. Tabletop and online role-playing games, for example, require the player to set their own long and short-term goals. There may be quests and such that have specific win-loss conditions, but ultimately it is the player who decides what they are trying to accomplish in the world, and there will often be squabbles over loot while the players are also communally celebrating a victory. Some games like *The Sims* have no goal and no ending, and require the players to set their own short and long-term goals, which can change as they do well or poorly in the game.

Many arcade games use points in a similar way to utility when there is no way to finish the game and the player is simply trying to maximize their score before getting game over. Note that using points as the sole measure of success is different from using them as a collectable in a game with a definitive endpoint; only the hardcore will be concerned with getting points in *Super Mario Bros.* How points are being used is sometimes difficult to define, however. In *Donkey Kong*, when the player gets to the "end," the game restarts at level 1 with the player's score intact and they can keep going at a higher difficulty. So is victory in *Donkey Kong* defined by getting a high score, or by beating the last level? The answer is probably different for different players, but in the similarly structured arcade game *Star Wars*, a game that takes roughly two minutes per

play through, most people would probably consider getting more points to be the goal rather than just getting to the "end" once.

These sorts of less concrete victory conditions don't really work in one-off multiplayer games where we are directly comparing our scores. If we are playing a game for points and you get more than I do, I'm naturally going to feel as though I lost (though I might still be happy about getting 2nd or 3rd), and if you got the most, you are probably unlikely to care how much you beat everyone else's score by. You might enjoy trouncing everyone with a massive lead, but you might also enjoy the victory more if you manage to beat me by one point rather than by a hundred. Point maximization naturally becomes less important in competitive games than defeating one's opponents. However, if the game is part of a tournament or series of games, or ongoing in some way like a role-playing-game, then point totals and individual maximization could potentially be as or more important than simply winning or losing.

This explains some of the reasons why we see almost no non-persistent games with individual victory goals and multiple potential winners, but this is also an opportunity. If designers can get over some of the hurdles of designing these sorts of partly-competitive and partly-cooperative games, it will open up a whole new area of gaming that hasn't really been explored, with many interesting new sorts of potential player interactions. To be fair, there are complexities in competitive games not necessarily found in games with multiple possible winners, such as players banding together to bring a leader down and the looming necessity of backstabbing, and there is a particular feeling of security only possible in completely cooperative games. Some games, such as *Cosmic Encounters*, still involve trying to come out on top, but have the possibility of multiple winners, which entails yet more strategic, diplomatic and philosophical possibilities. Countless untried possibilities exist here, and my point is merely that not every game needs to be either "me versus you" or "me and you on a team."

Failure Conditions and Punishment

Equally important to the victory conditions is the consideration of how a player loses your game. In any game, it must be possible to fail in some way or else the game contains no uncertainty. Failure can exist at both a micro and macro level; in *Donkey Kong*, at the micro level you can fail to jump over a particular barrel and be forced to start the level over, and at a macro level if you run out of lives you are forced to start the game over. In *Risk*, you can lose a battle, and eventually you can be eliminated from the game.

Sometimes it isn't even clear what is and isn't a failure. You might lose an auction that you wanted to win, but it might turn out to have been to your benefited in the end, and you might never even realize it. It also isn't always clear at what point a failure has occurred. You might realize you have lost a Chess game several moves after your opponent realizes it, but several moves before the actual checkmate has been played out. You might decide to concede and call it, or you might keep playing despite the lack of uncertainty.

As we saw, some games force you to decide for yourself what the objectives are. In *The Sims* you might fail at getting your Sim that promotion you wanted and be forced to try again the next day. Or you might try and kill your Sims in a house fire but find that the abode you designed for them is insufficiently flammable. Failure, or at least the perceived possibility of failure, is a necessary element of every game. If it seems that the possibility of failure is too low, the player either won't acknowledge it as a possibility and grow bored, or feel cheated when it happens (roll anything but a 1). If it is too high, the player may feel that the situation is hopeless, and if they continually fail at something, they may give up out of frustration. Obviously the ideal difficulty will depend largely on the intended audience, but generally players are most engaged when they feel as though they have about equal chances of success and failure.

So what should happen when a player fails? Losing hit points or lives is one thing, but what happens when they lose every hit point and every life you have given them? We'll start with single-player games. In old arcade and console games, when you ran out of lives you had to start over. This can be extremely frustrating, and players of today generally wouldn't tolerate it, but its advantage is that it creates a true emotional investment in the game. A player does NOT want to die; he or she has put too much time

and effort into the game for it all to just end! It can also evoke an unparalleled feeling of satisfaction if and when the player manages to actually complete the game (though of course many arcade games in fact had no real end).

In newer games, a player can almost always restart from some point before the death: either from a checkpoint or from the last time he or she saved. However, the unfortunate tradeoff is that the nearer the point from which the player is allowed to restart, the less the player will care whether or not they die, and therefore the less emotionally invested the player will be. It seems unfortunate that most games are designed around a structure that basically introduces the tedium of replaying a section in order to increase the involvement of the player. Since being forced to replay a section over again is almost by definition not fun, it is unfortunate that it seems inexorably tied to enjoyment. Without changing the basic structure of these games, there are very few ways around this. The additional problem is that if a player is not able to save the game frequently, or at least drop out of it somehow, it will interfere with real life, and therefore will not be played as often. Players may not have hours available in one sitting to play until the next checkpoint. If players are allowed to save at any time though, they can simply load whenever things start to go bad, which will make the game less emotionally engaging. Allowing the player to abuse the "quicksave" and "quickload" function has made many gamers feel that digital games have become too easy, and that the thrill of the challenge is gone.

One way around the "real-life" problem was used in the game *The Legend of Zelda: Majora's Mask* for N64. In this game, there are points where you make a normal save, but these are far between. Interspersed throughout the game world are points where a player can make a sort of temporary save and quit playing, but when the file is loaded the save is erased and the player continues. These are basically dropout points allowing a player to live their busy lives and quit the game without too much inconvenience, but they don't allow the player to load the game when things go poorly. *Fire Emblem* for Game Boy Advance took this a step further by creating a temporary save whenever the player shut off the system, and then erasing it when they resumed play.

A potential problem with temporary saves is that players who forget that the save is automatically erased, and turn the game off without saving again, will have to start

from the last proper save, which could be very far back. Also, this might solve the problem from a convenience perspective (and easy suspension of play of one sort or another should probably become a standard feature of games), but it doesn't answer the question of what the punishment for failure ought to be. Is forcing the player to replay sections the only viable form of punishment, or are there other ways to do it? Is punishment for failure even necessary?

Some games, such as *The Sims* or *Civilization*, are designed in such a way that a player rarely if ever has to replay sections of the game due to 'death', but this still leaves the problem that players can save as often as they like and load when things go bad. A player could simply choose never to save unless they had to quit, but an unfortunate problem (that tends to occur more frequently on computers than on consoles) is that of the game crashing or freezing, thereby destroying a player's unsaved work. For example, if a player is playing a game about conquering the world and has decides to save as little as possible and never load due to a defeat, this would make the battles more exciting as a loss couldn't be replayed. But if the game suddenly crashed, and the player saved very infrequently, it could mean losing many hours of work. A player (or the game) could save frequently, and the player could simply decide not to replay any defeats, but the battles would probably be inherently less exciting if the player had saved right before them, thereby giving at least a theoretical safety-net option of going back. It also seems wrong that a player should have to hamper their playing style, and basically play sub-optimally, in order to make the game more exciting (though the game could give rewards of some sort for loading or saving less often, such as the achievements on Xbox live). Online worlds like *World of Warcraft* have the advantage that a player can drop out of the world at any time without losing their character, and because it is a persistent world, there is no concept (at least in the player's mind) of saving or loading.

One thing to say is that if the player has the option to save frequently, the game really ought to do it for them with checkpoint and/or autosaves. Otherwise the game is penalizing the player for forgetting to save and is, in essence, punishing them for forgetting they are playing a game. If immersiveness is the goal, forcing them to remember to save frequently in order to play optimally seems very counterproductive.

Also, having your game revolve around replaying sections after failure is much more forgivable in games of emergence than in games of progression. Having to sit through a twenty minute cutscene multiple times because you can't beat the boss that comes afterwards (having an option to skip previously viewed cutscenes should be a law), or replaying something that involves walking from point A to point B or solving a puzzle you have already solved, can be excruciating. If the challenge that the player has to replay is new and still challenging however, because the gameplay is emergent in some way, then they might not mind replaying it at all. Whether replaying sections is a good punishment for failure really depends on what is being replayed.

By the same token, whether something like "permadeath," wherein a killed player loses their character completely, is a good punishment will depend immensely on how and where it is used. In a tabletop role-playing game like *Dungeons & Dragons*, it tends to make the game much more tense and exciting (assuming the Game Master doesn't make it their goal to slaughter the players as quickly as possible). In a digital role-playing game like *Final Fantasy VII* however, it would be extremely frustrating to have to restart the game every time your party was killed. This is partly because Dungeons & Dragons is inherently different from Final Fantasy VII in that it is completely new every time you play. In a sense, it is a game of total emergence in that almost everything "emerges" from the Game Master's imagination (though this is a debatable use of the term), whereas Final Fantasy is mostly a progression game, and being forced to replay sections of it isn't much fun. This isn't to say that permadeath isn't something to explore in digital and even progression games, and there are certainly ways to do it without requiring the player to start over with a new character, such as having characters around them die and having the game save so that they cannot get them back. This might sound cruel, but it would make "escort missions" more interesting. Note also that in Dungeons & Dragons, the campaign does not start over when a player's character dies, they simply create a new one and join in without having to replay anything. It is also possible to make digital games in which if you die, you lose the character permanently without the option of loading a previous save, and keep going from that point with another one. For example, in the iPhone game *Dr. Awesome*, your patients are people from your contact list, which makes it all the more

personal when one of them dies on your table. More importantly, it makes you that much more involved with keeping them alive.

This brings us to multiplayer games, and particularly multiplayer competitive games, which are quite different for a specific reason: if a player loses, there is no going back. Each game against human opponents is different, and there is likely no way to save and load the game (nor would other players be too happy if you immediately loaded after they killed you). This brings back the emotional involvement stronger than ever because, if the player dies, they can't even start again from the beginning; they lost, and they will never be able to play that game again. Of course they can always challenge their opponent(s) to a rematch, but it will be a different game with a new beginning and end.

As much as players might think they want to be able to immediately try a part again, it has the potential rob the game of all of its tension and emotional engagement because there is nothing at stake even within the context of the game. This is one of the main reasons that people like to play digital games online: not because of the human interaction, but because if they screw up there's no going back, thereby making the game and skillful playing seem worthwhile. Microsoft calls its online service "Xbox LIVE." This is a very apt term, because it is exactly this aspect that makes online gaming inherently more exciting. People might enjoy the challenge they get from facing off against human opponents, but the main difference is that they are 'live,' and any mistakes they make are permanent (and they might never have the chance to face-off against that opponent again). When designing offline experiences, we ought to try and capture some of this drama and excitement by creating penalties that are permanent, but which don't involve replaying sections, and we need to make save and dropout systems more automatic without players having to treat them as a sort of metagame. The penalties should be in the context of the game, not outside the game in the form of wasted time.

In the end, punishment is a double-edged sword. Except in special circumstances, players don't actually enjoy being punished, yet games cannot exist without some sort of punishment. Uncertainty requires the perceived possibility of failure, and failure is defined by something bad happening, even if it is extremely minor. Sometimes it is

possible to obscure what exactly the punishment for failure is and make the player think that it is worse, or more probable, than it actually is. For example, if some checkpoints aren't made explicit to the player, they might be fooled into believing that the last checkpoint is farther back than it actually is. But this sort of trickery will usually only last for a while as gamers are quick to learn a game's formal structure. Design your punishments and difficulty curve according to the experience you want to create and the audience you are trying to cater to, and keep in mind that a player tends to leave happier and with a better impression of the game if they finish it before they get bored or frustrated and quit, so set your tension level accordingly.

There is also another type of gameplay that we haven't touched on very much: the puzzle. Since the objective for a puzzle is simply to discover the solution, there may not be a need for any formal setback mechanism. When you try the puzzle piece and it does not fit, you may not lose a life or get sent back to the start, but at a personal level you have still failed, and the punishment is in the form of time and frustration which should ultimately make the correct solution more satisfying (assuming the puzzle is suitably well designed).

Despite the fact that the perceived possibility of failure is a necessary element of every game, it is not a necessary element of everything a player does in the game. Ideally, everything a player does should be interesting in some way, but this interest can be introduced in many ways. Fun is a difficult thing to nail down, but the constant looming shadow of defeat isn't always a necessary ingredient, and if a game is too easy to fail at, the player may not feel enough at ease to explore the gamespace as much as they might otherwise like. Having a potential for failure simply means that the consequences of a player's actions are uncertain at some level and that the player will not accomplish exactly what they intended with 100% certainty, but fun itself can be introduced through a variety of means. As we said in Section 1, uncertainty is a necessary element of games, but uncertainty alone does not guarantee quality.

- Section 5 -

The Role of Chance

Most games contain elements of chance, from the wheel in Roulette and the dice in *Settlers of Catan*, to the random encounters in a Japanese RPG. But what exactly is chance? Are there some kinds of chance that are more "random" than others? In this section, we will look at some examples of randomness in games, and, perhaps more importantly to us, we will look at how players tend to perceive it.

Experiential Randomness

Most "serious" or "hardcore" gamers tend to dismiss chance as being undesirable or childish. Indeed Go is often touted as being the ultimate strategy game for its complete lack of randomness (ignoring the possible flip for start-player). But is Go a good game because it is not random? Most would say that Checkers is a decidedly shallower game than Go (Checkers has been "solved" by computers), but it has no more randomness than Go. *Puerto Rico*, touted by BoardGameGeek.com for seven consecutive years as the greatest boardgame of all time, has more randomness in it than Checkers (the order of the plantations is random), yet most would agree that there is a lot more strategic depth to it than Checkers. Clearly there isn't a direct correlation between randomness and strategy.

