

Tools for Creating Dramatic Game Dynamics

Marc LeBlanc

Context

The topic for my essay comes from my first lecture at the Game Developer's Conference (GDC) in 1999, and owes some of its inspiration to my colleague Doug Church and his work on formal abstract design tools. At that time, it was becoming clear that our discourse on game design needed more of a conceptual framework, a way to place the individual topics of discussion in their proper aesthetic context. In the five years since, I have strived to develop such a framework, through my practical work as well as through my Game Tuning Workshop, held annually at the GDC. The essay represents those five years of refinement.

The Player Experience Games as Narrative Game Design Models

Marc LeBlanc is a twelve-year veteran of the computer game industry. He has contributed to such award-winning titles as the Thief series, the System Shock series, and the casual game Oasis. He has a Master's degree in Computer Science from the Massachusetts Institute of Technology.

Introduction: Stories and Games

In the study of game design, comparisons to traditional narrative forms—prose, theater, film and TV—are inevitable. The advent of digital games has brought games and stories closer together than ever before. In the 1970s and 80s, text adventures like Zork gave us a new way to combine play with prose. Today, video games like *Zelda* and *Grand Theft Auto* possess the sights, sounds, characters, and plots that we might expect to see in a feature film. Given so many points of similarity between modern games and traditional stories, it's natural for game designers to look for ways to incorporate the tools and techniques of storytelling into their own craft.

But the power of games as a story vehicle is hardly a new idea. The ancient Egyptian game of *Senet*—which, along with *Go*, is one of the top contenders for the title of “oldest game known to humanity”—tells the story of the passage through the underworld to the land of the dead. During the height of its three millennia of popularity, players of *Senet* believed that the game was an oracle for mystical divination. The events of the game foretold what the player might one day experience in his own passage through the afterlife.

Since the ancient days of *Senet*, we have seen countless other games with a vast diversity of fictional meanings and metaphors: games about warfare and conquest, about courtly intrigue, about sleuthing detectives and robber barons, and about nothing at all. We have also seen how games can become stories, as when a sporting event is transformed into the news of the day—or the stuff of legend. We have seen works of fiction that incorporate games as narrative devices, like a movie that culminates in a climactic bike race, or a boxing match, or a game of Chess. In these examples of stories about games, the story no longer relies on the metaphor of the game, but on the events of the game itself: the plans and gambits, the bluffs and stratagems, the reversals of fortune. The play of the game becomes a climactic struggle that builds to a satisfying conclusion. In other words, the game is *dramatic*.

It should be safe to say that drama is a desirable quality of games. Players often seek out games that are dramatic, and sometimes a game's drama becomes the primary motivation for playing. Drama is part of a game's play content; it's a kind of fun. Thus, as game designers, we strive to imbue drama into our creations, to create games that are climactic struggles in their own right.

The challenge of creating drama within a game is compounded by our limited control over the games we create. We don't—and can't—know the precise details of how our game will play out, each and every time it is played. We are not the authors of the events of the game; we cannot craft the game's drama directly, the way a storyteller scripts a story. Our task is more indirect. We cannot create drama; we can only create the circumstances from which drama will emerge.

As game designers, how do we go about the task of creating dramatic games? What tools can we use to guarantee a climactic struggle? These are the central questions we will be exploring over the next few pages. We'll gain a better sense of what drama is and how it happens. We'll identify the necessary ingredients for drama, and we'll uncover a collection of tools and techniques for introducing those ingredients into our game.

Mechanics, Dynamics, and Aesthetics

Our exploration of drama will be guided by a core framework of three separate aspects of games: mechanics, dynamics, and aesthetics. We can think of these three aspects as parts of the game play experience, or as perspectives from which a game can be viewed.

When we talk about *mechanics*, we are referring to all the necessary pieces that we need to play the game. This primarily refers to the rules of the game, but can also refer to the equipment, the venue, or anything else necessary for playing the game. The mechanics of Chess include not only the rules for how the pieces move, but other facts like the dimensions of the board. The mechanics of Baseball include not only the explicit rules of Baseball, but the physical laws that govern the game: gravity, energy, the limits of the human mind and body. The peculiarities of the venue are also part of the mechanics; Fenway Park's "green monster" is part of the mechanics of any game played there. In a video game like Super Mario Sunshine, the mechanics would include the program code (which is a complete description of the game's rules) and all of its equipment, including the physical layout of the controller. If we think of the game as a *system*, the mechanics are the complete description of that system.

Dynamics refers to what might be called the "behavior" of the game, the actual events and phenomena that occur as the game is played. In Baseball, the different kinds of batted balls (e.g., fly balls, line drives, grounders, bunts) are part of the dynamics of the game. In Chess, the dynamics include tactical concepts like the knight fork or the discovered check, as well as structural concepts like the opening and the endgame. When we view a game in terms of its dynamics, we are asking, "What happens when the game is played?" The dynamics of a game

are not mandated by its rules, and are not always easy to intuit from the rules themselves. It would take a fairly clever person to deduce the concept of a discovered check from the rules of Chess without ever having played the game. The relationship between dynamics and mechanics is one of *emergence*. A game's dynamics emerge from its mechanics.

