Nintendo’s approach to level design in modern 2D games.

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Abstract

The research conducted here examines how Nintendo approaches level design in 2D games; specifically their modern, after 2010, games in the *Super Mario Bros.* and *Donkey Kong Country* series. Game design is an constantly evolving field, and what Nintendo is using to design levels today may change in the future, as their past design techniques have also evolved into philosophies they currently use. This research will compare Nintendo level design to common game design patterns to see which established rules Nintendo uses and where they differ. The research will provide a general overview of the techniques Nintendo uses to design their levels.

Nintendos approach to level design in modern 2D platforming games.

"On my business card, I am a corporate president. In my mind, I am a game developer. But in my heart, I am a gamer" (Iwata, 2005).

One of the most famous quotes of the former Nintendo president Iwata Satoru exemplifies Nintendo approach to business and to games. Nintendo has always been distancing itself from other game development companies through innovative ideas and pushing the bounds of what gaming is thought to be. Iwata oversaw the launch of the Nintendo DS, Wii, Wii U, 3DS and the development of the Nintendo Switch before passing away in 2015.

Through innovative people like Iwata and Miyamoto Shigeru, the creator of iconic franchises such as Mario and Donkey Kong, Nintendo has always been changing the way games are designed and played. Miyamoto was the first at Nintendo to design levels using a kishotenketsu approach, which is now the driving force for level design in Nintendo 2D platforming games. This research paper will examine how the kishotenketsu design philosophy is used to develop 2D platforming games at Nintendo.

History of Nintendo

Nintendo was founded in 1899 and originally created cards for the Japanese game hanafuda. In the 1950's, Nintendo began to shift it's business focus from cards to other ventures, such as toys, games and taxi services. "In the 1970s, Japan had started to collaborate with overseas businesses as the creation of in-home consoles and computer games started to arise" (Takeda, 2020). Nintendo released their first home computer systems in the late 1970s but found international success with 1981's release of Donkey Kong. 1985 saw the release of Super Mario Bros. and the birth of the iconic character.

Nintendo continued with the, "release of the Super Nintendo Entertainment System (SNES) was released in 1991...Nintendo 64 in 1996...in 2006, the popular home video game system, the Wii cam out … in 2017, Nintendo released the Nintendo Switch" (Takeda, 2020). Nintendo is credited with saving the video game industry after the crash of the American video game industry in the early 1980s. "Since the company's first launch of the Nintendo Entertainment System, or NES, to the present day of the latest release of the Nintendo Switch from 2017, they have sold over 5 billion video games and over 779 million hardware units globally" (Takeda, 2020). Nintendo has been an pioneer in video game console development, game design and in creating news ways for people to play games.

Mario and Donkey Kong

"Many games have been released with iconic characters such as Mario, Donkey Kong" (Takeda, 2020). Mario is one of the most iconic and recognizable video game characters, found on merchandise, a theme park at Universal Studios Japan and was even featured in the 2016 Olympic closing ceremony during Japan's performance. Before Mario Bros. was released in 1985, Mario made his debut in 1981's Donkey Kong. "Donkey Kong is the villain that the hero (Mario) had to save his significant other from" (Takeda, 2020).

Players originally played as Mario trying to save Pauline, who was kidnapped by Donkey Kong. In the original Donkey Kong players ran, climbed ladders and jumped over barrels that

Donkey Kong threw down at them. This laid the groundwork for Super Mario Bros. which launched a few years later. Donkey Kong would see more arcade games released, but they failed to capture the success the original had.

"DK disapeared until 1994 when Nintendo handed the DK franchise over to Rare. The first DK game Rare made was Donkey Kong Country" ("The History Of Donkey Kong", 2004). Donkey Kong Country was released for the Super Nintendo Entertainment system and featured 3D graphics rendered in 2D, which at the time, was a huge technological leap forward and drew a lot of attention to the game. Donkey Kong moved from villain to hero with his friend Diddy Kong, as he searched for his bananas, stolen by King K. Rool. Donkey Kong Country saw immediate success and spawned a new franchise for Nintendo. Similar to the Super Mario Bros. series, Donkey Kong Country is also a platforming game. Mario is the most successful game franchise of all time, selling an estimated 760 million units, with the Super Mario games selling around 390 million; Donkey Kong has sold an estimated 82 million sales.

What is a platforming game?