And yet there seems to be some sort of correlation. In the card game "War," two players take turns drawing and playing the top card from their deck of cards, and the higher value takes both. There is no strategy or even choice in this game; it is completely random. Alternatively, each turn both players could look through their deck, choose a card and place it face down in front of them, and then flip up both players' choices simultaneously. In this variant version, both players have complete control, yet the game still feels completely random. Is there chance in this game? Is there strategy?

We will attempt to address all of these questions here, but the first thing to note is that the level of randomness and chaos a player perceives to be in a game is probably more important to the designer than the actual amount of randomness. The players are, after all, the ones who will be playing it. But why would players misperceive the amount of chance in a game? *Rules of Play* gives an example with the abstract game Chinese Checkers:

> When four, five, or six players play this game, it can feel quite random. As the game unfolds and players move their pieces, the center of the board becomes crowded with a seemingly random arrangement of pieces. This is true even though every single move on the board is the result of a player making a strategic choice about where to play next. If you closed your eyes and opened them only when it was your turn, it might seem like the board is merely reshuffling itself, particularly in the middle of the game. Perfectly logical players (who only exist in hypothetical examples) wouldn't feel any randomness: they could look at the board and immediately trace every move back to a series of strategic decisions.

So is Chinese Checkers random or not? The answer is thus: The formal gameplay of Chinese Checkers contains no elements of chaos, but the experiential gameplay of Chinese Checkers contains a noticeably high degree of chaos, particularly with more players.

This is true of many games: as the number of players increases, the experience of randomness also increases. This is particularly true with head-to-head games and games where the game itself is not working against players in some way. If we imagine all of the decisions and actions in a game as a pie and each player takes a piece of that pie, if there are more players in the game each will be given a smaller piece, and they will be able to exert less control over the game as a whole, thus the game will feel more chaotic to them. This effect will generally be more prominent in games where players' strategies hinge largely on the actions of others, as opposed to games in which every player is basically doing their own thing (see "multiplayer solitaire").

A game that feels "chaotic" is one that is difficult to predict and control. However, as with Chinese Checkers, a game can feel chaotic, random and unpredictable without actually possessing any formal randomness. So in our variant of the card game War where both players select their card simultaneously, the game possesses no formal randomness, but the experiential gameplay is highly random. The only skill is the skill of reading one's opponent, because the optimal play on each turn is to play the card that is one higher than that which an opponent plays, while throwing away twos on opponent's aces (assuming that aces are high), and unless you are a telepath, gameplay will be highly chaotic.

That said, there is certainly some skill in reading an opponent and anticipating, and this can be made more interesting if the options are differentiated somehow. For example, the psychology of Rock-Paper-Scissors suddenly becomes much more complex if you have to give me a dollar every time I win using rock.

Introducing Randomness

So assuming perceived randomness is the important part, how much randomness should be perceived? And if there is too much or too little, what can be done to a game's formal structure to alter this? Unfortunately there is no simple answer. As always, the relationship between experiential gameplay and a game's formal structure is murky and unpredictable. However, there are a few general principles that can be discussed.

Introducing random value generators such as dice and cards will almost certainly make a game more random. Traditional boardgames often use dice as a mechanic, but it is slowly being phased out in favor of more deterministic alternatives. Cards are generally somewhat more predictable than dice depending on how they are utilized, since there is always going to be a finite number of each physical card. Here are a few common methods for utilizing cards in games:

-A card is drawn from a deck, resolved, and discarded. This is the method most commonly used for game "events" such as perhaps a thunderstorm or a stock market

crash. This is less random than rolling dice because a player can learn what the distribution of the deck is and remember which cards have already come up. Another similar method is to put used cards at the bottom of the deck instead of discarding them, which means that they will then occur in a repeating order. This can be made more random by having a card in the deck that forces you to shuffle it. A shuffling card can also be added to a deck with a discard. Either way, a card that tells the players to shuffle the deck means that some cards may appear with more frequency than others, and some cards may never be drawn.

-A card is drawn from a deck, resolved, and then shuffled back into the deck. This is every bit as random as throwing a die. If you had a deck of six cards with the numbers 1 to 6 on them, and drew one and then shuffled it back into the deck, this would be formally identical to rolling a six-sided die.

-Players draw cards from a deck, and then play and discard them when they choose. This is less random than the methods above, but it is still quite chaotic. What cards a player gets are random, and though they can decide when to play them, they may find themselves with a hand of cards they cannot use effectively. This can be mitigated by designing cards to be as balanced as possible, and having each card serve multiple purposes, so that it is difficult or impossible to be stuck with a "bad hand." This system of using cards has the feature of the first example wherein players can remember what cards have been played and make choices based on that as well as what cards are in their hand, as long as they have some idea of the initial distribution of the deck.

-Players add cards to their hands from a face-up selection, and then play and discard them when they choose (examples include *Ticket to Ride* and *Thurn & Taxis*). A player will likely feel more in control than in the previous example, but they are still at the whim of fate when it comes to what cards are available when it gets to their turn. If the cards are not balanced, it will seem unfair when a good card comes up just before an opponent's turn, though this can be mitigated in various ways (In *Ticket to Ride*, the Locomotives are the best cards, but if you take one, you are only allowed that one card instead of the usual

two. In this game, players are also allowed to draw blindly from the deck and hope to get lucky if they don't like the selection of cards).

-Players start with a predetermined hand of cards. Obviously the chaos inherent in this method will depend, among other things, on whether players are allowed to acquire new cards somehow, or whether they are limited to these initial resources for the whole game. In some cases, players will discard a card when it is played (and perhaps take back the whole set when they run out). In other utilizations, players are always able to choose from the whole set, and the cards are merely used as a form of secret action rather than resources (because they are never lost or spent, or even acquired).

There are an infinite number of ways to use cards in games, and this list is by no means intended to be exhaustive, but this should give some impression that simply saying a game uses cards says very little about the level of randomness in it. "Cards" are a type of material useful for game designers, but they are not a single fundamental element of game design. Depending on how they are employed, they can serve as resources, markers, powerups, MacGuffins, secret-selection mechanisms, some or all of the above, or any number of other things.

Cards are versatile, but then dice too need not merely be rolled for a random value, they can be used to count and keep score, be used as markers, and probably many other things which have never been tried. The amount of randomness dice add will depend on how they are employed as well. Contrary to common sense, if more dice are rolled in a game, the game tends to be *less* random. If you roll one six-sided die, you have an equal change of getting anything from one to six. If you roll two six-sided dice, you can now get anything from two to twelve, but you are much more likely to get something close to seven. If a game has you rolling hundreds of dice, the results will be vastly more predictable than if you roll one die once for a single result. Keep in mind, however, that how much randomness the dice are adding to a game won't depend so much on how many or how you are rolling them, but more on what exactly you are rolling them for.

So unfortunately it is impossible to measure a game's randomness level by so simple a method as whether or not it uses dice or cards. In general, cards add less randomness to a game if players have more information about them and more ability to control them. Face-down cards feel less random than face-up cards, and more choices about acquiring, using, and getting rid of cards make them feel much less random. Of course, the more choice you present to the player, the more balancing you will have to do to make sure they don't always pick the same choice.

There are obviously many other kinds of random value generators used in games, but they tend to function surprisingly like either dice or cards. Random value generators in digital games, for our purposes, are basically dice being rolled by the computer. Tiles placed in games such as Carcassonne could easily be changed to (ideally square) cards with no alteration to formal gameplay. Indeed basically every random value generator conforms to one of these two basic types: a random value with no strings attached (like dice), or something more complex with some random or unpredictable elements to its behavior (like cards).

Varying Randomness

So what does it actually mean to say a game is more or less random? When players say a game is very random, what they really mean is not that there are a lot of chance-based mechanisms in the game, but that the overall outcome of the game (who wins and who loses) is determined largely by chance and not by skill. "The game is very random" means "the outcome of the game is very random." If a game had a mechanic whereby you roll one six-sided die, and on a 4-6 you win the game, the inclusion of this mechanic will make the outcome of the game much more random than if you are rolling for something less important like going first, or collecting a resource. A random resolution for battles adds more "randomness" to the game if the penalty for losing is significantly worse than the reward for succeeding, whereas if it is fairly unimportant to the outcome of the game whether you win or lose the battle, the randomness of the resolution mechanic has less effect on the overall randomness of the game. Basically, the more

impact a particular mechanic has on the outcome of the game, the more it matters how random that mechanic is.

In *Settlers of Catan*, every time a player rolls a seven, they get to use the thief to steal a resource from another player. If this rule were changed slightly to state that the player can steal *all* of the resources of a player, rolling a seven would be much more pivotal, and the game would be more about rolling sevens and less about skill. Without adding any new random elements, and by only changing a single word in the rules, we have made *Settlers of Catan* much more chaotic, not by making a mechanic more random, but by making a random mechanic a more important part of the overall game. This should demonstrate, if nothing else, what a subtle art game design is.

Now that we have a slightly better grasp on what randomness is, and some of the ways in which the quantity of randomness in a game can be altered, how much randomness should a game have? The formal study of game design unfortunately cannot offer any real answer to this, it's all about the sort of game you are trying to make and what the players happen to want. There are, however, a couple of things to be said.

More randomness means more uncertainty, and uncertainty is a crucial element of games. But more randomness also tends to make the outcome of the game based less on skill, which will bother some (but not all) players. Adding more randomness to a game does not in and of itself remove the skill-based elements that were already in the game, it just makes them a smaller part of the overall game (though it may introduce opportunities to exercise adaptation and chance-management skills).

Imagine a game of Chess where if a player achieves a checkmate, they then roll a six-sided die, and on a 3-6 they win, but on a 1-2 they lose and the opponent wins. The outcome of the game is now highly random, but none of the strategy of the game of Chess has actually been removed. The more competitive and focused on winning a player is, the more this change is likely to bother them, but if they only want to play for the mental and social aspects of the game, it logically shouldn't bother them at all.

Now imagine another variant where both players roll a six-sided die at the start of the match and, depending on the result, remove some type of piece from their side (1-2

remove both rooks, 3 remove both knights, 4 remove both bishops, 5-6 remove the queen). It could be that the outcome of the game will depend on whether they have a particular combination of pieces, which might make this variant just as random as the previous one, but it will probably bother most people less. Besides the fact that it alters the strategic dimensions of the game in interesting ways, it more importantly broadcasts the outcome and ramifications of the random mechanic, and then allows players to deal with it. This is an important aspect of random mechanics in games: if they happen before a player acts rather than after, the player feels that they are dealing with unexpected situations rather than putting their fortunes in the hands of fate. Many people tend to prefer this, as it feels as though they have more control. On the flip side, if important random factors are revealed earlier in the game, it reduces the uncertainty of the overall outcome, which is generally bad since uncertainty about the game's outcome is always a necessary ingredient. The later the random factor's outcome is revealed, the less room for strategizing there will be, but also the more uncertain and tense the outcome will be, so there usually has to be some sacrifice.

Not only does adding random elements not necessarily remove skill from a game, it can potentially add to the skill required of players. An understanding of odds and probability will help players win in most games with chance-based elements. In a card game, a good memory is also usually an asset (though many gamers frown upon memory tests being used overtly in games, and most casinos downright disallow "card counting").

Although making a game more random doesn't in and of itself destroy any of the skill-based elements built into the game (and may in fact add new ones), it does make them less important to the outcome of the game. In a game with no randomness, a superior player should be able to win virtually every time, but if there is randomness, a worse player will sometimes win by "being lucky," and if the ratio of skill to chance is low enough, a superior player might only win 50.001% of the time (assuming it is a two-player game). It also gives the loser a convenient, though possibly bogus, excuse ("He got lucky!"). This is where you must consider your audience. If the game is to be played by competitive and serious gamers, it should probably be less random than if it is meant for families, where eight-year-old Billy should occasionally be able to beat his older

sister. What sort of game you want to make should tell you what sort of ratio of randomness to skill you are aiming for.

All this being said, a lower degree if randomness tends to be the mark of a better game. A game needs a certain degree of uncertainty to be a game at all, and it is much easier to introduce this uncertainty through randomness than by carefully constructing a system which creates uncertainty through its emergent complexity. Poorly designed games often try to achieve uncertainty through random elements and lots of rules, whereas better designs are able to achieve uncertainty through a few elegant rules alone, thereby allowing skill and not chance to be the primary determinant. In a good game, randomness can also open up new possibilities for exercising different kinds of skills. One could say that randomness is often correlated to or a symptom of bad design, but not necessarily the cause of it.

Let's try, as a thought experiment, creating a simple game from the ground up. The game won't be any fun, but we won't worry about that for now. The game is called Red-or-Green. We'll say that on a turn, a player chooses either the color red, or the color green. The first player to pick the color green immediately wins.

So far there is no randomness in this game, but already there is a problem. The game is so simple and shallow that it is immediately obvious that whoever goes first will win by picking green, and so far the rules are incomplete by not stating who goes first. We'll say the tallest player goes first. Assuming there are no squabbles with the measurements, we'll quickly have our starting player, and then he'll pick green and win. What fun.

The game is in some sense functional: it can be played to completion and there are no obvious loopholes in the rules. It also has no randomness whatsoever. But it also has no strategy, unless one counts "being taller" as a strategy. More importantly, the game has no uncertainty: it is completely obvious who will win before the game even begins, and it is completely obvious *how* they will win (by picking green). So let's try changing the start condition. Now the starting player will be determined by a six-sided die, with the player who rolls the highest going first (and ties being re-rolled).