A game's *aesthetics* are its emotional content, the desirable emotional responses we have when we play—all the kinds of fun that result from playing the game. A game can challenge our intellect (or our physical prowess). It can foster social interaction. It can stimulate our imagination. It can provide us with a vehicle for self-expression. All of these properties are part of the aesthetics of the game. A game's aesthetics emerge from its dynamics; how the game *behaves* determines how it makes the player feel. Understanding how specific game dynamics evoke specific emotional responses is one of the greatest challenges of game design.

In a sense, the mechanics of the game always exist, even when the game is not being played. We can think of a board game (or a video game) that sits on our shelf as a box full of game mechanics, waiting for us to take it down and set the game into motion. The dynamics of the game, however, only manifest while the game is being played. Our ability to reap the game's aesthetic content depends on our actually playing the game and bringing those dynamics to life. Thus, when we play a game, our experience can be described as a kind of causal flow that starts with its mechanics, passes through dynamics, and ends with aesthetics.

For players, the purpose of playing is to enjoy the game's aesthetic content. As game designers, our objective is to *create* that content. Our relationship to the game is opposite that of the players. We begin our work with a set of aesthetic objectives—emotional responses we *hope* to evoke in the players. Our task is to work backward, determining what dynamics will accomplish our aesthetic objectives, and from there design game mechanics that will create those dynamics. So when we design a game, our experience begins with aesthetics, passes through dynamics, and ends with a set of mechanics.

This framework of three schemas for understanding games—mechanics, dynamics, and aesthetics—allows us to refine the motivating questions of our inquiry into drama in games:

- How does drama function as an aesthetic of play?
- What kinds of game dynamics can evoke drama?
- From what kinds of mechanics do those dynamics emerge?

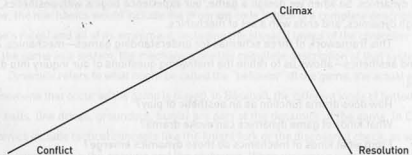
In the pages that follow, we will explore each of these topics in turn.

The Dramatic Arc: An Aesthetic Model for Drama

The goal of our exploration is to discover ways to make our games more dramatic. We want drama, as an aesthetic objective of our game design, to be part of the game's emotional content. The first step is to formulate a good definition of drama. How will we know drama when we see it? We need some kind of yardstick we can hold up to our game design to determine how well it succeeds or fails at being dramatic, a yardstick that encompasses our understanding of what drama is and how it happens. We call such a yardstick an "aesthetic model." As tools for formalizing our design objectives, *aesthetic models* can help us know when we have achieved them, and if we're headed in the right direction.

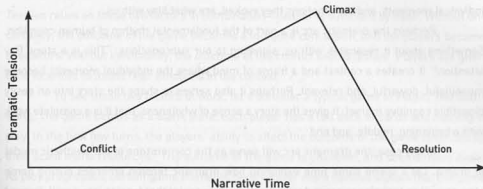
Before we proceed, we must acknowledge that drama is only one aesthetic among many. There are many reasons to play a game, many kinds of fun to get out of a game. Games can challenge us, realize our fantasies, bring us into social contact, and provide many more kinds of experiences. Each kind of experience is a separate aesthetic pleasure with its own aesthetic model. Different aesthetics can coexist within the discipline of game design, and even within the design of a single game. When we design a game, we hope its players will experience many kinds of fun, not merely a single kind. Because two different games might deliver the same aesthetics in different proportions, depending on the priorities of the designer—and the players—our aesthetic model of drama is not going to be a grand unified theory that encompasses all kinds of play or fun. We're looking for a specific model that explains drama, and nothing else. Other, broader models also exist, but they are beyond the scope of this essay.

Our quest for an aesthetic model of drama starts with a picture. Recognize it?



We've probably all seen this diagram at some point. The lines and proportions may be different, but the general shape is always the same. It visualizes the *dramatic arc*, the rising and falling action of a well-told story. The central conflict of a narrative creates *tension* that accumulates as the story builds to a climax, and dissipates as the conflict is resolved.

We can think of the diagram as a mathematical model. If we draw in the axes, it becomes a graph:



The mathematical model of drama imagines that dramatic tension is a kind of quantity that can accumulate and discharge, increase or decrease as time passes. That's not to say we could ever actually measure dramatic tension, of course. It's absurd to think that we could construct some kind of dramatic-tension-o-meter, a device that we could wave over the audience as a story is told, reading out the dramatic tension as a numerical value—no doubt measured in units called "millishakespeares." In that sense, it is not so much a quantity as a quality. Still, the idea that dramatic tension can increase and decrease is an important one for our diagram to have any meaning.

What is dramatic tension then? It's our level of *emotional* investment in the story's conflict: the sense of concern, apprehension, and urgency with which we await the story's outcome.

