

# **Flow in Games**

*a Jenova Chen MFA Thesis*



# 游戏中的流程

Jenova Chen 艺术硕士论文



## **Abstract**

This thesis provides a unique game design methodology to realize player-centric Dynamic Difficulty Adjustment (DDA) in video games, which creates optimized video game experiences for different types of players.

Rather than offering player a passive DDA experience by analyzing incomplete in-game data, this thesis uses Mihaly Csikszentmihalyi's Flow theory and provides players with subconscious choices to help them actively customize their optimal video game experiences. It treats active DDA as a new parameter for analyzing video games and seeks to address why certain video games had a wider appeal than others



## 抽象

本论文提供了一种独特的游戏设计方法，可以在视频游戏中实现以玩家为中心的动态难度调整 (DDA)，从而为不同类型的玩家创建优化的视频游戏体验。

本论文不是通过分析不完整的游戏中数据来为玩家提供被动的 DDA 体验，而是使用 Mihaly Csikszentmihalyi 的 Flow 理论，为玩家提供潜意识的选择，帮助他们主动定制最佳视频游戏体验。它将主动 DDA 视为分析视频游戏的新参数，并试图解决为什么某些视频游戏比其他游戏具有更广泛的吸引力



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## 介绍

- 本论文使用 Mihaly Csikszentmihalyi 的 Flow 理论，为玩家提供潜意识选择，帮助他们主动定制最佳视觉体验
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## 书目



# Introduction

"TWENTY-THREE HUNDRED YEARS AGO Aristotle concluded that, more than anything else, men and women seek happiness..."

- Mihaly Csikszentmihalyi (1990)

## Motivation

In the last 30 years, as a form of entertainment, video games have evolved from confined arcade activities into a mature media. Video games have deeply infiltrated our daily life and our society.

As if toys expanded every child's imagination, modern videogames take advantage of a player's active involvement to open more possibilities than any other existing mediums. [Wright 2006] More and more people grow up playing video games, treating them not only as an art form but also as serious media.

However, video games are still recognized by the majority, who do not play video games, as shallow and aggression-provoking materials. The difference between watching someone playing a video game, and playing a video game by yourself, is tremendous. The most efficient way to reduce bias and resistance from non-gamers is to create games they feel like playing. When a non-gamer can find a game they enjoy, they will no longer consider video games shallow.

Due to the nature of marketing and business, making video games purely for non-gamers is too risky and impractical. Game developers are looking for ways to expand the reach of their products. By taking existing intellectual properties from books or movies, making games appealing to both gamers and non-gamers is not as difficult as it seems to be. However making a game that both gamers and non-gamers can enjoy is quite a challenge.

The quality and the budget of typical commercial video games today can easily reach over 20 million dollars. Ironically, because of the richness and the length of their content, most gamers can't even finish their games today. While these games might be fine for their target audience, but are excessively boring or challenging for other gamers. Million-dollar production values are wasted at that point.

As the market of video games grows, methodologies for video games to adapt to different types of gamers, while keeping all of them engaged, are in demand for the next generation of gaming.

## Inspiration

20 years ago, with an intention to explain happiness, Mihaly Csikszentmihalyi found Flow, the feeling of complete and energized focus in an activity, with a high level of enjoyment and fulfillment. [Debold 2002]

Csikszentmihalyi developed a series of theories to help people get into their Flow state. Since then, these theories have been applied to various fields for designing better human interactive experiences. One of his most inspiring achievements in these theories is the definition of the Flow Zone, also known as "the Zone" by the gamers:



# 介绍

“2300 年前，亚里士多德得出结论，男人和女人最寻求幸福的是……” – Mihaly Csikszentmihalyi (1990)

## 赋予动机

在过去的 30 年里，作为一种娱乐形式，视频游戏已经从局限的街机活动发展成为一种成熟的媒体。电子游戏已经深深渗透到我们的日常生活和社会中。

就像玩具扩展了每个孩子的想象力一样，现代电子游戏利用玩家的积极参与来开辟比任何其他现有媒体更多的可能性。[赖特 2006 年]越来越多的人从小玩电子游戏长大，不仅将它们视为一种艺术形式，而且将其视为一种严肃的媒体。

然而，大多数不玩电子游戏的人仍然认为电子游戏是肤浅和挑衅性的材料。看别人玩电子游戏和自己玩电子游戏之间的区别是巨大的。减少非游戏玩家的偏见和抵制的最有效方法是创建他们想玩的游戏。当非游戏玩家可以找到他们喜欢的游戏时，他们将不再认为电子游戏肤浅。

由于营销和商业的性质，纯粹为非游戏玩家制作视频游戏风险太大且不切实际。游戏开发者正在寻找扩大其产品覆盖范围的方法。通过从书籍或电影中获取现有的知识产权，使游戏对游戏玩家和非游戏玩家都有吸引力并不像看起来那么困难。

然而，制作一款游戏玩家和非游戏玩家都可以享受的游戏是一个相当大的挑战。

当今典型商业视频游戏的质量和预算很容易达到 2000 万美元以上。具有讽刺意味的是，由于内容的丰富性和长度，大多数游戏玩家今天甚至无法完成他们的游戏。虽然这些游戏可能适合他们的目标受众，但对其他游戏玩家来说过于无聊或具有挑战性。在这一点上，百万美元的生产价值被浪费了。

随着视频游戏市场的增长，下一代游戏需要让视频游戏适应不同类型的游戏玩家，同时保持他们所有人的参与度的方法。

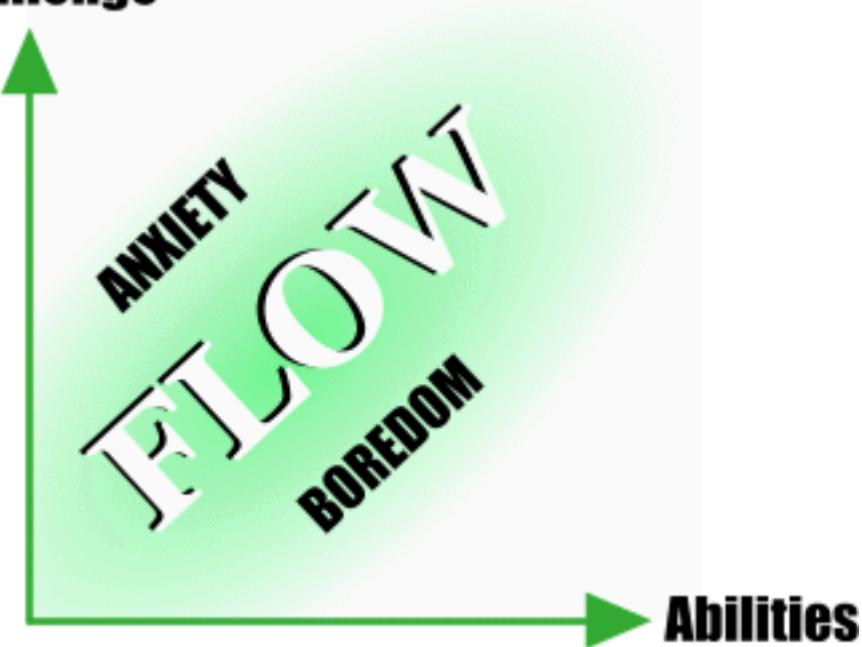
## 灵感

20 年前，为了解释幸福，Mihaly Csikszentmihalyi 发现了 Flow，即在活动中完全和充满活力的专注感，具有高度的享受和成就感。[Debold 2002 年]

Csikszentmihalyi 开发了一系列理论来帮助人们进入心流状态。从那时起，这些理论已应用于各个领域，以设计更好的人类交互体验。他在这些理论中最鼓舞人心的成就之一是 Flow Zone 的定义，也被游戏玩家称为“The Zone”：



# Challenge



In order to maintain a person's Flow experience, the activity needs to reach a balance between the challenges of the activity and the abilities of the participant. If the challenge is higher than the ability, the activity becomes overwhelming and generates anxiety. If the challenge is lower than the ability, it provokes boredom. Fortunately, human beings have tolerance, there is a fuzzy safe zone where the activity is not too challenging or too boring, and psychic entropies like anxiety and boredom would not occur. [Csikszentmihalyi 1990]

Due to the special relationship between challenge and ability, Flow has been used in fields like sports and tutoring. The famous GRE test is a good example of design based on the concept of the Flow Zone.

The description of Flow is identical to what a player experiences when totally immersed in a video game. During this experience, the player loses track of time and forgets all external pressures. It is obvious that gamers value video games based on whether or not those games can provide Flow experiences. [Holt 2000]

Thus, much research is being done about how to use Flow to evaluate video game experiences. However, there are only a few researchers out there dealing with the actual implementation of Flow inside video games.

Methodologies that help game designers to realize and maintain players' Flow experiences are not well defined.

## Overview of the Thesis

The remainder of this thesis is organized into four chapters.

In [Foundation](#) – We will further explore Mihaly Csikszentmihalyi's Flow theory, introduce the concept of DDA (Dynamic Difficulty Adjustment), and check out existing research and methodologies about DDA

In [Design Flow in Games](#) – We are going to discuss the in-depth methodology about implementing Flow and player-oriented DDA inside video game.