The game now has some uncertainty and perhaps even some replayability (it isn't the same every time). It still isn't very fun, but it's more of a game now. But now, instead of having no randomness, the game is completely random. The game is so basic and devoid of skill that adding a single random element has made the whole game completely chaotic. In general, it tends to be that adding a particular mechanic will change a game more if there were fewer mechanics to begin with. Red-or-Green has two mechanics, the selection of the start player, and the choice on a player's turn of the titular red or green. The latter isn't much of a "mechanic" because it is completely shallow and really adds nothing to the game, good or bad.

Now let's say that a digital games studio with too much money has decided to pick up Red-or-Green due to its immense potential with the dull-youth market. They deem the dice mechanic to be too random and eschew it in favor of a simple reflex test: the first player to hit a button after the buzzer sounds goes first. The game is back to having no formal randomness, but it now involves something completely new… skill! The game is still probably not much fun, but it has gone from being a completely random game with no skill, to a game of pure skill with no randomness.

This is an example of why designing digital games is so much easier than designing good non-digital games. Digital games make it much easier to have a baseline of skill in a game and make it at all interesting to play by allowing the designer to easily utilize players' "twitch" skills. Non-digital games tend to use random determinants like dice and cards in place of these twitch skills, which removes an element of skill and adds an element of chance. (For example, to kill an enemy in a digital game might require precise aim, whereas in a boardgame it might require a high roll.) Non-digital-game designers will be forced to learn to go that extra step to design games that require skill, but it's worth the effort and the lessons one learns will largely carry over to making better digital games that require more than just twitch skills.

To be complete, a couple of things should be noted about the example above. Firstly, unless the buzzer's timing is somehow broadcast to the players, there will technically be randomness as to when the buzzer will sound. If the buzzer always sounds exactly five seconds after the game is turned on, then the game may involve time-estimation as well

as reflexes. Secondly, though reflex and dexterity tests are much more common in digital games, they certainly do appear in non-digital games (i.e. Crokinole, Jenga, Attribute, virtually all sports).

Another thing to note about random value generators is that random mechanics tend to increase replayability, and they can often be incorporated before the game even starts. In *Settlers of Catan*, the layout of the island is randomly determined, but this is before any players have placed anything on the map or even determined starting player, so it shouldn't affect anyone's individual chances of winning.

The boardgame *In The Year Of The Dragon* forces players to deal with 10 disastrous events. The order these events occur in are randomly determined each game but they are public to all players from the start, so the players are all on equal footing and must find the best way of dealing with the disasters based on their order and the actions of the other players. If the disasters were randomized but not shown to the players until they were resolved, the game would be highly random as players would have no idea when to prepare for what, and being an experienced player would matter much less.

These are examples of how random value generators can be used in a game's setup to make each game a fresher experience yet add no randomness to the game whatsoever (unless a particular setup happened to make going first a bigger advantage/disadvantage or something along these lines).

Probabilistic Fallacies

To finish off this section, I will touch on a couple of things that do not really fall under the rubric of game design. First of all, many people have brought up the issue that rolling a die or randomly generating a number (or shuffling a deck) cannot be entirely random. The result is dependent upon how the die is thrown, or what equation the computer starts with. While this is technically true, it is more a philosophical question than a game design one. A game's formal system is a perfect mathematical system, and in this system there is no such thing as a poorly rolled die or a badly shuffled deck unless this is somehow supposed to be part of the gameplay. By the same token, a card could become damaged

and players might recognize it in the deck, or an online FPS might freeze suddenly, but these are faults of the physical games, and not the formal ones. It is not that these issues should not be dealt with, perhaps even by the designer, but they are not part of formal game design.

The other thing that must be said is that, at least as far as a game designer is concerned, there is no such thing as luck. Gambler's fallacy is the idea that if a player has had a run of "bad luck," their luck is bound to eventually improve. The truth is that any random results in the past have no bearing on the random results of the present or future. If I roll two six-sided dice, I am likely to get something close to seven because there are more ways of rolling a seven with two dice then there are of rolling, say, a three. If however I've already rolled one die and gotten a two, the second die is *not* more likely to be a five to make the total seven. It has the same odds as if I hadn't rolled the first die. The first die will affect the total (I can't get higher than eight now), but not the odds of the second die. Many people, even gamers, tend to believe in these sorts of things, or that good-luck charms or rituals will help them. Believing in luck in some sort of spiritual or karmic way is fine, but it has no bearing on game design. In a game's formal system, it is impossible to get lucky or provoke karmic retribution, and if a player somehow wins by wearing magic lucky socks, well, they were cheating.

- Section 6 -

Testing Properly

"Design" is a tricky and somewhat misleading word. Most definitions of it have to do with formulating plans and conceiving ideas. This is a somewhat minor part of game design because almost no game concepts survive the first playtest. Games are complex systems. They are meant to be too complex for people to fully understand, particularly if they are to involve meaningful choices and not just skill tests. Therefore it is perhaps understandable that even the designer will be very bad at envisioning how their game, their carefully constructed formal system, will actually play. Sure the designer might have very detailed and well-thought-out gameplay in mind, and if they are good the game may eventually achieve this ideal, but the first time playing the game will probably seem like a disaster to the uninitiated. That is because game design is not about design in a preparative sense but in an ongoing sense, seeing the game through each stage of testing and gradually and skillfully molding it to our vision. The term "iterative design" has been used to describe this process.

Despite the repetitive nature of the iterative design process, there are discernable stages of testing that a game goes through, though precisely where one stage ends and another begins isn't always gong to be clear, and going back to a previous stage of testing will often be necessary if the game is to reach its true potential. Digital game studios use a variety of naming conventions, saying stuff like "alpha" and "beta" testing, and undoubtedly different designers will have different standards about when a game has moved its next stage. None of this is particularly crucial, but it helps if the designer is using an appropriate testing method at any given point in a game's development. Also note that we are talking about testing to improve gameplay rather than to find bugs in code, though the two will sometimes intersect if some mistake in the code is making the game less fun. It is important to understand that a game can be polished and bug-free, and still be no fun.

One of the big advantages of non-digital games is that they can be play tested with a crude prototype mere hours or even minutes after their conception, and the game's formal system can be completely evident. Using physical prototypes to test out ideas in digital games is recently becoming more popular, and I fully endorse this, but the problem is that if there are any real-time aspects to the gameplay, or if the formal gameplay in any way depends on the subtleties and capabilities of a computer, the physical prototype the developers will be testing will not be the same formal game that they are eventually hoping to produce. Obviously the experiential gameplay of any crudely constructed prototype will be quite different from that of a polished final product with a nice presentation, but with a non-digital game, the *formal* gameplay can usually be made to be identical to that of the theoretical final product, and if the game made out of scraps of paper is fun and works, you know you have something.

All this talk of a theoretical final product is a bit misleading though because the first playtested version is likely to be very unlike anything that ever hits shelves. This is less true if the game uses a lot of tried-and-true gameplay mechanics and conventions from other games; if something already works, you might only have to tweak it a bit so that it fits with the rest of the game, and then voilà. But this is perhaps the main reason that the videogames industry is scared of new ideas, not because they might not find a market, but that they might not be any fun without years of playtesting and reimplementation, something most digital game studios simply don't have the luxury of. But whereas implementing a change might take days or weeks for a digital game, for a non-digital game it often takes minutes or seconds, and the designer can quickly move on to testing it.

Solo Testing

The first stage of testing a game is "solo testing," the act of playing a game on ones own just to test out the core mechanics. If it is a multiplayer turn-based game, the designer should simply play every part at this stage, and if it is a multiplayer real-time game or a game in which it is impossible or unfeasible to play multiple players, the designer should simply do as best a job as they can at this point. (This is not to say that a designer cannot

recruit handy developers to help out if they wish, but at this stage the game is likely to crash and burn, so involve others at your own risk.) You don't need to play anything resembling a complete game at this stage, in fact trying to test individual mechanics or sections on their own before trying to combine them is usually the way to go. The purposes of a solo test are to see whether the basic activities that the player will be performing seem interesting, and to see whether there are glaring loopholes in the game's rules. It may surprise you how often there will be some gaping omission in your game's rules, and almost nothing ever plays the way it did in your head. Don't worry too much about whether the game is fun or interesting until you at least get it to the point of being functional.

The first problem you may encounter when you test a game for the first time is that the flow of play is not at all what you had in mind. Maybe you are trying to remake *Pong* and the ball is traveling much too fast to deflect, or maybe you are designing a board game and you realize that tasks which you thought would be quick and easy are in fact cumbersome and non-intuitive (see: fiddly). This might carry with it a severe lack of game balance; it might be impossible to perform basic game actions, or perhaps the game is a cakewalk. The game might even be fully "functional" at this point despite its gameplay flaws.

The second class of problem you will likely run up against are those which reveal some gaping hole in the game's rules, either written or programmed. There will be situations that are not covered sufficiently, or are covered in a way you did not intend. The game's elements probably don't interact with one another the way you thought they would at this point, and it's time to reevaluate things.

Changes

There are two basic types of solutions to game design problems: "numerical changes" involve simply tweaking variables, and "structural changes" involve changing the game's structure. An actual gap in the rules usually requires a structural change (or else a numerical change that somehow prevents that situation from ever arising), but other than that there aren't really any general guidelines for which type of change you should utilize

to address a problem, just understand that these are the only two tools you have in your toolbox as a designer; you can change numbers, or you can change rules.

By rules, I mean the written rules, the programmed rules (if it is a digital game), the implicit rules (such as, players are allowed to talk to one another unless otherwise stated), and anything else dictating the use of game elements such as the text on the cards. By changing variables, I mean things like altering the quantity of a type of card in a deck, changing the amount of damage an attack deals, or altering speed at which an object falls, or even something like altering how many points a player requires to win the game. Numerical changes might involve changing numbers right in the rulebook or in the code, but they usually shouldn't require any more than this.

A particular problem can almost always be dealt with using either approach, but a good designer develops an intuition or a style for which route to take. In my experience, it tends to be best to try variable changes first and see if a problem can be corrected or eliminated in this way, and then move on to structural changes if this fails or somehow unbalances another part of the game. Structural changes will often but not always change the game more than variable changes, and it is often hard to find a structural solution that doesn't involve making the rules more complex, which you want to avoid if possible, particularly in non-digital games where the players need to learn those rules. Develop your own style but understand that these two types of changes are ultimately the only things you can do to change formal gameplay.

One thing that has been noted by prolific designer Reiner Knizia is that it is often easier to solve two problems that one because while there may be an infinite number of poor solutions to one problem, there is often one good solution that solves two problems at once. I have very often found this to be true. It is good to keep perspective on the entire game and keep track of everything you are trying to achieve so that you can make smart changes that don't just address one problem and create or exacerbate others.

Testing with Other People

Once your game "works' and you can get through a complete playthrough, you may be ready to move on to multiplayer testing. If your game is single player, this means you

watching other people play it, and asking them what they thought of it. If it is a multiplayer game, you can and probably should take part in some of the games, but you should also have a lot of games where you simply sit back and observe others playing it, preferably influencing things as little as possible. This hands-off approach is less important while you're just trying to get your game up and running, but once it is functional and you are trying to iron out the wrinkles or discover degenerate strategies, it is important to find out how people play your game when you are not involved.

It is also important to test out your game with as many different people as possible. It may not be necessary to test with people that absolutely don't play or enjoy the type of game you've designed, but a diverse set of opinions and criticisms can be extremely valuable if used properly, and you might end up being surprised who actually enjoys your game. Keep in mind, however, that the players generally won't understand the game's formal system as well as you do, depending on your level of experience, and so criticisms and comments at an experiential level are often more valuable than suggestions on actual structural changes. Let players describe what they like and don't like about the game, decide for yourself what direction you want to take it in, and then think about ways in which you might change the game's formal structure. Often brainstorming possible changes with the players can be useful to get the creative juices flowing, but just remember that it's your game and that you understand it more fully than anyone else, and ultimately everything should be your decision. That aside, humility is one of the most vital qualities in a designer, and if players have an issue with some aspect of your game, you need to listen and start out assuming that there are problems with the game that need to be addressed. Don't hesitate to remove a mechanic no matter how clever it is; it might be the most brilliant and innovative mechanic in the world, but if it doesn't improve this game, maybe you should save it for the next one.

If the game is multiplayer and allows for different numbers of players, you also want to make sure that you test it sufficiently with every number. Gameplay can be radically different with different numbers of players, and sometimes the game can be flat-out broken with particular numbers, so you need to be sure to test each sufficiently and possibly make tweaks to the game to accommodate specific numbers. If, for example, 3-

players is troublesome, you might be able to make tweaks to the game that don't particularly affect other complements of players, or you might have to make specific rules about playing with 3-players. Large numbers of players tend to have the problem of being overly chaotic, and they will involve more downtime if it is a turn-based game. Conversely, a small complement of players often has he problem of being too simplistic or otherwise uninteresting, either because the player interaction is less complex or varied, or because the mechanics themselves are too easy to grasp with less going on. We'll talk about all of this in greater detail in the section on common design problems.

One of the advantages of playing with many different types of players is that you will hopefully see many different strategies being tried, and you'll find that some players are particularly good at breaking games. These people are valuable; seek them out. You yourself should also try out many different strategies to see if they are viable and if they break the game. If some particular strategy seems fun but isn't particularly viable, or is very good but no fun to employ, consider tweaking the game's balance so that the player is encouraged to do the things which are most enjoyable, and discouraged from doing things which are repetitive or boring. Also, the strategies which are harder to employ should generally pay off a bit more to encourage players to explore the depths of the game rather than simply stick with what's easy and works. When it comes down to it, people are lazy, and though they are playing because they want to have fun, they will also try to win at all costs and as easily as possible, even if this leads them to employing strategies which are no fun. People also tend to feel safer with what is familiar, and may hesitate to fully explore the gamespace unless you give them reason to do so.

