

Flow Space – A Visual Guide for Flow and Simplicity in Games

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ABSTRACT

What is the recipe for engagement? Mihaly Csikszentmihalyi spent decades researching flow. He described both the ingredients used to create flow as well as what happens when you are in flow. His research has become a tenet of game design. It's so well known in the gaming industry that it barely needs introducing. And at the same time, the unfortunate truth is that those introductions rarely include more than the one single diagram that depicts the balance of difficulty. This paper aims to change that by introducing a new diagram that includes all four of the ingredients of flow, together, in one simple picture. It then goes a step further by looking at another tenet of game design: simplicity. It introduces a new recipe for simplicity that can be overlaid on top of the diagram of flow. Together, these diagrams create Flow Space – a visual guide for flow and simplicity in games.

ABOUT THE AUTHOR

Curtiss Murphy won “Best Tutorial” at IITSEC 2011 for “Why Games Work”. He presents with a unique blend of energy, science, and story-telling, that has earned him invitations to conferences across the country. He gives the yearly keynote at the National Science Foundation’s Edugaming workshop, has decades of development experience, and is widely recognized as a thought leader in serious games. As a twelve year veteran of the gaming industry, his career spans AAA, military, and Indy development. Curtiss has numerous publications on game development, including chapters in Game Programming Gems 6 & 7, and Game Engine Gems 2. He is an award winning speaker, author, and game designer. Curtiss hosts the Game Design Zen podcast, is the founder of Gigi Games, and is the Technical Director of Alion’s Modeling and Simulation Operation.

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INTRODUCTION

This paper begins with an anecdotal experience.

I was stumped. The educators in the room were staring up at me, waiting for me to finish my sentence. Unfortunately, my mind had blanked. I could not recall the ingredients of flow.

In that moment, it didn't matter that I had taught the material dozens of times to hundreds of learners, ranging from game developers, to leaders, to the educators that sat before me. All that mattered was that flow was just a list of raw text. With neither an acronym, nor a visual aid to guide me, I could not bring them to mind.

This is a real event that took place in the summer of 2013, during the National Science Foundation's Edugaming Workshop (Murphy, 2015). It was this event that began my quest to find a better way to talk about Flow. The quest required looking deeper into the four ingredients and eventually, to discovering a new way to visualize them. This paper is the result of that quest.

This paper starts by reviewing flow. It will introduce the four ingredients. It will then present a new diagram that combines the four requirements of flow. Then, the paper will take a slight detour, to explore a second game design tenet: simplicity. It will present a four-part recipe for simplicity, as well as a corresponding diagram. Finally, this paper will show how the ideas of flow and simplicity can be combined into a single guide called Flow Space.

Background

Games are used for both entertainment and for learning. For example, the Navy uses the Damage Control Trainer to teach basic techniques that can save lives during a catastrophic event (Hussain, et al, 2009). As another example, consider the Safe Surgery Trainer, a game-based trainer that helps healthcare providers communicate better (Kreutzer, 2016). Much has already been written about games such as these, their links to learning, and the ideas of flow and engagement (Hussain, 2009, Kreutzer 2016, Murphy, 2010, Murphy 2011, Murphy 2013, Hussain 2010). Therefore, this paper starts with several premises. First, is that video games are engaging, that games can be used for training, and that flow is a fundamental aspect of engagement. Second is that flow and simplicity are tenets of game design. Third is that games are complex systems, often involving multi-disciplinary teams. Fourth is that the author is unaware of any existing diagrams showing all the ingredients of flow together, in one picture.

Purpose

With these premises, this paper proposes a new way to visualize, teach, and think about the fundamentals of game design. In specific, it offers visualizations for the concepts of flow and simplicity. The result, Flow Space, is offered as a new way to think about both learning and entertainment games.

FLOW

It has been more than twenty five years since Mihaly Csikszentmihalyi published, Flow – the Psychology of Optimal Experience (Csikszentmihalyi, 1990). In that seminal work, he described flow as “the state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it” (Csikszentmihalyi, 1990, p4). He later described flow as a “magnet

for learning.” (Csikszentmihalyi, 1997, p33) Since then, flow has been expanded upon by numerous researchers (Seligman, 2011, Schwartz, 2005, Deci, 1995, and Pink, 2009). It is generally described as the optimal human experience of engagement.

