

Exploring How Changes in Game Systems Generate Meaning

Batu Aytemiz, Nick Junius, Nathan Altice

Department of Computational Media

University of California, Santa Cruz

Santa Cruz, CA, USA

{baytemiz, njunius, naltice}@ucsc.edu

ABSTRACT

In this paper, we use *Florence*, *Brothers: A Tale of Two Sons* and *Descent: Freespace - The Great War* as examples to analyze how changes in the game mechanics can be meaningful. We argue that play is essential for this interpretation and by changing their mechanics games can deliver plot points in a way unique to the medium. We look at a game's temporality in addition to its play to be able to further interpret changes to its systems. To conclude, we compile a list of interpretive and design-focused questions intended to further explore this space of interpretation.

Keywords

Game Design, Game Mechanics, Interactive Narrative

INTRODUCTION

It was difficult for me to drag the lifeless body of my brother into the freshly dug grave. Over the past three hours, I had formed a close bond with the titular characters in *Brothers: A Tale of Two Sons*, and now I was controlling Naiee, the young sibling burying his older brother. The game taught me the brothers' interdependence by requiring me to use their combined strength to make progress. Each brother was assigned one half of the controller, with a single button enabling their interactions with the world and each other. Naiee was terrified of swimming, and he could only navigate the waters by piggybacking on his older brother. Alone such tasks were impossible. Now, Naia was gone, leaving the left side of my controller lifeless and his younger brother to fend for himself.

The game was coming to a close. I had guided Naiee to the Water of Life, and now I needed to bring him home. I could see the house in the distance whenever lightning struck. A final obstacle remained—a river. I urged him into the river with the right analog stick, only to see him shake his head and refuse to go in. I continued to press forward, but Naiee refused to swim. Then I moved the left stick, the one that had allowed Naia to move. Only then did Naiee muster the courage to brave the waters and swim across. Though his brother was dead, Naiee was drawing on his strength. Without dialog or other overt representational prompts, *Brothers* had delivered this story beat by changing a core mechanical function late in its runtime.

How did the meaning connect so powerfully with the play experience? Many commercial videogames deliver their story beats through representational elements like cutscenes, text boxes, visuals, audio logs, and dialogue. In *Brothers*, the player must experience this beat through play, because it is directly connected to the mechanic changing.

Proceedings of DiGRA 2019

© 2019 Authors & Digital Games Research Association DiGRA. Personal and educational classroom use of this paper is allowed, commercial use requires specific permission from the author.

In this paper, we examine three games that compel players to experience story beats through play. The primary method *Florence* (Annapurna Interactive 2018), *Brothers: A Tale of Two Sons* (Starbreeze Studios 2013), and *Descent: Freespace - The Great War* (Volition, Inc 1998) use to deliver certain story beats is through changes in their rules and mechanics, rather than solely focusing on changes in the representational elements. Additionally, these games deliver these changes across varying temporal dimensions, both at different points in time and with differing frequency within their game's total duration. In each game, when, at what frequency, and at what scale the mechanics change is informed by their overall duration.

RELATED WORK

Building upon the definition proposed by Sicart (2008) the three terms we use in the rest of the paper are mechanics, rules and properties. Mechanics are defined as “methods invoked by agents, designed for interaction with the game state.” Rules are defined as constraints, guiding the way mechanics function. Finally, properties are values that modulate the rules.

While there has been much discussion of interpreting the meaning generated by game mechanics (Bogost 2007) (Treanor et al 2011) (Treanor and Mateas 2011), there has not been enough discussion of how changes in these elements are interpreted by players. Conversations on plot and story structure often revolve around understanding change, whether it is about how small units of action flow together to create arcs of plot or how the protagonist changes over the course of the story (Chemers 2010). Even though mechanical change is a critical part of how we understand and relate to games, it is an underdeveloped concept in game studies, especially how mechanics and play relate to narrative.

