An Exploration into "Perceived Sense of Challenge" in Level Design for fast paced Casual Mobile Games

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***Abstract*— Level Design is one of the core pillars of Game design. As a level designer, one creates experiences along the fine line of flow between frustration and fun. This paper takes a heuristic approach in understanding a player's perception of a level's challenge through case studies and by conducting an experiment (focusing primarily on single player fast paced casual mobile platformers and racers) with a sample size of 50 participants. Figuring out what constitutes as a challenge for the player, how it can be increased without drastically affecting the difficulty and how analysing this *'perceived sense of challenge'* can help designers influence a player's expected sense of challenge and create less frustration.**

***Keywords*— Level Design, Flow theory, Challenge, Casual games, Mobile, Perceived challenge, Player Frustration.**

I. Introduction[1]

Levels are the space where a player explores the rules and mechanics of a game [1]. They serve as a medium where the player can exercise the mechanics of the game in a setting bound by the rules of said game. While there are many broad design principles, level design is inherently genre-specific due to the wide variety of rules and type of challenges.

Many modern casual (mobile) games often focus on easy and fast paced experiences, catering to the rise of mobile as a console and a new base of midcore casual gamers. This comes with its own set of challenges in terms of game and level design. The gap (which facilitates good gameplay) between player frustration and boredom has been further narrowed down.

This paper explores the relationship between flow and challenge and how one can create levels that cater to this modern flow for casual (fast paced platformers/racers specifically) games.

This paper further explores the psychology of Flow and Challenge, what they mean and how they are being translated into game design. Combining the knowledge of the role played by challenge in a level flow and focusing on how a challenge is perceived by the players. Figuring out the role of this "Perceived sense of Challenge" and proving its effects by conducting an experiment to prove the hypothesis on how Perceived sense of Challenge (PSC) can help reduce player frustration or anxiety without reducing the challenge felt by the player, hence broadening the scope of flow.

This is an exploration into what constitutes as Perceived Sense of Challenge (PSC), its validation through an experiment (focussed on single player fast paced casual mobile platformer/racers) and its application in level design, level progression and overall game flow and design.

II. Psychology of Flow and challenge

Psychologist Mihaly Csikszentmihalyi, who is credited for his work in flow revealed that an experience can be genuinely satisfying when

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experienced in a state of consciousness which can be called as *flow* [8].

In terms of game and level design this state of flow is key for establishing a lasting immersion along with a challenging and enjoyable experience for the player. One of the key variables available to level designers for establishing a state of flow for the player is *the challenge* presented by the level.

Challenge in games can be termed as the culmination of skills required to complete a specified task along with the difficulty or opposition presented in completing said task.

When skill is too low and the task too hard, players may become anxious. Alternatively, if the task is too easy and skill too high, players might get bored. However, when skill and difficulty are roughly proportional, people enter what can be called a *Flow state* [9] *(refer Fig. 1)*.

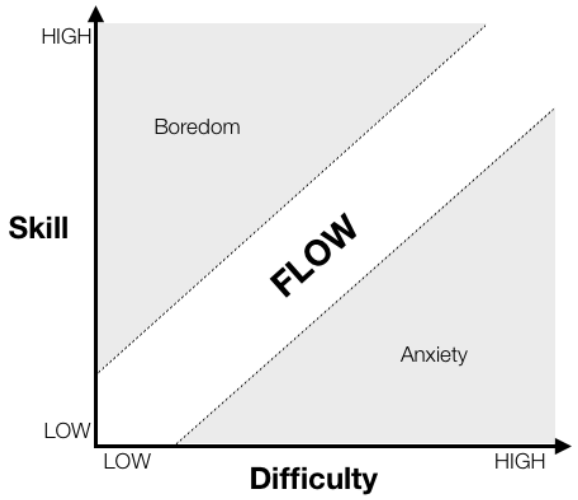


Fig. 1 Flow, boredom, and anxiety as they relate to task difficulty and user skill level. Adapted from Csikszentmihalyi, 1990.

Csikszentmihalyi says that one of the effects of being in a state of flow is having complete focus on immediate tasks, without any mind-wandering. When the mind is in the here-and-now, because it has to be [8].

The state of flow while playing games can be seen similar to 'being in the zone' as experienced by many gamers. 'The zone' is the product of a well balanced challenge to the skills of the player.

III. Flow Theory in Game Design

According to the research by Lazaros Michailidis, Emili Balaguer-Ballester and Xun He *(Flow and Immersion in Video Games: The Aftermath of a Conceptual Challenge*) [16] the terms flow and immersion in game design are fairly overlapping and can be used interchangeably, hence ensuring a good flow is ensuring a good immersive experience.