# Challenge



也称为为了维持一个人的 Flow 体验，活动需要在活动的挑战和参与者的能力之间取得平衡。如果挑战高于能力，则活动会变得势不可挡并产生焦虑。如果挑战低于能力，就会引起无聊。幸运的是，人类有宽容度，有一个模糊的安全区，活动不会太具有挑战性或太无聊，焦虑和无聊等心理熵不会发生。[Csikszentmihalyi 1990 年]

由于挑战和能力之间的特殊关系，Flow 已被用于体育和辅导等领域。著名的 GRE 测试是基于 Flow Zone 概念的设计的一个很好的例子。

Flow 的描述与玩家完全沉浸在视频游戏中时的体验相同。在这种体验中，玩家忘记了时间，忘记了所有外部压力。很明显，游戏玩家根据视频游戏是否能提供 Flow 体验来评估这些游戏。[霍尔特 2000 年]

因此，关于如何使用 Flow 评估视频游戏体验，人们正在进行大量研究。然而，只有少数研究人员在处理视频游戏中 Flow 的实际实现。

帮助游戏设计师实现和维护玩家的 Flow 体验的方法尚未明确定义。

## 论文概述

本论文的其余部分分为四章。

在基础 – 我们将进一步探索 Mihaly Csikszentmihalyi 的流动理论，介绍 DDA（动态难度调整）的概念，并查看有关 DDA 的现有研究和方法

在游戏中设计 Flow – 我们将讨论有关在视频游戏中实现 Flow 和面向玩家的 DDA 的深入方法。



In [Implement Flow in Games](#) – Two games created specifically for testing player-oriented DDA and their test results are presented.

In [Conclusion](#) – We would summarize the methodology, review the next research step, and look at possible application beyond video games.

## **Summary of the Contribution**

The goal for Jenova Chen's MFA thesis research is to explore and develop different design techniques to enhance the Flow experience in video games. It includes general Flow design theories & processes, analysis of the existing games' Flow designs and examples of how to implement Flow with these techniques.

The contributions of this thesis, with respect to this goal, include:

- A recap of Mihaly Csikszentmihalyi's Flow theory from a game design perspective
- An overview of the current generation system-oriented DDA research and techniques
- Reinvent DDA with user/player-oriented concept
- Two new games which embody the player-oriented DDA including a discussion of the inner workings of each
- An overview of further directions and unexplored avenues for future research in the domain of achieving Flow through video game design



在 Implement Flow in Games – 介绍了两个专为测试面向玩家的 DDA 而创建的游戏及其测试结果。

总之 – 我们将总结该方法，回顾下一步研究，并研究电子游戏之外的可能应用。

## 贡献摘要

Jenova Chen 的 MFA 论文研究目标是探索和开发不同的设计技术，以增强视频游戏中的 Flow 体验。它包括一般的Flow设计理论和流程，对现有游戏的Flow设计的分析，以及如何使用这些技术实现Flow的示例。

就这一目标而言，本论文的贡献包括：

- 从游戏设计角度回顾 Mihaly Csikszentmihalyi 的 Flow 理论
- 当前一代面向系统的 DDA 研究和技术概述
- 以用户 / 玩家为导向的理念重塑 DDA
- 两款新游戏体现了面向玩家的 DDA，包括对每款游戏内部工作原理的讨论
- 未来研究的进一步方向和未探索途径概述  
通过视频游戏设计实现 Flow 的领域



# Foundation

## Flow as Fun

People associate many feelings with "fun", the sense of timelessness, of being at one, of exhilaration, focus, immediacy. All of these are characteristic of "fun".

There is a universal agreement that without a dynamic balance between the challenge of an activity and the ability to meet that challenge, fun is something we are definitely not having. Interestingly, making it possible for anyone to find exactly the right amount of challenge to engage with the exact abilities is the only way to access Flow. This means that when work is fun we have created complex, but negotiable challenges, challenges that allow the individual to engage or disengage, to work harder or work safer. [Dekoven DeepFun.com]

At this point, fun can be defined as Flow, a balance of the relationship between challenge and ability.

## Elements of Flow

According to Mihaly Csikszentmihalyi's well-documented research and wide-scale gathering of personal observations, the phenomenology of Flow has eight major components.

1. A challenge activity that requires skills
2. The merging of action and awareness
3. Clear goals
4. Direct feedback
5. Concentration on the task at hand
6. The sense of control
7. The loss of self-consciousness
8. The transformation of time

Not all of these components are needed for flow to be experienced. [Csikszentmihalyi 1990]

Once we have digested the above components and revisited them with a game design perspective, here are the three core elements a video game must have in order to evoke Flow experience.

1. As a premise, the game is intrinsically rewarding, and the player is up to play the game.
2. The game offers right amount of challenges to match with the player's ability, which allows him/her to delve deeply into the game.
3. The player needs to feel a sense of personal control over the game activity.

As a result, the game will make player lose track of time and self-consciousness.



# 基础

## Flow as Fun

人们将许多感受与“乐趣”、永恒感、一体感、兴奋感、专注感、即时性联系起来。所有这些都是“乐趣”的特点。

有一个普遍的共识，如果活动的挑战和应对挑战的能力之间没有动态平衡，我们绝对不会有乐趣。有趣的是，让任何人都可以找到恰到好处的挑战来参与确切的能力是访问 Flow 的唯一途径。这意味着，当工作充满乐趣时，我们创造了复杂但可以协商的挑战，这些挑战使个人能够参与或退出，更加努力地工作或更安全地工作。[Dekoven DeepFun.com]

在这一点上，乐趣可以定义为 Flow，即挑战和能力之间关系的平衡。

## 流元素

根据 Mihaly Csikszentmihalyi 有据可查的研究和广泛的个人观察收集，心流现象学有八个主要组成部分。

1. 需要技能的挑战活动
2. 行动与意识的融合
3. 明确的目标
4. 直接反馈
5. 专注于手头的任务
6. 控制感
7. 自我意识的丧失
8. 时间的转变

并非所有这些组件都需要体验 flow。[Csikszentmihalyi 1990 年]

一旦我们消化了上述组件并从游戏设计的角度重新审视它们，以下是视频游戏必须具备的三个核心要素，才能唤起 Flow 体验。

1. 作为一个前提，游戏本质上是有益的，玩家愿意玩游戏。
2. 游戏提供了适量的挑战以匹配玩家的能力，这使他/她能够深入研究游戏。
3. 玩家需要对游戏活动有一种个人控制感。

结果，游戏会让玩家忘记时间和自我意识。



To make a game that different people can enjoy, the game itself must retain these four elements, especially to adjust the challenge based on each player's ability.

## **Dynamic Difficulty Adjustment**

Dynamic Difficulty Adjustment, also known as DDA, is a fairly straightforward and ideal concept in the game design field. The difficulty of a game should change dynamically based on its player's skill and performance.

However, designing and implementing a DDA system is not trivial. Every so often, DDA systems take control away from the game designers, which potentially causes more problems than a linear game. Few commercial developers have implemented DDA systems for their games, and even fewer have shipped them. [Arey & Wells 2001]

Over all DDA is just part of the core elements of Flow, it cannot stand-alone and reach Flow by itself. Rather than focusing on designing a DDA system for games, designing a general Flow system based on all core elements will be more direct and useful for the game designers



要制作一款不同人都能享受的游戏，游戏本身必须保留这四个要素，尤其是要根据每个玩家的能力来调整挑战。

## 动态难度调整

动态难度调整，也称为 DDA，是游戏设计领域一个相当简单和理想的概念。游戏的难度应该根据玩家的技能和表现动态变化。

但是，设计和实现 DDA 系统并非易事。每隔一段时间，DDA 系统就会从游戏设计师手中夺走控制权，这可能会导致比线性游戏更多的问题。很少有商业开发商为他们的游戏实施了 DDA 系统，而发布 DDA 系统的就更少了。[Arey & Wells 2001年]

总的来说，DDA 只是 Flow 核心元素的一部分，它不能独立地独立地到达 Flow。与其专注于为游戏设计 DDA 系统，不如基于所有核心元素设计通用的 Flow 系统，这对游戏设计师来说会更直接、更有用



# Design Flow in Games

Video games as a media can be reviewed as two essential components:

**Game Content** - The soul of a video game; a specific experience the game is designed to convey

**Game System** - The body of a video game; an interactive software that communicates Game Content to the players through visuals, audio and interactions

When treated as content, the definition of Flow is too broad. However, if applied properly, it can literally happen in every game. In order to make a game special, it requires content that is more sophisticated than Flow experiences.

But when treated as a system Flow explains why people prefer certain games more than other games and how they become addicted towards these games. If a game meets all the core elements of Flow, any content could become rewarding, any premise might become engaging. [Sweetser & Wyeth 2005]

From the simplicity of Tetris to the complexity of Civilization IV, video games have already proven to the world that anything can be fun if players can access Flow.

