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Experiencing the Passage of Time in Video Games

Federico Alvarez Igarzábal
Institute for Frontier Areas of Psychology and Mental Health
Freiburg, Germany

Introduction

"Seinfeld, four!" calls out the host at the Chinese restaurant. Its addressees Jerry, Elaine, and George have already left the establishment after an excruciating wait—the fourth party member, George's girlfriend Tatiana, never showed up. *The Chinese Restaurant* is an episode of the acclaimed sitcom *Seinfeld* in which its protagonists wait to be seated at a table. For 23 minutes, the audience observes the characters deal with one of the most boring situations of ordinary modern life. The uneventful state of affairs leads Jerry and George to ruminate about recent events: Jerry feels guilty about having lied to his uncle to avoid going to his place for dinner that evening; George is concerned that Tatiana will not show up because he ended their previous date awkwardly. Elaine is more present focused, trying to deal with her hunger, which makes her the most impatient of the three. By all means this is a frustrating and tedious situation.

That such a mundane occurrence fills the whole duration of an episode of a television show—a medium characterized by plots with highly condensed action—underscores the central characteristic of waiting situations: time stretches and slows down in the consciousness of those who wait. On the other side of the screen, however, spectators are presumably experiencing the opposite phenomenon. Since the aim of the show is to amuse viewers with Jerry, Elaine, and George's ordeal, the passage of time is likely to speed up in each audience member's experience.

Fig. 1 – Seinfeld, The Chinese Restaurant [1]

[1] Image source: https://www.imdb.com/title/tt0697675/mediaviewer/rm3772318976 (November 13, 2019).

These experiences of time speeding up or slowing down are all too common for us. Time does not go by at a steady pace, but changes speed as the interaction between our internal (bodily and mental) states and the environment influences our conscious experience. With relation to video games, the most common association is that several hours of gameplay can go by in the blink of an eye. But a gaming session can also result in a boring or frustrating experience that makes time drag, sometimes as the result of faulty design and sometimes as the result of intended design decisions that clash with the player's expectations. This article will explore why the experience of the passage of time changes speed during gameplay through psychological theories of time perception. But before I move on to video games, I will briefly outline the current understanding of the cognitive and affective mechanisms that influence our experience of the passage of time.[2]

The Elements of Temporal Experience

The first thing that should be noted about duration is that it can be judged *prospectively* and *retrospectively* (Zakay & Block 1997). Prospective judgements of time are made during the time period that is being estimated. When Jerry, George, and Elaine complain about how long the wait is taking, they are judging it prospectively. Retrospective estimations are made after the time period has concluded. These are two important paradigms in experimental psychology that not only differ in the timing of the judgement, but also in the cognitive systems they rely on (ibid.; Block et al. 2010). Prospective judgements of duration utilize attentional resources, whereas retrospective judgements are based on information stored in memory about the estimated event.

The speed of the passage of time during prospective estimations is contingent on two aspects of our experience: attention and arousal. The interrelation between these elements is neatly summed up by Zakay and Block's *attentional-gate model* (Zakay & Block 1995, 1996, 1997). This model postulates a mental pacemaker that emits pulses (figure 2).[3] The pacemaker can be affected by arousal. The more aroused we are, the faster the pacemaker fires (Droit-Volet & Meck 2007; Wittmann & Paulus 2008). Whenever we start paying attention to the passage of time, a gate opens that lets the pulses through. The pulses are then tallied by a counter. The amount of pulses counted during the estimated duration gives us a sense of how much time has passed. Since this model postulates that the system uses attentional resources, it would be expected that estimations differ between people who are only paying attention to time and those whose attention is divided between estimating time and another non-temporal task (Grondin & Macar 1992). If someone is asked to wait in a room devoid of distractions, they will start paying attention to the passage of time, that is, they will start judging the duration of this waiting period prospectively (Jokic et al. 2018). Since all attentional resources are free to be allocated to time, the judgement of duration will be longer than if the person were given a magazine to peruse while waiting.

[2] This paper expands on the analysis presented in the chapter *The Speed of Time* of my book *Time and Space in Video Games. A Cognitive-Formalist Approach* (Alvarez Igarzábal 2019, pp. 159-173).

[3] For the sake of brevity, I am using a simplified version of the attentional-gate model that describes the basic mechanism behind it. The full model is more complex, but its details exceed the scope of this paper.

