

Perfecting A Video Game with Game Metrics

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Abstract

A state of a perfect video game is what developers has been seeking for their product developments, to achieve the selected state, several standards and methods needs to be applied. These standards and methods are special: they are both verifiable and quantifiable, to make their action and end goal a clear one, the terms for this standards and methods are called 'game metrics' and we decided that this is a must-have tool or method to be implanted in a development of a game because it will boost your standards rapidly and will be able to tell you about your own progress of the development.

Keywords: *video game, game metrics, evaluation, perfect measures, user satisfaction*

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1. Introduction

Measures are a standard unit used to express the size, amount, or degree of something, qualities are often difficult to be measured as it needs to have some certain parameter or elements, and those parameters must be quantifiable and verifiable [1] to make it become a valuable numerical data which will offer quantitative, time-stamped information about the specific behavior of players or users of computer games [2]. Measures of success is very important in many ways, where it is needed when you want to know when is the best moment to make a stop to our current condition and defined it as a success or an accomplishment after countless of jobs done.

Using the result of metrics or measures, developers revises the product continuously to cover up the missing point and strive to reach the final accomplishment. Aside from the definition and the importance of game metrics, where the result or output of the game metrics is for the excellence of the game itself, thus what is exactly the final version? In this paper, we defined it as a perfect video game.

Game is one kind of play activity, in a pretended reality, which player try to achieve at least one goal by acting based on rules [3]. Game is not only for fun and entertainment [4]. Video games, the difference between a video game with a daily usual family games that we played is in the 'scope' or area of the game. A video game is literally a game which took place in a virtual world. A world is defined as an environment that its inhabitants regard as being self-contained, but there is also another definition from the same topics which is "a virtual world is a spatially based depiction of a persistent virtual environment, which can be experienced by numerous participants at once, who are represented within the space by avatars" [5]. From all those definitions, if include the emphasis on the essential element of people, will results to: "a synchronous, persistent network of people, represented as avatars, facilitated by computers [5]."

Thus, video games have been developed day by day using several methods and understandings, to do revision on the game and make it better. The role of metrics comes here, to create the perfect condition for the related software and games, a perfect video game is not a game who has the best story, or best gameplay, neither the best graphic, it all depends on the integration and the resonance of each elements. The adjective perfect itself is subjective, meaning there is no ideal formula to create a perfect game.

This paper will discuss the full explanation of game metrics, including its elaboration, what is a game metrics and what the game metrics do. There might be no ideal steps to reach a perfect game, but what is collected here will give you a glimpse of what should a video game have and need for it to become a game which is addicting, interesting, intriguing, influencing and of course entertaining.

2. Perfect Video Game

Not everyone likes Super Mario game, even in the time it was released it fulfilled some criteria for good game. We are talking about video game where this is a tool that gather and entertain people from across the world, also there's a lot of form these video games got out into. Some of them are educational games, games for fun, thrilling games, etc. but there are these criteria that is the red thread of these games which makes them wonderful to play with, and they are:

a. Narration

Teachers, scholars, critics and even including parents have been criticizing video game for its bad influence on kids nowadays. What's making them worst is by not having the ability to tell off stories, let alone good story [6].

Narrations, or usually more recognized as storytelling makes your game content tends to be livelier, and much meaningful. Creating a fictional character or word is also one of the way to make it richer, stories makes the inside of the game related to each other, starting from prologue to the epilogue. It acts as the link between them and brings excitement to the user, one of the reason a game is exciting, intriguing, thrilling, and addicting is about the game story itself, which makes people wonder what will happen if progressed further.

b. Graphics

Having an interesting yet meaningful story is a must, but graphics is the thing that will make the user or players attracted to the game, powerful graphics and effects may also make users addicted to the effects in the game. Graphics are also the first thing that most users will consider when they are going to choose for a video game, they will see if the graphics standards, the arts, effects, suits their taste in which this makes the graphics is the real important thing in the start. There are several choices and tastes basic graphics difference like 2D and 3D, most people will prefer 3D graphics since it is more likely like what they are expecting and is more real compared to 2D graphics.

c. Game Experience

Game experience is not unlike user experience a nebulous concept, which has garnered massive discussion and interest from theoretical and empirical angles alike. Games are products that are focused on delivering user experience, and being able to analyze how users interact with games is a prime source of information about the degree of success of a games' design to deliver engaging experiences [7-9]. One of the most debated means of providing a measure for the overall gaming experience that crosses game forms and formats is "fun" [10-11]. It is how you make it entertaining, it can be in any of form from the positive and negative perspective.