A significant body of work focuses on investigating the connection between game mechanics and game narratives. Clint Hocking initially coined the term ludonarrative dissonance (2009), referring to *Bioshock*, to describe how a game's mechanics might work against the meaning that its story intends to convey. Using *Passage* (Roherer 2007) as a case study, Mattie Brice (2011) coined the term ludonarrative resonance to describe how a game's emergent qualities can echo and strengthen its narrative. Pynenburg (2012) built upon the concept of resonance by introducing their own term, ludonarrative harmony, focusing on cases where the interplay between mechanics and story is not only sufficient to capture the narrative, but rather, especially synergistic and necessary. Wendy Despain (2016) attempted to operationalize these insights to create an actionable process for game designers to achieve ludonarrative harmony in the games they are developing. When we look at further deep readings of games we similarly see an extensive focus on the static aspects of game mechanics without much exploration of change. This focus fundamentally stems from the choice of games (if there is no change in mechanics, there is no change to explore) and the general methodology the authors take. Michael Nixon and Jim Bizzocchi (2013) conduct a deep reading of the game *Heavy Rain*, identifying how its mechanics add to its story. Mike Treanor (2016) does the same for *Sage Solitaire*. Both papers focus on the static content present in their selected games without much discussion of change.

The concept of *procedural rhetoric*¹ is an established lens of interpreting meaning from a game's rules and is generally unconcerned with the interpretation of the accompanying purely representational elements (Bogost 2010). Further developing

¹ The act of making an expression or argument through a game's processes or rules.

this lens, proceduralist readings were created to better emphasize the representational power of game rules (Treanor and Mateas 2011). Not only have these approaches, deemed proceduralism, been criticized for prioritizing the interpretation of a game’s rules over its play (Sicart 2011), an attempt to apply proceduralist readings to the classic arcade game *BurgerTime* proved there was a need to look beyond a description of the game’s rules and system diagrams, and turn an eye towards play, to create a more comprehensive reading of the game (Treanor and Mateas 2011).

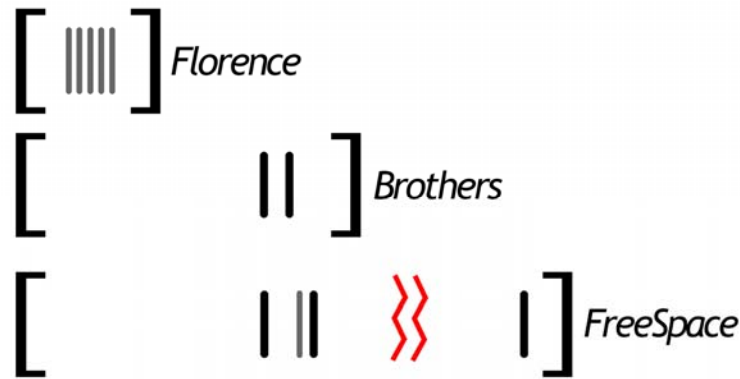


Figure 1: Beat diagram of our three examples. The lighter lines are smaller changes. The darker lines are larger changes. The jagged lines represent time compression to allow the three games to fit their durations into a single image.

What the criticisms of and exploration of proceduralist readings point to is the need to look at players’ interaction with game mechanics and rules and not simply at the mechanics and rules themselves. This also implicitly points to the need to look at how game rules and player interactions exist over time. In the following examples, we track thematic changes across three different axes of temporality, duration, time “slices,” and the frequency and spacing of time slices: *Florence*, through a frequent and small change over the course of a few minutes; *Brothers* with its two major changes in its control scheme late in a game lasting a few hours; and in *FreeSpace*, how its rules for combat change early in the game’s plot and again in its final moments. Each of these games use their changing rules of interactivity as a component of their storytelling and our readings focus on how time in addition to play is necessary for interpreting these changes.

FLORENCE

Florence, developed by the Australian studio Mountains and published by Annapurna Interactive, is a mobile game released in late 2018. The game tells the story of Florence Yeoh through a series of minigames that portray different moments in her life, starting from her childhood days and ending with her life-changing romance. The gameplay consists of simple interactions wrapped up in small puzzles that range from “liking” a post on social media to decorating drawings using different patterns. Unlike other similar interactive narrative games, *Florence* uses very few words to deliver its plot. Instead, *Florence* tells its story through short interactions and visuals.