Drama as an Aesthetic

The dramatic arc is an aesthetic model for stories; it's a statement about how stories convey their emotional content, and a yardstick that we can hold up to a story to see if it succeeds

or fails at being dramatic. The dramatic arc is not a universal fact of all stories, but rather a desirable property of dramatic stories. The dramatic arc is a value statement. It says that well-told stories should possess dramatic tension, and that over time the tension should take on a particular shape, building toward the story's climax, and then dissipating.

What's so special about this particular shape? Why should the tension first rise and then fall, instead of first falling and then rising? Is this shape somehow intrinsically beautiful? Maybe, but most people don't leave a movie, thinking, "Wow, what a lovely dramatic arc!" The individual moments, and the emotions they evoked, are what stay with us.

Perhaps the dramatic arc is a part of the fundamental rhythm of human cognition. Something about it resonates with us, signaling to our subconscious: "This is a story. Pay attention!" It creates a context and a frame of mind where the individual moments become meaningful, powerful, and relevant. Perhaps it also serves to shape the story into an easily digestible cognitive morsel. It gives the story a sense of wholeness, that it is a complete work with a beginning, middle, and end.

In any case, the dramatic arc will serve as the cornerstone of our aesthetic model of drama. Let's spend some time exploring how dramatic tension emerges during game play, as well as techniques game designers can use to sculpt that tension into a well-formed dramatic arc.

Drama in Games

In the context of a traditional narrative, it's natural to think of the dramatic arc as being hand-crafted by the story's author. In the case of film or theater, the authors have complete control over every moment of the unfolding narrative. As game designers, we have a greater challenge. We must assure that our game will be dramatic, even when we don't have direct control over the narrative, a narrative that isn't scripted in advance, but rather *emerges* from the events of the game.

All drama originates from conflict. Indeed, without conflict, no dramatic tension will ever emerge. In a game, the conflict comes from the *contest* around which the game is built. Contests can take many different forms: some might challenge the player's intellect, others his stamina. Some might be competitions between multiple players; others might be solitaire challenges for a single player. Any of these contests provides the conflict necessary for drama.

How does tension emerge from a contest, and how does that tension change over time? Dramatic tension is the product of two different factors:

Uncertainty: the sense that the outcome of the contest is still unknown. Any player could win or lose.

Inevitability: the sense that the contest is moving forward toward resolution. The outcome is imminent.

Tension relies on these two factors in combination—neither is sufficient by itself. Without uncertainty, the outcome of the game becomes a foregone conclusion, and the players become spectators. Without inevitability, the outcome of the conflict seems distant. Players are given little incentive to invest their emotions in the contest.

To see these two factors at work, let's consider a typical game of Magic: The Gathering. The game begins as a blank slate: each player has a full deck of cards and nothing in play. In the first few turns, the players' ability to affect the outcome of the game is limited by their scant mana resources.¹ The outcome of the game is unknown, and seems miles away. As play progresses, certain game elements become ever more obvious signals that the game is moving toward a conclusion: the waning height of the players' decks, the scarcity of life points, and the increasing number of cards in play. Late in the game, the abundance of mana resources means that either player could change the game drastically in a single move. The outcome of the game seems imminent, yet still hard to predict. Eventually, the stalemate is broken by a string of "power plays," from which one player will emerge with a clear advantage. That player will leverage the advantage into victory, or "die" trying. Either way, the game reaches its conclusion quickly. We can see how the dramatic tension of the game is regulated by the game dynamics: the escalation of resources and the "ticking clock" of the deck. These mechanisms sculpt the tension of the game into a proper dramatic arc.

Over the course of the game we expect the inevitability to increase and the uncertainty to diminish. The climax of the game happens at the moment of realization: the moment when the outcome of the contest is known, and the uncertainty has been dispelled. We can think of the time between the climax and the end of the game as *dénouement*, the process of resolving the tension created within the game.

Now that we understand the role of uncertainty and inevitability in creating dramatic tension, we can gain a better understanding of how these qualities can emerge from the dynam-

ics of a game. Next, let's examine a handful of different game dynamics, and explore their roles in creating dramatic tension.

Game Dynamics That Produce Dramatic Tension

How exactly do uncertainty and inevitability emerge from game play? Quite often, they emerge independently of each other. That is, a game's uncertainty and its inevitability are evoked by different systems and dynamics. This is good news for game designers; it gives us finer control over the dramatic arc of the game, by allowing us to tune and adjust inevitability and uncertainty separately. It is also good news for our discussion because it allows our exploration to tackle inevitability and uncertainty as distinct topics.