Incentives and Disincentives

One way to think about all this is in terms of incentives and disincentives. If the player is supposed to do certain things, there should be incentives for doing them, and they should outweigh the disincentives. Incentives and disincentives can be implicit or explicit. In *Risk*, players are explicitly encouraged to attack because they are awarded a card only if

they can capture a territory, but they are implicitly discouraged because combat tends to favor the defender (who wins ties).

Explicit and implicit incentives are both viable design mechanisms, but they both have upsides and downsides. If an incentive is made explicit, such as a specific reward for doing things, then players are more likely to grasp that they are supposed to do this and less prone to play poorly without realizing it and then complain that the game is bad or unbalanced. On the other hand, explicit incentives tend to add more rules complexity, and while a player can have the pleasure of discovering an elegant implicit incentive hidden in the game's structure, explicit incentives are generally presented to the player right from the start. The same can be said for explicit or implicit disincentives.

Incentives and disincentives also apply when you don't want players to do certain things. If there are degenerate strategies that involve a player always choosing a particular action which seem as or more viable than more difficult and fun to employ strategies, you can address this by discouraging the strategy in some way (perhaps raising the cost of the action or introducing some sort of penalty or restriction), and you can also look at trying to make other strategies better (perhaps by giving an endgame bonus for diversification, or by increasing rewards from things not encompassed by the strategy you are trying to eliminate).

When we are speaking of incentives and disincentives, we are mostly talking about game balance, but the reality is that a game can be perfectly balanced, as well as requiring skill to play, and yet still be no fun at all. Fun is an ephemeral thing that cannot be derived mathematically. If you are able to construct a balanced mathematical system with depth and strategy, it has the potential to be fun, but this is not all of game design. We must also try to envision some sort of gameplay which we think would be fun, and then try to construct a system that will carry our vision to the world. Some of the aspects of the game which we hope will be fun may be imagined before we begin designing, and some will likely be encountered or imagined after we already have something designed. Different stages of the design will have not only different problems, but also different advantages and aspects that are fun or interesting, and when we make changes, one of our goals should be to retain as many of those good aspects as possible. Sometimes we create

mechanics with particular positive aspects in mind, and sometimes those positive aspects reveal themselves to us after the fact, and we simply to retain or accentuate them.

The key is to always hold on to a vision of what the final game should be. This vision should change as we learn new things about our game, but it is crucial that we have this vision, because often we will be at a stage where our vision is the only thing fun or compelling about the game, and we need something to refer to. All design decisions should be made, not with an aim to fix a single problem, but rather with our vision of the final product in mind.

Historical accuracy can often pose problems for a game's balance. One side or the other was usually at a noticeable advantage, so special victory conditions (do better than historically) are often required, or else simply tweaking the game to be somewhat inaccurate but balanced. It is also often a big problem in historical simulations that the course of action one party took was strategically non-optimal, yet players expect the game to follow a historical course. For example, Germany carrying out a large air campaign against Britain was, for a number of reasons, rather unwise, so if a WWII game is going to consistently feature a Battle of Britain, various things will need to be skewed. Often the choice must be made between accuracy and gameplay, yet the designer should always examine the game to try and figure out why things aren't playing out the way they really did; the flawed leadership and increased complexity of the real world won't account for every case in which the historical strategies and the game's optimal strategies don't match up, and often it is because the designer simply has a somewhat faulty understanding. Simplicity does not necessitate inaccuracy.

In general, balance problems tend to be most easily solved with numerical changes, whereas more fundamental problems, like the game not being fun, tend to require structural changes. This is certainly not universally true. Also, it is risky to make more than one change between games, as the results can compound and obscure what each change accomplished by itself, and you can waste time thinking that one change was unsuccessful when in fact it just didn't work in conjunction with a different change. As you gain more experience though, you'll begin to learn what to expect certain changes

will do, and you won't need to heed the "one change per session" rule, particularly if the changes are relatively minor. Note that you also don't have to finish a game session before making a change, particularly during solo-testing. Often it becomes obvious early on that something isn't working, and there's no need wasting everybody's time (including your own) pretending that it is.

So how will you know when playtesting on a game is finished? Well, it's never really finished. Unless the game is perfect, there is always potential for improvement or changes, and no game is ever perfect for everyone. At some point, though, you'll feel the game is polished and "ready for prime time," whether in your case that means submitting it to a publisher, self-publishing it, or releasing it. The indicator is that as you progress further and further through playtesting, there tend to be fewer and fewer alterations being made or suggested. Early on you'll be making changes after almost every game, but as you continue, the changes will get more and more infrequent, until finally you are able to play it many times with many different people without any further issues surfacing.

Of course, if the game technically "works" but is no fun at this point, you might be forced to go back to the drawing board and reevaluate the project. Big studios are always hesitant to try new ideas with Triple-A titles because if it gets to this stage at the end of the development cycle, and everything works but the game isn't fun, going back to the drawing board is probably not going to be an option. This is why playtesting early and often is key.

- Section 7 -

Common Design Problems

This section is devoted to various problems and issues that you may encounter. Sadly, the list is hardly exhaustive, and you'll undoubtedly run into all sorts of strange issues during your time as a designer which aren't properly covered here, but hopefully this section will at least help prepare you and get you thinking like a game designer.

Repetitive Gameplay

A game can feel repetitive even if there is a plethora of things to do, either because the activities themselves are too similar, or because the game is unbalanced such that only a small subset of strategies are optimal. Most players won't be particularly inclined to explore new approaches to the game if they don't feel that they have to, and if they are doing fine just mashing the A-button or just building air units, they are more likely to simply dismiss the game out of boredom rather than trying anything different. One misconception is that repetition arises from a lack of options for the player, but as we discussed in the section on skill and choice, a choice is only meaningful if it has multiple viable options, so just presenting the player with a bunch of options is pointless if one of the choices is clearly the best or at least good enough.

A game can be fresh and interesting even with very few options if the factors that go into making the choice are varied. For example, many people devote their lives to Poker even though the only choice being made is whether to fold or to raise some amount. This is because to make that choice, they are many things to consider such as how likely it is that the remaining opponents are bluffing, and how likely it is that you have a winning hand. By contrast, if you're playing a fighting game or space shooter or role-playing-game with one attack that works well in every situation, it doesn't matter if there are 500 other attacks to choose from once the player figures out that they never need to choose anything else.

A game can also feel repetitive if it stops challenging the player. Figuring out that I need to pull away the enemy's shield to attack it might be fresh and challenging the first time, but making me repeat this operation dozens or hundreds of times loses its appeal unless I need to figure out how to do it in different situations or contexts. The game needs to be designed so that it continually throws new situations at me that I need to figure out how to overcome, or it will likely grow stale.

One way to approach the problems of repetition in your game is to think about it in terms of its central choice (discussed earlier). Rather than just having the player complete challenges by mastering a skill, force them to balance different tactics. For example, instead of having them just try to mash the attack button as fast as possible or in a particular rhythm, or having them master using combinations of buttons, force them to find a balance between attacking and blocking, or force them to decide when to use powerful, slow attacks rather than fast ones. This sort of approach requires more finesse because it means that the player needs to be presented with varied situations and challenges, rather than just challenges with increasing difficulty.

By challenge, I don't necessarily mean a whole level or battle. A single configuration of a battlefield might be a challenge in which the player needs to decide how best to proceed, and keeping the game fresh might not even require designing varied levels, but simply designing an underlying system that is elegant enough to produce exciting new challenges without any further modification. For example, Chess can provide countless varied gamestates with different challenges without the players needing to set up the board differently every time, whereas many action games become dull even with varied and elaborate level designs simply because the mechanics boil down to "press 'A' when the enemy is next to you."

With games that are meant to be played many times through, such as most boardgames, one can talk about repetition at both a micro and macro level. Micro-repetitiveness is the kind we usually talk about in videogames where the basic actions that the player is performing start to feel repetitive. Macro-repetitiveness is when the game as a whole starts to feel repetitive from session to session. For example, in *Axis & Allies*, the board is always set up in the same configuration to try and reflect the actual strategic picture in

1942. The disadvantage of this is that it means that the strategies each country tends to employ is less varied than if the setup were randomized in some way every time. This is an issue for every game that attempts to simulate a specific situation. There are many historical wargames which would not stand the test of many playthroughs because an optimal strategy would become evident after only a couple of sessions, due to the lack of variation between games. Some sort of randomization can greatly alleviate this, either in the initial setup, or in mechanics involving things like decks of cards. Dice are random, and they will make a game more variable, but the problem is that the odds of rolling a particular number on a particular set of dice will always be the same, whereas the odds will generally be more varied and less straightforward if there are cards involved, or something else that uses hidden information and varied distribution such as a bag of tiles or chits.

With strategy games played at a high level, a common problem is that a payer can feel obliged to follow a particular strategy for the duration based on the choices they made early on; it's going to be difficult for me to produce flying units or corn if all of my infrastructure is geared towards footmen or tobacco. Though in general it is good to offer the player as much flexibility as possible, the key thing is that, if it is difficult for a player to shift gears mid or late-game, the course they are on must still present interesting and unforeseen challenges at a lower level, even if the overarching strategy becomes clear. And most importantly, *a strategy should not be viable if it is not fun*. If a boring strategy is viable, then the game isn't balanced.

Turtling

In conflict games where players control armies, a common tendency is to hold back in a corner of the board amassing forces and waiting for your opponents to weaken each other. This is referred to as turtling, and if every player adopts this strategy, the game can potentially be very dull, or at least have very little combat. Often these games will culminate in huge final battles possibly without any battle beforehand. Real-time-strategy games are prone to fall prey to this to some degree.

One thing to consider is that there are many multiplayer conflict games, while in real-life there are virtually always only two sides in a war, which reduces the spirit of "let's you and him fight." The casualty percentages in real warfare also tend to be far lower than in most games, making battles less costly. Another factor is that in real warfare, it is usually in someone's best interest to initiate a battle *now* rather than at some indeterminate time in the future. Napoleon, for example, wanted to conquer Europe as quickly as possible before they could mobilize proper defenses, and it wouldn't have helped him to sit back and train more soldiers, or the ones he had would have grow old and retired. War also tends to weigh heavily on a country's economy, and it is in everyone's best interest that the conflict be ended as quickly and at as small a scale as possible. Conversely, in many games there is no particular reason for anyone to try and end the game quickly. One of the rare examples of turtling in real-world military history is the cold war, where Russia and the U.S. sat back and stockpiled armaments, and this "conflict" didn't even have a battle at the end (not that I am complaining). The cold war is an interesting event in world history, but it wasn't a war in the regular sense, and "war" games should not inadvertently resemble it.

As usual, the way to stop players from doing things you don't want them to do is to alter the relevant incentives and disincentives. You could have rewards of some sort for attacking, or reduce the costliness of an unsuccessful attack, or make it impossible or impractical to stockpile units (perhaps by having a low limit on the maximum number of units you can field, maybe proportional somehow to the territory you control. Or maybe by requiring players to pay wages to their entire army every so often.). There are countless possible approaches, but I will give some specific examples.

-In the boardgame *A Game of Thrones*, the casualties are low, and if an attack succeeds, the attacker generally does not take any casualties. Couple this with the fact that when a "muster" event card is drawn, each city gives its controller new units, and there is a high incentive to go out and capture territory. There is in fact no way to get new units other than when a muster comes up. A player also does not need all of their opponents to be

dead in order to win, they just have to capture a set number of cities, so if a player does not try to capture territory, someone else will and win.

-In the real-time strategy game *Warcraft 3*, each player can recruit one or more heroes, and these heroes gain experience from battle and become more powerful, gaining new abilities. Heroes are very powerful units and tend to have a huge effect on the game. If you sit back and simply build units, and don't at least make your hero battle some of the neutral monsters that inhabit the map, you will almost certainly lose when your opponent attacks you with an army led by a level 10 wizard who proceeds to rain death and destruction down on your forces. Another smart choice is that you can generally gain experience much faster by fighting against other players' armies rather than against random monsters, so in a multiplayer match, if one player sits back while the other players go at it, their heroes will likely be at a lower level than the defenders' when they do decide to attack. Another mechanic is a unit cap that most players are likely to run up against, which makes amassing forces past a certain point explicitly impossible, as well as an ongoing upkeep tax imposed on players with large armies. If there was no unit limit and a player could just keep pumping out units indefinitely, then sitting back and letting your opponents fight would give you a long-run, rather than just short-run, numerical advantage, and turtling might be a viable strategy, even with the heroes. But with the upkeep tax and the unit limit, holding back with a large army is just an ongoing waste of gold, which is a finite resource.

-In the turn-based strategy game *Worms: Armageddon*, the deadly water slowly begins to rise after the clock runs out, and players are forced to battle for the high ground as the level becomes more and more cramped.

Some games, such as *Twilight Imperium*, may be intentionally designed to allow for turtling. There is nothing inherently wrong with it as long as there is still enough going on that the game is still interesting. It all depends on how you want your game to play. If there are supposed to be lots of battles and you want plays to have to constantly weigh

when to be aggressive and when to hold back, yet the optimal strategy almost always seems to be defense, then it means the game is unbalanced.

Predictable Outcome

As we've said, uncertainty is a key element of games at both a micro and macro level. Sometimes a game can have enough uncertainty at smaller scales to be fun and engaging for some of the duration, yet it becomes obvious before the end who is going to win. A game should always build to some sort of interesting climax, yet this is ruined if the winner is broadcast before the end. Just as bad is the situation where, although you may not know who specifically will win, you are certain that it will not be you. If a player is obviously going to win, and there is no way to catch them, this is referred to as "runaway leader" syndrome. In multiplayer gaming, there isn't really a term for a player who is guaranteed to lose, but in one-player adventure games, if it becomes physically impossible for the player to win, this is referred to as "dead-man-walking," and the term can easily be utilized here as well; if we are playing a game and I fall so far behind that I clearly have no hope of winning, the game has succumbed to "dead-man-walking" syndrome. It has lost its uncertainty (at least as far as that player is concerned), and this is bad. Sometimes the player will be completely out of the picture, but often they will still exert some influence on the game, and may potentially decide the winner, either inadvertently or deliberately. This is referred to as "kingmaking," and though it worked on *Survivor*, it is usually something to be avoided. It does add the dimension that if I make everyone else angry with me, they may end up giving the game to someone else.