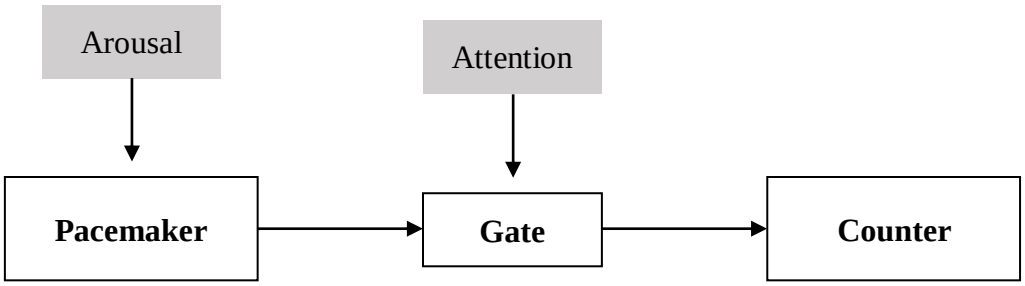

Fig. 2 – The attentional-gate model (Zakay & Block 1995)

If a person is asked to judge the duration of an event retrospectively, attentional resources play a secondary role. The attentional-gate model is therefore inadequate to understand retrospective time judgements. Zakay and Block (1997; Block et al. 2010) proposed a *contextual-change model* for retrospective timing. In this case, the memory load of changing events is the main factor influencing the duration judgement. That is, the duration of the time period will depend on the quantity of contextual changes that the person has stored in memory in association with the remembered event. Time spent in an empty waiting room will thus retrospectively feel shorter than time spent reading an interesting text or watching television.

Arousal can affect both prospective and retrospective duration judgements. On the one hand, emotional arousal affects the pacemaker in the attentional-gate model by making it fire more pulses. As a result, the counter accumulates more pulses than usual, leading to the stretching of time in experience. During emotionally arousing moments, we also accumulate more information in memory, which leads to a retrospective feeling of time dilation.

A near death experience is an example of the above. A car accident, for example, seems to occur in slow motion because arousal increases the speed at which pulses are fired. Retrospectively, this feeling that the crash was experienced in slow motion persists and we would still tend to overestimate the duration of the event, since we stored an unusual amount of information about it in our memory. Experimental psychologists cannot produce car accidents to test this effect, but one study showed that spiderphobics who were exposed to spiders for 45 seconds overestimated this time when compared with controls (Watts & Sharrock 1984). A number of studies also showed that seeing images with high emotional valence also leads to the overestimation of the exposure time (Angrilli et al. 1997; Droit-Volet et al. 2004; Gil et al. 2007; Tipples 2008; Bar-Haim et al. 2010).[4]

The different natures of prospective and retrospective duration judgements can lead to a paradoxical relation between the lived experience of an event and its recollection. While the time spent in a waiting room might feel longer than it actually is, the retrospective estimation of the same duration will likely be shorter, given the lack of interesting events during that period. The inverse paradoxical phenomenon is experienced during, for example, a vacation

[4] It is still unclear, however, if emotional states do not constitute a cognitive timekeeping system on their own (Craig 2008; Wittmann 2009).

in a new city or country. Such a trip can keep us busy with novel experiences (food, locations, customs), which move our attention away from time. This will make a day of that vacation feel as if it were over in an eye blink. Retrospectively, however, we get the feeling that that day was longer than it actually was.

At the extremes of our experience, while bored (and hence under-stimulated) and while aroused (and hence overstimulated), the passage of time tends to slow down from a prospective point of view. It is in between those extremes that our perception of time speeds up. From a retrospective point of view, given the reliance on memory of this type of estimation, we only overestimate the duration of moments that are emotionally arousing while we underestimate the duration of those that are boring.

In what follows I'll analyse how these phenomena can relate to video games while describing them in more detail.

Time speeding up in video games

When we think about time perception and video games, the most common association is that they make hours feel like minutes. In a survey conducted by Wood and co-workers, 99% of respondents, all of them gamers, reported losing track of time while playing (Wood et al. 2007). Further evidence for this phenomenon was provided by a number of experimental studies (Wood et al. 2004, Rau et al. 2006, Wood & Griffiths 2007, Luthman et al. 2009, Tobin & Grondin 2009, Tobin et al. 2010, Bisson et al. 2012, Bisson & Grondin 2013).