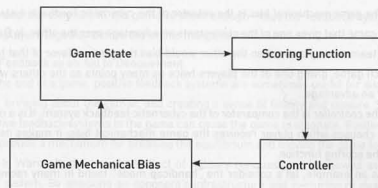
In order to imbue our games with dramatic uncertainty, we need to create an ongoing sense that the game is *close*, that the contest is yet undecided. There are many techniques available to us, but all of them take one of two general approaches: force and illusion. *Force* is the approach of creating dramatic tension by manipulating the state of the contest itself. The game is close because we *make* it close, or at the very least we limit how much an advantage one player can have over another. *Illusion* is the approach of manipulating the players' perceptions so that the game *seems* closer than it is. Force and illusion are more of a spectrum than a dichotomy. In the pages that follow, we will explore techniques of pure force (e.g., cybernetic feedback systems) and techniques of pure illusion (e.g., fog of war) as well as techniques that combine the two (e.g. escalation).

Our discussion of dramatic inevitability will center on a single organizing concept: the ticking clock. The idea of the ticking clock is the sense of imminent resolution that gives a game its sense of momentum and forward progress. It stands as a constant reminder that the game will end, and soon. We will discuss how games create inevitability through ticking clocks that are both real and metaphorical.

We will begin our exploration with a very common source of dramatic uncertainty in games: cybernetic feedback systems.

Feedback Systems as Sources of Uncertainty

Rules of Play provides a discussion of cybernetic feedback systems, and the ways in which they apply to games. A feedback system found in a game might be constructed like this:



The *game state* is the complete status of the game at a particular moment. We can think of the game state as all the information you would need to put in a "save game" file for the game. In Checkers, the game state would include the positions of all the pieces, and indicate which player has the next move. In a first-person shooter, the state would include the name of the current level, the position of every object on the level, as well as the player's health and inventory. In a physical game like Basketball, the state includes not only the score and the time left on the clock, but the complete physical and mental state of all the athletes. Constructing a "save game" for a real physical sport (as opposed to a sports video game) would require a staggering amount of memory.

The *scoring function* is the sensor of the cybernetic feedback system. It is a rule of the game that gives us a numerical measurement of who is winning and by how much. Some games, like Basketball, have a score built into the rules. In this case, the scoring function might be the difference between the two scores (e.g., one team is ahead by six points). Other games, like racing games, have no explicit score. The scoring function would be some measurement based on the facts of the game. In a two-player car-racing game, the scoring function might be the distance between the two players' cars. The scoring function could even produce an aggregate number based on several different facts about the game, such as the distance between the cars and the amount of fuel in each car. A good scoring function produces a larger number the greater the winning player's lead, and produces the number zero when the game is tied.

The *game mechanical bias* is the *actuator* of the cybernetic feedback system. It is a rule of the game that gives one of the contestants an advantage over the other. In Basketball, giving one team more players than the other would bias the game in favor of that team. In a death match game, giving one of the players twice as many points as the others would give that player an advantage.

The *controller* is the *comparator* of the cybernetic feedback system. It is a rule of the game that chooses which player receives the game mechanical bias; it makes its decision based on the scoring function.

As an example, let's consider the "handicap mode" found in many racing games. Handicap mode is a special game option designed to keep the race close: when one player falls behind, that player's maximum speed increases so that the player can catch up to the leader. We can think of this as a feedback system: the scoring function is the distance between the two racers, the speed boost is the game mechanical bias, and the controller is the rule that says the speed boost goes to the losing racer.

This kind of feedback system keeps the game close by driving the scoring function towards zero. Because it strives to make the difference in score as small as possible, it is called a "negative feedback system." We can imagine another feedback system—let's call it "spite mode"—that is the direct opposite of handicap mode. Using the same scoring function and game mechanical bias as handicap mode, spite mode would hand the speed boost to the leading racer. When one player gained an advantage over the other, spite mode would let that player keep the advantage for the rest of the game. This kind of feedback system strives to make the difference in score as large as possible, and so we call it a "positive feedback system."

Negative Feedback as a Source of Uncertainty

Dramatic uncertainty depends on the player's perception that the outcome of the contest is unknown. Any game where the score is tied—or very close—is inherently uncertain. This means that negative feedback systems are a powerful tool for creating dramatic tension; by driving the scoring function toward zero, they create dramatic uncertainty.

In the example of the racing game in handicap mode, the negative feedback system helps sustain the dramatic tension of the game. It guards against the situation where one player takes an early lead and keeps it for the entire race. Thus the feedback system assures that the climax occurs late in the game, at a moment when one player's lead is large

enough—and the time left in the game is short enough—that the feedback system cannot bring the players together before the end of the game.

Positive Feedback as an Aid to Denouement

Toward the end of a game, positive feedback systems are sometimes useful for dispelling uncertainty, bringing about the climax, and creating a sense of finality and closure. Sometimes the negative feedback systems in the game can cause the game to stagnate. Positive feedback systems provide a mechanism for breaking the equilibrium and moving the game forward.

In Warcraft, the snowball effect of military conquest can be viewed as a positive feedback system. By attacking an opponent's infrastructure and capturing or destroying resources, one player can leverage a slight military advantage into a large one, and then leverage the large military advantage into victory. This process of routing the enemy dispels the dramatic uncertainty and creates a sense of closure. It is an end-of-game ritual that prepares the winner to win and the loser to lose.