A platformer is a video game focused on controlling a character who runs and jumps. The name platformer comes from early 2D games in the 1980s where a character ran from the left side of the screen to the right side and jumped from platform to platform. The exact origin of the name is unknown, with the British press being the first to use the term int he late 1980s. Platformers during the 1990s were among the most popular video game genres, but their popularity fell in the early 2000s. Recently there has been a resurgence, with many 2D indie platforming games releasing on platforms like Steam and Nintendo Online.

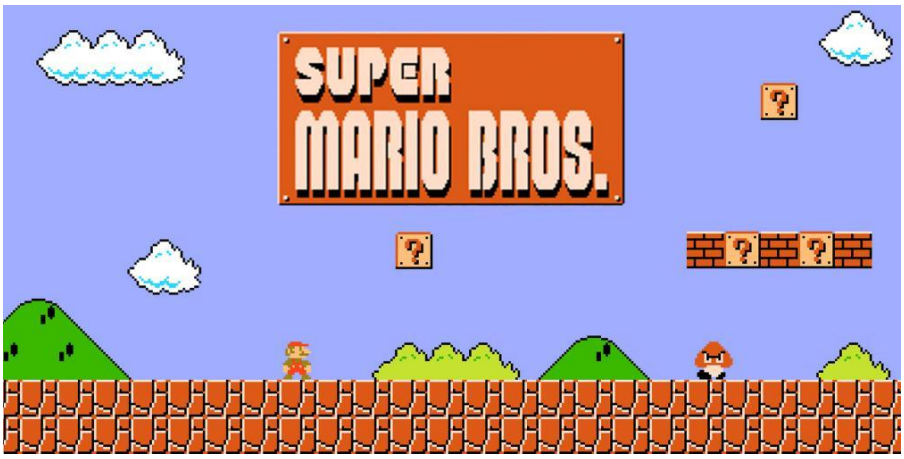
Platforming Game Objectives

Platforming games are can be mixed with other game genres, such as shooting or action games because the goals and challenges of a platforming game easily lend themselves to other game types. The simplest way to explain platforming games is successfully completing a series of jumps to progress to the next level. Each game is different, and the

difficulty of the game and level will impact these jumps, as well as other factors, such as environmental hazards or enemies.

Aside from jumping and running, other mechanics are also commonly found in platfroming games, such as double jumping, melee combat, shooting, item collection and power-ups/abilities. Each of these mechanics changes the gameplay and may take the focus away from platforming and move it more towards an action adventure or puzzle solving game, but the challenge of jumping remains. Traditional platformer games also feature hidden paths or exits, items that test the players abilities and bonus stages.

Examples of platformer games



Nintendo (1985). [Super Mario Bros.]

Originally released in 1985, Super Marios Bros. would go on to become a classic game and spawn the Super Mario Bros. franchise. Players play as Mario, running, jumping and shooting fireballs to save Princess Peach from Bowser.

Nintendo (1994). [Donkey Kong Country]

Donkey Kong Country reinvented Donkey Kong. Similar to Mario, Donkey Kong Country is a 2D platforming game, adding items to collect, animals to ride on and bonus stages. Donkey Kong Country also focuses on more challenging platforming.

Nintendo (1996). [Super Mario 64]

Super Mario 64 brought platforming into 3D and created the foundation for Mario's controls in future 3D iterations.

Nintendo (2020) [Super Mario Bros. U Deluxe]

The latest entry in the Super Mario Bros. series on the Nintendo Switch.

2D vs 3D platformer

Video games are divided by genre but can be further broken down by the graphics of the game. Games such as Super Mario Bros. are played on a 2D plane are thus called 2D. Super Mario 64 gives players the freedom to move in three directions and are referred to as 3D games. 2D games traditionally use the X and Y axis, whereas 3D games also use the Z axis. 2D platforming games typically move left to right along the X axis, but levels can also make use of the Y axis and have players moving up or down the screen as well.

The original Super Mario Bros. and Donkey Kong games used 2D sprites, but modern games use 3D models. The characters in the game are full 3D, and when they move and turn around, this can be seen; however these games are still only played in two directions. These games are also commonly referred to as 2.5D. For the research conducted in this paper, 2D will be used to describe these games.