An advantage of player elimination is that it means the losing player will be out of the game completely, not only allowing them to do other things with their time, but also preventing them from deciding the game's outcome. (Under this definition, the TV show *Survivor* does not have real player elimination, the players' roles in the game merely change, and they become explicitly unable to win. They also don't participate until the endgame, at which point they convene to vote for the winner. Though they aren't actively involved, they are still, in some sense, part of the game.)

An easy way to increase uncertainty about who is in the lead or who is behind is simply to make the victory points private. If I can't see your score pile, then depending on the game, you could be beating me by a lot and I might be blissfully unaware. There is a limit to this, of course, and one disadvantage is that certain dimensions of strategy and drama may be removed if we cannot see each others' scores. It is sometimes possible to have only one part of the scores hidden, or have the scores merely obscured in some way. (By score, I mean a player's progress towards victory, and not necessarily literal "points.")

Ideally though, you want a game to actually be close and exciting until the end. To keep a game tight, there can be balancing mechanisms in place which helps or hinders players in some way, such as the blue shells in *Mario Kart* (which target the player in 1st place) or the advantageous move order for the player with the least power plants in *Power Grid*. Allowing players to hinder each other in any way in a multiplayer game will usually have some balancing effect as players cooperate to bring down a leader. If it is too easy to affect other players though, the game might start to feel like a popularity contest, or succumb to kingmaking. Overt or excessive balancing mechanics can seem unfair, and superior players may feel cheated out of victory. On the other hand, a more level playing field may allow players of varying skill levels to have fun. As always, it depends on what sort of experience you are trying to create.

Another approach is to have the game escalate so that it doesn't matter if a player is winning by a lot early on because the inflation of the scores will dilute this. Games should have some sense of escalation, even if it is merely generated by the approaching end, but if the inflation is too large, it can make the early game seem pointless.

It is also important to understand the difference between a game being easy to learn and being beginner-friendly. Go has rules which could be taught to a first-grader, yet a beginner won't stand a chance against someone of even moderate experience (remember that complexity and depth are two different things), and the game itself does little to hinder the leader (which is why Go is often played with a handicap).

To summarize, three basic ways of keeping the winner uncertain are hiding or obscuring the players' positions, utilizing balancing mechanisms to help out players who are losing

and to keep the leaders in check, and having the game escalate so that more happens near the end. By themselves, each of these approaches can feel contrived if utilized poorly, but when they are used well or used in concert, a game can generate a tense drama until the very end.

Excessive Downtime

For most games to be fun, the players need to feel involved for as much of its duration as possible. This can be a hurdle for turn-based games because of their very nature. There needs to be enough for the players to do when they are not actively playing to tide them over between turns or actions. This can be accomplished either though the game's strategic depth (it takes until my turn to figure out what I'll do), or by having other players' turns simply be entertaining to watch for whatever reason (possibly out of schadenfreude). It is generally easier to extend someone's interest over many short periods rather than fewer long ones, so many modern boardgames try to mix up the turns so that the active player alternates more frequently than in traditional games like *Risk*. On your turn in *Puerto Rico*, for example, you select a role (builder, captain, etc.) and then every player in clockwise order takes the selected action. Every "turn" is split into mini-turns, and everyone gets one, so it's never very long before you are active again even though it's only for a short time.

If turns are too far between and the strategy for the game is not complex or subtle enough, players can be bored waiting for their turn to come around. Another possibility is that a game's strategy is sufficiently complex, but the game is dynamic enough and your turns hinge on other players so much that making any plans until every other player has gone is futile. This can then slow down the pace of the game as each player decides what to do on their turn, which then makes the time between turns even longer. This can sometimes be improved by changing the order that things happen in; for example, drawing cards at the end of your turn rather than at the beginning means that you can decide how to use the new cards while other players are going, and you won't be presented with as much new information to process at the start of your turn. If turns can be cut down either by allowing the players to do less on a turn, or by intermingling the

turns in some way like in *Puerto Rico* or *Tower of Babel*, then the time between a player's turns or actions might be the perfect amount for them to decide what they will do next, regardless of the game's strategic depth.

Of course, there is a limit to how short a player's turn can be. The game will likely be lengthened by some degree due to the "friction time" it takes for players to start and end their turns, and it can be frustrating to do too little on a turn. There are also more possible combinations of more actions, so it may be more interesting to decide how to spend three actions than one; it might be obvious which one action is the best, but there may be many interesting tactics than can be enacted with three. But if the player is doing too much on a turn, it may take too long for them to decide what combination to choose, which then exacerbates the downtime even further. If a player does too much on a turn, this also means that the gamestate will change more between a player's turns, which likely means more information to process at the start of your turn, which means a yet-longer turn, etc. etc. Ideally there is a balance which maximizes strategic possibility and control, but minimizes downtime and "analysis paralysis."

There are also often important things that can be made public to the players before it is their turn so that they can incorporate them into their strategic picture. For example, in *Ticket to Ride* there are face-up cards that are always public, and on a turn a player can take one or two of them into their hand as an action. If a player simply drew five cards at the start of their turn, they would likely take longer to decide what to do because they would be getting presented with completely new information. It might work if the player drew and selected from five cards after their turn ended though (although this would make the game less interactive since players wouldn't be taking from the same pot). In *Thurn & Taxis*, there is a selection of face-up cards to choose from, but they get wiped and replaced every so often, which some players have found frustrating because it makes between-turn planning more difficult.

Elimination Boredom

Another cause of downtime is player elimination, wherein the player is out of the game and must wait until it ends (or leave and do other things). Player elimination is greatly

frowned upon by most modern boardgamers, particularly those who play Eurogames. *Monopoly* and *Risk* are two prime examples of elimination implemented very badly. The games take a very long time to play, and a player can be eliminated well before the end, which means lots of waiting around. If a game is to feature elimination, the waiting time should be as short as possible. Many card games feature player elimination, and it is less of an issue because the games themselves are shorter.

If a game's only end condition is that all but one player are eliminated, there are two basic ways that the game can be set up: The game can be built around positive feedback loops to help whoever takes the lead quickly eliminate the competition and put everyone else out of their misery, or the game can be built around negative feedback loops that work to keep the game tight and balanced. Since tight and balanced is usually more fun than a big blowout, most gamers will prefer the latter method, in which case there should be other mechanics in place to insure that the game will eventually come to a close, such as finite or unreplenishable resources of some sort. In truth, most multiplayer elimination games (and most multiplayer games in general) have both types of mechanics in place, some working to help those who are doing well, and some working to hinder them. For example, players who are doing well in *Risk* will be getting more armies a turn, but this is counteracted by the alliances that tend to form against them, which usually causes the game to last significantly longer than it would otherwise.

But the victory conditions need not be that the winner is the last one standing. In many versions of Three Player Chess, the objective is to checkmate an opponent. This wins you the game even though the other opponent is still standing, so the game is immediately over after a player is "eliminated." *Monopoly* tends to drag because every player must be eliminated one by one until there is only one remaining, but what if another goal were to amass some amount of money, regardless of who was eliminated? As it is, *Monopoly* is designed so that money constantly flows out of the game via various events (property tax), and rarely flows back in (beauty contest). This brings the game towards the inevitable state of penultimate elimination. But if it were designed so that there was more and more money in the game, it could potentially build towards some other goal (such as

having 3000 dollars) without anyone needing to be eliminated. With these rules, elimination would be unnecessary (and should probably be removed altogether), but is there a way to fix the game such that it retains player elimination as a mechanic without long downtime?

To give *Monopoly* a more structured flow of play with a more defined endgame, there could be something like a chance card or the nth pass by "Go" which triggered a change in the rules such that money began flowing out of the game at a much higher rate. Perhaps every player must pay a high tax every turn, or maybe the rents on all monopolies are doubled. The idea would be that players would be eliminated soon after this event started and not before, so the waiting period between elimination and the game's end would be much shorter. The basic rules do this to a certain extent by allowing players to build hotels on monopolies and create squares that can more effectively take other players out than in the early game, but this is only in terms of each player's overall strength and progress, and not really in terms of the overall progress of the game. More and more spots will get houses and monopolies, but then these will have to be torn down to eliminate the player who owns them, making the board less potent once again. If selling houses to the bank meant that they remained on the space, but that a player who landed on the space had to pay the extra money to the bank, this might give the game a more defined progression and a steadier buildup, and it might make the eliminations more close together. (Of course I am not suggesting that you try playing *Monopoly* with any of these variants, there are much better games out there…)

Another approach is to try to keep the eliminated players involved in the game in some way, either because they have some stake in the outcome, or because they are actually still playing in some way (though I would argue that this doesn't really qualify as elimination). In the cooperative boardgame *The Lord of the Rings*, a player can still win after being eliminated if the team wins, so they will be rooting for the other players and, more importantly, offering strategic advice. They aren't really playing because they aren't doing any more than a random bystander could, but their presence will affect the game. *Counter Strike* allows eliminated players to watch the rest of the match with a free cam, but they cannot chat with any of the players still in the game, and therefore cannot

affect it directly, though perhaps the knowledge that they are being watched could still affect those who are still playing in some way; it's not always clear when someone has left or entered the magic circle.

A few games give some new role to the eliminated players. In *Survivor*, contestants who are voted off the island later in the game form a jury which decides the ultimate winner. In the boardgame *Mall of Horror*, eliminated players place a zombie every round to attack the players who are still alive. A nice side-effect in *Mall of Horror* is that the extra zombie precipitates the game's end so that, as players are eliminated, it creates a positive feedback loop to expeditiously bring the game to a close and reduce elimination boredom. A player is eliminated when all of their characters are killed, so players will tend to gang up against those with many remaining characters rather than targeting the players close to elimination, which keeps the game tight but also means that players likely won't be eliminated until near the end. In both of these games, the eliminated players take on relatively minor roles. An extra zombie here or there won't affect all that much, and though the *Survivor* jury decides the final winner, they are basically out of the game. The eliminated players also cannot win at this point, and are therefore playing in pursuit of whatever goals they have set themselves. If the eliminated players had more power, such as being able to place ten zombies, this combined with their lack of defined direction would ruin the game, and the outcome would be at their whim. It would be the worst kind of kingmaking, being crowned by someone who isn't even playing and has no stake in the game.

But what if these players did have goals, and what if they still had a prominent role in the game after their "elimination?" In some versions of dodge ball, a player who is hit with a ball immediately joins the other team. The problem with playing this way with serious players is that everyone always ends up on the winning team at the end, so in some sense there is insufficient uncertainty because everyone is always going to win in the end, and loyalty or emotional attachment to either team is counterproductive since you will likely have to switch teams at least once. The only serious challenge or emotional attachment then comes down to an individual level. Each player attempts to do their best, and perhaps tries to upstage the other players on both teams. As it stands, this form of dodge ball is a casual game, but if individual players were scored for how many

players they converted while on either team, then the game could potentially be played in a more serious setting, with a single player crowned the winner.

Alternatively, you could take a traditional elimination game with teams, such as the version of dodge ball where players have to take a seat when they are hit, and say that not only do eliminated players still win if their team wins, but also that they aren't totally "eliminated" and can help out their team in some way such as passing balls to them which go out-of-bounds. This not only keeps the players involved, but it also keeps the game closer because as a team starts to lose players, they have more and more help in getting ammunition and are consequently more capable of evening the score.

As we've seen, there are many ways that games can feature elimination without it meaning a player has to sit out for a long time being bored. Elimination can be only pseudo-elimination with the player still taking part somehow, or it can happen only near the end so that the time between elimination and the game's conclusion is brief. Elimination has gained a bad rap lately, but it does have some notable advantages. Firstly, it potentially removes the dead-man-walking issue of a lagging player by making that player *actually* dead, which consequently reduces the potential for kingmaking. Secondly, as we talked about in Section 4, a game becomes more exciting if the penalty for failure is higher. Counter-Strike is very tense largely because dying means that you'll have to sit out until the next round. On the other hand, waiting for six hours for a game of *Risk* to finish can be intolerable. Player elimination isn't necessarily a game flaw, but should you decide to utilize it in some way, do so with great care.

Improper Difficulty

One of the main reasons that games have been predominantly multiplayer-competitive for most of recorded history is that the difficulty can be scaled simply by finding a new opponent. Single-player games don't have this luxury available to them, and so the need to strike the proper balance between frustrating difficulty and tedious ease that changes as the player gains familiarity with the game. The problem is that the ideal and preferred

range is going to be different for every player. A number of solutions have been invented to deal with this inherent problem, and I will cover them one-by-one.

Many games address the problem by simply letting the player choose their own difficulty. This is fine, but if the player is only allowed to choose once at the beginning of the game, they won't know which difficulty is right for them, and they may have to start again from the beginning after they discover that they have chosen wrong. Additionally, the difficulty slope might be such that with the game on for example "hard," the parts are fun and engaging, but the more challenging later parts are virtually impossible, forcing the player to start over on a different difficulty. The difficulty slope may be aimed at novice players who will need the early game to be far easier than the late game so that they can learn the ropes, while more experienced players might have preferred a subtler increase. If a player is allowed to change the difficulty at any point, they could lower the difficulty to get past a particularly challenging section, but this might feel like cheating and leave the player ultimately unsatisfied with the experience; finishing the game on "hard" doesn't mean much if you did 99% of it on "easy." The best system I have seen was used in *Aliens vs. Predator*, in which the player can select the difficulty before each mission, but may not select a difficulty for a mission unless they have completed the previous mission on at least as high a difficulty. You could thus tone down the difficulty when the game got too difficult and play through till the end, but in order to complete the later levels on hard you would need to go back and replay the one you had gotten stuck on to unlock the hard difficulty for the next mission, and so on. Note that after every mission the game allows you to go back and replay completed missions; if this were not the case, then scaling the difficulty back would be permanent until the end of the game, which could be frustrating if the game later became too easy. Cooperative (or solitaire) boardgames have an advantage that difficulty can always be scaled, and games are usually short enough that improper difficulty can easily be remedied between games.

