Features

Designer's Notebook: Positive Feedback

by Ernest Adams [Designer's Notebook]

Most of the time The Designer's Notebook is full of opinionated jottings about creativity, storytelling, or the social effects of interactive entertainment - in other words, blue sky. Every now and then, though, I feel compelled to write something abstruse and technical about game design, something that's more of a how-to than a why-to or a why-not-to. This is one of those times. This month I'm going to talk about the effect that positive feedback has on game balance.

What Is Positive Feedback?

When we speak of feedback in everyday life, we're usually referring to that horrible shriek that happens whenever the microphone in a public-address system gets too close to the speakers. The mic picks up whatever's coming out of the speakers and tries to amplify it again. More generally, feedback occurs whenever the output of any system is "fed back" into it as some kind of an input. What happens with the microphone and the amplifier is an example of positive feedback - a situation that tends to amplify the output of the system.

Positive feedback plays an important role in game design, although you don't hear many designers talking about it. It can gravely harm a game if improperly implemented, but it also has significant benefits. It's an element of game design that every designer needs to understand and learn to use.

Before I go into how it works, though, let's look for a minute at the way games are won and lost. When you happen across two friends playing a game, what's the first thing you say? "Who's winning?" of course. That's not always an easy question to answer. Some games have a metric that determines who's ahead at any given time; others don't. In ping-pong, for example, it's obvious: whoever has the most points is winning. In chess, it's less clear because the victory condition - checkmating the king - is not defined in terms of accumulating points. You can very generally say that whoever has taken the most pieces is winning, but it's perfectly possible to win at chess with fewer pieces than your opponent has.

In game design, positive feedback can be defined as occurring whenever one useful achievement makes subsequent achievements easier. In other words, whenever someone gains something in a game, it gets easier to make further gains. If the role of positive feedback in a game is too great, then whoever first obtains the slightest lead in the game is guaranteed to win, because they just keep getting farther and farther ahead. This makes it sound as if positive feedback is always undesirable, but it isn't; it's just a question of employing it properly.

Positive feedback appears mostly in games in which the victory condition is defined in numeric terms, and throughout the game you're working to achieve that victory condition by accumulating something. In Monopoly, for example, it's money. Obtaining money in Monopoly allows you to buy and improve properties, which makes it possible to obtain more money. Positive feedback can also appear in games in which a numeric advantage of some kind helps to achieve a non-numeric victory condition. Although the victory condition in chess is non-numeric, it does generally help to have more pieces than your opponent.

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included several of them below. A balance graph plots the progress of a zero-sum two-player game. Time is represented on the horizontal axis. The vertical axis indicates who's ahead by some numeric metric, usually the difference in points scored by the two players. If player A is ahead, the number is above zero; if player B is ahead, it's below zero. At the left edge of the graph, the beginning of the game, the players are even at zero. Dotted lines at the top and the bottom of the graph indicate the victory condition for either player A or B.

My first balance graph represents a simple sprint foot race in which player A is a faster runner than player B. A immediately goes ahead and remains ahead for the duration of the race. Straightforward races have no positive feedback. Gaining the lead does not make it easier to retain or increase the lead. (In fact, there's psychological evidence to suggest that the opposite is true: runners try harder if there's someone slightly ahead of them. When Roger Bannister was training to break the four-minute mile, he ran with pacesetters who ran in front of him. This phenomenon has also been observed in racehorses and sled dogs. However, it isn't part of the rules of the game, which is what we're concerned with here.)