Level Design

"Level design isn't something that can be easily defined in a sentence - it's a far too varied discipline to confine to one area." (Johnson, 2003). There are many facets to level design, but the most common image for many people is a designer laying out a level using a game engine. This is certainly the case for many types of games, such as platformers, but level design also encompasses mission design, enemy placement, game balancing and many other areas. In a small studio, all of these may fall on to a single level designer, where as in a large studio, they may only be responsible for the layout.

Each game is different and requires different levels, but there are established patterns level designers can make use of while creating their levels. Open world games generally have one large area, and players are free to explore the game in any order. Open world level design focuses more on approaching spaces from any direction, creating landmarks to help guide players and lines of sight. A first person shooter game with levels will focus on creating rooms for players to take cover while fighting enemies or weapon and ammo placement in the map to challenge players with resource management.

Platforming game level design focuses on creating new challenges for players to run and jump across. Jumping across the same areas repeatedly can cause players to lose interest, so enemy placement, environmental hazards, time limits and other challenges are added to make levels feel fresh. There has been much research performed on level design techniques and processes.

Level Design Patterns

"Underlying level design vary by genre, and a deep understanding of level design requires genre-specific analysis" (Smith et al., 2008). There are many other types of patterns used in level design for games, but the ones most applicable to 2D platforming games are explained here.

Guidance

"Videogame designers use tips and tricks and tools of the trade to design levels. Some of these tips are based on their gut feeling and others have been known in the game industry for the last 30 years" (Khalifa et al., 2019). Level designers use established patterns to guide and influence player behavior. Shapes and colors can be used to guide players to specific parts of a level; a stack of platforms can indicate to a player to jump upward. Bright colors will draw a players eye towards an area of the screen, guiding them to the desired location.

Collectables are frequently used in platforming games to "guide players away from, bad decisions" (Khalifa et al., 2019) or to encourage players towards "a path that initially looks 'dangerous' or 'incorrect'" (Khalifa et al., 2019). Collectables provide guidance for players when moving through the level but also can provide a challenge for more experienced players. Many players like to complete a game not just by clearing all of the levels, but also collecting all of the collectables. This extends the playtime of the game and gives players new goals they can work towards.

Enemies and changes in environment can also be used to guide players. "Enemies in seemingly inaccessible locations cause the players to wonder how to reach such" (Khalfia et al., 2019). A common technique for level designers is to put enemies in view of the player, but the path to fight the enemies is not immediately obvious. This gives players a chance to stop and think about the level and look for a path to an area they may have otherwise missed. Another way to guide players is, "using environmental cues such as highlighted tiles" (Khalfia et al., 2019). The Legend of Zelda series uses a cracked tile on a wall to indicate to players they can blow it up using

a bomb and reach a hidden room. Using environmental clues rewards players for paying close attention and can be repeated throughout the game as a form of language, conveying a secret to players.

Landmarks are one of the most used techniques for guiding players in games, "Landmarks are crucial in games, they help the player to remember a location and they could also be used to guide players where to go"(Co, 2006 p. 101). Landmarks are instantly recognizable for players and help them move towards a goal and aid them in not getting lost. According to Veloso (2019), landmarks are, "entertaining diversion from gameplay to veer players towards the goal."

Safe Zones

"Safe Zone is the pattern that refers to one or more areas in the current scene where the players are not exposed to negative interactions" (Khalfia et al., 2019). Safe zones are a chance for players to take a break from the level and "analyze the surroundings and safely plan their next actions" (Khalfia et al., 2019). Safe zones are particularly important for spawn locations because players spawning into enemy attacks can be incredibly frustrating and feel unfair.

Safe zones are also used to communicate to players what is coming next without explicitly telling them. The New Super Mario Bros. Series uses a safe zone before every boss encounter to communicate to players a boss is coming and allow them time to prepare. Before a challenging section of a level, a safe zone can be used to let a player think about their actions and create a plan to succeed.

Foreshadowing

"Foreshadowing is a helpful pattern to help players experience a new game mechanic or game object without an explicit tutorial" (Khalfia et al., 2019). Foreshadowing is a common technique used across all media, not only limited to games. Foreshadowing can, "instigate players curiosity, making them excited about future possibilities" (Khalfia et al., 2019) but also introduce a character they will fight later in the game.Foreshadowing

also, "gives players incentives to backtrack" (Khalfia et al., 2019), after they have a new ability or have improved their skills, to revisit old areas and explore previously inaccessible challenges.