More and more developers are attempting an auto-scaling difficulty system that attempts to ramp things up when this are becoming dull, and back off when things get too difficult for the players. A recent example is *Left 4 Dead*, a computer game where a team of four

players attempt to fight their way through a zombie-infested city. The game constantly evaluates how well the players are doing, and uses these calculations to decide whether to throw larger hordes at them, or lay off and let them reload and catch their breath. Of course, the scaling here is limited, and survival is by no means a guarantee. Tabletop role-playing games have been using this method for a long time, with a game master (GM, DM) perennially scaling challenges to keep things exciting but not hopeless. The downside to this approach is that a player who succeeds may feel as though the game (or GM) held their hand the whole way through.

Traditional arcade games generally have the interesting characteristic that, rather than a player either winning or losing, they keep playing and try to get as far as they can before inevitably dying. The advantage is that every player will eventually reach the point where they are being challenged. The downside is, assuming a lack of a save feature or difficulty selection, this likely means a lot of time spent playing at an unchallenging difficulty to get to this point, unless you are new to the game and don't have practice with similar ones. Most arcade games also lack the satisfaction of eventually completing the game, which may leave the player with a disfavorable impression.

Setting a game's difficulty is like writing a story: you can't please everyone. The best you can do is gear the game towards your target audience, and find ways to accommodate those you aren't targeting. It's hard to estimate (or underestimate) a player, though, and this is one more reason that playtesting is critical. Secret areas in digital games are usually fun to find, but not when the player is desperately trying to locate the door to the next part of the level.

An additional complication is that on the one hand, players should feel like they are being rewarded for playing your game properly, but on the other hand, players will ultimately enjoy the game more if it is close and suspenseful right till the end. Whether to reward or hinder players who are doing well is always a difficult balance, in both multiplayer and single-player games. It is somewhat ironic that the players who will find all the secret items that beef up their characters in a digital role-playing or action-adventure game will

typically be the players who need it the least, whereas the less-skilled players will potentially be making poor choices that will cause things to become even more difficult for themselves down the road. Like everything else, it's a delicate balancing act.

Laborious to Play

Sometimes a game is simply difficult to play somehow. It could be that the game is initially hard to get into due to complex rules or unusual mechanics, or it could be that the game is confusing or taxing even after the player has become familiar with it. Boardgames that are hard to play due to reasons other than the game's formal difficulty are in some cases referred to as "fiddly." This term is used when the mundane tasks of managing and updating the game's pieces are mentally or physically difficult. Maybe the game uses too many cards or tokens, or uses them in ambiguous or confusing ways. An elegant game is not one which simply looks good on paper or has very few rules, but one which is also intuitive and straightforward to run so that the players can focus instead on the gameplay and strategy. This often means somehow lowering the total number of game components, but more than this it is important to watch how players are trying to play your game, and then changing the game to accommodate this; if players keep accidentally doing particular things differently than the way you intended, perhaps you can find a way to change the game to allow this instead.

A fiddly game can annoy players and slow the game down, but it can also mean that they will make mistakes and change or wreck the game. If the players need to do something every round such as update the round marker, and they forget to do so, this can potentially cause lots of problems. A good way to avoid this is to make such tasks either unavoidable or unnecessary. Maybe instead of a round marker, the deck of cards somehow serves as a game clock, since players are drawing from it anyway. Or maybe there is something else during that phase that reminds players to do the update. Perhaps the round track indicates how many resources are placed on each particular round, and when the players consult the table each round, they are thus reminded to move the round marker to the next slot. Sometimes it is possible to make the action completely unnecessary; in *Puerto Rico*, the players are supposed to refill the colonist ship according

to a specific formula when a player chooses to be the Mayor, but if everyone forgets, then the ship is refilled to the minimum number instead (whenever anyone remembers or when new colonists are needed). Sometimes the game can simply be designed so that hard-to-remember rules are optional. Maybe every player has a bunch of things they *can* do, but if they don't notice then they simply fail to take advantage if the ability, and no rules are broken; problems tend to arise when a player forgets a rule and thereby gains an advantage, since there will be little incentive for them to remember it the next time. In general, players tend to be better at remembering to do things which are beneficial to them.

Digital games with clumsy interfaces could also be called fiddly, and as with the physical pieces of a boardgame, they should be designed as intuitively as possible. Ideally your UI or control scheme should be a pleasure to use in and of itself, and the actual gameplay should simply be the icing on the cake. A good game can salvage a poor interface, but a smooth-as-butter interface can make a good game great.

Sometimes the game isn't fiddly, it's just mentally taxing to the point of not being fun. Figuring out strategies and making decisions is fun, but not if it necessitates excessive counting or mathematical calculation. In general, doing basic math isn't fun, and players may become irritated having to constantly add up the number of certain pieces on the board or calculate their purchasing power in order to play optimally. Sometimes there is simply too much information available, and players who try to absorb all the information end up slowing the game down. This is known as "analysis paralysis." A player prone to this may spend a very long time to take their turn because they are trying to work out the game's decision tree, and this can be particularly frustrating in a game with traditional turns. If the game changes a lot every turn, it may encourage players to not bother planning so far ahead, but it can also exacerbate the problem since each player will then have to reevaluate the gamestate at the beginning of their own turn the more that they are unable to do so during other player's turn; I can plan my turn during your turn, but if what you do on your turn completely changes the situation, then I may have to start planning all over on my turn. Sometimes turns order can be done so that players are deciding and then carrying out their plans at the same time with some sort of

simultaneous turns, which has the potential to greatly reduce game length and downtime (as was discussed in "excessive downtime").

One way to address analysis paralysis is to reduce the amount of information available to players. This can also prevent players from doing dull calculations, but it can also make the game more random if there is unknown information. Ideally a piece of information should be public if it allows players to make smart strategic choices, but not if it forces them to make uninteresting calculation. An example is most card games, where the decision trees would be too open if all hands were played publicly, slowing the game down and reducing the surprise elements. Thus a player can only see the cards in their own hands and what has been played, and must infer what the capabilities of the other players may be. This makes the game likely to play faster, and shifts the primary skills required from information processing to educated guesswork, but on the other hand there may be too little information available to make interesting decisions. The amount of information you have available should reflect what your target audience is, and what sorts of skills you want your game to call upon.

Too Chaotic

Less available information means less ability to plan ahead, which may speed up turns, but at the cost of strategy. Often, though, the lack of information is the only thing making the game playable. Uncertainty is a key element of games, and many games simply aren't experientially complex enough to be uncertain without randomness and hidden information. Casino Blackjack is a fairly random game, but if all the cards were made public, then the choices would become obvious (and thus wouldn't be choices), and the game would lose all uncertainty. It is difficult to create a game that has no hidden information or randomness but can't be easily solved. Tic-Tac-Toe is an obvious example of a game that is too simplistic for its level of randomness; between good players, the game always ends in a tie. If a player had to roll a die to see whether they could take their turn, it wouldn't improve the game much, but it would make it uncertain.

Many games are like this. Without the obscuring random factors, the game's decision tree would become too transparent, and the game would degenerate into analysis

and predictability. In order to make a game less chaotic, it is often necessary to make it more complex as well. This does not mean that the rules need to become more complex, but they need to be changed in some way so that their interactions create more complexity, allowing you to safely scale back the random factors. This is much easier said than done, and there isn't really a recipe for how to design a simple system that creates complexity. The key is that the rules and game elements must interact in many subtle and non-obvious ways. Go is perhaps the ultimate example of this, as the rules are dead simple, but nearly every rule and every placed stone have vast ramifications.

A downside is the steep learning curve for new players. A first-timer has roughly zero chance of defeating even a Go veteran, let alone a master. If there were random elements, they likely wouldn't decrease the strategy, but they would decrease the impact that strategy has on the game by some degree. In a game between a master and a beginner, a more random version of Go would be more uncertain, but might also feel unfair. If you can design a game that contains a sufficient amount of complexity without any randomness, then the amount of randomness you decide to include should reflect your target audience and intended gaming experience. It's good when a game can slowly reveal more and more strategic depth as players improve, but still allows them to form basic strategies and have fun at a lower level.

Being chaotic basically means that the players cannot see very far into the future for whatever reason, and cannot see much of the decision tree. In Section 5 we looked at how Chinese Checkers is fairly chaotic, yet possesses no formal randomness. This is primarily due to the high number of allowed players. Played as a two-player game, Chinese Checkers is much less chaotic, and players can plan ahead much more effectively (though the game isn't necessarily more fun). It is almost always the case that, when a game is played with a higher number of players, it becomes more chaotic, and this is also proportional to how much interaction there is between players. Most games have an ideal range of players. If there are too few players, the game will be too simplistic or uninteresting, and if there are too many players, the game will be too chaotic.

This is true for digital games as well. Consider the fighting game *Super Smash Bros. Melee*. The game is designed for four players to play at once in a giant battle, and

this is how it is played casually, but in tournaments there are usually only two combatants, because this way the outcome is more likely to be decided by skill, rather than by chaos or by kingmaking. The game is also usually made less random in tournaments by turning off items and wacky stages.

More chaos means that less of the decision tree can be accurately predicted, and so less long-term planning is possible. This is often referred to as the dichotomy of "tactics" versus "strategy," where a game with little long-term planning is more tactical, and a game that allows more long-term planning is more strategic. For example, tactics in Chess involve what piece to move and how to set up moves for the next turn or two, whereas strategy involves considering board position and the overall layout of the pieces, and how this might lead to a checkmate many turns down the road. A puzzle is a bit like a game with only one turn, and what sets games apart from puzzles is that whether you have found the correct solution to one puzzle or turn often isn't clear even after the fact, but whatever solution you choose will continue to affect every puzzle down the road. If a game has too much chaos and not enough strategy, it may begin to feel less like a game and more like a crossword puzzle.

As more and more games are designed, designers are able to build on each others' ideas and constantly increase our ever-expanding repertoire of solutions to these problems and others. Hopefully this section has at least helped to clarify some of the problems you will face as a designer; may you find many new and elegant solutions to each of them.

- Section 8 -

What are Games?

In this section, I will not attempt to answer what exactly the definition of "games" is. This question has been tackled numerous times already (see Bernard Suites, Jesper Juul, Johan Huizinga, Roger Caillois, and others), and though it can be an interesting and revealing thought experiment, I am dubious of its ultimate importance to game design since I hope that by testing the boundaries we can continually force the definitions to be reevaluated. Rather, I wish to explore some of the other aspects and issues surrounding games which I do not see as falling strictly under the rubric of formal game design yet I feel are important in understanding games as a whole.

Back in section 1, we talked about some of the differences between digital and non-digital games, and I briefly stated my firm belief that the fundamental principles of design that we have covered apply to all types of games. Some might challenge this assertion, so let's explore it further. It is obvious to any bystander that there are visible differences between digital and non-digital games, yet I assert that these visible differences are primarily at an experiential level, and that things like music, theme, and how the game is controlled have relatively little to do with actual formal gameplay. Sometimes what is tedious accounting in a non-digital game might be random fun in a computer game, and an elegant layout and a hand of cards in a board game can look like a cluttered accounting sheet with important information hidden off-screen in a digital game; to be sure, there are significant differences between *Super Mario Bros.* and Backgammon. But are there not also significant differences between Backgammon and Crazy Eights, or between *Super Mario Bros.* and *Age of Empires II?* The fact is that there are many different sorts of games, and various design methodologies will apply better to some than to others, but to split games into digital and non-digital is just as arbitrary a distinction as to split them into multiplayer and single-player, or zero-sum and non-zero-sum, or with an average playing time of less or more than an hour. Every type of game

will have different hindrances and advantages, and "digital or non-digital" is just one classification.

Part of the problem comes from the fact that most videogames are wildly more costly and time-consuming to produce than boardgames or role-playing games are, and obviously the elements that go into their creation will reflect this difference. However, these elements are primarily related to the production and development of said games. The design process is likely going to be different as well, but it shouldn't have to be. The underlying formal structures of games across all media are, while certainly not identical, comparable enough that most of the same methodologies will apply. But due to bigger budgetary and time constraints, videogames are not always designed the way that they should be. Going back to the drawing board or making major changes to a game's basic structure usually isn't an option with a ship date looming, and even if there's no firm schedule set, the costs associated with videogame production are liable to sink a company if they can't get something, anything, out the door. And we generally underestimate the value of good gameplay, too. We tend to focus instead on graphics and such because we can see these right away, and I challenge anyone to show me a picture of a good gameplay mechanic. Yet the gameplay is what keeps the player engaged and coming back for more, and it should ultimately be put first. In the words of the great Shigeru Myamoto, "a delayed game is eventually good, but a bad game is bad forever."

To further explain what I am trying to say, I use the analogy of a story. The production of a movie or a TV show is vastly different from that of a book, yet constructing a compelling story, irrespective of use-of-language or special effects, is going to be quite similar across all media. It is true that there are many things that will work well in books and not so well in film, but there are also many things that will work well in a romance and not so well in a horror story. Excessive soliloquies might break up the flow of an action flick, but so might a knife-wielding maniac in *The Sound of Music*.

Obviously the game designer is the storybuilder in this analogy, and you may say to your self "sure, but they have a storywriter for games, and he's not the designer." However, my second contention is that although writing a good, rather than a hackneyed,

plot for a game is an important job, much of the game's narrative is in fact created by the designer.