## Expand the Flow Zone

Assume the content is attractive to the audience. Designing a video game is very much about how to keep the player in the Flow and eventually be able to finish the game. Therefore, the game system needs to maintain different players' experiences inside the Flow Zone.

In Figure 2, the red curve represents an actual experience a player gained through playing one segment of a video game. The player may feel a certain part of the game experience is a little bit harder or easier than their expectation. But he can still tolerate and maintain his Flow experience inside the safe zone.

If the actual experience gets too far away from the Flow zone, the negative psychic entropy like anxiety and boredom will break player's Flow experience. See Figure 3.

Unfortunately, like fingerprints, different people have different skills and Flow Zones. A well-designed game might keep normal players in Flow, but will not be as effective for hardcore or novice players. See Figure 4.

For example, a simple action to an FPS player such as shooting, might be an extremely difficult task for a casual gamer just starting a game. Even though the rest of the game might be something that casual gamers enjoy a lot, the harsh beginning just turns them off.

In order to design a game for broader audiences, the in-game experience can't be linear and static. Instead, it needs to offer a wide coverage of potential experiences to fit in different players' Flow Zones.

To expand a game's Flow Zone coverage, the design needs to offer a wide variety of gameplay experiences. From extremely simple tasks to complex problem solving, different



# 游戏中的设计流程

视频游戏作为一种媒体，而不是专注于为游戏设计 DDA 系统，而是可以将其视为两个基本组成部分：  
游戏内容 – 视频游戏的灵魂;游戏旨在传达的特定体验

Game System – 视频游戏的主体;一款交互式软件，通过视觉、音频和交互将游戏内容传达给玩家

当被视为内容时，Flow 的定义过于宽泛。但是，如果应用得当，它实际上可以在每场比赛中发生。为了使游戏与众不同，它需要比 Flow 体验更复杂的内容。

但是当被视为一个系统时，Flow 解释了为什么人们更喜欢某些游戏而不是其他游戏，以及他们是如何沉迷于这些游戏的。如果游戏满足 Flow 的所有核心元素，任何内容都可能变得有益，任何前提都可能变得引人入胜。[Sweetser & Wyeth 2005]

从俄罗斯方块的简单性到文明 IV 的复杂性，电子游戏已经向世界证明，如果玩家可以访问 Flow，任何事情都可以变得有趣。

## 展开 Flow 区域

假设内容对受众有吸引力。设计视频游戏在很大程度上是关于如何将玩家保持在 Flow 中并最终能够完成游戏。因此，游戏系统需要在 Flow Zone 内维护不同玩家的体验。

在图 2 中，红色曲线表示玩家通过玩视频游戏的某个部分获得的实际体验。玩家可能会觉得游戏体验的某个部分比他们预期的要难或容易一些。但他仍然可以在安全区内容忍并保持他的 Flow 体验。

如果实际体验离 Flow 区域太远，焦虑和无聊等负面心理熵会破坏玩家的 Flow 体验。参见图 3。

不幸的是，就像指纹一样，不同的人有不同的技能和 Flow Zone。设计良好的游戏可能会让普通玩家留在 Flow 中，但对于铁杆玩家或新手玩家来说不会那么有效。参见图 4。

例如，对于 FPS 玩家来说，射击等简单动作对于刚开始游戏的休闲游戏玩家来说可能是一项极其困难的任务。尽管游戏的其余部分可能是休闲游戏玩家非常喜欢的东西，但严酷的开始只会让他们失望。

为了为更广泛的受众设计游戏，游戏内体验不能是线性和静态的。相反，它需要提供广泛的潜在体验，以适应不同玩家的 Flow Zone。

为了扩大游戏的 Flow Zone 覆盖范围，设计需要提供各种游戏体验。从极其简单的任务到复杂的问题解决，各不相同



players should always be able to find the right amount of challenges to engage during the Flow experience. These options of different gameplay experiences need to be obvious, so that when players first start the game they can easily identify the corresponding gameplay experience and delve into it.

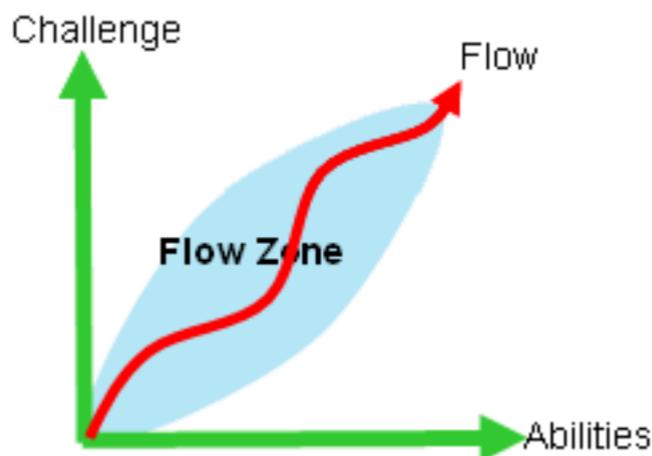


Figure 2 Player in-game Flow experience

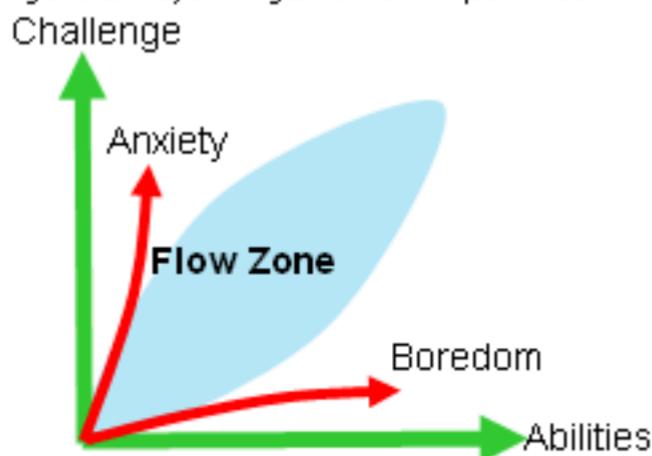


Figure 3 Player encounters psychic entropies

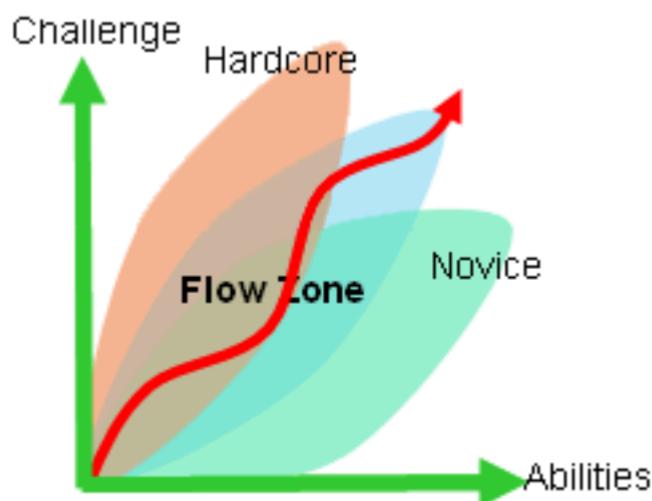


Figure 4 Different players and Flow Zones



不同的玩家应该始终能够在 Flow 体验期间找到适量的挑战来参与。这些不同游戏体验的选项需要很明显，这样当玩家第一次开始游戏时，他们可以轻松识别相应的游戏体验并深入研究。

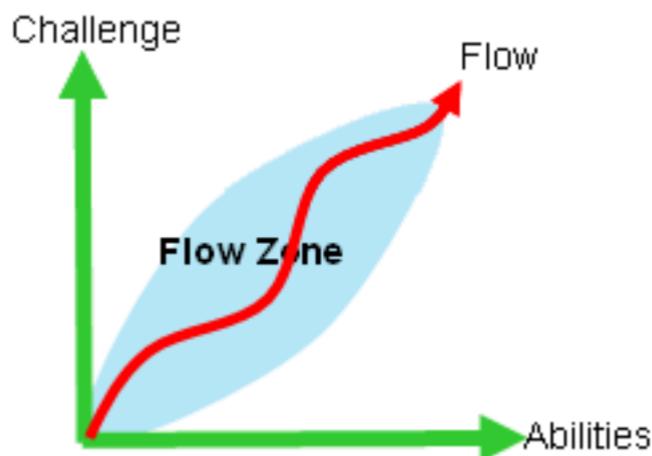


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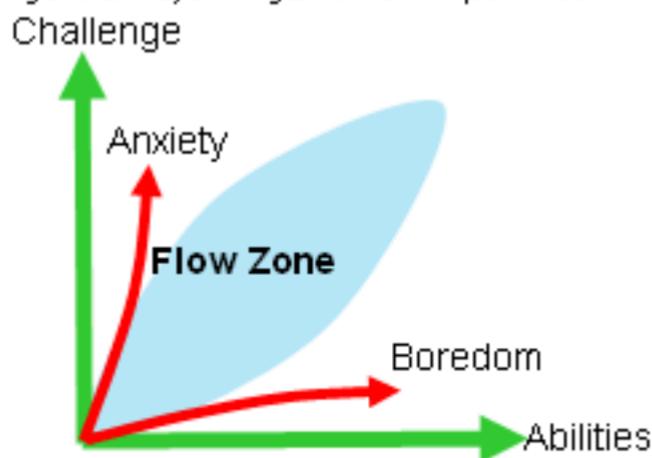