In certain moments, *Florence* uses mechanical change to convey the progression of the plot. Chapter Five (“First Dates”), for instance, highlights Florence’s first date with Krish, a cello player who she met in the previous chapter. The episode guides the player through Kris and Florence having dinner, sharing dessert, and finally

kissing, all while they are learning about each other through conversation. The visuals depict their venues throughout the evening and mainly show images of the pair talking. The main mechanic in this chapter is completing puzzles by dragging individual pieces to fill out a wordless speech bubble, signifying the next line in their conversation.

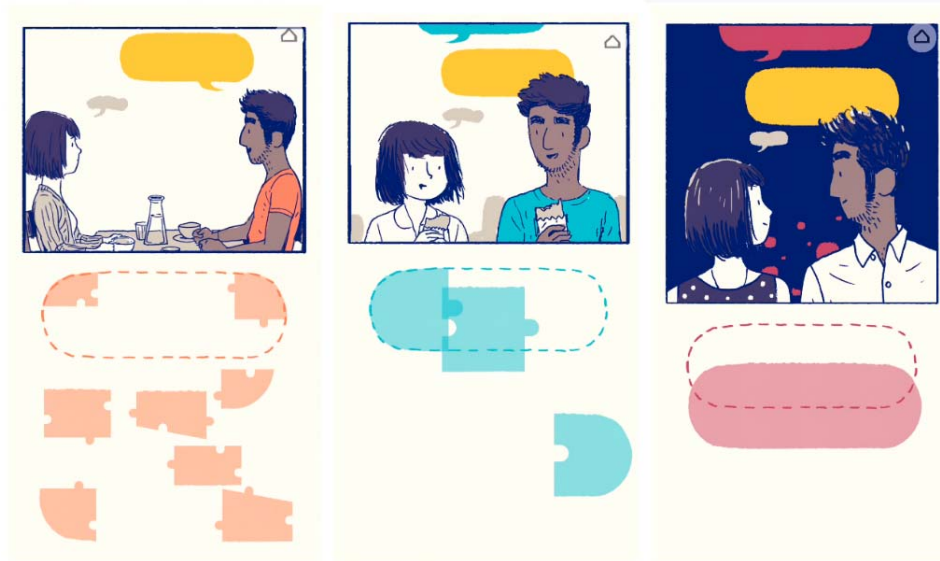


Figure 2: The puzzle progression in *Florence*, Chapter Five “First Dates”.

Although the central drag-and-drop mechanic does not change as the chapter progresses, the number of puzzle pieces comprising their dialog gradually decreases. This is a change in the properties of the drag-and-drop mechanic. There is a total of eight puzzles the player must complete to finish this chapter, and initially, the player must drag eight different fragments to form a complete sentence bubble. This number shrinks to six, then four, and so on, until the player only needs to drag one puzzle piece to form a thought. Dragging one piece is seamless compared to fumbling with eight pieces, signaling that similar change has happened in Florence’s conversation. Another change worthy of note happens in the last two puzzles with two pieces. In the former the pieces are start opposite their correct slots, whereas in the latter the pieces are presented in the correct order.

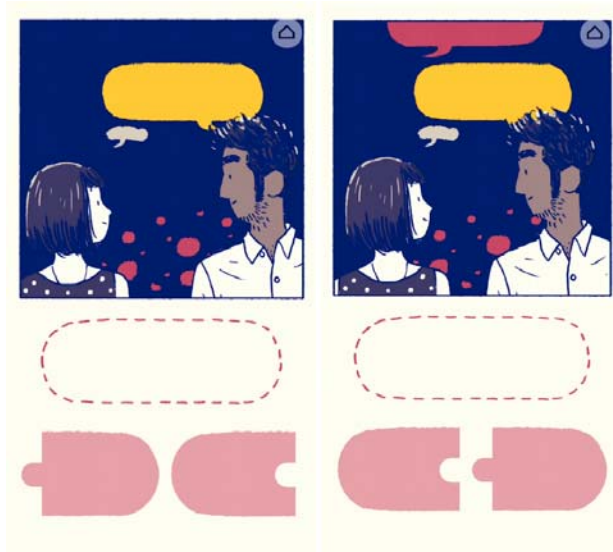


Figure 3: The two puzzles where the ordering of the puzzle pieces change in *Florence*, Chapter Five First Dates.