Other Sources of Uncertainty

Feedback systems are one of the heaviest possible hammers available to game designers for sculpting the dramatic uncertainty of their game. Now let's explore some other kinds of game mechanics that create dramatic uncertainty. Many of the systems we are about to examine could be described as "illusory"; rather than altering the state of the game, they manipulate the player's *perceptions*.

Pseudo-Feedback

The first two mechanisms we'll examine can be described as "pseudo-feedback." Quite frequently, these sorts of mechanisms create game dynamics that appear as if the game were being driven by a negative feedback system: when one player takes the lead, quite frequently the other player will catch up. When we inspect the inner workings of the game systems, however, we discover that there is no actual cybernetic feedback system present—just the perception of one.

Escalation

Escalation describes a game mechanic in which the score changes faster and faster over the course of the game, so that there are more points at stake at the end of the game than at the beginning. The game show *Jeopardy* is a textbook example of escalation. The first round

begins with questions worth \$100 and ends with questions worth \$500. More significantly, the value of all questions is doubled for the second round. This means that at the end of the first round, only one-third of the total available prize money has been given out, and roughly half of the game's total time has elapsed. The player perceives the game as being "half over," and measured in terms of *time*, it is. But measured in terms of *prize money awarded*, the game is only a third over. The player perceives that the game has progressed further than it really has. The escalation of prize money helps protect the dramatic uncertainty of the game; there is no first-round lead that can't be overcome in the second round. In the final round of the game, players can wager any amount of their prize money on a single question. We can think of this as yet another level of escalation, giving the trailing players one last all-or-nothing chance to overcome the leader.

Hidden Energy

Imagine a racing game—one not driven by a feedback system—in which each player has a reservoir of "turbo fuel" to use during the race. The turbo fuel gives the player a speed bonus for as long as he holds down the "turbo" button on the controller. However, the reservoir only holds 30 total seconds of fuel in a race that will last a few minutes. The game is designed so that effective use of the turbo is the key to success.

In this game, one player might use turbo fuel to gain an early lead. That player would appear to be winning, with a score that was certainly higher, although achieved at a resource cost. If, however, we consider the whole state of the game—accounting for the players' resources in addition to their positions on the track—we see that the game is actually quite close. At some later time, the trailing player will choose to use his turbo fuel to close the gap, perhaps creating the illusion that handicap mode is in effect. This creates a sense of uncertainty as the true state of the game is revealed.

We can think of the turbo fuel as the "hidden energy" of the game. It is energy because it represents the potential to score, and it is hidden because it is not part of the player's own appraisal of the game scoring function. In sports like Basketball, the hidden energy is energy in the literal sense of the word; a team that takes the lead often does so at the expense of its own stamina, leaving itself vulnerable to a reprisal by the other team.

Another interesting example of hidden energy occurs in Pool. In Eight Ball, a player inches closer to victory each time the player sinks a ball. But the fewer balls the player has on the table, the fewer good shots there are to take, and the less likely the player's balls are

to interfere with those of the other player. Each ball represents a liability (in that it must be sunk) but also an opportunity (to be an easy shot, and also to obstruct the opponent). Combined with the short-term positive feedback of the game (i.e., making a shot entitles you to another turn), the energy gives the trailing player a chance to catch up to the leader.

Hidden energy creates dramatic uncertainty by manipulating the player's incomplete understanding of the true score of the game. It creates artificial dramatic reversals of fortune by inflating and deflating the ostensible score of the game.

Fog of War

Strategy games like Warcraft and Civilization use a game mechanic called *fog of war*, which simulates limitations of game characters' ability to perceive and monitor the world around them. The "fog" covers all parts of the map that the players' units cannot see. As the players' resources develop, their units cover a greater area and push more of the fog back, giving the players progressively more information about the world. A player cannot see other players' resources unless the player commits units to scouting enemy terrain.

Fog of war represents a way of creating dramatic uncertainty by limiting the information available to the players. At the beginning of the game, players cannot predict the outcome of the contest, because they simply aren't given enough information. As the game progresses, more and more information becomes available, and the outcome of the game seems more and more certain.

Decelerator

The *decelerator* describes an obstacle that slows the players down late in the game. It makes the game seem closer by changing the scale and pace of the game.

A perfect example of a decelerator comes from that famous athletics-oriented game show of the 1990s, *American Gladiators*. At the end of each episode, the winner was determined by an obstacle course called "The Eliminator." One of the late obstacles of this course was a cargo net that the contestants had to climb. Climbing the net was slow work, so the trailing player would usually reach the net before the leading player had cleared it. The cargo net brought the players into physical proximity without necessarily changing the true score of the game. Measured in seconds, the distance between the players was the same as before they entered the cargo net, but measured in feet, the distance seemed much closer. The decelerator creates dramatic uncertainty by creating the illusion of a close game.