The positive happens when enjoyment is building up, challenging, it teaches, and brings people together. Whilst the negative perspectives, at the same time is a problem that occurs at the same moment of the concepts of fun, and entertainment [12]. From these aspects, the experience will be felt when the users or players are interacting with the game directly, the hype they felt when facing a certain moment in the game, crafted, designed, and planned by the developers to make the users feels more to the game.

During game playing, e.g. aggression, frustration and stress. It could be argued that these are not necessarily experience components that game design should aim for, although this is not a simple issue, e.g. in relation to aggression. However, the problem stands that these

components of the game experience exist. It therefore does not make sense to discuss game experience without considering these potential components [13].

As stated above, a perfect video game is not about having neither best story, best graphics, nor the best experiences. But it all depends on how the developers connect and integrates those elements to create a massive excitement and enjoyment for the users and players to feel when they are playing the games. When the users and players shows satisfactory, it will be a private consideration which judges perfect game exclusively for themselves.

3. Categories of Game Metrics

Metrics are the mission-critical parameters by which you will evaluate your game's true current state and progress over time. It is the time where the industry should standardize common functionality, using common metrics to allow meaningful comparison of the ever-growing set of middleware components, open source modules and entire game engines. Based on an expansion and slight redefinition of which the following categories of game metrics, the categorized game metrics (by Mellon 2009) can be defined into [14]:

3.1. Metrics for in-game growth

It should be noted that all games constrain the freedom of the user to interact with the game content in some ways, notably via the game mechanics. Metrics are objective; can be collected in large numbers and map to specific points in a game. In comparison, player-based feedback has much less resolution and is inherently biased due to individual preferences.

Regarding the measures considered for the in-game growth, we are talking about how the game works, the mechanics, rules, game world, and other elements affecting how does it really running to the eyes of users. Mechanics are related with what users are doing in the game, users' behavior and mental state, also what are affecting them to behaving like that, which is why we needed these 3 measures to look for information related to our users which are: User-Initiated Events (UIE), Start, Fail, and Complete (SFC), and in-game performance metrics.

Game metrics contain however an inherent limit in that these data cannot provide any contextual data. The former type of game metrics is basically User-Initiated Events (UIEs) [7], for example movement within the virtual environment, use of the game interface, use of specific in-game abilities, interaction with entities (agents) or objects in the game world or other players, etc. [13]

In essences, metrics cannot count the social state factor of users, and game experiences components (emotional, behavioral, sensorial and cognitive) [15]. Next will be explained 3 metrics which are usually required to measure the in-game growth in a game mechanics and they are:

3.1.1. User-Initiated Events (UIE)

Information technology has provided us opportunity to learn and access information easily [16]. IT becomes an important role in here [17]. The growth of information technology as tools for helping and making people easy to use must be accompanied by wanting to make fun and happy when they contact the information technology itself [18,19]. User-interaction metrics varies in a lot type of forms, like e.g. recorded on continual basis, movement in the virtual world as explained in the first page, or even recorded using some specific frequencies like the avatars' location every x seconds. These metrics can determine the popularity of a location, which area inside the games that trigger the players or users to visit the most, what kind of advantages can be collected or gathered in the certain location is what worth to be analyzed.

After the process of analyzing, when you found out what is the actual cause that makes the players or users do so e.g. The players stay in a location for hours because that position or place is the best spots to gather monsters for mobbing purpose. Handle these kinds of situation by making several extra spots that might gather monsters together also, by doing so the developers has do an action plan to the results of analysis from the UIE report that has been done.

3.1.2. Start, Fail, and Complete (SFC)

This is one of a metrics used to gather in-game data, also known as a progression metrics to check what is the mental status or progress of our daily users or players. Normally, it'll work in every type of video games and this method of metrics work the best for games with levels, so that it can weight up each pro and con of every levels in the game.