By changing the mechanic’s property, i.e., reducing the number of puzzle pieces necessary to complete the puzzle and making their spatial positions increasingly trivial, the game is indicating how much easier it has become for Florence and Kris to converse. While there are other techniques used to signify that the characters are becoming more comfortable with each other, such as the depictions of the characters’ bodies becoming more open and their faces occupying more of the frame, this change is a significant way the characters’ confort is conveyed.

While playing *Florence*, a streamer named App Unwrapper exclaimed: “The puzzle is getting easier, aaaahh, the puzzles are getting easier because they are having an easier time figuring out what to say. They are having an easier time talking!” (2018) This quote shows that the change in the mechanic delivers the idea that Florence is having an easier time talking to Kris.

The weight of this change is tightly coupled with the overall length of the game—the changes are perceived in context. Had *Florence* been a grueling eighty-hour-long experience the overall impact of this shift would have been diminished, yet, in this 30-minute long love story simply reducing the number of puzzle pieces is enough to vividly convey Florence’s delight in her date.

BROTHER TALE OF TWO SONS

Brothers: A Tale of Two Sons was released by Starbreeze Studios in 2014. The game tells the story of Naia and Naiee, and their journey to find a magical potion to heal their sick father. The player guides the older, stronger Naia and the younger, nimbler Naiee through a series of puzzles on this fairytale-like quest.



Figure 4: The control scheme in *Brothers, Tale of Two Sons*.

The controller is split into two, with each half assigned to one brother. The puzzles use this control scheme to inform the player of the brothers' inter-dependence. For example, in one of the introductory obstacles, the older brother has to lift his younger sibling up a cliff, allowing his younger counterpart to dangle a rope down.

A thematically significant, recurring obstacle is any river deep enough to swallow Naice, the younger brother. The opening cinematic establishes his fear of swimming by showing his mother drown. Whenever the pair needs to cross a river, Naia is forced to swim across with his younger brother holding on to his back. For this interaction to happen the player must first move the brothers close to each other. Then they can press Naice's interact button, making him cling onto his older sibling. Only after that the player can move Naia to allow the brothers swim across.

Throughout the game the siblings traverse diverse landscapes, solving puzzles until they reach the Tree of Life. However, just before they can collect the healing waters, an intense boss-fight ensues. During the fight Naia gets severely wounded and even the Water of Life fails to save him from death. From that point onwards, the player only controls the younger brother; half of the controls rendered useless, the buttons and the joystick assigned to the older brother now ineffective.

Brothers uses the bulk of its puzzles to reinforce the connection between its main mechanic and what it represents in the narrative — the interdependence of the siblings. Thanks to this established connection, manipulating the game mechanics also manipulates and enhances the themes that are conveyed: Naice's feeling of loss resonates more strongly with the player because half of their agency is now similarly lost. The way the player plays the game changes to match the narrative.

After the death of the older brother, the player must solve several more puzzles on the way home, this time with only half of the controller active. A river is the last major obstacle standing between the player and the end of the game. Yet, as the game taught the player earlier, the younger brother cannot swim without the help of his older sibling. When the player moves Naice into the water, he shakes his head and refuses to go deeper. Only when the player also pushes the analog sticks assigned to his older brother, Naice finds the courage to enter the waters and swim across. With this move, the game taps into the connection that it had established throughout the game: the brothers supporting each other to make progress. By introducing another change in

the game mechanics the game delivers the next plot point in the story: Naiee finding the strength to swim thanks to the memory of his older brother.

Unlike more traditional methods such as cinematics or dialogue boxes this plot point is primarily delivered through the change in mechanics. As such this moment can only be truly experienced by playing and engaging with the game. Let's compare this to the earlier moment we discussed, the older brother's death. After the boss fight a short cinematic shows us that Naia has passed away. This plot point is introduced to us through what we watch, not what we play. The changes in the control scheme amplify the feelings caused by his death. In the scene near the river however, we discover the plot point of the younger brother drawing strength from his older sibling by engaging with the games systems. This is worthy of reiterating: By changing their mechanics games can deliver plot points in a way unique to themselves.