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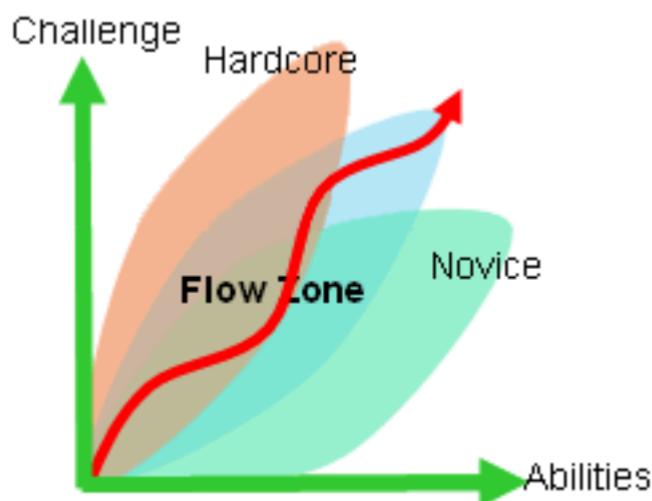


Figure 4 Different players and Flow Zones



## Create Dynamic Flow

### Game Tuning & Static Flow

Every so often, gamers describe an engaging game experience as "Well tuned". Tuning represents the process of a game designer using playtesting to iterate the design and manually polish the game experience until it gets close to evoking Flow. However, as the video game market expands, game tuning based on playtesting cannot satisfy the mass audience any more.

Playtesting usually involves multiple testers to reveal the potential Flow entropies in the game. On one hand, these entropies can be obvious at a micro level e.g. crashes, typos, texture flaws and bad dialogs. On the other hand, from a macro level, flaws inside core mechanics, plot arrangement, level difficulties and overall game progression are hard to identify. Today's playtesting is also very discontinuous. Each tester is in charge of different segments of the game. Without a view of the big pictures, Flows at the macro level are never really tested.

Game tuning also indicates the rigidity and linearity of the final game experience. The experience is adjusted for the specific testers and designers who cannot represent the variety of the mass audience. Flows in these games are very static. They can't adapt to different types of gamers.

In order to realize optimal experiences for a much wider audience, not only do we need to offer a wide Flow Zone coverage, we also need a highly adaptive system to weave the rich gameplay experiences together, adjusting Flow experiences based on the players.

### Passive Flow Adjustment

The biggest dilemma on Flow adjustment is whether or not to create a system to adjust the gameplay for the player. Under this kind of passive system, players can enjoy the Flow experience fed by the system.

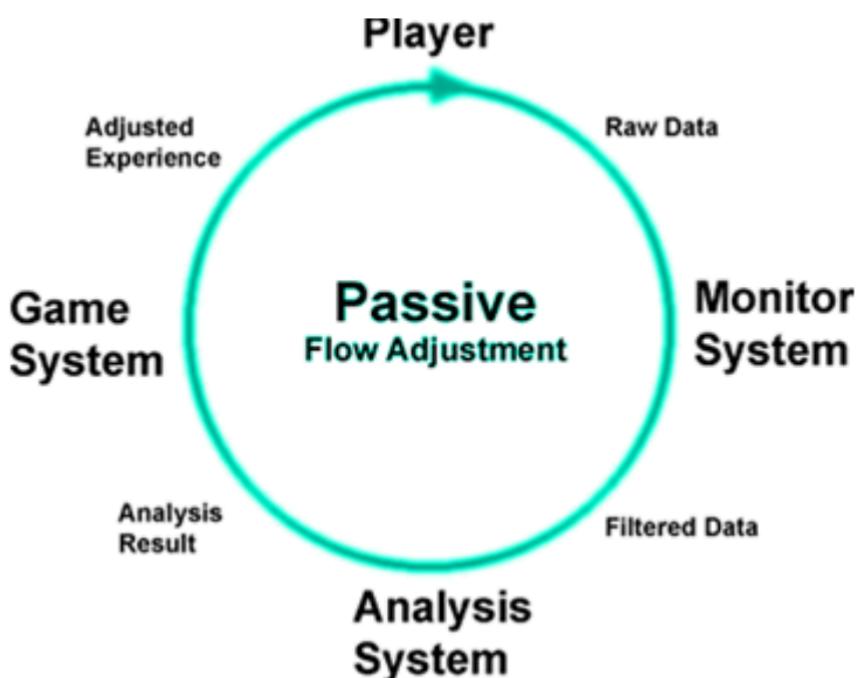


Figure 5 System-oriented DDA loop



## 创建动态流

### 游戏调整和静态流程

每隔一段时间，游戏玩家就会将引人入胜的游戏体验描述为“经过精心调整”。Tuning 代表了游戏设计师使用游戏测试来迭代设计并手动完善游戏体验直到它接近唤起 Flow 的过程。然而，随着视频游戏市场的扩大，基于游戏测试的游戏调优已经无法满足大众观众的需求。

游戏测试通常涉及多个测试人员，以揭示游戏中潜在的 Flow 烂。一方面，这些烂在微观层面上可能很明显，例如崩溃、拼写错误、纹理缺陷和糟糕的对话。另一方面，从宏观层面来看，核心机制、情节安排、关卡难度和整体游戏进展内部的缺陷很难识别。今天的游戏测试也非常不连续。每个测试人员负责游戏的不同部分。如果没有大局观，宏层面的 Flows 永远不会真正受到考验。

游戏调优还表明最终游戏体验的刚性和线性度。该体验针对无法代表大众受众多样性的特定测试人员和设计人员进行了调整。这些游戏中的流程是非常静态的。他们无法适应不同类型的游戏玩家。

为了为更广泛的受众实现最佳体验，我们不仅需要提供广泛的 Flow Zone 覆盖范围，还需要一个高度自适应的系统，将丰富的游戏体验编织在一起，根据玩家调整 Flow 体验。

### 被动流量调节

Flow 调整最大的困境是是否创建一个系统来为玩家调整游戏玩法。在这种被动系统下，玩家可以享受系统提供的 Flow 体验。

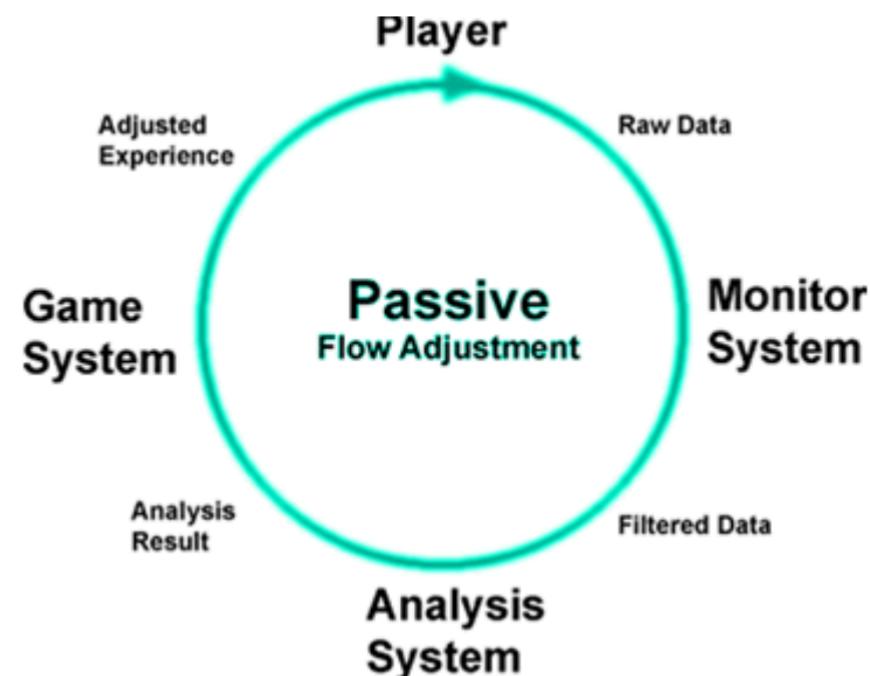


Figure 5 System-oriented DDA loop



Much research centers around designing a system that adjusts the difficulty based on the player's performance. This kind of system-oriented DDA works under an iterative adjusting loop.

The loop consists of four fundamental elements:

1. Player - Create raw data inside the game through playing
2. Monitor System - Choose critical data reflecting player's Flow state and pass it over Analysis System.
3. Analysis System - Analyze player's Flow state and notify the Game System about what needs to be changed
4. Game System - Apply changes to the gameplay based on the request from Analysis System

Theoretically, this system should be able to maintain player's Flow by constantly reacting to the feedback collected from him. [Bailey & Katchabaw 2005] However, there are still several key unsolved problems , which makes this type of passive flow adjustment hard to implement.