The step starts with a 'Start' where the users or players started the new level, and record it into a data to be analyzed. When the users or players fails to complete the level, it will be constantly recorded on the same cohorts. Re-attempt by the users or players will also be counted as the last step, and will successfully complete the last step if the level is done.

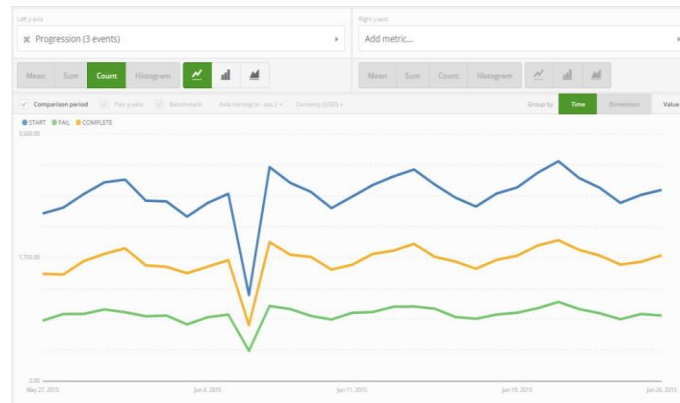


Figure 1. Tracking how does the Start, Fail, and Complete metrics works; as shown in the illustration there is a sharp fail throughout the results (gameanalytics.com)

Figure 1 shows that there is a sharp turn-around throughout the process, those lines resemble the process of different difficulties of the game, with the topmost being the difficulty. After the sharp fall or considered as a fail in this term, the players are still can manage it out, this means that the game has a good tolerance for those who faced the consequences of failing. By using this method of metrics many results can be collected like level balancing. E.g. is the level is too hard for most of the population of users? And, which part should be improved in the level to make it more interesting, which level is the most popular with the users can be tracked also from the frequency of plays.

3.1.3. Performance Metrics

In games where a massive number of users is involved, performance metrics is ideal when it is used to collect data from 10 or more people, because it should be able to derive meaningful performance metrics with confidence levels. There is this measure called Efficiency [20], it is used to measure the effort given to perform a useful task or work with the usage of a minimum number of resources to avoid wastes, e.g. numbers of click, etc. several key steps to measure efficiency:

1. Identify action to be measured: these measures should be quantifiable and verifiable, e.g. number of plays on each level
2. Define the start and end state: where the action begins, and ends, we need to know these detail before measuring since it will affect the result later
3. Count the actions: after knowing when to start and stop, starts counting the actions done you should be able to collect responsible data out of this
4. Actions must be meaningful: by meaningful it meant that it should correlate and give impactful and effective results, e.g. by playing the levels, users are promised to be rewarded with prize or experiences equal to the effort they had done in the level
5. Look only at successful tasks: looking from the failed task sometimes doesn't really count, e.g. there might be someone who just quit the whole level because they felt so lost doing the levels, so ignore these measures and focus only to tasks which is completed [20].

In-game metrics is as important as maintaining the assessments and standards of the developer team. Converting the raw metrics data output from a metrics tracking software package into useful reports by Quality Assurance, researchers and designers, requires a series of potentially iterative steps, and must be done continuously [21]. These kind of game metrics can be recorded during all phases of game development, as well as following launch [22,23,24].

3.2. Metrics for engagement, and monetization

Several metrics has been used for the different usage of scale and field, the previous metrics which is *In-game growth metrics* explained about the metrics to be used to measure up the contents of a game, what should be taken care to seek for perfection through revision. Meanwhile, the metrics for engagement and monetization is different, where it focuses more to the business-side of the game and for monetization of the game. Data collected here will be the assessment of where can be improved by seeing the overview and including how to optimize the optimization of the application or video games. There are 3 measurement factors which can be used for measuring the engagement & monetization, they are:

3.2.1. Retention

Most free-to-play application or video games use this method of metrics and this method arguably become one of the most important metrics to be used. The retention method is used to check whether players or users is attracted to the game and we successfully hold them into using our products, that way we can see usually how long can the product last in the market. Can be solved with solutions like adding more features, innovations, updates regarding the application or video games, etc.