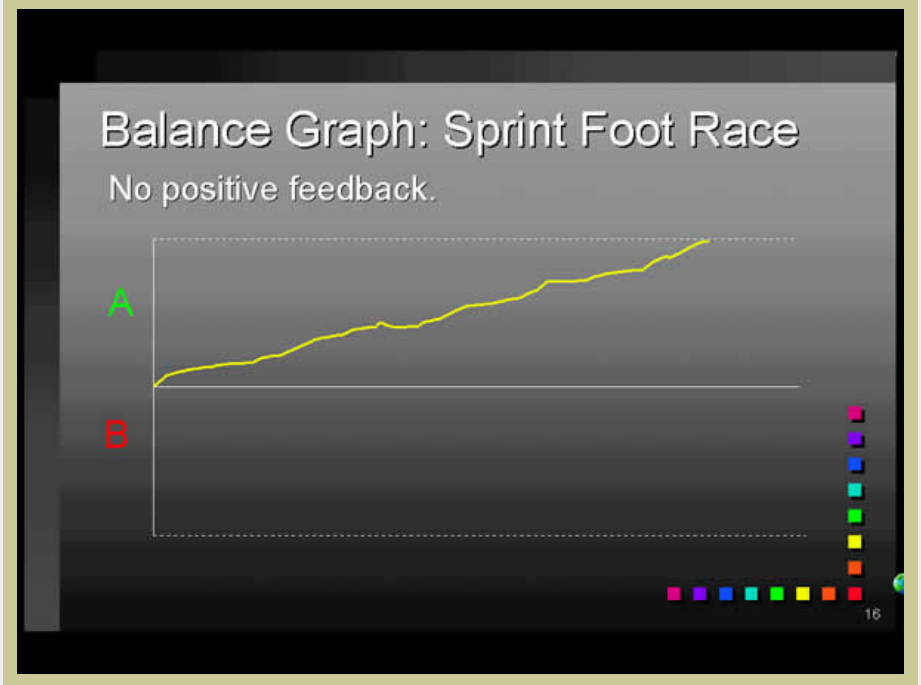

Figure 1

The next graph is an example of an unbalanced, i.e. unfair, game - whether or not it includes positive feedback. Assuming that A and B are of equal skill and there is no element of chance involved, something about the rules is giving A an advantage, such that she takes the lead and maintains it throughout a very short game.

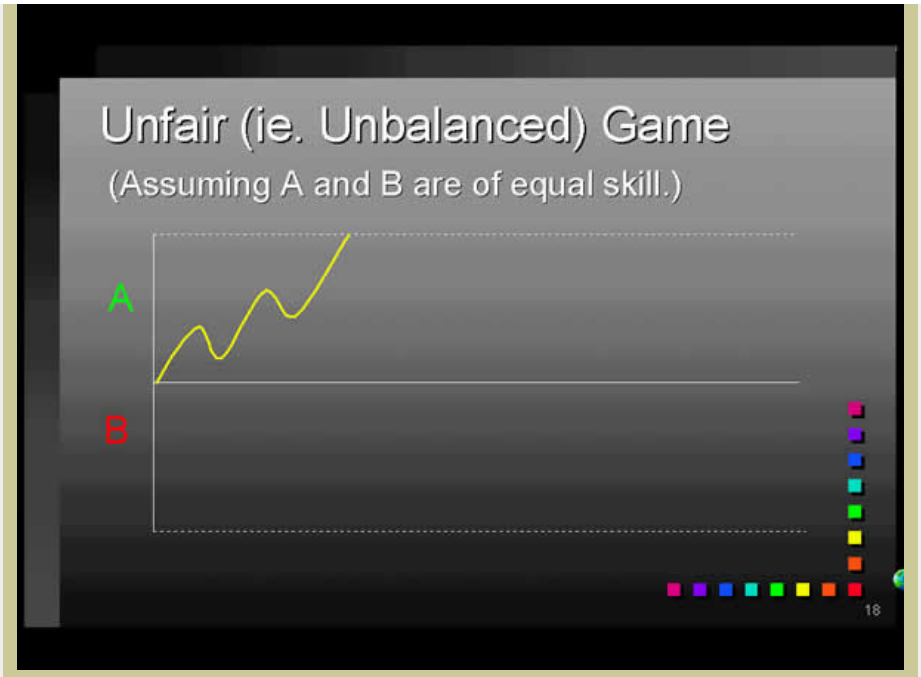

Figure 2

In Figure 3 we have a stalemate, a game that goes on forever with neither player able to assume a commanding lead. This is a game that's too balanced: neither player is able to achieve victory. The children's card game War is a good example of this kind of game: it's all luck, no skill, and no positive feedback, so it can go on for hours. This illustrates why positive feedback is a useful thing: it helps to prevent stalemates. Once a player assumes enough of a lead, the advantage that positive feedback confers guarantees that he will win.

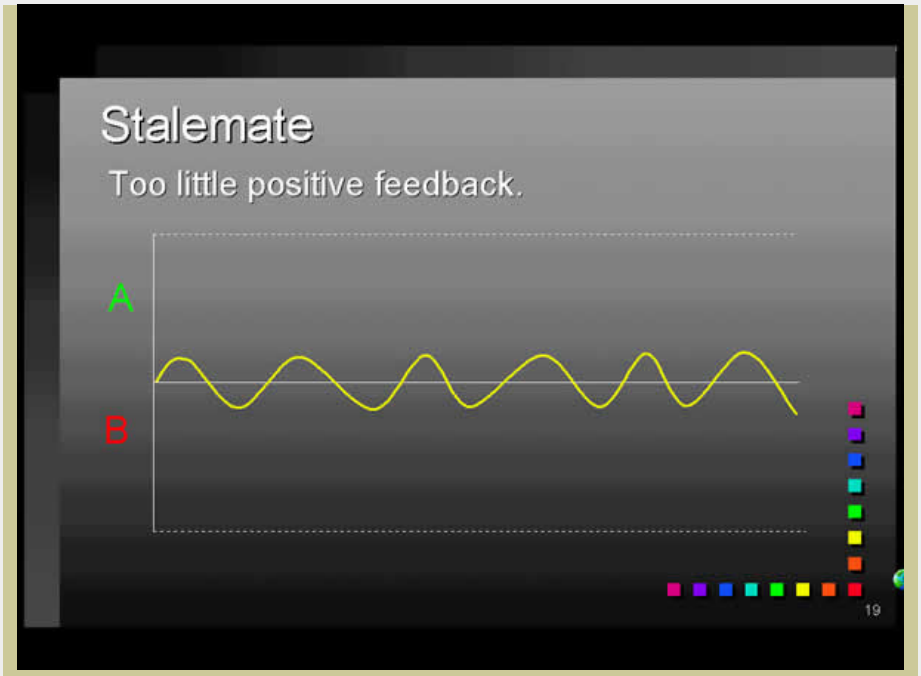

Figure 3

Figure 4 illustrates a game that's balanced, but positive feedback sets in too soon, producing a fair but very short game. B gains a slight advantage, then A retakes a slight lead, then B again, then A takes a longer lead and promptly wins the game.