Narrative and Gameplay

Imagine you are making a first-person shooter, and you decide you want to have a level where the normal gun-wielding enemies are replaced with zombies. What needs to be done? Maybe you'll have the mission briefing at the start of the level tell the player they will be facing zombies, and you'll have the artist create zombie skins and the animator to create zombie animations so that they look suitably undead and terrifying. Maybe you'll even get the sound guy to come up with some creepy zombie moans, and you'll have the other NPCs shriek "Aah, zombies!" at appropriate intervals. This is all well and good, but in order to truly bring across the idea of zombies, the formal gameplay will need to be altered as well.

Zombies traditionally shamble, so we'll set their movement speed down. They also get up close and personal to attack with their bare hands and mouths, so we'll replace their ranged firearm attacks with unarmed melee attacks. There are usually hordes of zombies as well, so we'll have more enemies in the level, and give them all more hit points to reflect zombies' relentlessness. Zombies are also brainless (which is possibly why they want yours), so maybe the enemies no longer try to take cover or attempt coordinated flanking maneuvers, and instead just wander straight towards you. And zombies should be scary, so they should be positioned in spots most likely to surprise or corner the player. If you made only these formal changes, and maybe threw in some groans and creepy music, you'd likely have much more convincing zombies than if you only changed the enemies to look and sound like zombies and didn't tweak the underlying variables. A game's formal structure is a crucial part of its portrayed narrative.

The same thing holds true for a game's overall story. A "story" is a series of events, and what events a player experiences in a game will be largely dictated by the gameplay. The story in a game doesn't start and end at each cutscene, it is the entire series of events a

player experiences before they reach the end. However, the tone of in-game events tends to differ from those told in cutscenes or backstory in two ways. Firstly, the actual actions the player is performing and the things they are encountering tend to become fairly repetitive even if the gameplay is deep. Go is possibly the deepest game ever created, yet all the player is doing is placing and occasionally removing stones. Secondly, the events that transpire in cutscenes or backstory tend to be more explicitly narrated. If a character is killed in the "storyline," there will be some dialogue or text to this effect, yet you don't hear a word whenever Mario plummets to his doom. This relates to the previous point; because the events that happen in-game tend to be fairly repetitive, any narration on these events would likely also become repetitive unless they were especially clever (such as the comments when the player dies in *Prince of Persia: The Sands of Time*) or there was a large variety. Narrative tends to lose its meaning through repetition, so having Mario continually die, or having a narrator say "Mario plummeted to his death" every time, makes it feel less like it's part of the story. The illogical plurality of Mario's deaths also contributes to their lack of narrative relevance. *Half-Real* describes this illogicality in terms of "incoherent worlds":

> The fictional world of *Donkey Kong* is only very superficially described, but it is possible to imagine a world in which Mario's girlfriend is kidnapped by an evil gorilla and has to be rescued. This is repeated on levels 1 and 2. On level 3, Donkey Kong kidnaps Mario's girlfriend again and apparently returns to the original hideout. It is harder to understand why Mario has three lives: Being hit by a barrel, by a fireball, or by an anvil should reasonably be fatal. Furthermore, the player is rewarded with an extra Mario at 10,000 points. This is not a question of [the fictional world] being incomplete, but a question of the fictional world being *incoherent* or unimaginable. While, technically, any world *can* be imagined, and we could explain Mario's reappearance by appealing to magic or reincarnation, the point here is that nothing in *Donkey Kong* suggests a world where people magically come back to life after dying. In an informal survey of *Donkey Kong* players, all players explained the three lives away by appealing *to the rules of the game:* With only one life, the game would be too hard.

For these reasons, there is often a sort of divide between gameplay and story. As a player becomes familiar with a game's formal structure, they will begin to ignore the things that are not relevant to it, and this may include the game's story. Developers thus try to make the story more gripping or extensive to keep players focused on it, but if players are ultimately going to be focusing on the gameplay, then in order to tell them a good story it has to be done largely in the context of the gameplay. The divide between story and gameplay can be narrowed by trying to change some of the above factors: if completely new things are periodically being presented to the player, this gives them more narrative significance than if the player is simply doing the same things over and over; if the game gives literal and varied feedback to the players actions, such as having a character exclaim at the large amount of ammo in a room, this also gives in-game events narrative significance; and if the events during gameplay make sense in the context of the fictional world, such as a bullet being very lethal, this also goes a long way towards connecting the gameplay to the narrative. A game's story is a lot more than what is presented in a cutscene or on the back of the box.

There is much talk about making games more "cinematic," and Hideo Kojima has demonstrated the extent to which this can be achieved through cutscenes with his *Metal Gear Solid* series. But emergent gameplay can be cinematic as well. Making gameplay more cinematic requires envisioning what sorts of things you want the players to do and think, and what sorts of situations you want them to face, and then setting up the formal system so that this is likely to happen, and formal game design is at the core of this. The trick part is that with gameplay, you are in some sense crafting a story that is supposed to be interesting no matter what the protagonist does. Graphics and plot can only take you so far.

Players are good at ignoring things that aren't relevant to a game's formal structure. This is because we humans are good at selectively ignoring information that is not relevant to the task at hand. If a part of experiential gameplay isn't closely tied to the game's formal structure, either through causation (I did *this*, so he said *that*), or through correlation (that happened to me and to my character in the story), it has a tendency to become background noise. This ability to strip a game down to its formal structure is not all bad;

people enjoy games at many different levels as they play them, and they might pass between different narrative and strategic levels many times in a single game; but if there is a lack of unity between a game's fictional world and its structure, it may disengage the player from the theme and narrative, and cause them to experience it as more of an abstract game.

Violence in Games

Recently, the thorny issue of videogame violence has become a hot-button issue. As with comic books in the 1950s, videogames are seen by some as corrupting the nation's youth. Obviously the issue of violence in the media is very complex, but *Raph Koster* illuminates why many gamers find the accusations ridiculous:

> Back in 1976, a company called Exidy scored a first in videogame history: its game *Deathrace* was taken off the market because of public concerns about the game's violent nature. *Deathrace* was loosely based on a movie called *Deathrace 2000*. The premise involved driving a car to run over pedestrians for points.
>
> Mechanically, *Deathrace* was the same as any other game that involved catching objects moving around the screen.[…] The fact that I can describe *Deathrace* as being a game about picking up objects on a two-dimensional playing field is evidence that its "dressing" is largely irrelevant to what the game is at its core. As you get more into a game, you'll most likely cut to the chase and examine the true underpinnings of the game, just as a music aficionado can cut past the lyrical content of different types of Latin music and determine whether a given song is a *cumbia* or a *marinera* or a *salsa*.
>
> Running over pedestrians, killing people, fighting terrorists, and eating dots while running away from ghosts are all just stage settings, convenient metaphors for what the game is actually teaching. *Deathrace* does not teach you to run over pedestrians any more than *Pac-Man* teaches you to eat dots and be scared of ghosts.
>
> None of this is to minimize the fact that *Deathrace does* involve running over pedestrians and squishing them into little tombstone icons. That's there, for sure, and it's kind of reprehensible. It's not a great setting or staging for the game, but it's also not what the game is really about.

As we become more and more familiar with games, we pay less and less attention to theme, whatever it may be. This is not the same thing as "desensitization," unless you say that one can become "desensitized" to the cherries in *Pac Man*. Players may become in some sense desensitized to the game's theme, but this is very different from being desensitized *by* the game's theme.

Players are good at mentally reducing games to their formal essences, and we have a tendency to become distanced from whatever narrative or theme might be laid overtop. This becomes truer the less the theme and narrative resembles the mechanics. There is nothing about *Deathrace's* gameplay that is very closely tied to running down pedestrians, and any number of alternate themes could easily be substituted without any alterations to formal gameplay. It is also true that the pixelated graphics and quaint soundtrack don't help promote the theme for today's audiences. But what about more modern violent games? *Manhunt* practically gives step by step instructions on how to murder someone with a variety of household items, and the graphics and soundtrack bring the results vividly to life. Does playing *Manhunt* teach people to murder?

One problem here is that the accusation is ambiguous; teaching somebody *how* to murder is very different from teaching them that they *should* murder. It's quite possible that *Manhunt* informs players about murder techniques just as well as various films, books or websites do. This in and of itself does not mean that the game skews the morals of players and causes them to kill, in the same way that a nature documentary about otters won't necessarily cause people to try floating on their backs cracking sea urchins open with rocks. At the moment, there simply isn't definitive proof as to whether or not media violence makes people act more violently, or whether they react more or less strongly to videogames than they do to other media. As to whether games teach people things, this seems self-evident; whether the things the games are teaching extend outside the magic circle is often unclear.

The US military seems to believe they do, however, and has put millions into creating and utilizing combat games to recruit and train soldiers. Countless pilots have been successfully trained using fight simulators, so it seems reasonable that first-person shooters ought to teach firearm combat. When designing such a game, however, certain

tradeoffs must be made. If the game is too realistic, and players can be instantly killed by a sniper they never saw, players may find the game too frustrating or unappealing. If the game is designed as conventional shooters are, i.e. with the players having a minimap and the skin of twelve rhinoceros, then players may get the idea that war is a jolly good time, which is probably the goal, but they may also develop completely useless and suicidal firearm tactics.

This all begs the question of whether or not it is ethical to design games with the intent to attract prospective soldiers, but it is quite possible that games can train better soldiers, which in itself seems ethical if it ends up saving lives in the long run, depending perhaps on whether the game is being used to train soldiers in a barracks or potential recruits in their parents' basement. But if games can really teach someone enough that they can be better soldiers, then why aren't we using them to teach other things?

Educational Games

There is quite a long history of educational games, and by most peoples reckoning, they have been almost universally bad. The sentiment seems respectable and sound: use games as teaching tools. The problem is that when games are designed with this aim in mind, they usually tend to be inferior to games designed without these parameters. To be sure, there have been a few exceptions, such as *The Oregon Trail, Super Solvers: Gizmos & Gadgets* or *Where in the World is Carmen Sandiego*. The problem is that, because much of today's educational paradigm is structured around learning facts and assimilating information, educational games also tend to be built around imparting facts and become either trivia games, or games with a trivia element awkwardly inserted. Trivia is by far one of the easier branches of game design to do, yet most people simply aren't particularly enthralled by trivia questions. To be sure, games can help people memorize facts by giving them context and incentive, but the educational power of games lies far more in their structural nature.

Games are, at a formal level, mathematical systems, and as players gain more experience with a game and grasp the intricacies of its mechanics, they understand and experience it at a more formal level. In essence, games teach systems. Sometimes they teach systems that are unrealistic or unhelpful in the real world, but every game teaches a system of some sort. The key to using games as teaching tools is to create a system where the strategic choices the player has to make are representative and realistic, and where in order to choose correctly, the player must understand the system, not simply memorize facts. In fact, games have been teaching people for years. If you want to teach somebody about the military realities of Napoleon's campaign in Russia, *War and Peace* is fine, but there are many fine wargames on the subject. For reasons highlighted in Section 4, games about war and conflict are more common than, say, games about astrophysics or biochemistry, but there is no reason such games could not be made. The important thing is that the game would have to resemble the subject matter at a formal level, and not simply a *Monopoly* clone with important terms inserted.

Physics engines have reached a point where it is quite doable to teach people about Newtonian mechanics, and games like *Super Solvers: Gizmos and Gadgets* succeeded in teaching electrical engineering in an engaging way. Hopefully we will continue to incorporate games into the classroom, and continue to devise new ways to teach a broader range of subjects in more engaging and meaningful ways.

Fun

Ultimately it all comes down to what's fun. But what do players really want in a game? People aren't always so good at knowing what they want. It provides a certain kind of fun to make the player a demigod with high-tech weapons and armor, with hordes of enemies to fight. Yet it provides a completely different sort of fun to make the player a scared underdog, running in terror from things unseen. Many gamers fondly remember the first level in *Call of Duty* in which the player is an unlucky Russian soldier who finds himself shepherded into a brutal battle in Stalingrad without a gun.

Despite popular image, most gamers do not actually need to kill something every ten seconds in order to stay interested, and death and destruction do not need to be central themes for a game to be fun. More and more females are becoming gamers, and the popular image is that they prefer creation and preservation to destruction. This issue of creation versus destruction is perhaps one of the most important dichotomies between digital and non-digital games. The very first non-digital games involved rolling dice and moving around a track, which is formally commensurable to adding numbers to an ever-growing score. Conversely, for various reasons digital games started out largely as exercises in removing objects from the screen, as in *Asteroids*, *Space Invaders* or *Pac Man*. This dichotomy has persisted up until today where the representative videogame is about blowing away aliens, whereas the representative Eurogame is about building up farms or colonies and acquiring resources and victory points.

The fact that things must be set up in a boardgame may be part of the reason. It just makes sense that the physical unfolding of the game should be part of the game, as in *Carcassonne* where the board is created out of tiles as the game progresses. In digital games, it makes a weird sort of sense that the game makers prefabricate things for the players to gleefully tear down, as though the game makers and the player are locked in some sort of battle to the death. Yet, as I have tried to argue, there is no significant divide between digital and non-digital games, and these conventions, and indeed all conventions, should be broken and played around with. As a general rule, humans are bad at escaping dogmatism and tradition, and it is nearly impossible for us to look at something with fresh eyes and evaluate it objectively, but as game designers we need to try.

Games in all forms have so much untapped potential. They have the potential to engage us at an emotional and not just a mental level, and they have the potential to make us care about what happens more than any other storytelling media. At the formal level, players are just players, but at the experiential level, they can also be characters in the narrative, and whose wellbeing do we care more about than our own?