Flow is also widely accepted as one of the fundamental reasons that people play games (Csikszentmihalyi, 1997, 1990, Schell, 2008). For game designers, like Jenova Chen, they don't ask if flow is important, they only ask how long they can keep their players in it (Chen, 2007).

The Ingredients of Flow

Csikszentmihalyi described four pre-conditions that are necessary to enter the flow state (Csikszentmihalyi, 1997, 1990, Schell, 2008). To simplify the discussion, this paper will call these pre-conditions the *ingredients* that make up the *recipe* for flow. In addition, this paper will discuss flow primarily as it relates to games.

Clear Tasks

The first ingredient of flow is *clear tasks*. The tasks can be nearly anything, can be complex or simple, and can even be layered (i.e. tasks, sub-tasks, sub-sub-tasks). To describe tasks, games often use terms like goals, objectives, quests, missions, directives, and of course, tasks.

An important distinction is that the tasks must be clear to the player. To that end, there are three types of tasks that are often used in games (Murphy, 2013). The first is *explicit tasks*. These are explicitly dictated by the game. They include things such as collect 10 coins, match 3 colors, or beat the boss.

The second type of tasks is *implicit tasks*. These are tasks the game might implicitly expect the player to work toward, even if they are not explicitly defined. These include tasks such as staying alive as long as possible, maximizing your characters skills, and finding secrets.

The final type of tasks is *player-driven tasks*. These are self-directed goals that players chose for themselves. They are neither explicitly defined, nor implicitly expected of the player. These could include tasks such as building a castle out of glass, beating a boss-mob with only a pistol, or helping a friend. Player-driven tasks are limited only by the creative desires of the player.

Immediate Feedback

The second ingredient of flow is *immediate feedback*. As Csikszentmihalyi explains, “... the kind of feedback we work toward is in and of itself often unimportant. ... What makes this information valuable is the symbolic message it contains: that I have succeeded in my goal” (Csikszentmihalyi, 1997, p57) Or, more simply stated, feedback is how we perceive progress (Murphy, 2013). And, as flow is a real-time experience, the feedback should be given immediately.

There are as many ways to provide feedback as there games. And though the type of feedback is not important, there is one subtle note for game designers. Sometimes, games provide feedback that the player doesn't notice. This might happen when the action is very intense, when using small fonts, or when the feedback is subtle. The logical take-away is that if the player didn't notice it, then from the perspective of flow, the feedback did not occur.

In the gaming industry, feedback is so important that they've invented a special term for when feedback is taken to the extreme – *juice* (Jonasson, Purho, 2012). To understand juice, imagine tearing open an extremely ripe orange in slow motion, watching the juice spray everywhere. When a game provides that much feedback, it is called juicy.

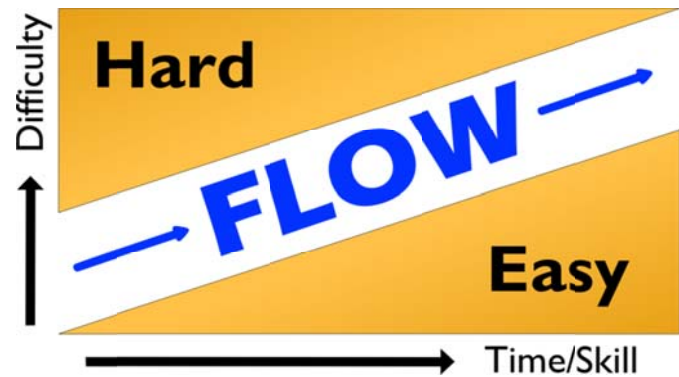
As it relates to learning games, it is important to note that in addition to promoting flow, feedback is also critical for both understanding and learning (Bransford, et al, 2000).

Balanced Difficulty

The third ingredient of flow is the one that people are generally familiar with. It is the idea that the goals should be somewhat challenging, also achievable, and not overly long. It is also the only ingredient that came with its own diagram (see Figure 1).

When tasks are too hard, we become agitated. When tasks are too easy or take too long, we become bored. It is only when tasks have a perfect balance of difficulty that we can enter into the *flow channel*.