Using play to deliver plot points ends up being very impactful. Several youtube let's players² comment on the emotional weight of this moment while noting the changing mechanics. These notions are further echoed in the comment section by their audience.

A further positive side effect of this approach is evoking a powerful sense of discovery unique to the games medium. When meaning is embedded inside changing game systems, the player must explore and interact with the game to unearth that meaning. This sense of exploration is much less pronounced, if it exists at all, in other types of reveals, such as traditional cutscenes or textual exposition. When important narrative moments are delivered through cutscenes or scripted events that happen regardless of player actions after they are triggered, the player is relegated to a passive observer role watching the events unfold. Whereas in crossing the river as the younger brother, the player by themselves must remember Naia's and take the decision to push the analog stick that represented him. This simple act of remembering creates a connection between the player and the characters that is hard to replicate in other mediums.

FREESPACE

In 1998, Volition, Inc (now Deep Silver Volition) told the story of a fourteen-year long war between humans and the first alien species they encountered, interrupted by the arrival of a second alien species. This story is *Descent: FreeSpace - The Great War*.

Panic and terror are what greet anyone who starts the game. The game's opening cutscene shows the player the inciting incident of the plot: a pilot limping home, trying to tell anyone he can about something new and dangerous he encountered. As the crew of the space station he's flying towards try and calm him down, what he is panicking about finally catches up, killing him and destroying the space station. The cold indifference of *FreeSpace's* main menu follows, along with a fairly dry rundown of the basics of the core game systems, with a particular emphasis on targeting other ships. There is something missing from this early tutorial but this could just be a space combat game without the trope of energy shields.

² Cryaotic: <https://youtu.be/k8EGAUQF0GM?t=2959>

Bog Otter: <https://youtu.be/KbsW6MTNa48?t=12311>

TheGirlFromAus: <https://youtu.be/9DAT8BFn610?t=1685>

GazHD: <https://youtu.be/OPM05OCrQ7U?t=1282>

One of the first things the game makes clear is that the player should disregard what they saw in the opening cutscene. Instead all attention should be paid to the Vasudans, who have yet to make an appearance beyond a few cursory mentions. *FreeSpace's* early missions primarily involve cleaning up the aftermath of events that happened prior to the player's deployment in the war and are simple dogfights between small groups of fighters. This changes when stolen plans for a new cannon are discovered while attacking a Vasudan supply depot.

After another mission involving the attempt to return the plans to the Vasudans and the capture of multiple ships, the mission "Out of the Dark, Into the Night" tasks the player with escorting the twice-recovered plans to a facility to begin producing the new weapon. Any comfort on the first major escort mission of *FreeSpace* vanishes once the untargetable and shielded Shivans arrive. Suddenly the time spent teaching the player about targeting and user interface elements are rendered useless, along with the bulk of the weapons the player has available, all from the Shivans being dropped into the middle of a mission without warning. While the other pilots' chatter in the mission lends some extra gravitas to the situation and explicitly calls out the inability to target these new ships, most of the player's understanding of the game's shift in rules comes from the change in interaction.