Interestingly enough, *American Gladiators* followed its decelerator with an *accelerator*. After the contestants climbed the cargo net, they would descend to ground level on a zip line. This acceleration would reveal the true difference in the players' positions (perhaps even exaggerate it), dispelling the uncertainty and resolving the tension created by the cargo net. It's no accident that the rising and falling action of the drama resembles the ascent and descent of the altitudes of the players.

Cashing Out

Cashing out describes a game mechanic where the score of the game is reset to zero. The simplest example of cashing out occurs in the "best of 7" format used for the World Series and other tournaments, where the contest is actually several games played in succession. Although at the end of a single game of a series, the game is recorded as a win for one team, beyond that, the score no longer matters. The result is the same whether the game went into extra innings or was a blowout. Until one team wins its fourth game, both teams have a chance to win the series. Cashing out creates dramatic uncertainty by forgiving the trailing player's score deficit, and giving every player a chance to win, however unlikely.

Bombberman uses a similar form of cashing out. The game is played in rounds of a few minutes. Each round is a contest of serial elimination: players vie to blow each other up with bombs, and the last player standing wins a trophy. The first player to win three trophies from three separate rounds wins the game. During the round, players accumulate power-ups, becoming more and more powerful until elimination becomes inevitable, although nothing is carried over from one round to the next except for the trophy awarded to the winner. All the events of the round are cashed out and reduced to a single consequence: one player got the trophy and the others didn't. All power-ups are reset, and all mistakes are forgiven, giving each player a clean slate for the next round.

"The Eliminator" from the game show *American Gladiators* is another example of cashing out. Throughout a particular episode, contestants would earn points for successes in each of the episode's events. The final event ("The Eliminator") was winner-take-all, but the player with the leading score was given a head start in the race, in proportion to the player's lead. In effect, points earned before the race were converted into seconds for the race. We can think of this conversion as a kind of cashing out. No matter how great the deficit, the trailing player has a chance to make it up, however slim that chance may be. We can also think of the

moment where points are converted into seconds as an instantaneous moment of positive feedback, where an advantage in score is converted into a game mechanical bias.

Sources of Inevitability

We've just explored five different ways that dramatic uncertainty can emerge from a game's dynamics. But uncertainty alone is not sufficient to create dramatic tension; we also need *dramatic inevitability*, the sense that the contest is moving forward toward a conclusion. If our contest appears as if it will never conclude—or not conclude any time soon—then it has no sense of urgency, and the dramatic tension is dispelled.

Uncertainty and inevitability are not opposites. Uncertainty concerns itself with the question, "Who will win?" whereas inevitability concerns itself with the question, "When will we know?" Our game is most tense at the moment both factors intersect: the outcome of the contest is unknown, but we feel that it will be determined imminently.

In games, dramatic inevitability emerges from any game mechanic that can function as a *ticking clock*, which gives the players a measurement of their progress through the game, as well as a sense of how far away the end might be. The clock also conveys a sense of forward motion: as time runs out, the players feel propelled toward the conclusion of the contest. Clearly then, a *literal* ticking clock—the time limit in sports like Basketball or in video games like Pikmin or Bombberman—is the simplest, most straightforward example of a game mechanic creating dramatic inevitability.

But literal time limits are not the only way the ticking clock manifests itself in game dynamics. We see it in the increasingly crowded game board in Go and Reversi, the waning deck sizes in Magic: The Gathering, the decreasing health bars in Virtua Fighter, the gradual filling-in of the word puzzle on Wheel of Fortune, and the depleting gold supplies in Warcraft. All of these "clocks" give us a measure of our progress through the game, warning us that the end is approaching; indeed, they can be characterized as *nonrenewable resources*, quantifiable assets within the game state that deplete over the course of play and are never replenished. When we consider *time* as a resource, we see that even the literal ticking clock falls within this category of nonrenewable resources. The notion of a nonrenewable resource is a powerful extension of the ticking clock concept—and a valuable nuts-and-bolts tool for game designers interested in assuring a sense of dramatic inevitability in their games.²

Other kinds of ticking clocks also exist. In the mystery board game *Clue*, the gradual accrual of information leads the game toward its inevitable conclusion. In a linear race game like *SSX*, the progress of play expresses itself in space rather than in time. The landmarks and checkpoints on the racecourse serve as reminders of the race's end. Many such games provide players with a "radar" overview of their linear progress through the level. These cues remind us of our place within the narrative, and of the constant forward motion toward an inevitable end. If hard-pressed, we could probably come up with a way to fit these concepts into our nonrenewable resource model of the ticking clock. [In *Clue*, can we think of ignorance as a resource?]

Rather than resort to such contrivances, we can identify an even more general model for the ticking clock: instead of nonrenewable resources, we can think of our ticking clocks as *nonreversible processes*. Nonreversible processes are exactly what they sound like: changes to the game state that can't be undone. Like a tightening ratchet, the process brings the game ever closer to completion, while at the same time prohibiting backward movement.