There are a variety of names for this third ingredient, even within the original works (Csikszentmihalyi, 1990, 1997). To simplify the discussion, this paper will use the term, *balanced difficulty*.



**Figure 1. Flow Channel –
Balance of Difficulty vs Skill/Time**

Minimal Distractions

The fourth ingredient of flow is concentration. Csikszentmihalyi explains that flow requires being able to concentrate on the task at hand. This requires minimizing both internal and external distractions. Since games have little control over real-world distractions or the player's ability to concentrate, this paper describes the fourth ingredient in relation to the game itself - *minimal distractions*.

As stated in the original premises, games are complex systems, requiring multi-disciplinary teams including programming, art, and design. They often require audio assets, user interfaces, and input controls. There are mechanics to be taught, challenges to overcome, and stories to tell. In short, there are a lot of parts to a game, which may create a situation that hinders flow. For instance, complex interfaces, interruptions to gameplay, or overly intrusive story elements. In these cases, we may say that the game itself is distracting the player. Or when looked at from the designer's perspective, we are the biggest distraction.

The Recipe for Flow

When you put these four ingredients together, the recipe looks like this:

1. **Clear Tasks**
2. **Immediate Feedback**
3. **Balanced Difficulty**
4. **Minimal Distractions**

The Problem of Flow

The recipe for flow is rather simple. It's just four simple ingredients, which brings us back to the anecdote that started this paper. In that situation, the speaker was fully engaged with his audience. In fact, he was so involved with the discussion that when the conversation came back around to flow, he was unable to recall the four ingredients.

It's fair to argue that in this situation the problem was neither with the ingredients of flow, nor with the recipe itself. It is much more likely that the problem was related to working memory (i.e. cognitive load theory) (Plass et al, 2010). Working memory argues that we generally have 4-7 working slots for most activities. In this situation, the presenter was thinking about the people in the room, the moment to moment interactions, and the topics of discussion. All of which occupied working slots, so that when the discussion shifted back to flow, the presenter had to reach deep to pull up the recipe. This was further complicated because there is no easy way to compartmentalize the ingredients of flow. In other words, the full recipe for flow requires four slots.

This paper proposes that this anecdotal story provides some insight into a problem that could be relevant to all game designers. Remembering the premise that games are complex systems, involving multi-disciplinary teams (Hussain, 2010), it is reasonable to assume that game designers are balancing many factors at all times. This leaves less room

to constantly consider the four ingredients of flow. Therefore, this paper argues that just as the lecturer in our anecdotal story needed an easy way to bring the recipe to mind, it is reasonable to conclude that many game designers would benefit from a single, concise visualization of flow.

A Visual Guide

Below is a visual guide for flow. To the author's knowledge, it is the only attempt to include all four ingredients into one diagram (see Figure 2).

It's a simple diagram, comprised of three circles and a triangle. Conceptually, each of the circles contains one of the core ingredients of flow including tasks, feedback, and balanced difficulty. The triangle then represents a barrier that keeps distractions away. As you factor in each of the ingredients, you begin to get overlap. So that when you have tasks, feedback, and balance, without distractions, then you end up in the tiny triangle in the center. That triangle shows where the recipe for flow is complete. And the triangle is tiny to remind designers that flow is hard to achieve.

As of this writing, there has not yet been any research into the efficacy of this diagram as compared to the original text. It is worth noting that the author has used this diagram in workshops sponsored by the National Science Foundation as well as workshops with game development students in multiple high schools (Murphy, 2012-2015). These experiences suggest that this new guide compartmentalizes the concept of flow, which makes it easier for learners to recall. In practice, the learners tend to first remember the simple picture (3 circles and a triangle). Then they remember what goes in each shape. The result is that they can recall all four concepts without help. The author welcomes additional research on this topic.