Csikszentmihalyi refers to flow as a state of *effortless concentration* [12]. As game designers, one aims to better the elements and features in control to create the state of flow in the player's mind [13], which helps creating the 'zone' for extensive immersion of the player leading to a fun, engaging and challenging (key) experience.

Essentially there are two types of flows that can be applied in game design (as described by Daniel Berube in *The flow applied to game design* [14]), namely *Microflow and Macroflow* . Here Microflow equates to one play session and Macroflow equates to the duration of the entire game. This paper majorly focuses on Microflow as it is the flow that predominantly influences individual level design.

Microflow can be defined as an intense and focussed state of mind where the player feels enjoyment and fulfillment, often generated by a series of successful events [13]. Microflow being fueled by a series of successful events is a concept that will be discussed further when talking about Perceived Sense of Challenge (PSC).

There are three major means that can be integrated into game design to help create the microflow for the game (or levels) [13] :

1. Gameplay Rhythm (having a defined pattern for the player's input experience).
2. Gameplay mechanics that encourages or promotes the series of success.
3. Positive Feedback and Rewards to validate and motivate players on a series of success.

Konami's Dance Dance Revolution creates an amazing microflow: Providing players with a distinct gameplay rhythm with an inherent pattern, mechanics and feedback which validate the series of success for the players.

So, we can conclude Flow is inherently similar to immersion in games [16], Microflow is a focussed state of mind resulting in an engaging experience and is often generated by a series of successful events [13], Microflow in games can be created with Gameplay Rhythm, Encouraging Mechanics and Positive Feedback in games.

IV. Perceived Sense of Challenge: Overview

Maria-Virginia Aponte, Guillaume Levieux and Stephane Natkin explored difficulty and challenge [5]: *"A good game design must accurately scale the difficulty of a challenge to have a tension level that leads to the player's enjoyment."*

Combining this definition of challenge with what was learnt from Flow in Game Design, it is safe to say that Challenge is the function of difficulty (of a level) and skill (of the player) and in an ideal case of setting up the flow state, the challenge perceived by the player lies in the Flow region (refer Fig1).

Furthermore the challenge presented in a level is further divided into:

- Actual Challenge: This is the difficulty of said challenge.
- Perceived Challenge: This is how difficult it is perceived by the players.

This distinction is minute but can really help us as game or level designers to ensure a better flow and widen the fine line of balance between frustration and boredom.

Perceived Sense of Challenge (PSC) is a concept that nudges Level Designers to create levels which emphasize the danger of challenges presented to the player, without substantially increasing the actual difficulty.

Simply put, PSC as a concept tells us to prioritize the feeling of "*It **felt very hard** and challenging"* over *"It **was very hard** and challenging."*

Consider Ubisoft's Trials Frontier level design to see a glimpse of what can be meant by PSC: In the casino rooftop level, the player is presented with a 'tight' jump (Refer Fig 2a) which feels very dangerous due to the presence of the buzzsaw. In reality, the buzzsaw is only encountered in case of a failed jump at the platform (an already botched jump) its presence merely quickens the outcome, but it makes the challenge feel more dangerous than it actually is.

John Feil and Marc Scattergood define fun and satisfaction as the moment when players feel empowered by achieving some level of competence that was formerly beyond them [3]. PSC aims to capitalize on that feeling of empowerment by influencing the player's perception of challenges presented to them.

The concept is not limited to the paper's focus (casual fast paced platformers and racers), but is prevalent in that genre. Consider Alan Wake for one such out-of-genre example.

At the end of the first mission, the player has to make a final sprint to the lighthouse. The final "obstacle" is a collapsing bridge with debris falling on it and the player being chased by an enemy (Refer Fig 2b). In a level where the player had to destroy multiple hardcore enemies (considering player level) , this final instance is just a series of simple jump and avoid obstacles. Populating the bridge with smart enemies instead of debris would have made it too hard and frustrating, but on the other hand having just the bridge (without the collapse and debris) would have been very anti-climatic. This simple *layering of obstacles* [7] grips the player in fear of failing, causing them to perceive the challenge much more seriously. Crossing it gives a sense of achievement and escape from what felt like serious danger.

(a) (b)

Fig. 2: Perceived Sense of Challenge in level design for Trials Frontier (a) and Alan Wake (b)

V. An Experiment to Prove the Effects of PSC

After understanding the theory and concepts behind what can be called as "Perceived sense of Challenge" This experiment was designed and

carried out to prove and test out the conception and application of PSC in freshly created levels by testing them out with relevant audiences.