Date	Users	% Day 1	% Day 2	% Day 3	% Day 4	% Day 5	% Day 6	% Day 7	% Day 14	% Day 28	% Day 30
May 22, 2015	307.00	31.80%	30.43%	31.65%	26.38%	23.45%	21.50%	22.15%	9.45%	1.63%	2.93%
May 23, 2015	326.00	34.70%	36.20%	31.85%	27.81%	26.07%	23.01%	19.94%	9.82%	4.60%	-
May 24, 2015	318.00	30.34%	32.70%	27.84%	26.42%	24.53%	23.58%	23.58%	11.64%	1.57%	-
May 25, 2015	309.00	31.54%	34.63%	30.74%	26.80%	28.18%	23.30%	18.45%	10.30%	-	-
May 26, 2015	289.00	36.68%	35.64%	33.56%	32.53%	30.45%	23.88%	20.07%	9.69%	-	-
May 27, 2015	259.00	39.20%	35.91%	34.56%	30.89%	24.71%	23.17%	20.85%	8.49%	-	-
May 28, 2015	284.00	40.85%	39.08%	35.56%	28.17%	23.59%	20.42%	21.48%	10.56%	-	-
May 29, 2015	298.00	41.28%	40.60%	32.21%	27.52%	22.15%	23.15%	20.81%	9.40%	-	-
May 30, 2015	306.00	40.14%	35.95%	31.70%	27.78%	24.51%	23.53%	22.55%	8.82%	-	-
May 31, 2015	341.00	39.30%	32.20%	27.80%	26.88%	24.62%	24.93%	21.70%	9.68%	-	-
Jun 1, 2015	305.00	37.05%	34.10%	30.16%	28.52%	25.90%	23.28%	20.66%	9.84%	-	-
Jun 2, 2015	295.00	37.29%	33.56%	32.29%	31.93%	27.80%	22.37%	20.66%	9.49%	-	-
Jun 3, 2015	275.00	38.91%	38.55%	35.27%	34.95%	24.73%	21.45%	17.09%	9.09%	-	-
Jun 4, 2015	293.00	39.59%	38.93%	33.79%	29.01%	24.27%	21.84%	18.43%	8.87%	-	-
Jun 5, 2015	284.00	42.81%	39.79%	33.10%	28.52%	25.79%	23.59%	19.37%	10.92%	-	-
Jun 6, 2015	329.00	43.47%	37.98%	31.31%	27.05%	22.49%	23.71%	21.28%	12.46%	-	-
Jun 7, 2015	347.00	43.80%	35.16%	27.89%	27.87%	25.94%	23.82%	21.04%	11.93%	-	-
Jun 8, 2015	312.00	40.10%	33.01%	29.17%	29.17%	27.88%	24.04%	20.51%	-	-	-
Jun 9, 2015	296.00	34.80%	34.80%	31.88%	31.88%	28.38%	22.30%	20.61%	-	-	-
Jun 10, 2015	268.00	36.94%	35.82%	33.21%	30.97%	25.37%	22.38%	17.16%	-	-	-
Jun 11, 2015	278.00	34.70%	38.85%	37.77%	27.34%	23.02%	20.86%	20.86%	-	-	-

Figure 2. Tracking the daily usage of users (gameanalytics.com)

Step starts from making a database of users or players using the product, and then daily we checked whether our market returns to use the product or not e.g. Day 0 they downloaded the product, and started to play right away, the next day they returned by logging in by opening the product again and so on until a certain specified date, usually the time-interval is 3 days, there is also some retention method using a week interval.

Figure 2 shows the tracks of users who managed to come back to the game after a few times, from the darker area in the left means that a lot of users are still playing the games, to the softer color in the right side where it means the retention doesn't really work and the daily usage of users are dropping.

3.2.2. Daily Active User (DAU)

Most people put focus on using DAU (Daily Active Users) as ways of measuring user engagement [25,14]. Tons of video game uses this way of measuring to know the behavior of their market. The daily active users count how many 'active users' are currently on with the product. Active users mean that user who logged in to the game and stays for a certain time-span.