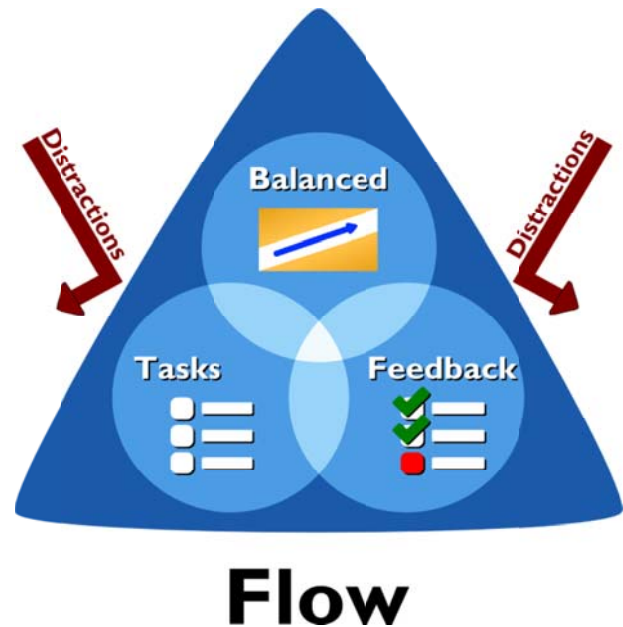


Figure 2. A Visual Guide of Flow

SIMPLICITY

This paper has introduced the concept of flow as well as a new visualization for it. Now, we will take a similar look at another tenet of game design: *simplicity* (Murphy, 2011, 2013, Schell 2008).

The Problem of Simplicity

Simplicity is a word that is like fun. It has powerful implications and at the same time, it is also quite vague (Murphy, 2013). It includes definitions such as, “being simple, uncomplicated, or uncompounded” (Merriam, 2016) and “plain, natural, or easy to understand” (Oxford, 2009). It also has deep meaning as seen in these words often attributed to Leonardo da Vinci, “Simplicity is the ultimate sophistication.”

A quick search will turn up lots of information about simplicity. Unfortunately, for game designers, there is little practical research about how we can put simplicity into our games. Rather, it seems to be one of those vague words that fall under the category, “I know it when I see it.” (Justice Stewart, 1964)

This section of the paper hopes to address that by introducing a theoretical framework for simplicity in games. It offers a practical recipe based on extensive research into the use of training games, including twelve years of game development experience and four years of design work with the National Science Foundation's Edugaming Workshop. It is presented as a starting point for future research.

The Ingredients of Simplicity

For the recipe for simplicity, we will start with a basic statement often attributed to Albert Einstein, “everything should be made as simple as possible, but not simpler”. We will then look at Csikszentmihalyi’s ideas that games simplify the world down to “goals and rules of action” (Csikszentmihalyi, 1990, p29) and allow players to focus entirely on “what should be done, and how” (Csikszentmihalyi, 1990, p29). With those two starting points, this paper offers the following recipe for simplicity.

Core

The first ingredient of simplicity is *Core*. Core is derived from this quote, attributed to Will Wright, “Your garden is not complete until there’s nothing else you can remove”. Simply stated, core is the essential experience.

For game designers, this means that all the elements of our game should tie directly to the experience we want the player to have. This applies to almost everything about the game including the user interface, the goals, the mechanics, feedback loops, user input, screen layout, story narrative, and rules. It further means that we can test every new game idea to make sure it is core by asking a simple question: would the game still work without it?

In practical terms, core also refers to limiting the amount of instruction in our games; reducing extraneous story elements, and being mindful about how much customization we allow. Core means introducing new elements only once they become a core part of the current gameplay (i.e. just-in-time).

An advanced form of core is the idea of empty space – leaving room for your game to breathe. Empty space implies elegance, conveys high quality, and allows appreciation of specific items (Reynolds, 2012).

Limited Choice

The second ingredient of simplicity is *Limited Choice*. This ingredient can seem counterintuitive at first because choice is itself a tenet of games. Sid Meier is often quoted as saying, “Games are a series of interesting and meaningful choices.” (Koster, 2005) Schell makes almost the exact same argument in *The Art of Game Design* (Schell, 2008). With such strong arguments in favor of choice, it is not surprising that designers put a lot of thought into it. Further, designers sometimes take that even further, concluding that if some choice is good, then more choice is better. Unfortunately, this latter conclusion is false.

Choice has a dark side: the paradox of choice. The paradox of choice was explored by researcher Barry Schwartz (Schwartz, 2005). As he explains, while some choice is good, too much choice can be very bad. His research shows that when faced with too many choices, people have difficulty weighing the options. This leads to three outcomes: 1) we simplify the decision with increasingly arbitrary criteria; 2) we hit option paralysis (inability to decide); or 3) we postpone decisions. In games, as in life, this is bad.