The research methodology, level design philosophy and inferences of the experiment are detailed below:

Step 1: Level Design to showcase and contrast PSC

The first step was designing three almost identical levels in a single player casual mobile fast paced platformer-racer game (the ideal game world for this case study).

The gameplay involves crossing a fast paced obstacle course (consider the game like Trials frontier meets Sonic in a casual setting).

The mechanics of the game include accelerate, brake and rotate (balance) in the air.

The terrain, overall level layout, list of obstacles and flow remained almost identical, the difference came from minor tweaking of the obstacles present in all three levels as follows:

- Level A: (Low challenge) Maximum window of success while crossing obstacles. *(Fig3a)*
- Level B: (High challenge) Small window of success. Timing is key. *(Fig3b)*
- Level C: (Perceived challenge) Window appears small but is close to Level A. *(Fig 3c)*

The included snippets from all three levels *(Figures 3a,3b,3c)* illustrate an instance of what is meant by Perceived Sense of Challenge.

The snippets showcase two obstacles, namely a bouncing obstacle and a moving obstacle.

Level A possesses minimal difficulty and all the player needs to worry about is landing on the consecutive bouncing obstacles successfully. This could feel very boring due to the lack of any significant challenge.

Level B introduces another level of complexity (*via layering* [7]) and this increases the challenge faced substantially. Timing and control becomes key for getting a successful bounce and avoiding the moving obstacles.

This level of difficulty, although adequately challenging can also be very frustrating (especially in a casual mobile game).

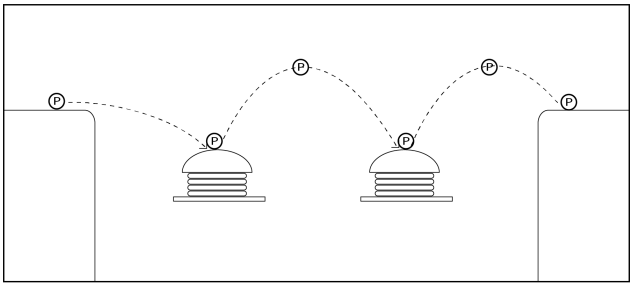


Fig. 3a Level A: The player only needs to focus on properly landing on the bouncing obstacle. Minimal difficulty.

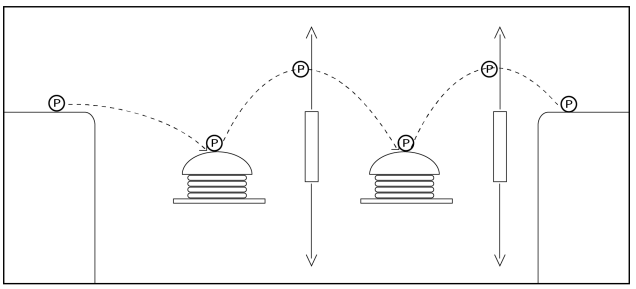


Fig. 3b Level B: Moving obstacles make the bounce and subsequent landings harder. Timing and control becomes key. Substantial difficulty.

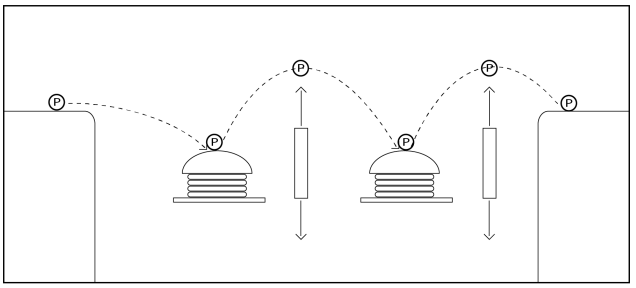


Fig. 3c Level C: Moving obstacles only get the player in case of an already botched bounce. Effectively posing as a perceived difficulty.

Level C is where the desired design is achieved (in the form of PSC). The moving obstacles have a smaller path and will only result in a crash when the player has already botched the bounce (most of these cases, the player would never have reached the second bouncing obstacle and would have crashed nonetheless).

So effectively, the presence of these moving obstacles in Level C do not alter the difficulty by a

large degree (difficulty is much closer to Level A than B), but just their presence evokes a sense of challenge in the player, intimidating them and making them perceive a sense of danger and challenge. This was proven in the further steps.

Step 2 : Establishing relevant Focus group for Playtesting

Once the initial level designs were bug-free and ready, the next step was getting a good set of players and carrying out the experiment.