3.2.3. DAU/MAU Ratio

Aside from DAU (Daily Active Users), from a more overview of the measure is the MAU (Monthly Active Users) where the system counts for the current active users who stays every month [26]. Most developers rely to the DAU/MAU ratio to gauge the level of retention of a video game, the DAU/MAU ratio is defined as the average of $\frac{DAU(t)}{MAU(t)}$ overtime. For instance, the popular Facebook game MAU(t) *Scrabble* has a DAU/MAU ratio of around 0.30, while *Bejeweled Blitz*, another popular Facebook game, has a DAU/MAU ratio of 0.27. The DAU/MAU ratio is widely interpreted among practitioners as the ability of a game to retain its users, and specifically as a "retention probability" at the daily level. A higher DAU/MAU ratio is believed to be predictive of the success of a social game. More specifically, some practitioners claim that a DAU/MAU ratio of 0.15 is considered the "tipping point" to sustain growth, and that a DAU/MAU ratio of around 0.2 to 0.3 for an "extended period" is necessary for the ultimate success of a game [26].

3.3. Metrics for process development

Metrics related to the actual development of a game is called the 'process metrics' [24]. Game development is to a smaller or greater degree a creative process, which – like other creative areas in IT-has necessitated the use of agile development methods. In turn, this has prompted the development on ways of monitoring and measuring the development process. For example, by combining task size estimation with burn down charts, or measuring the average turnaround time of new content being delivered, type and effect of blocks to the development pipeline, and so forth, like performance metrics, several process metrics and the associated management and monitoring methods are adopted and/or adapted from the methods and strategies in use outside the games sector [14].

These are the must-do metric to use when developing games. For a team or two to move, developers will need employees or teammates to work with, resources (money, labor, etc.), and a system that will run the whole development process. Starting from the system, you start to think of a suitable system for the team from the methodology to be implanted to the development process, and then decides the job descriptions of the employees. The development of information technology at present is very fast and increasingly sophisticated with various advantages [27]. There are some measures to estimate the effort necessary to make a project based on the complexity and number of use-case owned by the software project [28], but what the methodology here is different which related to the employee's performance.

3.3.1. Methodology

The base of methodology used for the game development, whether it could be using the agile methodology, waterfall, scrum, or any other that is suited with the developer's style. there is a substantial overlap in the methods employed in game development across the industry, e.g. a common use of agile frameworks, similar marketing strategies, and so forth [29].

3.3.2. Employee's effectivity and efficiency

Developer team composition matters also, does the team already has the right people in the right position. The job descriptions of each employee have been checked or not, is there

unnecessary action to be done? Less action can do more impacts, and the impacts needs to be critical to the objectives that has been set in the first place.

4. Critical Thinking

These metrics are necessary and important, but depending on each project, is it the best choice to use these metrics? Out of the 3 metrics categories, the universally most used metrics everywhere in any kind of platform is the performance metrics. This metrics is used to determine the whole process of a game mechanics, since we should see from the needs of the user, and all users wants to play the game as convenient and as cozy as possible, which makes we need to have a system or a game mechanics that is very simple and easy to understand. As for engagement & monetization, the Daily Active User (DAU) method is the most used everywhere, since it evaluates daily needs and daily reports of the project. These 2 metrics are the most universally used in development these days, relating to the millennial generation and information technology advancement. Lastly, the process development metrics depends on each developer culture and style. Different way of developing will make a different method.

5. Conclusion

In the future, measurement, metrics, and analytical data-gathering techniques will be crucially needed for someone when they are evaluating a certain kind of circumstances. By continuously evaluating what has been done it will reach closer and closer to the state of a perfect video game, because evaluations tend to satisfy more and more people, it is increasing in numbers. The metrics of course will give a proper academic foundation (data-driven academia) and needs to be quantifiable and verifiable to be called a measure or metrics of a video game [30].

The truth is: *metrics matter*, anyone who cares about the performance of a game needs to learn to understand the study over user data, regardless of the platforms [14]. And in the game development, metrics for in-game growth and process development will be used since it is the metrics where we can evaluate or measure the standards of our game before it launched. It is necessary to provide a better infrastructure related to the system operations [31].

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