The full depth of how choice impacts game design is beyond the scope of this paper (Murphy, 2013). However, as it pertains to simplicity, the practical take away is clear – games need choices, and they also need to limit how many choices they have. The question then becomes, “How many?”

To answer that, we need to consider that games often involve a lot of learning. In fact, there is so much learning in most games that Raph Koster has argued, “The definition of a good game is therefore ‘one that teaches everything it has to offer before the player stops playing.’” (Koster, 2005, p46). So, if games are heavy learning activities, then we can look to see what learning science has to say about choice. And, the general consensus seems to be based on keeping the number of choices low so that we have enough working slots left for consideration. When looking at the vast sea of possible choices, a simple rule of thumb is three (Rodriguez, 2005).

Intuitive

The third ingredient of simplicity is Intuitive, which has definitions like, “feels to be true even without conscious reasoning” (Oxford, 2016). Though, again, this definition may not be as practical as we’d like. For that, we turn to the works of Malcolm Gladwell, Scott McCloud, and Daniel Kahneman.

In Malcolm Gladwell's book, *Blink* (2005), he explores the idea of the adaptive subconscious by explaining that we reach most conclusions in just a few seconds. This is similar to Kahneman's work in, *Thinking Fast, Thinking Slow* (2011), which explores that reach conclusions within seconds using System 1 thinking. It's also similar to Scott McCloud's, *Understanding Comics* (1994), which explores the idea of amplification through simplification – bringing clarity by using the simplest form such as an icon that people will instantly recognize. With these three as a background, we can now derive a more practical definition.

Intuitive means using what players already know. This is now easy to apply to most aspects of games. For instance, for the user interface, we'd use familiar concepts like Play, Back, and eXit. In the case of fantasy games, we'd use familiar names like elves, orcs, and magic. In the case of game play, we'd use familiar mechanics for movement, attacks, and non-player-character interaction. Intuitive design might use shapes that are easily recognized, standard movement that draws attention, and behaviors that are widely understood. All of these would be leveraging what the player is already likely to know.

This can be further reinforced by remaining self-consistent. That is, re-using design elements from earlier in the game. Jonathan Blow demonstrates this to great effect in his game, *The Witness*. Blow introduces a relatively new line-drawing mechanic in the first five seconds of the game. He then builds upon that mechanic, slowly expanding it, until eventually it is woven throughout every aspect of the game. Blow's consistent use of this clever new mechanic is likely one of the reasons his game has enjoyed such unusually high-profile press for an Indie puzzle game (Munch, 2016, Parkin, 2016)

The practical takeaway is clear. Use standard mechanics, accepted interfaces, and well-understood patterns to create a more intuitive game. Or simply stated, use what the player already knows.

Player's Perspective

The final ingredient for simplicity is a little different. Rather than focusing on what you put in or what you take out, **Player's Perspective** gives the designer a different frame of reference.

Modern games are complex systems. They can involve 300+ developers, across 5+ years, at a cost upwards of \$500M (The Economist, 2014). With all of this complexity, it is easy for designers to become absorbed in the systems, art, and infrastructure. This is compounded by the **curse of knowledge** (Camerer, et al, 1989). That's the cognitive bias that makes it hard for designers to see their games the way their players see them. Another way to think about the curse of knowledge is that it's hard to ignore what we already know.

The player's perspective ingredient helps address these by reminding the designer to always stay focused on the player. Always try to see the game the way the player sees it, even if that's hard to do. In practical terms, this might mean hiding the inner complexities of the mechanics, the details of the implementation, or the data that makes it all work. For every new thing we add, try to consider how the player will see it – being fully aware that the curse of knowledge exists.

The Recipe for Simplicity

Together, these four ingredients become a recipe:

1. **C**ore
2. **L**imited Choice
3. **I**ntuitive
4. **P**layer's Perspective

In the spirit of simplicity, the ingredients of this recipe also spell the word CLIP. This is to help remind designers that if it doesn't fit within the recipe, consider clipping it.