A sample set of 50 individuals (age group: 19-28) living in the city of Da Nang, Vietnam (where the experiment was carried out) were chosen and screened on the basis of following criteria:

- Familiarity with the genre (Played at least 2 games like this on mobile).
- Mid-core casual gamers (Spend 6-15 hours a week gaming on mobile).
- Successfully played a few other levels of the game used for this experiment.

These criteria helped getting a focus group comprising of people who were into this genre of fast paced casual mobile platformers/racers but not hardcore players (to get a more uniform result).

Each player was instructed to play one of the three designated levels and complete it with minimal crashes and we recorded this data (discussed in the next section).

An illustration of the Playtest steps and overall flow while performing the experiment can be referred from Fig4.

The sample size of 50 was divided into 3 groups of 15 (for each of the 3 levels) to avoid scenarios with one person playing two iterations (as technically all 3 levels share the same base). 5 people were kept as a buffer in case of any issues while collecting data (like corrupted readings from previous observation of the levels or any issues that might cause a tampered gameplay experience during one's turn).

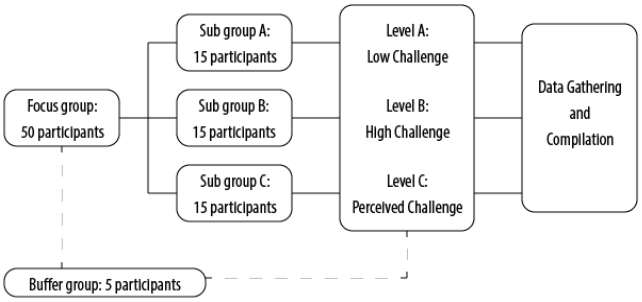


Fig. 4: Schematic Representation of the Playtest steps.

Step 3: Data Compilation

The main focus of this experiment was to figure out if the hypothesis for the designed level C (Perceived Sense of Challenge in Level design) held true for a larger targeted audience. The data was gathered in two separate categories:

- Perceived data from players.
- Factual data from levels.

TABLE I
PERCEIVED DATA FROM PLAYERS

Roster	Challenge felt by Players		
	Level A (Low challenge)	Level B (high challenge)	Level C (PSC)
1	2	8	5
2	5	7	9
3	4	7	6
4	4	6	6
5	5	9	5
6	1	10	7
7	3	7	6
8	2	8	7
9	2	10	6
10	2	8	8
11	4	8	7
12	3	7	7
13	1	6	5
14	5	10	8
15	3	8	7
Mean	**3.07**	**7.93**	**6.58**

Each player was asked to evaluate the challenge felt by them after completing their assigned level and rate said challenge on a scale of ten *(Refer Table I)*. This was the Perceived data from the players. The average of this evaluation by each player gives an idea about the perceived sense of challenge felt while playing the three designed levels. (*Fig. 3*)

On the other hand, the number of crashes per player in each level was recorded. The average of these crashes gives the factual data for each level's challenge in terms of frustration and difficulty which is the average crash rate per player. *(Refer Table II)*.

TABLE II
FACTUAL DATA FROM LEVELS

Crash data recorded	**Level A**	**Level B**	**Level C**
Total crashes per level	30	138	44
Average crash rate per player	2	9.2	2.9

Step 4: Inferences and Result

On compiling the average of the Factual data (*Table II*) and Perceived data (*Table I*) into one table for all three levels (*Refer Table III*) it can be seen that the average challenge felt by the players in level C (6.58) is closer to the challenge felt in level B (7.93) than level A (3.07), indicating that the players felt level C to be challenging enough (in fact they felt it to be more than twice as hard as level A). So, it is safe to assume that level C was perceived almost as challenging as level B.

Also, looking at the factual data compilation, the average collisions in level C (2.9) is closer to level A (2) as compared to level B (9.2).

In case of Factual data it can be seen how much of a difference Level B has in comparison to the other two. An average collision rate of 9.2 can be considered extremely frustrating in a casual game level. In contrast, a collision rate of 2-3 (severely lesser) seems great (satisfied by levels A and C).

TABLE III
COMPARISON OF PERCEIVED AND FACTUAL DATA

Crash data recorded	**Level A (Low challenge)**	**Level B (High challenge)**	**Level C (Perceived challenge)**
Challenge according to players *(Perceived data)*	3.07	7.93	6.58
Average crash rate per player *(Factual data)*	2	9.2	2.9

So, having effectively designed a level that technically has a lesser challenge (comparatively), yet is perceived as adequately challenging by the players the experiment has proven to reduce the frustration (by reducing the number of crashes) without reducing the challenge felt by the players significantly. Going back to flow, it can therefore be said that good microflow has been ensured.