Branching

Branching is "providing the players with multiple paths to reach their objective" (Khalfia et al., 2019). Player choice has been increasingly popular in recent years, with some games designing the entire game around choices the player makes. Not all player choices have to impact the story, a simple choice of which path to take or enemy to fight empower players and let them feel as if they are apart of the story. Branching can also be used to provide a challenging path for more experienced players and an easier path for younger players or those less skilled.

Combined Patterns

Patterns can also be combined to create new challenges in levels. The player might encounter two different enemies and then later, fight both of them at the same time. The enemies are foreshadowed to the player and later they fight both of them. The shape of a level can guide a player towards the bottom of the screen, but a coin on the top can lead them to pick a different path and explore a hidden part of the level. Combining level design patterns, "introduce new and harder challenges, without the need to present new elements to the player" (Khalfia et al., 2019).

Breaks

Just like with real life, taking breaks in levels is important. The tension of a game is often described as having peaks and valleys, while generally moving in the upward direction. (Khalfia et al., 2019) described changing a games pace as, "purposely changing the dramatic arc of the game from one scene to the next". This technique is commonly used to "r increase or decrease tension" (Khalfia et al., 2019) and "make players more invested in the overall experience" (Khalfia et al., 2019). Breaks can take the form of a safe zone or town for players to catch their breath. Audio and visual changes generally accompany breaks in the gameplay. Decreasing the tension, "give players time to relax and enjoy other aspects of the game, such as new environments or abilities" (Khalfia

et al., 2019).

Nintendo's Design Patterns

Does Nintendo Make Use of These Established Patterns?

Nintendo has been using these patterns for decades, and examples can be found in their early games, before they were established across the industry. The Legend of Zelda series provides a small room before every boss fight, where players can refill their life and prepare to fight. New Super Mario Bros. uses coins to guide players to hidden areas and secrets in the levels. Donkey Kong makes frequent use of safe zones to allow players time to think before a challenging platforming section. As games have evolved, so have Nintendo's design ideas. Nintendo now uses Kishotenketsu to guide their level design philosophies.

Kishotenketsu is a form of story telling originating in China. It consists of four parts - introduction, development, twist and conclusion. It is used in Japanese gag manga, which is the was inspiration for its use at Nintendo." *Kishoutenketsu*, where you introduce a concept, and then in the next panel you develop the idea a little bit more; in the third panel there's something of a change-up, and then in the fourth panel you have your conclusion" (Hayashida, 2012).

Kishotenketsu

"We provide that concept, let them develop their skills, and then the third step is something of a doozy that throws them for a loop, and makes them think of using it in a way they haven't really before." (Hayashida, 2012). Nintendo treats each level as its own small story in a larger story that is the game. This affords them the flexibility to use a new mechanic in each level, introduce it to the player and teach them to master it. Then mechanic is then thrown away at the end of the level and may not return the rest of the game. At first, this seems counter intuitive, as during the game development process, finding ways to reuse previous work can help speed up the game's development. Developing a mechanic for one level can seem wasteful, and many studios would not take this approach.

Through the Kishotenketsu, Nintendo is able to concisely isolate each level and form a

design around one mechanic. This in turn makes the game feel much more expansive than it is because, "clear concept in the beginning, and that's carried through absolutely all the way" (Hayashida, 2012). There are many different mechanics constantly popping up, and old mechanics return, mixed with new mechanics, to create meaningful challenges for players. Nintendo has transitioned into using this methodology and through playtesting by using, "feedback that we can see in the expressions on people's faces" (Hayashida, 2012), Nintendo has again innovated in game design.

New Super Mario Bros. U Deluxe Level Examination

I will be using world 5 Soda Jungle Level 1 Jungle of the Giants to examine the kishotenketsu method. Until this point, there are not giant enemies in the game. When entering this level for the first time, players see that all of the block, pipes and enemies are giant, but Mario is the same size. Mario's primary attack is jumping on enemies; with enemies now much larger, the challenge of fighting them also changes. This is a unique idea, not seen in the game until this point, and follows the Kishotenketsu idea.

Nintendo (2019) [New Super Mario Bros. U Deluxe]

The above picture is the introduction to the level. It is reminiscent of the first level in Super Mario Bros. on the NES, with the block setup and gomba enemies. This area servers as a safe playground for players to practice fighting large enemies. They cannot fall as all the ground is flat, without holes.