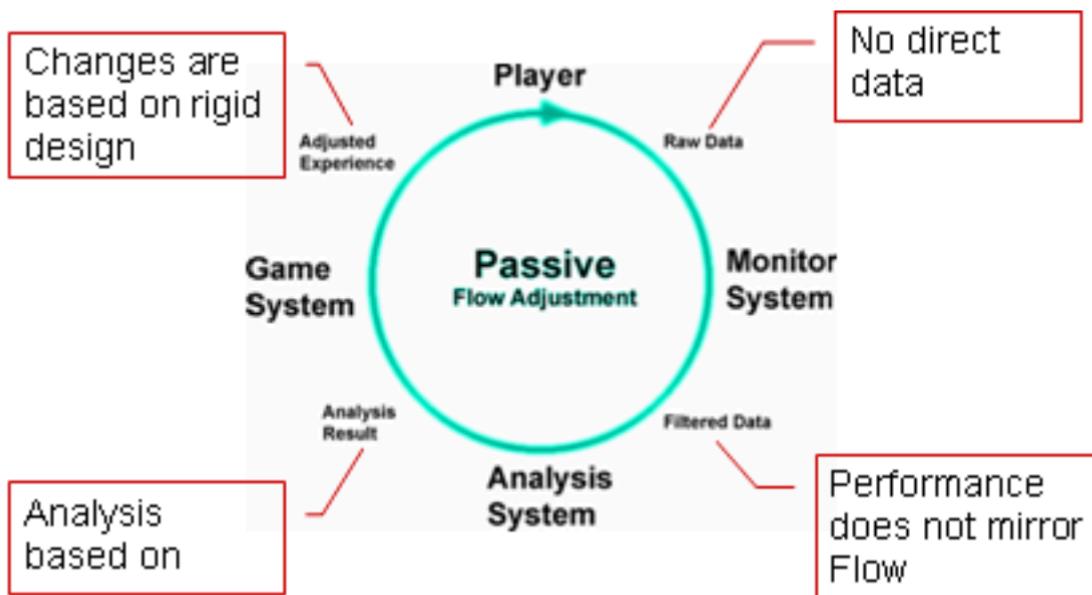


Figure 6 Issues inside System-oriented Flow DDA

No direct data - Video games do not read what player thinks yet. Up until today, the most common connections between players and video games are still going through game controllers. With limited inputs, the possibility to sense player's Flow state directly is very low. Although there are biofeedback devices on the market, people still lack the knowledge for imaging data into Flow and emotions. Most of the measurements are still based on assumptions and incomplete statistics.

Performance does not mirror Flow - Video game designers and researchers have figured out ways to estimate player's performance through sampling limited data like "Total Kill", "Accuracy" and "Headshot". However, performance is objective while Flow is subjective. When a player is in the Flow of just jumping around in Super Mario Bro but not finishing any level, the DDA system will have trouble to sense that.

Analysis based on assumptions - Assumptions never work for mass audience. When a player enjoys performing a suicidal stunt in Grand Theft Auto, it would be ridiculous for a DDA system to assume that the player's skill is too poor because of the death count.



许多研究都围绕着设计一个根据玩家的表现调整难度的系统。这种面向系统的 DDA 在迭代调整循环下工作。

该循环由四个基本元素组成：

1. Player – 通过玩游戏在游戏内创建原始数据
2. Monitor System – 选择反映玩家 Flow 状态的关键数据，并将其传递给 Analysis System。
3. 分析系统 – 分析玩家的 Flow 状态并通知 Game System 需要更改的内容

游戏系统 – 根据分析系统的请求对游戏玩法进行更改理论上，该系统应该能够通过不断响应从玩家那里收集的反馈来维护玩家的流程。[Bailey & Katchabaw 2005]但是，仍有几个关键的未解决的问题，这使得这种类型的被动流量调整难以实现。

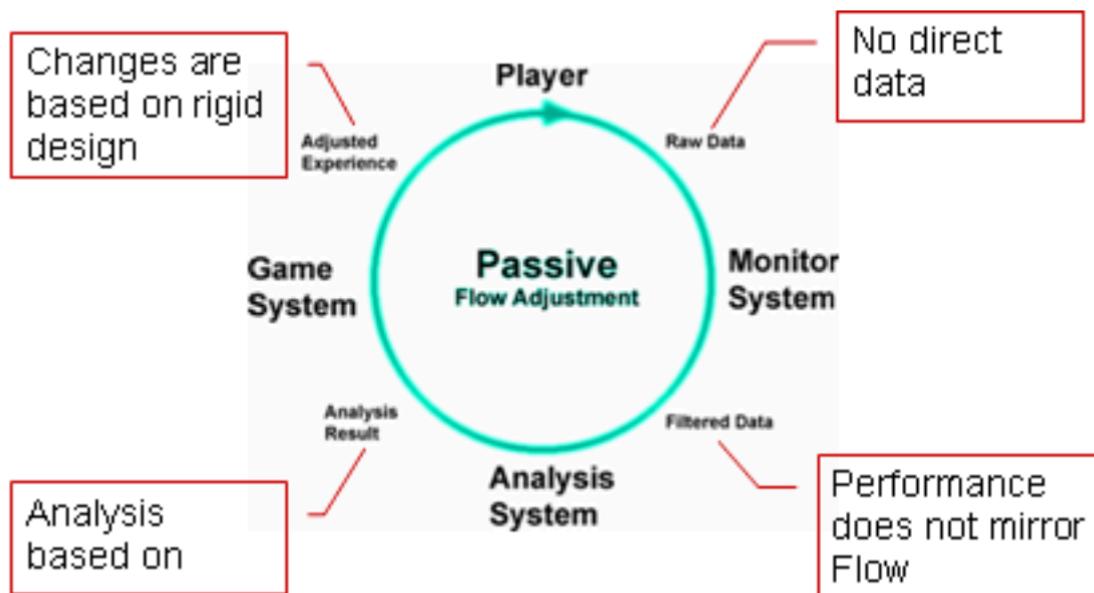


Figure 6 Issues inside System-oriented Flow DDA

没有直接数据 – 视频游戏还不能读取玩家的想法。直到今天，玩家和视频游戏之间最常见的连接仍然通过游戏控制器进行。在有限的输入下，直接感应玩家的 Flow 状态的可能性非常低。尽管市场上有生物反馈设备，但人们仍然缺乏将数据成像成 Flow 和情绪的知识。大多数测量仍然基于假设和不完整的统计数据。

性能并不能反映流量 – 视频游戏设计师和研究人员已经找到了通过对“Total Kill”、“Accuracy”和“Headshot”等有限数据进行采样来估计玩家性能的方法。但是，性能是客观的，而 Flow 是主观的。当玩家在《超级马里奥兄弟》中只是跳来跳去但没有完成任何关卡时，DDA 系统将难以感知到这一点。

基于假设的分析 – 假设永远不适用于大众受众。当玩家喜欢在侠盗猎车手中表演自杀特技时，DDA 系统因为死亡人数而假设玩家的技能太差是荒谬的。



Changes are based on rigid design – The way a system adjusts its difficulty is pre-determined by the designer. Different designers use their own preferences when deciding how many changes should be applied; however, the individual preferences of a designer will never represent the preferences of a mass audience. [Costikyan 2004]

### Active Flow Adjustment

Considering the core elements of Flow, most of the system-oriented DDA designs were over focused on one aspect, balancing between challenge and ability. However, they ignored the other important core element, to make player feel a sense of control over the game activity.

Mihaly Csikszentmihalyi often describes Flow as driving a small boat in parallel to the current. Being able to drive freely gifts a sense of control over micro action, and being carried by the current offers a sense of control over the macro activity, therefore evokes Flow.

In traditional passive media, like the current, the sense of control comes from the sense of progression and positive feedback. [Adams 2002] In video games, not only can players gain control from the progression, they can also earn it through driving the boat, which is in fact making meaningful choices. So why don't we give the players choices in a video game and let them navigate their Flow experience?

In order to create a game like this, as we mentioned in 4.1 Expand the Flow Zone, the game needs to offer a pool with a wide spectrum of activities and difficulties for different types of players to swim inside. Based on players' tastes, each individual will choose different choices and work at a different pace to navigate through the game.

Challenge

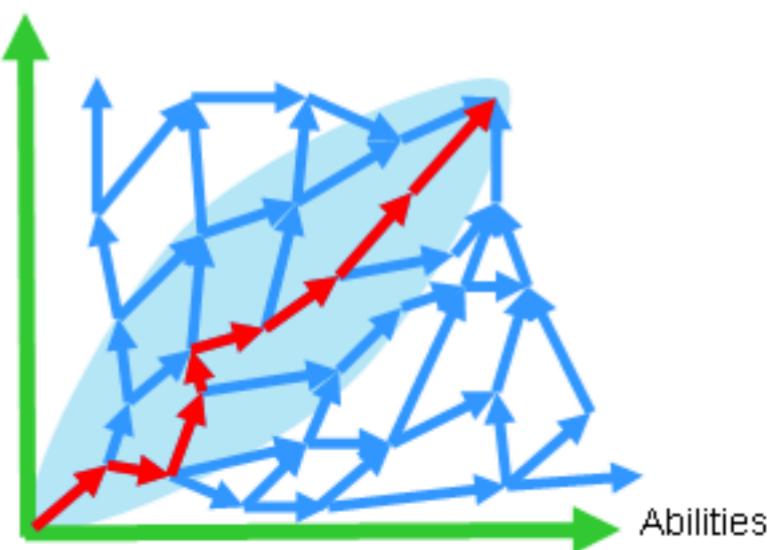


Figure 7 Active Flow Adjustment through Choices

Once a network of choices is applied, the Flow experience is very much customizable by the players. If they start feeling bored, they can choose to play harder, vice versa.