It should be clear that dramatic inevitability is all a matter of perception. In order for the ticking clock or nonreversible process to function as a dramatic device, the player must be able to perceive and understand its operation. A secret ticking clock does not convey the same sense of inevitability, nor does a nonreversible process whose workings are so complex that its nonreversible nature is not obvious.

Now let's take a look at an important historical example in which the lack of dramatic inevitability resulted in catastrophe. This example will give us a chance to flex our analytical muscles, as well as give us some perspective on the role and power of dramatic inevitability in games.

Twenty-One

The year 1956 saw the debut of the infamous game show *Twenty-One*, which became the centerpiece of the quiz show scandal. During the 1950s, the producers and sponsors of the show discovered that dramatic tension converted directly into big ratings and big business. They sought to sculpt their programs into ongoing narratives, with contestants cast as recurring characters. Many shows like *Twenty-One* resorted to rigging the results of the contest. The producers became authors, scripting not only the outcome of the game, but the dramatic details of its events.

Interestingly enough, it was only after the first episode that the producers of *Twenty-One* chose to rig the game:

The show went on the air in 1956 and we felt that it had such great quality and content to it that we would not have to rig it. In fact, the first show of *Twenty-One* was not rigged and the first show of *Twenty-One* was a dismal failure. It was just plain dull.—*Dan Enright*,

Producer

From then on, the producers decided to rig the game. Three years and one national scandal later, *Twenty-One* became an object lesson in the perils of "scripting" a game.

21/21 Hindsight

Let's examine the dynamics of *Twenty-One* to see if we can find out why it was such a "dismal failure." We'll start with the rules.

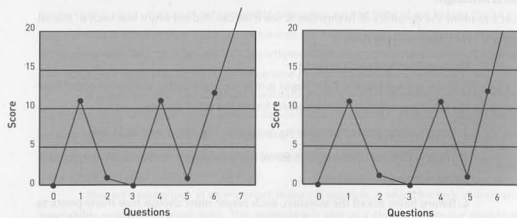
Rules of Twenty-One (Summary)

1. There are two players. Each player is in an isolation booth, and cannot see or hear the other player's play. Neither player knows the other's score.
2. Players score points by answering questions. The first player to 21 wins.
3. In the first round, each player is asked two questions. In subsequent rounds, each player is asked one question.
4. Before being asked the question, each player must choose how many points to wager on the question. Any number of points from 1 to 11 may be wagered. The player *must* wager at least one point, and *must* answer the question.
5. If a player answers the question correctly, the player gains the wagered points; if not, the player *loses* the wagered points. A player's score can't drop below zero this way.
6. At the end of a round, either player may choose to end the game and the player with the most points then wins.

Since each player is playing the game "in a vacuum," unaware and unaffected by the other player's choices, we can view a game of *Twenty-One* as two simultaneous solitaire games. Aside from the player's own score, an individual player has very little information to use when deciding whether or not to end the game. A player is free to play until one player

drops from exhaustion, until his opponent chooses to end the game, or until he has earned an amount of points—let's say 19—that seems high enough to have a good chance of winning. So, we can say that each player is playing a solitaire game that only ends when one player reaches 19 points or more, and the winner is the player who reaches that value in fewer questions. This view will simplify our analysis of the game, at the very least by reducing the number of ending conditions from two to one.

Having made that simplification, it should be clear that the game lacks any kind of ticking clock. The only way that the game can end is for the score to increase, and points can be lost as easily as won—more easily, in fact. If scores were allowed to drop below zero, then the game might never end. Computer simulations bear our observations out:



Two Simulated Games of Twenty-One

In the simulation, it was assumed that the player had a flat 40% chance of answering any question, wagered aggressively, and stopped at 19 points or more. In 1,000 simulated games, almost 42% of all questions resulted in a score of zero. The median game was 6 questions long, and the longest was 58.³

In the computer simulation, the score typically oscillates back and forth between 0 and 11. The game comes down to whether or not a player can answer two questions in a row. There is no sense of progress through the game; past performance has essentially no meaning. We can see how the lack of a ticking clock dispels any hope of creating a dramatic arc.

How do our observations compare to history? We know that the first night of *Twenty-One* was plagued by zero-zero ties. Given that the score was zero 40% of the time in our simulations, this is hardly surprising.

Instead of fixing the game in the sense of rigging it, how might we fix the game in the sense of repairing the game design? There are many possible ticking clocks we could introduce: limit the total time to play, limit the number of questions or the number of wrong answers, and so forth. We could also try to salvage the notion that the score might function as the game's ticking clock by reducing or eliminating the penalty for a wrong answer. This might not be adequate if there were many rounds where neither player answered a question. We could handle that case explicitly: when neither player answered correctly, we would give each player one point, or perhaps reduce the number of points needed to win the game by one (from 21 to 20, then 19, etc.).

These are just a few examples among many; any game mechanic that causes the game to march forward to a guaranteed end has the potential to create the dramatic inevitability we need. Had the creators of *Twenty-One* realized the need to create dramatic inevitability within their game dynamics, they might have avoided a career-shortening scandal.