Interestingly, the effect does not seem to be straight forward. Just grabbing a controller and starting to play a video game does not necessarily mean that the player will lose track of time. Experienced players are more prone to lose track of time while playing than inexperienced players (Wood et al. 2004, Rau et al. 2006). The causal relation in this case could go in two directions: Experienced players could lose track of time more easily because they don't need to learn how to play and are thus less frustrated than inexperienced players; or it could be the case that experienced players are more prone to lose track of time in the first place, which leads them to play videogames more often. It could also be the case that both explanations are true, since they are not mutually exclusive.

Another noteworthy finding in the studies conducted by Tobin, Bisson, and Grondin (Tobin & Grondin 2009, Tobin et al. 2010, Bisson et al. 2012, Bisson & Grondin 2013), is that there seems to be an adaptation period of a dozen or more minutes before players start losing track of time. Within the adaptation period, participants were more likely to overestimate the duration of the play session.

These caveats aside, it seems safe to say that video games make the passage of time accelerate in experience. Jerry, Elaine, and George could have certainly used a Game Boy. Following Zakay and Block's attentional-gate model, this can be explained as a result of players paying attention to the stimuli provided by the game and the tasks they carry out within them. This would leave fewer attentional resources free to think about time, which, according to the model, leads to the underestimation of duration.

The phenomenon of losing track of time and therefore underestimating the duration of a play session is related to the state of *flow* as described by Csikszentmihalyi (2009). This state has eight characteristics (ibid., p. 49):

1. The task at hand can be completed
2. Deep concentration
3. The task has clear goals
4. The task provides immediate feedback
5. Acting with deep but effortless involvement
6. Sense of control of one's actions
7. The sense of self disappears
8. Losing track of time

Three of the eight elements listed by Csikszentmihalyi are features of the activity: It can be completed, has clear goals, and provides immediate feedback. The remaining five refer to the state of mind of the person undertaking the activity. Three of those five elements describe aspects that the experience possesses: concentration, effortless involvement, and a sense of control. The final two describe elements that the experience lacks: the sense of self and the sense of time.

Incidentally, that both the sense of self and the sense of time vanish is a hint of their connection. An fMRI study conducted by Wittmann and colleagues (Wittmann et al. 2010) showed that the insula, a region of the brain that keeps track of internal states, was activated in time reproduction tasks of intervals longer than three seconds. Participants heard a tone and then had to reproduce its duration by listening to a second tone and pressing a button when they thought that it was as long as the first one. This task correlated with a pattern of activation in the insula that increased as time passed and peaked, in the case of the first stimulus, at the moment the tone ended and, in the case of the second stimulus, at the moment the tone was judged to be as long as the first (right before the button press). This study supports the hypothesis that the perception of bodily states is the basis for our experience of time (ibid., p. 10).

The state of flow can be experienced in a variety of activities, such as dancing, climbing, giving a speech, or playing chess. As already noted by game designers and scholars (see for instance Voiskounsky et al. 2004, Salen & Zimmerman 2003, Juul 2005, Schell 2008, Nah et al. 2014, Nuyens et al. 2019), the state of flow is common when playing video games. It could be argued that it is even considered an ideal mental state in gaming. As I will note in the next section, an argument could be put forward against this claim. But it does seem reasonable when starting a new game to wish for it to be interesting enough that it will capture our full attention. Spontaneously thinking about time is often a sign of dissatisfaction; it indicates that we want the current moment to be over and move on to something else. Thus, if we lose track of time during gaming, we take it as a sign that the game is enjoyable.

The attentional-gate model fits well with the definition of flow: as we lose ourselves in an activity, we dedicate most of our attentional resources to tasks related to this activity, leaving relatively little space for temporal judgements. This leads to the acceleration of the passage of time. Given that games are audiovisual and interactive experiences, they require a larger amount of attentional resources that activities that are, for instance, audiovisual but not

interactive (e.g. watching a movie). For this reason, they are more likely to keep our attention fully focused. But games need to be designed in a way that players are challenged to the extent of their skill. This is a tricky thing, since the skillset of the potential players of a game can vary according to their previous experience. For this reason, games often provide difficulty settings. But not every video game is for every player. The run-and-gun game *Cuphead*, famous for providing a steep challenge, can prove too frustrating for many, while it can be a fun challenge for others. A game like *Euro Truck Simulator 2*, on the other hand, in which players drive trucks on digital renditions of European roads (cf. Leino 2018), can prove monotonous for someone seeking a challenge like the one provided by *Cuphead*, but can also be a source of pleasure for others.