### Embed Choices into Gameplay



更改基于严格的设计 — 系统调整其难度的方式由设计师预先确定。不同的设计人员在决定应应用多少更改时，会使用自己的首选项；但是，设计师的个人偏好永远不会代表大众受众的偏好。[科斯蒂克扬 2004 年]

### 主动流量调整

考虑到 Flow 的核心元素，大多数面向系统的 DDA 设计都过度关注一个方面，即在挑战和能力之间取得平衡。然而，他们忽略了另一个重要的核心元素，让玩家对游戏活动有一种控制感。

Mihaly Csikszentmihalyi 经常将 Flow 描述为驾驶一艘与水流平行的小船。能够自由驾驶赋予了对微观行动的控制感，而被水流携带提供了对宏活动的控制感，因此唤起了心流。

在传统的被动媒体中，就像当下一样，控制感来自于进步感和正反馈。[亚当斯 2002 年]在电子游戏中，玩家不仅可以从进度中获得控制权，还可以通过驾驶船只来获得控制权，这实际上是做出有意义的选择。那么，我们为什么不在视频游戏中为玩家提供选择，让他们浏览自己的 Flow 体验呢？

为了创建这样的游戏，正如我们在 4.1 扩展流动区 中提到的，游戏需要提供一个具有广泛活动和难度的池子，供不同类型的玩家在里面游泳。根据玩家的口味，每个人都会选择不同的选择，并以不同的速度在游戏中导航。

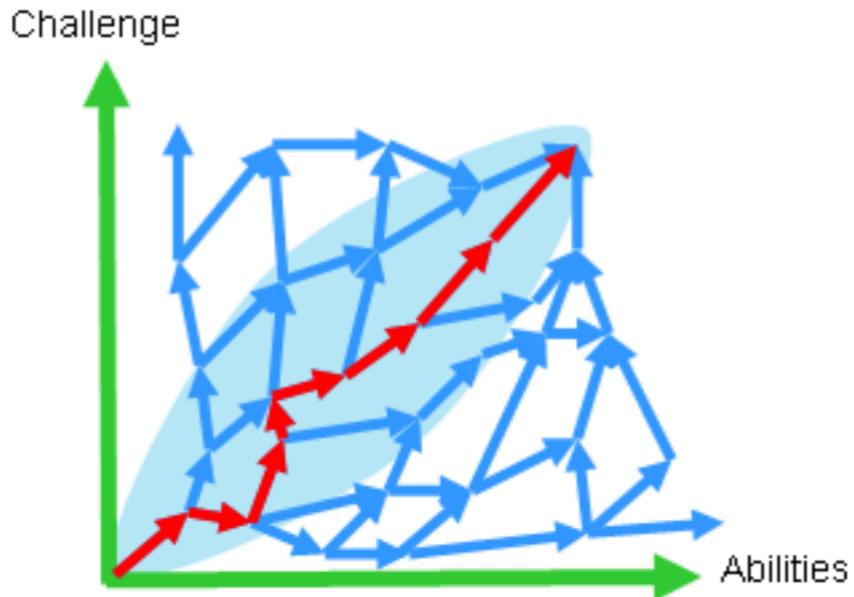


Figure 7 Active Flow Adjustment through Choices

一旦应用了选择网络，玩家就可以在很大程度上自定义 Flow 体验。如果他们开始感到无聊，他们可以选择更努力地玩，反之亦然。

### 将 Choices 嵌入到 Gameplay 中



Player-oriented DDA offers an active mechanic for players to control their in-game Flow experience. However, the implementation of these choices is not trivial.

In order to adjust Flow experiences dynamically and to reduce Flow noises, the choices have to appear in a relatively high frequency. These frequent choices might become potential interruptions for players who are in the Flow Zone.

The easy solution that might come to mind is to implement a monitor system to detect whether or not it is a good time to offer choices to the player. However, monitor systems are still not mature enough to be able to detect player's Flow. The only solution is to embed choices into the gameplay, let the player treat choices as part of the play and eventually ignore them. Thus their choices will become intuitive and reflecting their actual desires.

## Conclusion

Designing game systems where a wide range of players can get into Flow is not difficult:

1. Expand your game's Flow coverage by including a wide spectrum of gameplay with different difficulties and flavors
2. Create an Player-oriented Active DDA system to allow different players to play in their own paces
3. Embed DDA choices into the core gameplay mechanics and let player make their choices through play

If a game designer can apply the above methodologies upon his own design, the game will become more dynamic and flexible, allowing more people to get into the Flow and finish it.



面向玩家的 DDA 为玩家提供了一个主动机制来控制他们在游戏中的 Flow 体验。但是，这些选择的实现并非易事。

为了动态调整 Flow 体验并减少 Flow 噪音，这些选项必须以相对较高的频率出现。这些频繁的选择可能会打断 Flow Zone 中的玩家。

可能想到的简单解决方案是实施一个监控系统来检测现在是否是向玩家提供选择的好时机。但是，监控系统仍然不够成熟，无法检测玩家的 Flow。唯一的解决方案是将选择嵌入到游戏中，让玩家将选择视为游戏的一部分，并最终忽略它们。因此，他们的选择将变得直观并反映他们的实际愿望。

## 结论

设计让各种玩家都可以进入 Flow 的游戏系统并不困难：

1. 通过包含具有不同难度和风格的各种游戏玩法来扩大游戏的 Flow 覆盖范围
2. 创建面向玩家的主动 DDA 系统，允许不同的玩家按照自己的节奏进行游戏

将DDA 选择嵌入到核心游戏机制中，让玩家通过游戏做出选择如果游戏设计师能够将上述方法应用于自己的设计，游戏将变得更加动态和灵活，让更多的人进入 Flow 并完成它。

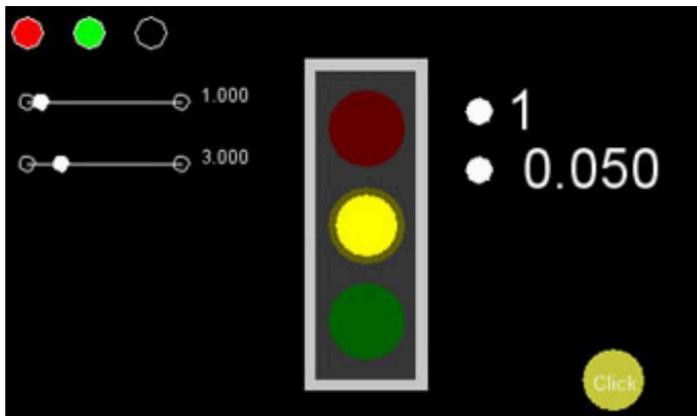


# Implement Flow in Games

The best way to test out the player-oriented DDA system and methodologies is to create games designed around these methodologies and compare the result between using and not using the DDA

## Traffic Light

Traffic Light is my first attempt to create a simple prototype and test whether or not player-oriented DDA helps the Flow experiences.



### Overview

Traffic Light is designed to be a game with minimal interaction and a test bed for choices based DDA. The only thing a player needs to do in this game is to predict and click the button as late as they can before the red light goes on.

By default, the player has three times to try in each round. If the player won two out of the three, he can keep his total score and go to the next round. If the player failed in one round, he loses the total score.

Between each round the system will ask the player if they want to play faster or slower or stay as the current speed.

### Interface

On the top left of the screen are lights representing the total times player can try in each round. If they failed it turns red, otherwise it is green. If they have not tried, it shows as black.

The two scrollbars allow players to change the speed and the total times in each round.

The two rows of numbers on the right represent the total score and how many seconds earlier the player clicked the button.

### Test Result

Player-oriented DDA based on choices effectively extends the game Flow. It extends a simple timing game's lifespan from 1-2 minute to about 5 – 12 minutes.

However, the frequent DDA choices broke the player's Flow. It started offering the player a sense of control, but eventually reduces the player's control.