Nintendo (2019) [New Super Mario Bros. U Deluxe]

The development section can be seen with the introduction of different enemies (koopa, piranha plant) and blocks adding platforming while fighting the enemies. The player can not fall and be forced to fight enemies in situations where they cannot fully jump, such as under either of the block platforms. This section also introduces platforming where the player can fall and die in the level.

Nintendo (2019) [New Super Mario Bros. U Deluxe]

The twist section has the player performing a series of jumps while also dealing with the giant enemies and blocks. The pipes are wider here than in normal levels, which may lead a player to think the platforming is easier, but the enemies are also larger, causing this to be a difficult platforming section. The player is forced to make accurate jumps onto enemies or perform a difficult jump over an enemy to another platform.

Nintendo (2019) [New Super Mario Bros. U Deluxe]

The conclusion of the level is the player performing a series of difficult jumps to collect the final star coin and reach the top of the flagpole to end the level. The player does not need to perform these jumps and can safely run on the ground below to the end of the level. Experienced players and players looking for a challenge will want to collect the star coins in each level, as these contribute to unlocking bonus levels, later in the game. Players are given a choice here of which path to take. If players choose to perform the challenging jumps for the star coin, there is a star power-up before this section they must collect because the jumps are not close enough to simply jump on the enemies. The players need the star power-up for invincibility to defeat the koopas.

Donkey Kong Country Tropical Freeze Level Examination

I will be using world 2 Autumn Heights level 3 Horn Top Hop for this examination. Contrary to the Mario series, Donkey Kong does not follow a traditional kishotenketsu structure. The Donkey Kong games use a modified methodology, where they combine 2 different mechanics together in levels and use the kishotenketsu structure on both of them. Horn Top Hop is about falling leaves and also about horns pushing the player up in the air.

Falling leaves can be defined as falling platforms, while the horn usage in the level can be defined as zones moving the player up. Both of these mechanics have been used before in the game, but the themeing and combination has not been used. Therefore, this level feels fresh when players play it for the first time. These mechanics are encountered after this point in the game as well, but

again with a different theme in a different level, leading to this level feeling distinct and unique.

Nintendo (2014) [Donkey Kong Country: Tropical Freeze]

The introduction for the falling leaves. The leaves fall from the top of the screen, and the player has to jump between them to move up and jump to the top of the platform on the right. If the player falls, they do not die and there are no enemies. This creates a safe space for players to practice.

Nintendo (2014) [Donkey Kong Country: Tropical Freeze]

The development section for the falling leaves has the player jumping between falling leaves above spikes. If the player falls here, they will take damage. This forces the player to master the falling leaves. There are also bananas for the players to collect and further improve their platforming skills.

Nintendo (2014) [Donkey Kong Country: Tropical Freeze]

The introduction section for the horns has a collectable for players to collect. The horn blows air, then stops, but almost immediately blows air again. While possible, it is very difficult for a player to miss the horn and fall to their death here. The collectable is also fairly easy for players to see and collect, further leading them to be successful with the horn mechanic. There are enemies on top of the next platform, but the horn will put players on the left, most part giving them ample time to plan their next move.

Nintendo (2014) [Donkey Kong Country: Tropical Freeze]

The development section for the horns incorporates the falling leaves. These horns do not blow the player into the air but falling leaves, which the player must jump on. If a player jumps on a falling leaf, it acts as a safe space for the player to plan their next jump. The leaf will always be blown back into the air, and there are no enemies here that can attack them. There is one enemy players can jump over or on top of to progress to the next leaf.

The twist section reuses the falling leaves on the horn but introduces falling leaves not above a horn, which slowly drift to the bottom of the screen and disappear. Players here must carefully time their jumps, manage their position on the leaves and avoid enemies. There are also collectables for more skilled players to collect as well. The twist continues with the next section of the level.

Nintendo (2014) [Donkey Kong Country: Tropical Freeze]

Nintendo (2014) [Donkey Kong Country: Tropical Freeze]

The second part of the twist section has enemies shooting projectiles, which the player must dodge while jumping up the leaves. If the player stands on a leaf too long, they will fall to the bottom of the screen and die; if a player jumps too fast, they will hit the fireball. Players must time their jumps correctly here to progress.