Fig. 3 – Cuphead [5]

Fig. 4 – Euro Truck Simulator 2 [6]

The flow state is achieved when the challenge provided by the activity is not too high to make the player frustrated or anxious and not too low to make the player bored (figure 5). In figure 5, a player P starts playing a game with a low skill level but the game also provides a low level of challenge, allowing for the player to enter a state of flow (P1). As the game progresses, the player's skill level will increase. If the video game does not meet this increase in skill with a higher level of challenge, the player can get bored (P2). If, on the contrary, the game provides a level of challenge that exceeds the skill level of the player, this will make them anxious (P3). By progressively intensifying the challenge proportionally to the increasing skill of the player, the player can remain in the flow channel (P4).

This is easier said than done and gameplay sessions are most probably characterized by fluctuations, where players have periods of flow separated by periods of either boredom or anxiety. That said, video games can also be boring or unfairly difficult. Both an arousing state of anxiety and a state of boredom, as described by the attentional-gate model, would produce time to slow down in the player's experience. While boredom and anxiety can be easily seen as states that players wish to avoid while playing games, there can certainly be a legitimate place for them in the gaming landscape and should not be understood as a sign of poor design in every case. The next section will put forward arguments for the primacy of boredom and anxiety in video games.

[5] Image source: https://store.steampowered.com/app/268910/Cuphead/ (November 13, 2019).
[6] Image source: https://eurotrucksimulator2.com/media.php (November 13, 2019).

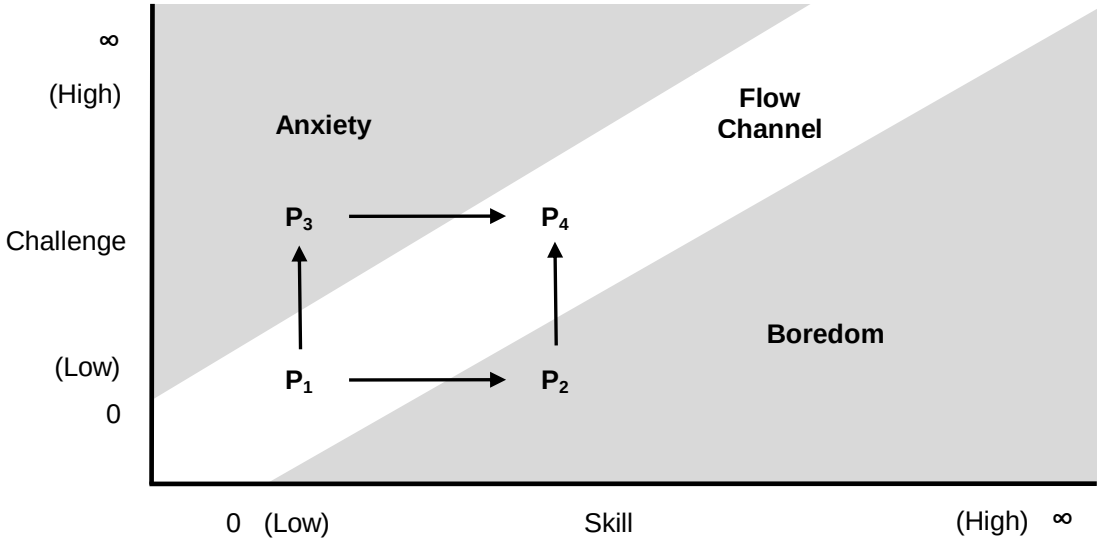

Fig. 5 – The flow channel (Csikszentmihalyi 2009, p. 74)

Time slowing down in video games

While playing an action game like *Bloodborne*, the sudden appearance of a mighty foe might produce a spike of anxiety and fear that slows down time in the player's consciousness. The fight might at first prove too difficult, but after a series of trials players could start losing their fear and gaining more focus on the activity itself. Arousal can also be related to positive emotions, and these can slow down time as well. A study by Kim & Zauberman (2012), for example, showed that sexual arousal leads to the overestimation of duration. The elation produced by defeating the challenging enemy in *Bloodborne* could then lead to a dilated experience of time just like its abrupt entrance did.