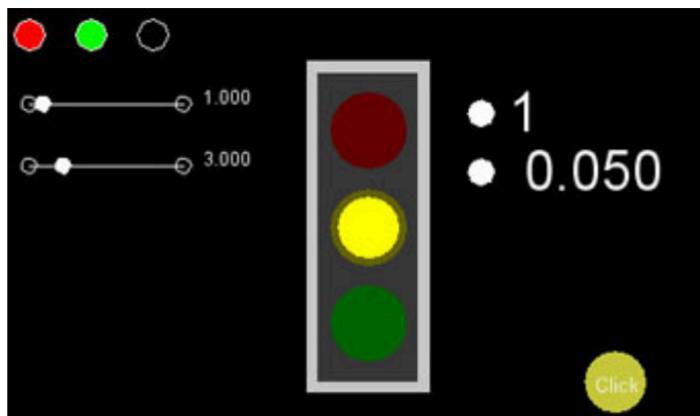


# 在游戏中实现 Flow

测试面向玩家的 DDA 系统和方法的最佳方法是创建围绕这些方法设计的游戏，并比较使用和不使用 DDA 的结果。

## 交通灯

Traffic Light 是我第一次尝试创建一个简单的原型，并测试面向玩家的 DDA 是否有助于 Flow 体验。



### 概述

Traffic Light 旨在成为一款交互最少的游戏，也是基于选择的 DDA 的试验台。在这个游戏中，玩家唯一需要做的就是在红灯亮起之前预测并尽可能晚地点击按钮。

默认情况下，玩家每轮有 3 次尝试时间。如果玩家在三场比赛中赢了两场，他可以保留他的总分并进入下一轮。如果玩家在一轮中失败，他将失去总分。

在每一轮之间，系统会询问玩家是想玩得更快、更慢，还是保持当前速度。

### 接口

屏幕左上角是代表玩家在每轮中可以尝试的总次数的灯。如果失败，它将变为红色，否则变为绿色。如果他们没有尝试过，则显示为黑色。

两个滚动条允许玩家更改每轮的速度和总时间。

右侧的两行数字代表总分和玩家点击按钮的秒数。

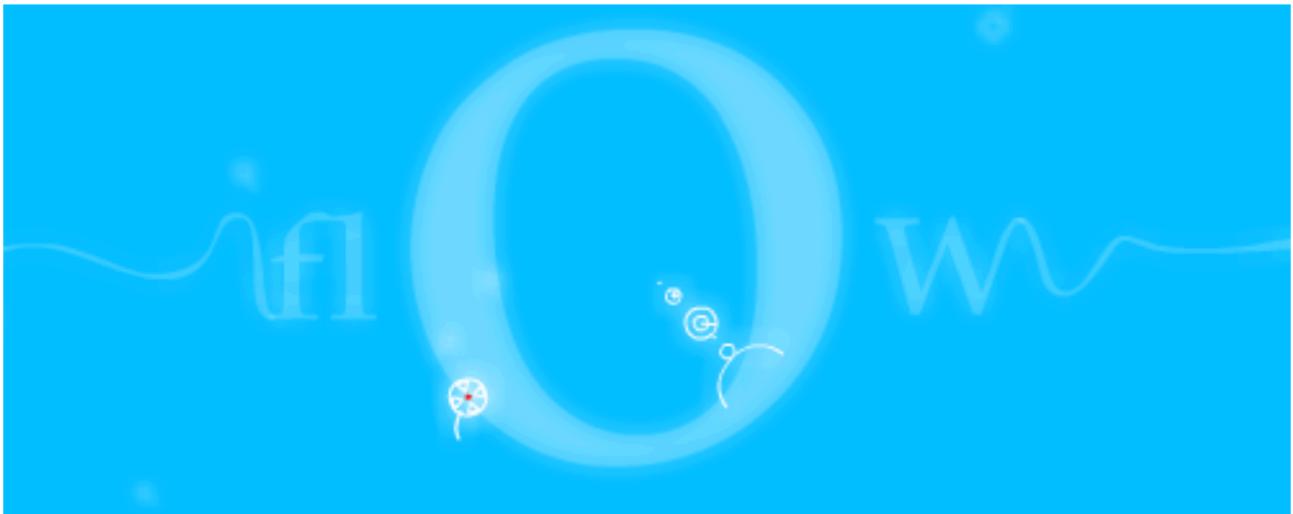
### 测试结果

基于选择的面向玩家的 DDA 有效地扩展了游戏 Flow。它将简单计时游戏的生命周期从 1–2 分钟延长到大约 5–12 分钟。

但是，频繁的 DDA 选择破坏了播放器的 Flow。它开始为玩家提供一种控制感，但最终会削弱玩家的控制。



## FIOw



### Overview

FIOw is created to test player-oriented DDA with choices embedded inside the gameplay.

In fIOw, the player uses the mouse cursor to navigate an organism through a surreal biosphere where it consumes other organisms, evolves, and advances into the abyss.

The gameplay is intentionally designed to be extremely minimal for easily evaluating the efficiency of the player-oriented DDA system. The only action players can perform is to swim around and eat other organisms in front of its mouth.

### Expand Flow Coverage

FIOw uses minimal control to open the door for casual gamers and non-gamers, but still leaves space for hardcore gamers to master it. It offers a wide range of gameplay from simply swimming around and eating to strategically evolving and intensive fighting.

### Adjust Flow

FIOw is divided into 20 levels. Each level introduces new creatures with new challenges. Different from traditional games in which players have to complete one level in order to progress to the next one, fIOw offers player power to control their gameplay progress. By choosing different food to eat, players can advance to the more difficult level and return to the easier level at any time. The game features a minimal death penalty. If player died in one level, he will be pushed back to the previous level that is relatively easy. Player can also choose to avoid the challenge, skip the level, and come back later.

### Embed DDA Choices into Gameplay

In fIOw, players can customize their Flow experience naturally through the core gameplay, swimming and eating. By swimming closer to or farther away from other organisms, and eating different types of food, players subconsciously balanced their Flow experience.

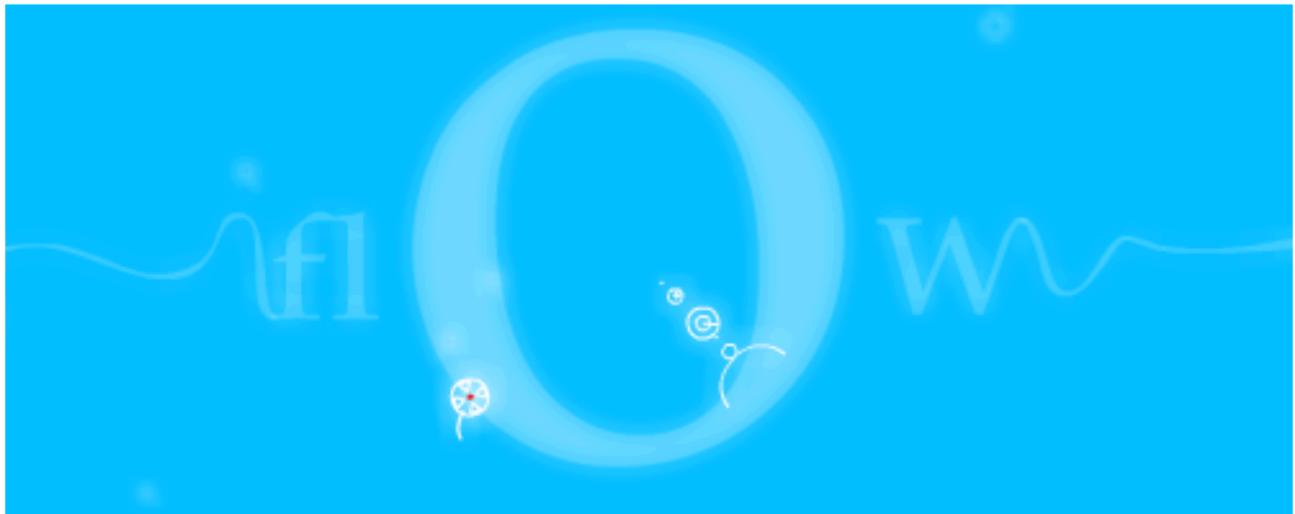
### Test Result

The current version of fIOw is prototyped in Macromedia Flash 8. During the first two weeks after fIOw was released online, it attracted more than 350,000 downloads.

“Addicting” is the most common word its fans use to describe it. FIOw was invited and presented at the annual Experimental Gameplay Workshop during the GDC 2006. It also won the Internet Game of the Month on EDGE magazine, May 2006.



## FlOw



### 概述

FlOw 的创建是为了测试面向玩家的 DDA，其中选项嵌入到游戏中。

在 flOw 中，玩家使用鼠标光标导航生物体穿过超现实的生物圈，在那里它吞噬其他生物体，进化并进入深渊。

游戏玩法被特意设计为极小，以便于评估面向玩家的 DDA 系统的效率。玩家唯一可以做的动作是游来游去，吃掉它嘴前的其他生物。

### 扩大流量覆盖范围

FlOw 使用最少的控制为休闲游戏玩家和非游戏玩家打开大门，但仍为铁杆游戏玩家留下了掌握它的空间。它提供了广泛的游戏玩法，从简单的游泳和进食到战略性进化和激烈的战斗。

### 调整流量

FlOw 分为 20 个级别。每个级别都会引入具有新挑战的新生物。与传统游戏不同，玩家必须完成一个级别才能进入下一个级别，flOw 为玩家提供了控制游戏进度的能力。通过选择不同的食物吃，玩家可以随时前进到更难的关卡，并返回到更容易的关卡。该游戏具有最低的死刑。如果玩家在一个级别中死亡，他将被推回相对容易的上一个级别。玩家也可以选择避免挑战，跳过关卡，稍后再回来。

### 将 DDA 选项嵌入到游戏中

在 flOw 中，玩家可以通过核心玩法、游泳和饮食自然地定制他们的 Flow 体验。通过靠近或远离其他生物，并吃不同类型的食物，玩家在潜意识中平衡了他们的 Flow 体验。

### 测试结果

flOw 的当前版本是在 Macromedia Flash 8 中构建的原型。在 flOw 在线发布的前两周内，它吸引了超过 350,000 次下载。

“令人上瘾”是其粉丝用来描述它的最常见词。FlOw 受邀参加了 GDC 2006 期间的年度实验性游戏研讨会。它还赢得了 2006 年 5 月《EDGE》杂志的月度网络游戏奖。



To get a sense of how widely enjoyed f1Ow is on the Internet, here are some of the quotes from the online community:

"There must be something wrong in playing the whole morning with this evolution game... It has no guns, blood or explosions, but something kept me glued to my seat for a long, long time.