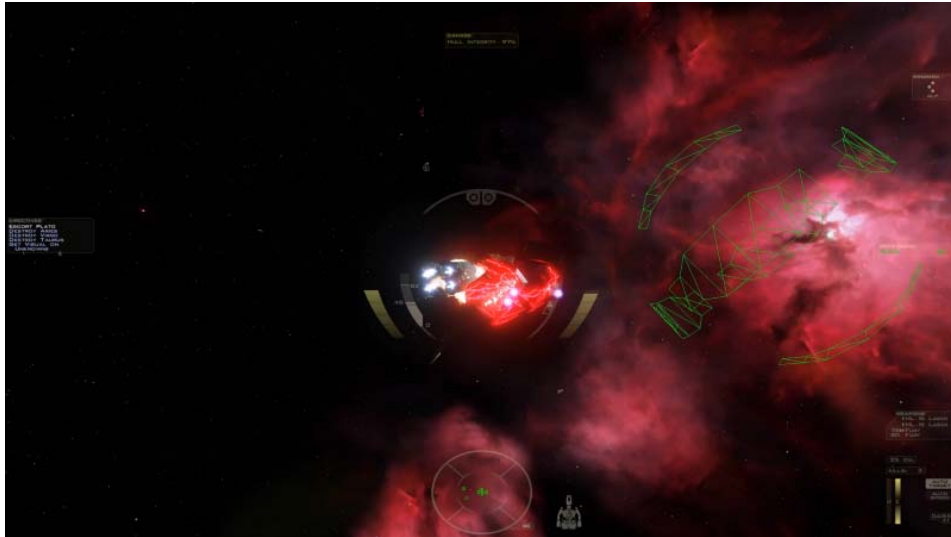


Figure 5: The Shivans' first appearance in a mission.

Buttons and functionality that were presented as integral to playing *FreeSpace* no longer have the utility or purpose they once did. The only hostile ships that can be targeted are quickly destroyed by the Shivans, making both the auto-targeting utility and heat-seeking missiles worthless. Worse still the only available cannons do almost nothing to the shields protecting the Shivan ships. This leaves the point-and-shoot missiles as the only viable option, should they have even been loaded onto the escort ships, though they are far from ideal, as they too benefit from the targeting information that had been present up until now.

The Shivans' stealth technology not only confronts the player directly with a dramatic change in the combat rules, it foregrounds the narrative importance of the first mission they appear in beyond their presence in the opening cutscene. Without the Shivans, the weapon plans the player is tasked with protecting in the mission "Out of the Dark, Into the Night" would simply be the first escort mission in the game. With

the Shivans' appearance and the sudden rule changes, this primarily narrative element holds the promise of a future rule change, namely allowing the player to effectively combat the Shivan fighters.

It takes another two missions for the ability to target the Shivans to be restored, one of which tasks the player with gathering information and technology about their new enemy. The player's main goal of the raid is to scan cargo containing shielding technology with information about the Shivans' stealth technology only being a secondary priority. The raid does not go as planned and the depot is instead a trap. The Shivans proceed to destroy most of the depot themselves, leaving the player only able to scan the remaining containers full of sensor equipment. It is here where the drip feed of rule changes starts and it is here where the most important change is setup.

Of the combat rules the Shivans upended (shields and targeting), the addition of shields is by far the most impactful even if it is not as core to *FreeSpace's* mechanics. Even the marginal success of the player's raid allows them the ability to target Shivans from this point on. In addition to the return of a core combat feature, the promise of a new weapon, the original focus of the mission "Out of the Dark, Into the Night", is finally made good on. While the new cannon and the return of targeting get the player's ruleset close to that of the Shivans', there is still the problem of shields.

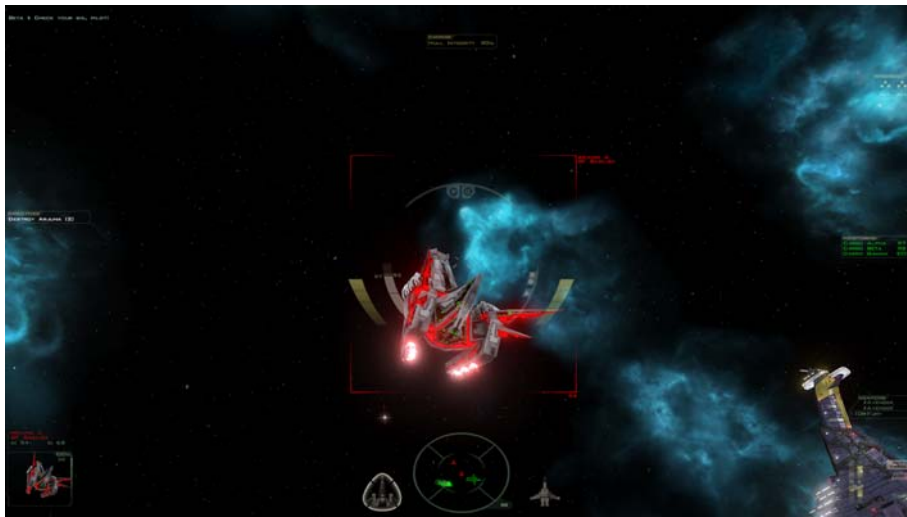


Figure 6: Targeting the Shivans for the first time.