The conclusion uses the previous sections, falling leaves with enemies and incorporates the timing aspect. There are no horns for players to use as a safe zone when jumping across the

leaves.There are enemies on the leaves, including enemies the players cannot jump on. This forces players to continuously jump on the leaves and wait for the enemy to fall to the bottom of the screen and die. If a player is not careful, they, too, can fall to the spikes below. Mastery of platforming on the falling leaves is required to progress here.

Nintendo (2014) [Donkey Kong Country: Tropical Freeze]

The conclusion section ends with three horns which shoot enemies out in place of blowing up falling leaves. The outer two horns blow in sequence, while the middle horn blows opposite them. The final collectable for the level is there, and players must time the horns to collect it. Players can ignore the collectable and continue if they wish. This gives a choice for more experienced players and an easy way to progress for inexperienced players.

Mario vs Donkey Kong Level Design Analysis

For this research, I used the games New Super Mario Bros. U Deluxe and Donkey Kong Country Tropical Freeze. The Mario game is a Switch port of the original New Super Mario Bros. U for the Wii U released in 2012, two years before the Donkey Kong game. Both games have very similar guiding level design principles but also some key differences. Before explaining the level design differences, we must also understand the gameplay and goal of each game.

Mario is a platforming game meant to be accessible to anyone. Extra lives are commonly found in levels; there are multiple characters, some of which have extra jumps for beginners. Mario focuses on mastering platforming and relaxing; there are difficult levels in the game, but it is still

considered an easily accessible game anyone can pick up and play. This explains the reliance on one mechanic per level.

Donkey Kong is a challenging platformer game requiring more precise jumps than Mario. The game focuses on challenging platforming and exploration, encouraging players to look around the levels and find secret areas while they play. Donkey Kong is an accessible game anyone could pick up and play, but it forces players to master the core mechanics in a way Mario does not.

Both Mario and Donkey Kong follow the kishotenketsu level design philosophy. While it may appear Donkey Kong strays from this approach by introducing multiple mechanics in levels, I believe this is not the case. Donkey Kong mixes mechanics and uses them as a single challenge to build the kishotenketsu structure around, while Mario always focuses on one. This leads to key differences; where a mechanic in Mario may only be seen once, Donkey Kong will continue to reuse mechanics and its focus on strong themeing to re-skin the mechanics in ways to make them feel fresh.

One final key difference to note is Mario is developed by Nintendo's Tokyo office, while Donkey Kong is developed by Nintendo subsidiary Retro Games in Austin, Texas. One might argue there is an east vs west philosophy difference here causing the level designs to stray from one another. However, Donkey Kong is overseen by Japanese producers, and the use of the kishotenketsu structure is evident in Donkey Kong's level design. I believe Donkey Kong is the evolution of this level design methodology, and Nintendo will continue to build upon it for future releases.

Conclusion

Nintendo has been developing games for nearly fifty years. They have innovated many level design techniques which are now common place throughout the industry. Today, they continue to use these techniques while also developing new ones. Doing a full level breakdown of each area in the level is past the scope of this paper but would show multiple uses of various level design patterns for each level, including some not covered in this paper. The kishotenketsu level

design technique is a uniquely Nintendo design approach that may spread to other studios in the future, but it is firmly in place in Nintendo. The approach is not only used in 2D games, but also in the 3D Mario games as well.

Mario and Donkey Kong both use the same technique to construct levels, but their games core design principles guide them down different paths to create distinctly different levels that appear to use different design ideas. Donkey Kong levels appear to be more complex and incorporate more use of the world to tell a story, while Mario levels use the world purely for an art perspective. Both games are positively received and applauded for their level design. I think, in the future, Mario will begin to borrow ideas from Donkey Kong to further improve the kishotenketsu approach to level design, but as the Mario franchise is the originator of the technique, I also believe they will continue to create new innovative ways to use the technique as well.

Definitions of Key Terminology

Level

According to Hullet (2012), "The precise definition of a level varies by game and genre, but it is generally thought of as a subdivision of a game" (Hullett, 2012). Levels are the individual parts of a game.

Side-Scroller

A side-scroller is a level in a video game in which the player moves from on side of the screen to the other (generally left to right) and the background scrolls as the player runs.

Kishotenketsu

A four part story structure originating in China, which contains the steps introduction, development, twist and conclusion. The structure focuses on the third part, twist, and can be completed without conflict. This is mostly used in eastern storytelling.

Platform

"A platform is defined as any object that the avatar can walk or run across safely." (Smith et al., 2008). Platforms are the building blocks of levels for platforming games.

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