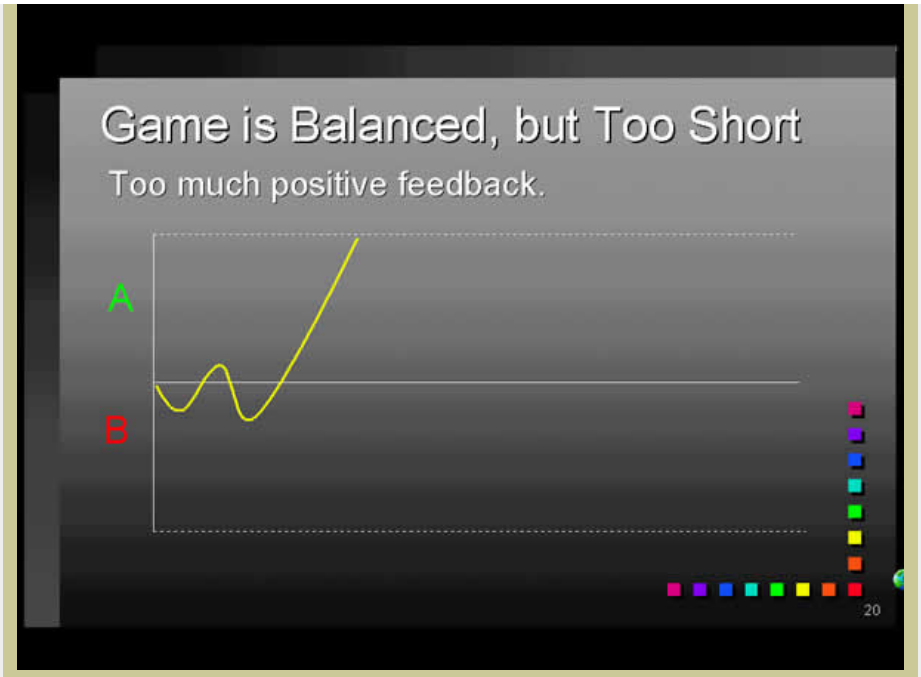

Figure 4

The ideal game, in my opinion, starts off even and balanced, but slowly becomes unbalanced over time until one player inevitably wins - preferably the better player! Figure 5 shows one example, although in this case player B struggles on valiantly for quite a while.

Figure 5

Once a player's lead becomes commanding, the game shouldn't take too long to finish. This is one of the (very few) problems with Monopoly. From the time that it becomes clear that one player must win until he has actually bankrupted all the other players is usually half an hour or more. The other players just have to sit and wait through their slow slide into oblivion.

Positive Feedback in Games

So let's look at some examples of games with and without positive feedback. As I mentioned before, races and most other athletic competitions don't have positive feedback - at least, not designed into the rules. Scoring points in basketball doesn't make it any easier to score further points. Nor do most card games;

to destroy the next unit, and so on.

Another genre of computer game that has positive feedback is single-player role-playing games. You start off with poor weapons; you kill some monsters; you get some treasure, and you use it to buy better weapons. The better weapons enable you to kill more monsters, you get more treasure, you buy still better weapons, and so on.

Positive feedback needn't have a direct influence on the path to victory; it can appear in other areas of a game as well. While I was at Bullfrog Productions, I was lead designer on a new game (never published, alas) called Genesis: The Hand of God. Genesis was a god game in the spirit of Bullfrog's original Populous, in which you could affect the weather of a landscape with divine power, drawing on mana generated by your simulated worshippers to do so. One of our innovations was that there were several different types of mana, depending on the nature of the landscape in which your worshippers lived. For example, if they lived in a wet area, you got a lot of water mana, which you could use to make rain. Of course we realized immediately that this was a positive feedback loop: the more water you had, the more water you could get. On the other hand if your people lived in a desert, it was very difficult to make rain because they were producing very little water mana.

In the end we concluded that this wasn't a problem for the game. Making rain in a wet area made it wetter, but so what? If you made it rain all the time you would drown your own people, and there was no benefit in that. We also thought that making the desert bloom shouldn't be too easy at first, but once you got it started, it should get easier. Although it was positive feedback, it didn't endanger the balance of the game because it didn't confer a direct advantage over your opponents.

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