The cutscene that plays between the end of the raid on the cargo depot and the next mission makes the promise that the player will, at some indeterminate point in the future, get access to shields. Before that however, the player must help escort the only shield prototypes currently in existence to a star system where they can be mass produced. While this setup is certainly more traditional in how it hints at rule changes, it puts the onus of getting to the rule change on the player. In other words, if you want shields, you have to earn them.

The escort of the shield prototypes is relatively straightforward until the final minutes. The waves of Shivan fighters give way to two wings of apparently friendly Vasudan ships saying they'll take over the escort right before the convoy is supposed to leave. The odd behavior is confirmed when another Vasudan ship appears and identifies the group of fighters as traitors. With this last skirmish over, the convoy can

safely leave and the player will finally have access to the energy shields they've had to go without until now. While the splintering of the Vasudan forces is briefly discussed before the player takes escort of the convoy, the final sting of the mission drives that point home and adds another rule for the player to worry about with regard to working with their new Vasudan allies.

After a quick overview of the new controls that come with the addition of the shield system, the player is tasked with hunting down a group of the hostile Vasudans. The briefing goes out of its way to tell the player that these Vasudans should not possess the new energy shielding. As the mission begins, everything seems in order. There are a few Vasudan fighters without shields and the cargo and capital ship are present. This all changes when the second wave of fighters arrives. They are shielded. Similar to the Shivans' arrival, the player's allies will call attention to the change, just in case they miss it in the chaos of combat. Again, this is a change that is felt through the interaction first and the narrative second. Not only does this moment of subversion create a smaller scaled version of what was felt back in "Out of the Dark, Into the Night", it creates a mechanical hook for a minimal amount of exposition to be attached to.

The game explicitly calls out what its goal with the mission was in its debriefing: make the scale of the hostile Vasudan faction obvious and worrying. Like with the Shivans, this is done through a combination of rule changes and narrative setup. While this moment doesn't have the same visceral impact that the Shivans' arrival did, it has the player interact with the narrative implications of being allied with a government fighting an insurrection in a mechanical way— simply by switching the shield system on during a mission.

From this first mission focusing on the Vasudan traitors (mission nine) all the way to the final mission of the game (mission twenty-nine), *FreeSpace* keeps its rules for combat consistent. The final wrinkle it adds in its last mission is a mechanical inversion of the Shivans' arrival in "Out of the Dark, Into the Night" (mission four). Rather than fight the Shivans on their terms with energy shields, the final mission strips everyone of this system that has become just another part of combat, putting the Shivans on roughly the same level as the player was at the beginning of the game.

FreeSpace uses its changing mechanics primarily as a way to emphasize story beats and bring the game's narrative into the realm of the rules and mechanics, not just contextualization. The game wants its major beats to be made directly applicable to the player's interaction with its rules, making these story beats personal for the player. The scope of a new existential threat might be too nebulous an idea to be scary to players but taking minutes to destroy a single fighter using point-and-shoot missiles, without knowing how much damage is being inflicted, is real, tangible, and unnerving after being used to a wealth of information at the press of a few buttons.

Without its lengthy runtime, in comparison to our other examples, the substantial changes *FreeSpace* makes to its combat rules would not carry the same weight. The Shivans' arrival is placed deliberately to happen when players will likely have started to be comfortable with the game's systems. The final mission serves as a mechanical callback to *FreeSpace's* first hours and again uses the comfort that comes with familiarity and time for one last stab of change induced tension.

CONCLUSION

Through our desire to better explore how game rules and mechanics can be analyzed, we found out that *change* was an essential piece of interpretation. Additionally, through our process of reading these three games, it became clear that more work

needed to be done studying games as artifacts with a temporal nature to them. In our readings, we discussed how subtle property changes can inform the player of the characters' experience and how changes in rules and mechanics can be used to both emphasize and deliver plot points. Based on these readings, we created a set of questions to inspire both design and critique of games focusing on how mechanical changes are interpreted.