The key aspects being, ensuring a series of successful events (less crashes) and rewarding the player for sticking to the gameplay rhythm.

VI. APPLICATIONS OF PSC IN GAME FLOW

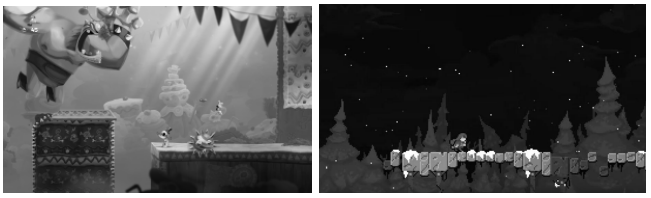
The experiment showcasing PSC (discussed in the last section) gave a glimpse on how PSC can be useful for creating challenging levels while minimizing frustration. Although, in practice it is not encouraged to use Perceived Challenges all throughout the designed levels, rather instances where it can accent the gameplay and flow even further. This section will discuss possible applications for PSC in level design, where and when to use it along with some examples.

PSC in gameplay:

a. Helps reinforce specific (major) game mechanics.
b. Makes the player feel more confident in their skills.
c. Establishes and controls the pacing of levels.
d. Makes the experience feel more fun, dynamic and challenging.
e. Can help in keeping the players 'on guard' at needed instances in levels.

In Ubisoft's Rayman Legends, the Luchador chase level *(Refer Fig. 4a)* is a brilliant example for some of the points discussed above. The player traverses through a collapsing level, being chased by a boss. The collapsing level results in creation and destruction of platforms, (objectively the relevant platforms remain till they are needed). Having platforms destroyed on screen or right behind the player makes it seem more intimidating but makes the level appear more dynamic and

challenging (d),(e). Also, the player having to manage pace between the chasing boss and the level being destroyed in front of them helps set up the level pace using PSC (c),(b). The player (if performing adequately) is always at a safe distance away from the boss, but the boss's presence still puts a pressure on the fact that it's a chase, emphasizing on the movement mechanics of the game (a).



(a) (b)

Fig. 4: Application of PSC in game flow and progression as seen in (a) Rayman Legends and (b) Celeste.

Lastly, Let's discuss the application of PSC in level progression. Celeste is a perfect example. Early in the game, the player is introduced to a breakable platform as an obstacle *(Refer Fig 4b)*, this seems daunting to a new player. Later, in the game (somewhere mid-game duration, by then the player has learnt the pacing, flow and rhythm to realize that the breakable platform poses no significant threat given their speed and the game's fast paced flow), the player encounters layered obstacles [7] which pose as intense challenges. Having a breakable platform at the end of those layered obstacles is a great example of PSC in level progression. Even when the player has learnt how to deal with one obstacle easily, adding it at the end of an intense challenge makes the player stay *'on guard'* even while crossing something easy and known.

Thus, PSC plays a major role in level design by influencing the player's expectations. It is a great concept and a tool for single player mobile (fast paced) platformer/racers as it minimizes frustration (by reducing crashes) and gives (relatively easy yet challenging) opportunities for a series of successful events in seemingly challenging and fun experience.

VII. Conclusions and Summary

Through the course of this paper it was concluded that Flow and challenge play an integral part in level design. Ensuring a good flow ensures good immersion.

Challenge is a function of skill and difficulty. It ideally should balance between them to achieve a flow state. Flow state is also fueled by a series of successful events, hence a good way of retention through challenge is providing the player with obstacles that seem difficult, require skill and fuel the player with a rapid series of successful events in the form of positive feedback.

This is where the concept of Perceived Sense of Challenge comes in. It tells us to focus on the player's perception of the challenge over absolute challenge to help broaden the flow gap between skill and difficulty.

To focus on the feeling of "*it felt very challenging*" over "*it was very challenging*".

The experiment (for the case of casual fast paced platformer/racers) concluded a similar result, where players felt PSC to be substantially challenging and less frustrating, hence leading to a bigger margin in the flow curve.

So, PSC as a medium (especially for casual fast paced games) in level design can be used to boost player morale and reduce frustration (both by giving opportunities for the 'series of successful events') thereby ensuring a good flow and hence immersion.

PSC as a tool in level design can also be used to reinforce major game mechanics, Establish the pace of the level and can even help put players 'on guard' when needed.

In conclusion from the experiment and case studies, the "Perceived Sense of Challenge" can help create levels which are more dynamic, fun and feel more challenging while making the player feel more confident in their skills.

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