Resolving Dramatic Tension: Denouement in Games

So far we've examined several techniques for ratcheting up the dramatic tension in our games. But the dramatic arc shows us that tension shouldn't climb forever. Eventually the tension needs to reach a climax, change direction, and fade away.

When should the game's dramatic climax occur? How much time should pass between the climax and the end of the game? We've said that the climax occurs at the moment of realization, when uncertainty is dispelled and the outcome of the contest is known. Given that definition, it would seem that the climax of the game should occur as late as possible. After all, a contest whose outcome is known has ceased to be a game on some level: the players have become spectators. We could argue that such an interval should be as short as possible. On the other hand, there is also some value to providing the players with a denouement to resolve the tension and give them a sense of closure. We need to prepare the winner to win and the loser to lose. A game whose climax comes too late can seem to end too abruptly, catching the players off guard. In that case, the dramatic tension can linger, unresolved.

Sometimes, the resolution of the game's dramatic tension can occur after the end of play. In a social setting, this can happen informally as a kind of post mortem of the game by the players. Many computer games build "post-mortem" features into the product itself, such as the end-of-mission statistic screens in *Warcraft* or the game replay at the end of *Civilization III*. We can also see examples of this in movies whose story culminates in a climactic

game. When the game ends, the movie goes on for a while afterward, in part to resolve tension created during play.

Summary

As game designers, we hope that our games will be climactic struggles; we strive to imbue our games with a sense of *drama*. In these pages, we explored the concept of drama in games.

We explored a framework of three schemas for analyzing games:

- **Mechanics:** the complete description of the game system; the rules and components we need to play the game.
- **Dynamics:** the way a game “behaves” when it is played. The strategies, events and behaviors that *emerge* from the mechanics of the game.
- **Aesthetics:** the emotional content of the game. The kinds of fun we have when we play. The emotional message we hope to impart as game designers.

We defined an *aesthetic model* for drama in terms of *dramatic tension*, the intensity of the struggle, and *dramatic structure*, the way that intensity changes over time. Good dramatic structure takes the shape of a *dramatic arc*, where the tension builds toward a climax and is resolved. We identified the two necessary ingredients for dramatic tension: *uncertainty*, the sense that the outcome of the game is still unknown, and *inevitability*, the sense that the end of the game is imminent.

At some length, we discussed a handful of different game dynamical tools for producing dramatic uncertainty: *cybernetic feedback*, *escalation*, and *hidden energy*, *fog of war*, *deceleration*, and *cashing out*. We examined how the dynamics of the “ticking clock” can create the inevitability we need for dramatic tension. We identified several different kinds of ticking clock: the *literal clock*, the *nonrenewable resource*, and the *nonreversible process*. We briefly explored the need for denouement in games.

The fruits of our exploration are a new set of conceptual tools for our game design toolbox. We can use these concepts to analyze the games we play, deconstruct their designs, and gain a greater understanding of how they succeed or fail at delivering their aesthetic content. We can also use them in designing games, to create and evaluate the game mechanics that will bring us closer to our aesthetic goals.

Beyond the study of drama, there is a larger inquiry to be made: other aesthetics to be examined, other mechanics and dynamics to be understood. The more of these game design elements that we explore, the larger our design toolbox will grow. The craft of game design will become a richer, more sophisticated, more powerful form of artistic expression.

End Notes

1. In *Magic: The Gathering*, the fundamental game resource is called “mana.” Almost all of the potent moves a players can make drain her mana resources. Each turn, a player has as much mana as the number of land cards she has in play. A player’s land cards start in her deck, are drawn into her hand, and are put into play at a rate of one per turn. Thus an action’s mana cost places a limit on how early in the game that action can be played; for example, an action costing five mana cannot [in general] be played before the fifth turn of the game.
2. Computer scientists will recognize the striking similarity between these nonrenewable resources and the “decrementing functions” used to prove whether a computer program terminates. Often, they are the same thing. On the other hand, a game’s “ticking clock” does not always provide us with an ironclad proof that the game will halt; some ticking clocks depend on random events, or on the cooperation of the players. So we sometimes end up with a game that “probably” halts, or that halts if any player wants it to. Although forcing a proper decrementing function into a game can sometimes run counter to other design goals, sometimes it is exactly what is needed.
3. Random numbers for this simulation were generated using the MT19937 algorithm.

Bibliography

- Salen Katie, and Eric Zimmerman. *Rules of Play: Game Design Fundamentals*. Cambridge, MA: MIT Press, 2004.
- Piccione, Peter A. “In Search of the Meaning of Senet.” *Archaeology*, July/August 1980: 55–58. Available online at www.cofc.edu/~piccione/piccione_senet.pdf.
- Lucey, Paul. *Story Sense: Writing Story and Script for Feature Films and Television*. New York: McGraw-Hill, 1996.
- “The Quiz Show Scandal,” prod. Julian Krainin. *The American Experience*, PBS. Available online at www.pbs.org/wgbh/amex/quizshow/.