Fig. 6 – Bloodborne [7]

[7] Image source: https://www.playstation.com/en-us/games/bloodborne-ps4/#media-section (November 13, 2019).

In contrast to the experience of time speeding up, there is (to my knowledge) no empirical research conducted on the slowing down of time in video games to this date. At the moment, only inferences can be made from research in other areas, such as the studies outlined in the previous section. One other case is a study by Pollatos and co-workers that showed that an emotionally arousing movie clip was judged to be longer than an emotionally neutral one of the same duration (Pollatos et al. 2014). It seems reasonable to expect the same to be true of video games.

But there is an area of experience that is most likely out of bounds for video games: the slowing down of time in near death experiences. Video games are safe activities. We might experience fear or anxiety when confronting challenging opponents, but this fear is circumscribed to the virtual contingency of the game. In reality, we play in safe situations, or we would otherwise put the controller down and focus on whatever is endangering us.

Philosopher Valtteri Arstila summarized the experience of time in dangerous situations in six features (Arstila 2012, p. 2):

1. The feeling of external time expanding and slowing down to a great extent
2. Dominant mental quickness as demonstrated by the increased speed of thoughts
3. There is often an altered sense of the duration of the event lasting longer than it actually does
4. If possible, in the event in question, people often act fast and purposefully.
5. In the latter case, their attention is also altered and narrowly focused on the issues relevant for survival
6. Unusually sharp vision or hearing

Two factors are necessary for this experience to take place: the event must be surprising and the person must believe that death is imminent (ibid.). A prototypical case is when climbers experience potentially deadly falls, as studied by Heim (in ibid., p. 1). Another example is the aforementioned case of a car accident. These experiences are sudden and potentially deadly, triggering experiences with the six features listed above. If the belief of imminent death is not there, time does not slow down as drastically. And if a person is in a situation that will lead to certain death that is not sudden, such as a hospital patient with a terminal illness, they do not report the experience described by Arstila (ibid., p. 2).

Video games might present us with sudden experiences that threaten the life of the player character, but our own lives are always safe. What games can do is simulate the experience of life threatening situations, as in the case of bullet time mechanics. These mechanics typically slow down time in the gameworld while allowing the player character to move relatively faster than computer-controlled opponents, emulating to some extent the six points of the experience of dangerous situations. Mechanics like this have been implemented in games like *Max Payne* or *Vanquish*.[8]

Still, even though the extreme case of life threatening situations is out of bounds for video games, there are many ways in which they can make time slow down during gameplay, and good reasons for designers to seek this effect. Going back to the example of the sudden appearance of a challenging enemy in *Bloodborne*, the slowing down of time produced by the

[8] I discuss bullet time mechanics in more detail in Alvarez Igarzábal 2019, pp. 167-168.

fear triggered by its appearance and the thrill of its defeat are punctuated moments in the game. So can be the frustration experienced after every failed attempt at defeating the enemy. But these moments where time slows down are intertwined with pockets of flow, where players combat against the enemy and lose track of time. Games like *Bloodborne* thrive in the tension produced by the pursuit of staying in the flow channel.

Flow could be seen in this sense as a reward for the player's dedication: A pleasurable state in which players forget themselves and time, and become enthralled by the interaction with the artifact. In this case, the state of anxiety that slows down time is a desirable experience because it leads to a future reward. This is part of the mainstream view on gaming: Face a challenge, practice to get better, and overcome it. While flow is a deeply entertaining and pleasurable state, there is also a place for video games that swim against this current and focus on experiences that the stereotypical player seeking flow would try to avoid.

Game scholars Sebastian Möring (2014, 2018) and Olli Tapio Leino (2018) have put forward cases for boredom in games following Heidegger's account of the phenomenon (Heidegger 1995; Harman 2007; Slaby 2010). I cannot make justice to Heidegger's take in these pages, but at least the first of the three levels of boredom proposed by the German philosopher largely agrees with the psychological account presented here, in that it is connected to lack of stimulation (cf. Danckert & Allman 2005; Zakay 2014).