Inspired by *Florence*, we pose the following questions:

- “How do the specific parameters I chose for my game mechanics relate to the assumptions that my player makes?”
- “Is there opportunity to tweak the specific parameters to create a contrast in what it was initially?”

Inspired by *Brothers, A Tale of Two Sons*, we pose the following questions:

- “What assumptions am I leading my players to make with the given game mechanics?”
- “Is there an opportunity to change those mechanics to play on the assumptions I am creating?”
- “Can I make changes to the control scheme of the game to engage with these assumptions?”

Inspired by *Descent: FreeSpace - The Great War*, we pose the following questions:

- “What does the presence (or lack) of a game mechanic imply about the rest of the game world?”
- “When are game systems introduced and who is responsible for the introduction?”
- “Does the player immediately have access to the system after it is introduced?”
- “Is there a narrative reason to introduce a mechanic or system later in the game?”

These questions are by no means an exhaustive set, even from our own analyses, but we hope they, along with our interpretations, provide more tools to design and analyze games. Additionally, we hope to inspire more attention to be paid to the importance of play and time in interpreting game mechanics and narrative. Finally, we hope these insights allow for more digital games to effectively make use of the flexibility present in their systems.

ACKNOWLEDGEMENTS

We would like to thank our reviewers and Isaac Karth for their time and valuable feedback and Attilio Rigotti for helping form the basis of these ideas.

BIBLIOGRAPHY

Bogost, Ian. 2007. *Persuasive games: The expressive power of videogames*. MIT Press.

- Chemers, Michael M. 2010. *Ghost Light: an Introductory Handbook for Dramaturgy*. Southern Illinois University Press.
- Treanor, Mike, Bobby Schweizer, Ian Bogost, and Michael Mateas. 2011. "Proceduralist Readings: How to find meaning in games with graphical logics". In *Proceedings of the 6th International Conference on Foundations of Digital Games*, 115-122. ACM.
- Treanor, Mike, and Michael Mateas. 2011. "BurgerTime: A Proceduralist Investigation." *DiGRA Conference*.
- Mountains, 2018. *Florence*. Mobile Game, Annapurna Interactive.
- Starbreeze Studios, 2013. *Brothers: A Tale of Two Sons*. PC Game, 505 Games.
- Volition, Inc. 1998. *Descent: FreeSpace - The Great War*. PC Game. Interplay.
- Caldwell-Gervais, Noah. 2013. *From Shock to Awe: System Shock, Bioshock, and Infinite*. Video, YouTube, 11 May. <https://www.youtube.com/watch?v=s7DVOw1IcM>
- Hocking, Clint. 2009. Ludonarrative dissonance in *Bioshock*: The problem of what the game is about. *Well played 1* : 255-260.
- Brice, Mattie. 2011. "Ludonarrative Resonance". Article. Mattie Brice, 11 September. <http://www.mattiebrice.com/ludonarrative-resonance/>
- Rohrer, Jason. 2007. "Passage". PC Game. Jason Rogrer
- Pynenburg, Travis. 2012. "Games Worth a Thousand Words: Critical Approaches and Ludonarrative Harmony in Interactive Narratives". Honors Theses and Capstones. 70. <https://scholars.unh.edu/honors/70>
- Sicart, Miguel. 2011. "Against Procedurality." *Game Studies* 11 (1). http://gamestudies.org/1103/articles/sicart_ap.
- Sicart, Miguel. 2011. "Defining Game Mechanics." *Game Studies* 08 (1). <http://gamestudies.org/0802/articles/sicart>.
- Despain, Wendy. 2016. "Designing for Ludonarrative Harmony". Thesis Project.
- Nixon, Michael, and Jim Bizzocchi. 2013. "Press X for Meaning: Interaction Leads to Identification in *Heavy Rain*." In *DiGRA Conference*.
- Treanor, Mike. 2016. "Finding Meaning in Abstract Games: A Deep Reading of *Sage Solitaire*." In *DiGRA/FDG*.
- AppUnwrapper, 2018. "Florence: iOS iPhone Gameplay & Full Game Walkthrough (by Annapurna Interactive)". Youtube. 13 February" <https://www.youtube.com/watch?v=ISd30wt9wl0&t=595s>