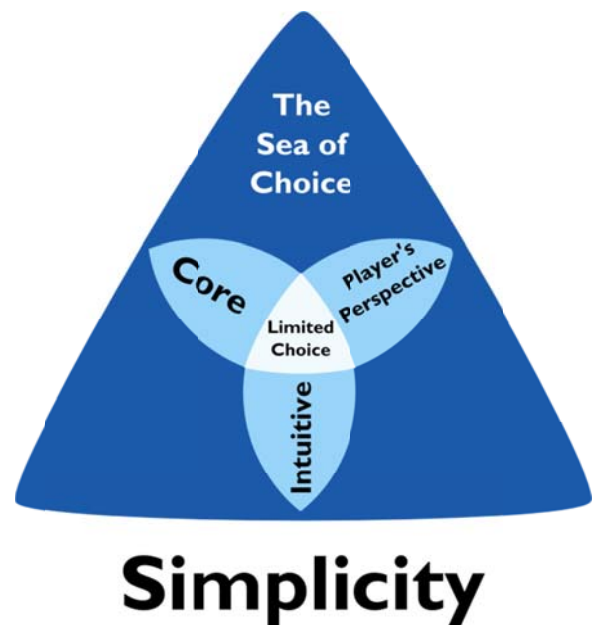


Figure 3. A Visual Guide of Simplicity

A Visual Guide

The visual guide for simplicity is shown in Figure 3. Like flow, it's a simple diagram, comprised of simple shapes. This time, the outer triangle represents the vast sea of possible choices. The flattened circles represent the other three ingredients: core, intuitive, and player's perspective. As you include each of the ingredients, you begin to get overlap. Simplicity is then achieved by overlapping core, intuitive, and player's perspective, as well as limited choice.

The author notes that the recipe for simplicity is offered as a theoretical framework. It is intended to give game designers a practical, purposeful, and visual way to design for simplicity. It is a starting point for future research.

FLOW SPACE

Now that we have explored both flow and simplicity, let's explore how they overlap to create *Flow Space*. Flow and simplicity are two separate tenets of game design. And at the same time, when putting them into practice, they often overlap. For instance, it is hard to think about feedback without also thinking about how to make it more intuitive. It is equally natural to consider that tasks should be related to the core. And, it is a simple extension to imagine that large numbers of choices could easily become a distraction.

To further strengthen the relationship between flow and simplicity, the two diagrams were created to look similar. They use similar shapes, colors, and orientation. This section continues exploring this overlap by connecting the ingredients of simplicity back to flow.

Core

The first ingredient of simplicity is core. It reminds designers to stay focused on our essential experience. It is summed up by these words attributed to Will Wright, "Your garden is not complete until there's nothing else you can remove". Core connects most directly with two aspects of flow: tasks and balanced difficulty.

1. **Clear Tasks** – The idea of core connects to tasks by reminding designers that the tasks, objectives, and goals in the game should be highly relevant to the core experience. For learning games, this means the tasks should be focused directly on the learning. For entertainment games, this means the tasks should be focused directly on the engagement of the core game loops.
2. **Balanced Difficulty** – The idea of core connects to difficulty by reminding designers that the challenge in the game should be focused on the essential experience. This argues against adding excessive difficulty in areas that are tangential. It also argues against adding extremely time-consuming tasks in tangential areas.

Limited Choice

The second ingredient of simplicity is limited choice. This reminds designers to keep the number of choices to around three. The surprising thing about choice is that it can impact all the ingredients of flow including tasks, feedback, balanced difficulty, and distractions.

1. **Clear Tasks** – Too many choices makes the tasks less clear. Is the task to pick the correct choice, to understand all the options, or even to experiment with each individually. This is further complicated depending on how impactful the choices are. Decisions with long-term impact might add the player-driven-task to consider the end-game consequences much too early. All of which adds confusion to the tasks.
2. **Immediate Feedback** – The addition of many choices can make it difficult to understand what the feedback means. Consider a situation where the player failed a mission. If there were lots of choices involved, the player is now trying to figure out how to improve, except it is unclear whether they failed from the choices they did make, the choices they didn't make, or simply from a lack of skill.
3. **Balanced Difficulty** – The addition of choices can directly affect the difficulty. More choice requires more thinking, which raises difficulty. Similarly, more choices could also make the task take a long time, as the player tries to learn about each option. So, more choices can make the task harder, more boring, or both.