As we iterate a design, interesting gameplay dynamics will emerge, and as much as we'd like to believe we planned for them all, the truth is that sometimes they will simply be happy coincidences that we didn't expect or consciously devise; it is then our job to try and preserve these desired features as we continue to iterate our games towards their ultimate potential.

May you fulfill this potential with your own designs.

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Glossary of Terms

Active player: In a turn-based game, the player whose turn it is.

Autosave: A feature in many digital games that automatically creates a save file for the player at specific intervals in the game. The "auto" generally implies that the player has the ability to manually save their game. Autosaves are often less permanent than player saves by automatically overwriting themselves.

Avatar: The physical manifestation of a player in a game, i.e. the player's character.

Broken: A game is broken when it is unplayable due to egregious balance or rule flaws. A player is said to "break" a game when they discover a way to win every time, or otherwise ruin it, by exploiting a structural flaw.

Camping: A term usually used in first-person shooters to call out players who are simply waiting in one hidden or easy-to-defend spot to try and gain an advantage. "Spawn camping" is the act of waiting by a "spawn point," and killing players immediately after they respawn there. Both are generally seen as unsportsmanlike.

Challenge: Something that the player has to overcome using their repertoire of skills and to some extent their understanding of the game's structure.

Chaotic: A game feels more chaotic and random the less control players feel they have over the game, though there may be no formal chance-based elements at all. The terms "chaotic" or "volatile" can also be applied to games where things seem to change a lot between moves (which may give a feeling of randomness).

Campaign: Usually a series of scenarios or levels linked together in some way, sometimes played over multiple gaming sessions. In digital games, this often applies to the single-player mode in strategy games with a heavy multi-player element.

Card counting: Keeping track of what cards are still in the deck during a game, generally in a casino setting.

CCG: A collectable card game, or trading card game (TCG), is a game where players purchase and trade cards, and then build their own decks to play with out of their collection. CCGs tend to be played two-player, and tend *not* to involve playing for cards (with the winner taking some of the loser's cards, as with marbles).

Central choice: The primary balance that a player must maintain to play a particular game well. In a given wargame, the central choice might be between being too defensive vs. spreading one's self too thin.

Choice: A decision with at least two solutions that seem viable to the player and that are formally different in some way.

Competitive: A game wherein the object is to come out ahead of other players in some way.

Cooldown time: In digital games, cooldown is the amount of time before you can use an ability again. The term is usually only used when the cooldown time is made explicit to the player through a visual indicator.

Cooperative: A game wherein all players are trying to achieve a particular outcome. There is sometimes a secret traitor or traitors who are working against the group, but if the identity of these person(s) is known from the start, the game would likely fall into the category of "team game" rather than "cooperative game."

Cutscene: A movie (or "cinematic") in a digital game in which the player is not actively playing (except sometimes through quick time events). In-game cutscenes use the game's normal graphics engine, whereas pre-rendered cutscenes are of higher quality and look different from normal gameplay. It is hard to say whether games such as *Indigo Prophesy* are made up of cutscenes, because the game almost entirely consists of quick time events and in-game cinematics, and cutscenes are usually inserted as a break from normal gameplay, usually to move the story along.

Dead-man-walking: This means that the player is in a position where they cannot win the game. The term sometimes carries the additional connotation that they do not realize this to be the case, but if it is and if the game is approaching a defined ending, then guaranteed loss isn't necessarily a problem.

Dead time: Time spent in a digital game doing nothing at all interesting or difficult. This could be walking back to a previous location in an adventure game, or fishing in an MMORPG. Waiting for a game to load, a cutscene to conclude or an opponent's turn to finish isn't the same as dead time under this definition if the player isn't actually playing the game.

Downtime: Time a player spends in a game not actively participating. (The term is more often used for non-digital games.) In some games, it is somewhat unclear exactly what is downtime, but during a simple turn-based game where a player cannot do anything out of turn but strategize, everything except when it is a player's turn would be considered downtime.

Element: The basic parts of a game's formal system. Resources, values and rules, as well as many other things, can all be elements of this structure. Different elements are assembled and the relationships between them are utilized to create game mechanics.

Elimination boredom: The boredom experienced after being eliminated from a game.

Emergence: Emergent complexity is achieved by having game elements that interact with one another in interesting and hard-to-predict ways. Games of emergence are games with this property, wherein things will happen that the designer did not foresee (see "progression"), though virtually all games will have some degree of emergence. One could talk about "formal emergence" as only unexpected formal gameplay, excluding the other things that the game might produce such as unforeseeable conversations between players.

Ending conditions: The rules for when a game ends (see "victory conditions").

Escort mission: A type of mission used in many digital games wherein the player must "escort" an NPC from point A to point B without them being killed by attacking enemies. Many players find these missions frustrating when the NPC does "stupid" things like walk into enemy fire and die, thereby forcing the player to replay the section.

Eurogame: A boardgame from Europe. The term has come to describe games with elegant rules, short playing times, "pasted-on" themes, and relatively little randomness (though there is disagreement about what exactly constitutes a Eurogame). Various non-European games have often been referred to as "Eurogames" based on the above criteria.

Experiential: The aspects of a game a player experiences and sees when playing a game. What is experiential will be subtly or overtly different for different people and is also likely to change for any given person as they learn the game better.

Fiddly: An adjective used to describe a boardgame in which mundane tasks such as shuffling decks or placing/removing markers take up an inordinate amount of time or are mentally/physically difficult, or in some other way the physical game impedes smooth gameplay. The term could also apply to awkward or needlessly complicated user-interfaces or controls in a digital game.

Filler: Things in a digital game intended simply to increase its length (see "dead time"). Alternatively, a short non-digital game that can be played between other activities or games.

Formal: The aspects of a game that are directly related to game design. Rules, mechanics and mathematical relationships are all parts of a game's formal system, though they may not make themselves obvious to the players.

Frag: The term for a killing a player or bot (computer-controlled opponent) to gain a point in first-person shooters. The term likely derives from "fragmentation grenade," but may have more complex connotations. A "telefrag" is a frag made by teleporting "into" another player, usually resulting in that player's avatar exploding, i.e. being "gibbed" (which is derived from "giblets").

Fun: The enjoyment players derive from playing a game.

Game Master: The person who runs a game, usually a tabletop role-playing game. This person isn't a "player" in the sense that they are not simply trying to achieve an outcome within the game, but rather are (hopefully) trying to make the game as enjoyable as possible for the players. They create content for the game, moderate it, and describe what is going on in the game to the players, but they are often somewhat at the mercy of the dice and generally try not to wield 100% control over the game.

Hand: A collection of cards that is yours to look through and use. In most games players aren't supposed be able to see what is in your hand, though it can often be deduced or guessed at through various methods.

Implicit rules: Things that are not stated but are culturally or unconsciously known to the players such as "you can't do something that the rules don't cover."

Inventory: A place to store your items, often with limited space.

Item: Any sorts of things you can acquire which may be resources, powerups, MacGuffins, or collectables (or red herrings), though generic resources in large quantities such as gold pieces or lumber usually aren't referred to as items.

Kingmaking: When a player who has little or no chance of winning ends up deciding who does win, usually by attacking the other main contender or otherwise helping out the eventual winner in some way. This is usually seen as a flaw, though it can add extra dimensions to the diplomacy.

Magic Circle: A metaphorical line that separates the game and its players from the rest of the world. Anything within the magic circle is part of the game, and anything outside is not.

Marker: Anything whose physical location denotes something important to the players.

MacGuffin: (or McGuffin) An item that a player must retrieve in order to continue in the game wherein the player has no choice as to how to use the item. If the item is automatically given to the player, if it does not bestow any benefits or hindrances while they possess it, and if they will only lose/relinquish it at a specific point in the game, then it is wallpaper. (The term was coined by Alfred Hitchcock to describe in a film the object which everyone is seeking but which has little importance in and of itself, such as the documents in a spy thriller.)

Mechanic: The building block of a game's operational structure. Game mechanics prescribe or describe how a game's elements function together, and can be grouped into broad categories such as "blind auction," "roll and move," "reload," "resource gathering," "card drafting," etc. but these categories are mostly extreme oversimplifications of the actual mechanic being utilized. The term "mechanic" can also be applied to an important aspect of the game's variables, such as better powerups having higher costs. Broadly, a mechanic is any formally important aspect of a game.

Metagame: A sort of game outside a game. Metagaming could include reacting to opponents based on their playing styles or accomplishments in previous games, building decks in a CCG, or acting based on knowledge that their character in a role-playing game should not know. Certain metagaming is frowned upon, but sometimes it is actively encouraged by the game's structure.

MMORPG: A massively multiplayer online role-playing game (see "persistent world").

Multiplayer: A game that allows multiple people to play at the same time, even if not all players are participating at all times during the game. When referring to non-digital games, the term usually implies more than two players.

Multiplayer solitaire: A game in which players feel that their decisions do not affect, and are not affected by, other players. Players are likely to disagree about whether and how much this applies to any particular game.

NPC: A non-player character who is controlled by the computer or Game Master. A "PC" is a player character, e.g. controlled by a human player.

Numerical changes: Alterations a game designer makes to variables in a game, such as the makeup of cards in a deck or the number of hit points a player starts with, which do not affect the game's "rules" (see "rules").

Permadeath: A state in which a character is permanently dead and unable to be recovered. Common to tabletop role-playing games.

Persistent world: A digital game world that is populated by many different players on many different computers wherein the game has no victory or ending conditions and keeps running in real time 24/7 regardless of who is online, usually across many different servers.

Player elimination: In a multiplayer game, if it is possible for a player to be eliminated and no longer be part of the game, then the game contains player elimination (even if this is unlikely and not a core part of gameplay). Sometimes the player still has the power to affect the game in some way, either formally or informally.

Points: An abstract measurement of a player's progress towards victory, with the total number being their score. With most victory conditions, you could talk about the thing being sought after (money; glory) as being points, even if the things also serve some other purpose in the game, so I use the word "points" to refer to anything that marks progress towards victory. Most Eurogames use the term "victory points" (or VPs) instead of "points" to make it clear that this is the thing used to determine victory.

Powerup: Something that a player can acquire that allows them some privilege or special action. A powerup can be lost or run out, but the player has no control over when they

lose it, otherwise it is a resource. Link acquires a powerup which gives him the ability to shoot arrows, but the arrows themselves are a resource and not powerups.

Progression: The act or impression of moving forward in a game in some way. Games of progression have little by way of emergent gameplay (see "emergence"), and mostly involve the player going from one specific challenge to the next, as envisioned by the game designer. Adventure games are mostly games of progression.

Red herring: Something a player acquires or encounters which has no bearing on any formal aspects of the game even though it seems that it might. The thing may be inserted to intentionally divert the player's attention, as a joke or irony, or merely as a piece of thematic flavor. In classic adventure games, often what seems like a red herring is in fact the solution to a puzzle. This occurs frequently in the *Monkey Island* series. Arguably, if this trick is used often enough, then the things may lose their red herring status as the player is conditioned to assume that they will need to use seemingly useless objects.

Replayability: The extent to which a game can be enjoyed each subsequent time after its initial completion.

Resource: Anything a player gets that can be spent or lost (even momentarily) if the player has some choice about how use it.

Rules: In this book, I use the word "rules" to mean the ones in the rulebook, the "implicit rules," and also the technical workings of each element in the game such as the text on each card or the physical properties of crates.

Session: A single playing of a game. The game might not be played to completion, or it may be a game that was already underway from a previous session.

Single-player: A mode wherein a digital game is played by only one player.

Skill-Test: A challenge that requires the player to have attained some level of mastery at a given skill, such as jumping a gap or aiming a gun.

Solitaire: A game played by one player with a deck of standard playing cards. To play a board or card game "solitaire" is to play by one's self.

Spawn point: A location on the map in a (usually multiplayer) digital game where players "respawn" (come back to life) after they have been killed.

Speedrun: An attempt to complete a digital game as quickly as possible, usually videotaped or otherwise recorded in some way.

Strategy: A series of choices made by the player in an attempt to achieve a desire outcome or state of affairs (see "tactics").

Structural changes: Alterations a game designer makes to the game's "rules" (see "rules").

Tactics: Choices made for some sort of gain. Tactics often implies a choice or set of choices which furthers a short term goal, in contrast to strategy which often implies a lengthy series of choices working towards a long-term goal (i.e. battlefield tactics versus campaign strategy).

Team: A collection of players in a game who are all working towards the same goal(s). In some games, individuals on a team might secretly or publicly have additional goals which may conflict with the goals of the team.

Temporary save: A point in a digital game that allows a player to drop out and suspends their progress until they resume play, at which point the temporary save is deleted by the game.

Turtling: A game which is said to encourage turtling is one in which players have too little to gain and/or too much to lose from attacking, and so instead tend to sit back and defend. This could be considered a flaw if the players want more action or more diverse strategic options.

Twitch gaming: Skill-tests in digital games which test the player's reflexes and timing, or "twitch skills."

Utility: An abstract measurement in game theory somewhat similar to points. It is a way of conceptually and mathematically measuring an outcome in terms of a player's satisfaction with it. A player's goal is to maximize their utility.

Victory conditions: The rules for determining a winner or winners at the end of a game. Sometimes this is tied to the ending condition wherein the game ends when a player fulfills their victory conditions. Not all games have victory or ending conditions.

Wallpaper: Elements of a game that add nothing to formal gameplay such as most graphics and sounds. The aspects of these elements that do affect formal gameplay, such as a soldier's camouflage making him harder to see, are not wallpaper.

Zero-sum: A game is zero-sum when a player or players' gain is always equal to another player or players' loss such that they sum to zero. All purely competitive games are technically zero-sum in the sense that any gain by one player hurts the chances of victory for the others (and vice versa), though the term is often reserved for games in which it is impossible or difficult to make gains without explicitly hurting other players. Gambling games like Poker or Blackjack, played with just chips or with actual money, are zero-sum games.