Fortunately, my critter ran out of food and I was forced to leave it there.

Look at my mutations and changes (the best I could get in 3 hours!)"

- [rc.blog\(\)](#)

"Show some appreciation, then, by checking out the lovely, mindful Flow. Set in a clear blue monochrome sea inhabited by Euclidean cellular critters and your own slowly evolving Tinker toy paramecium, Flow sucks you in with its sinuously elegant physics and keeps you hooked on the ever so slightly yet increasingly challenging task of gobbling up your fellow sea bugs. A brick-simple, submarine Pac-Man, Flow pulls off the remarkable feat of feeling as meditative as it is addictive."

- [Zen and Art](#)

"For some reason I can't stop playing it. It doesn't make much sense, since I can't imagine why I would continue to play it, but it's almost soothing to play. The graphics and sound are amazingly perfect. Try it out, you won't be disappointed. Unless you think all flash games are wastes of your time."

- [Always Beta](#)

"Beautiful, relaxing and confusing, Flow allows you to take over the evolutionary steering wheel for a scoop-equipped microbe in a shifting sea of predators and prey.

Pros:

Easy to play

Endless

Addicting and relaxing

Very atmospheric and attractive despite the extremely basic graphics

Cons:

It's addicting like the government putting something in the water supply: you're addicted but you don't know what you're addicted to.

Almost too esoteric for its own good"

- [Something Awful](#)



要了解 flOw 在互联网上受到的广泛欢迎，以下是来自在线社区的一些引述：

“玩了一整个上午的这个进化游戏肯定有什么问题……它没有枪支、血迹或爆炸，但有什么东西让我在座位上粘了很久很久。

幸运的是，我的小动物吃完了，我被迫把它留在那里。

看看我的突变和变化（我在 3 小时内能得到的最好的！

-rc.blog ()

“那么，通过查看可爱、正念的 Flow 来表达一些感激之情。Flow 设置在清澈的蓝色单色海洋中，居住着欧几里得细胞小动物和您自己的缓慢进化的 Tinker 玩具草履虫，Flow 以其蜿蜒优雅的物理效果吸引您，让您沉迷于吞噬海虫同伴这一微小但越来越具有挑战性的任务。作为一款砖块简单的潜水艇 Pac-Man，Flow 完成了非凡的壮举，感觉既令人沉思又令人上瘾。

-禅宗与艺术

“出于某种原因，我无法停止玩它。这没有多大意义，因为我无法想象为什么我会继续玩它，但玩起来几乎是舒缓的。图形和声音非常完美。试试吧，你不会失望的。除非你认为所有的 Flash 游戏都是在浪费你的时间。

“美丽、放松和令人困惑，Flow 可让您在不断变化的捕食者和猎物海洋中接管配备勺子的微生物的进化方向盘。优点：易于玩 无尽的令人上瘾和放松 尽管图形极其基本，但非常大气和有吸引力

缺点：这就像政府在供水中放了什么东西一样令人上瘾：你上瘾了，但你不知道你对什么上瘾了。

对它本身来说几乎太深奥了”

-可怕的事情



# Conclusion

## How to Realize Flow in Games

Based on Mihaly Csikszentmihalyi's positive psychology research, when a person totally focus into an activity and forget about time and pressure, he reaches the optimal experience, Flow. There are many conditions in order to reach Flow.

In the field of game design, there are three fundamental conditions:

1. As a premise, the game is intrinsically rewarding, and the player is up to play the game.
2. The game offers right amount of challenges to match with the player's ability, which allows him/her to delve deeply into the game.
3. The player needs to feel a sense of personal control over the game activity.

In order to enhance Flow experience, here are the methodologies game designers can pick up and apply to their own designs and make them enjoyable by a much broader audience.

1. Expand your game's Flow coverage by including a wide spectrum of gameplay with different difficulties and flavors
2. Create an Player-oriented Active DDA system to allow different players to play in their own paces
3. Embed DDA choices into the core gameplay mechanics and let player make their choices through play

With the proof of Traffic Light and fLOW, as well as the other successful commercial games whose designs match the above methodologies, designing games enjoyable by both gamers and non-gamers is totally feasible and should be applied to help expanding video game market and essentially make video games a more mature media.

## Application in Other Media

The concept of player-oriented DDA also known as active DDA is a powerful design tool applicable not only in video games.

It can be applied to nearly any fields where there are human interactions. For example, if active DDA is applied to GRE (Graduate Record Examination) test rather than its original passive DDA, here will be the changes.

1. There is no cap for the total score. Students can gain as much score as possible during the test period. Therefore, even top students can still challenge themselves every time they take test.
2. Students should be able to see scores gained through each questions and feel the joy of answering them correctly, which encourages them to do more.
3. The difficulty and the score of each question should be related. More challenge equals more reward.
4. Student should be able to sense the difficulty of each question and have the control to skip hard questions.

And you can imagine how the overall experience will change from a passive question after question based test into an active free roaming score collecting contest.



# 结论

## 如何在游戏中实现 Flow

根据 Mihaly Csikszentmihalyi 的积极心理学研究，当一个人完全专注于一项活动而忘记时间和压力时，他会达到最佳体验，即心流。要达到 Flow，有很多条件。

在游戏设计领域，有三个基本条件：

1. 作为一个前提，游戏本质上是有益的，玩家愿意玩游戏。
2. 游戏提供了适量的挑战以匹配玩家的能力，这使他/她能够深入研究游戏。
3. 玩家需要对游戏活动有一种个人控制感。

为了增强 Flow 体验，以下是游戏设计师可以采用并应用于他们自己的设计的方法，并使它们被更广泛的受众所享受。

1. 通过包含具有不同难度和风格的各种游戏玩法来扩大游戏的 Flow 覆盖范围
2. 创建面向玩家的主动 DDA 系统，允许不同的玩家按照自己的节奏进行游戏

将 DDA 选择嵌入到核心游戏机制中，让玩家通过游戏做出选择有了 Traffic Light 和 flow 以及其他设计符合上述方法的成功商业游戏的证明，设计游戏玩家和非游戏玩家都喜欢的游戏是完全可行的，应该用于帮助扩大视频游戏市场，从根本上使视频游戏成为更成熟的媒体。

## 在其他媒体中的应用

面向玩家的 DDA 概念也称为主动 DDA，是一种强大的设计工具，不仅适用于视频游戏。

它几乎可以应用于任何有人工交互的领域。例如，如果主动 DDA 应用于 GRE（研究生入学考试）考试，而不是其原始的被动 DDA，则此处将发生更改。

1. 总分没有上限。学生可以在考试期间获得尽可能多的分数。因此，即使是尖子生，每次参加考试时，仍然可以挑战自我。
2. 学生应该能够看到通过每个问题获得的分数，并感受到正确回答的乐趣，这鼓励他们做更多的事情。
3. 每个问题的难度和分数应该是相关的。更多的挑战等于更多的回报。
4. 学生应该能够感觉到每个问题的难度，并能够控制跳过困难的问题。

您可以想象整体体验将如何从一个又一个被动的基于问题的测试转变为主动的自由漫游分数收集竞赛。



How do you use active DDA in advertising, negotiation or even in dating? Designers in any field should be able to apply these methodologies.

## **What's Next for Flow in Games**

The Flow researches have been mainly focused on the relationship between challenge and ability, which naturally assume the interaction. However, Flow-like experiences also exist in passive media like movie, literature and music.

Games like Sims and [Cloud](#) has already proven that there are more interesting aspects in the field of Flow that are beyond challenge and ability. Thus, the soul of video games should also be able to leap far beyond challenges and conflicts.



您如何在广告、谈判甚至约会中使用主动 DDA？任何领域的设计师都应该能够应用这些方法。

## 游戏中 Flow 的下一步

心流的研究主要集中在挑战与能力之间的关系上，这自然而然地承担了相互作用。然而，类似 Flow 的体验也存在于电影、文学和音乐等被动媒体中。

像 Sims 和 Cloud 这样的游戏已经证明，Flow 领域还有更多有趣的方面，超出了挑战和能力。因此，电子游戏的灵魂也应该能够远远超越挑战和冲突。



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