4. **Distractions** – The addition of choices affects distractions in obvious ways. More choices will require more time, effort, and brain power that can distract the player away from the game they are trying to play.

Intuitive

The third ingredient of simplicity is intuitive. It reminds designers to use elements that will be familiar to players. Intuitive connects most directly with tasks and feedback.

1. **Clear Tasks** – The idea of intuitive connects to tasks by reminding designers that the tasks, objectives, and goals in the game should be familiar to players. This is why popular games often use familiar tasks such as matching gems, collecting X objects, and beating a mini-boss.
2. **Immediate Feedback** – The idea of intuitive connects to feedback by reminding designers that the feedback should use patterns the player already understands. This is why popular games often use score values on the top of the screen, use tokens to represent collections of things, and provide both audio and visual cues for accomplishments.

Player's Perspective

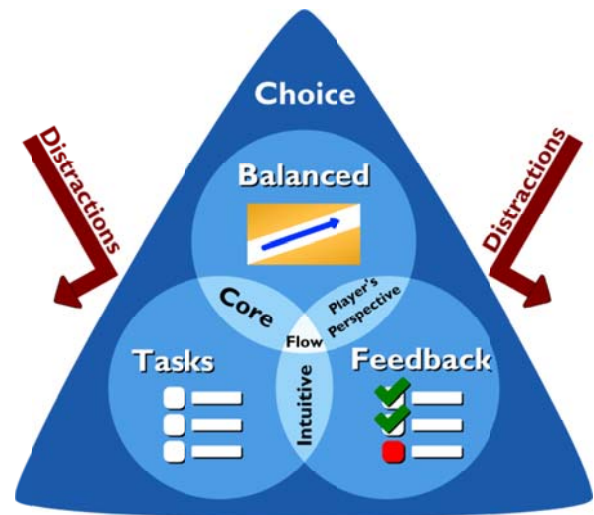
The final ingredient of simplicity is player's perspective. It is the 'P' in CLIP, and it reminds designers to always consider how the player sees the game. Player's perspective connects most directly with balanced difficulty and feedback.

1. **Immediate Feedback** – Player's perspective connects to feedback by reminding the designer that feedback did not occur if the player didn't perceive it. This is why games often use high-contrast, excessive movement (aka juice), and lots of audio cues. Player's perspective also reminds designers that player's might not know enough about the game to absorb all the feedback they are getting. So, we design carefully, so as to provide the most important feedback, as clearly as possible, when the player needs it most.
2. **Balanced Difficulty** – Player's perspective connects to difficulty by reminding the designer that what seems easy for them is probably really hard for the player. The curse of knowledge is particularly troublesome in puzzle games, where the solution is often an 'aha!' moment that is painfully obvious to the designer.

A Visual Guide

Now that we have explored how flow and simplicity relate, we can put the two diagrams together (see Figure 4).

Once again, this guide uses simple shapes to connect all of the elements of flow and simplicity into a single cohesive picture. The diagram reminds designers how the tenets relate. For instance, because of the placement, it is clear that core relates to tasks and balanced difficulty. In addition, it is clear that intuitive relates to tasks and feedback. Further, it is clear that player's perspective applies best to balance and feedback. Finally, the diagram hints that the best results are likely to be achieved in that tiny triangle in the center, where all of the elements overlap. This reminds designers that achieving both flow and simplicity is hard.



Flow Space

Figure 4. A Visual Guide of Flow Space

CONCLUSION

This paper explores the game design tenets of flow and simplicity. It proposes that there are better ways to think about flow that will improve the way designers think about their games. It also proposes a theoretical framework for simplicity that is specifically tied to games. Then, it proposes visual guides for both of these concepts before connecting the two together into a single diagram called Flow Space.

This paper is not a comprehensive exploration of this topic. It is an introduction that includes new visual guides for two of the tenets of game design. It is the hope that these new guides will help designers to design better games, whether for learning or for entertainment. This paper is also the answer to the original quest. After all, since the creation of these guides, the author has not been caught tongue-tied, trying to remember the recipe for flow.

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