Boredom in video games can be an unintended result of a game's design. During the recent launch of *World of Warcraft Classic*, servers were so crowded that players had to wait for other players to finish a particular task so that they could have their go at it. One quest, for example, requires killing a specific non-player character (NPC) to complete it. Players had to form lines and patiently wait until it was their turn to slay the NPC (Hernandez 2019).

Fig. 7 – Players standing in line in World of Warcraft Classic [9]

Möring analyzes *Proteus*, a game in which players wander around a colorful pixelated island that has very limited possibilities for interaction. *Proteus* offers a novel way to be in a virtual world that departs from what Möring calls the "fear structure" (Möring 2014) typical of video games. In *Bloodborne*, the gameworld threatens to make players lose precious progress and time if the player character is defeated. Other games, like *Pac-Man*, threaten to stop entirely

[9] Image source: https://www.polygon.com/2019/8/27/20835116/wow-classic-queue-lines-blizzard-launch (November 13, 2019).

if players lose all their lives. These threats give rise to the fear structure that orchestrates the events of a game. Players cannot choose to ignore it if they wish to keep playing. In contrast, the world of *Proteus* does not offer this kind of threat. Nothing can make players lose progress or lives, and the game does not stop unless the player decides to exit it. This lack of threats, however, risks tipping the scales in favour of boredom.

Fig. 8 – Proteus [10]

Leino works with the example of *Euro Truck Simulator 2 Multiplayer* (*ETS2MP*), which he classifies within the genre of "mundane vehicle simulators" (Leino 2018). In this genre players are "required to drive a vehicle and to complete a series of repetitive and/or monotonous tasks like making deliveries, harvesting crops, or, cleaning streets" (ibid., p. 2). According to Leino, not even the environments in *ETS2MP* are that interesting, with cities only differing form each other on the presence of a prominent landmark (ibid., p. 3). Like *Proteus*, *ETS2MP* lacks a fear structure. Unlike *Proteus*, it does not seem to offer much in terms of visual aesthetic pleasure. Both Leino and Möring argue that games that lean into boredom open a space for a different type of gameplay.

The lack of interest of the environment characteristic of boredom makes us turn our attention inwards, focusing on internal states. Remember Jerry, Elaine, and George in the waiting area of the Chinese restaurant. Elaine becomes focused on her feeling of hunger, which makes her impatient. The stereotypical player is hungry for a challenge and the state of flow that comes with it, and is thus easily irritated when confronted with a game that lacks a challenge like *Proteus* or *ETS2MP*. George and Jerry, however, experience another common effect of boredom: They start mind wandering and reflecting about their behaviour in past events. It is difficult, if not impossible, to be reflective during a challenge that demands our constant attention and interaction. Thus, a game that gives players time to pause invites thinking and promotes a contemplative mind-set. To achieve this state of consciousness, video games have to eschew the fear structure and risk boring the player.

Calm games that do not pressure the player with the possibility of imminent failure are not necessarily aiming to bore them. Boredom can be part of the *Proteus* experience, just like anxiety in *Bloodborne*, but it is not the ultimate goal. While *Bloodborne* threatens players

[10] Image source: http://twistedtreegames.com/proteus/ (November 13, 2019).

primarily with failure, *Proteus* and *ETS2MP* present them with the prospect of boredom. The way out of boredom in these games is to actively *pay* attention to the gameworld. It is easier to be immersed in a game when attention is captured by the fear structure that threatens to end the game or reset painstakingly earned progress if we do not stay alert. Games like *Proteus* will not end if we fail to pay attention. If the player does not actively attend to the details of the gameworld, *Proteus* just becomes tedious and time starts slowing down in experience. Paying attention is rewarded with a contemplative experience filled with pleasurable visual and auditory stimuli. In the case of *ETS2MP*, enjoyment is associated with the engagement with a relatively trivial task and relaxing while performing it. Reviewer Topper Harley commented the following on the game's Steam store page:

"It's great to disconnect and simply drive on the highway.

It's especially cool when you tune in to a radio station that plays music you like. Then it's really fun…"[11]

Csikszentmihalyi gives the example of Rico Medellin, a man who reported entering a flow state at his work at an assembly line (Csikszentmihalyi 2009, pp. 39-40). Medellin's job was repetitive and trivially easy but, by paying attention and trying his best to improve his skills, he found a way to thoroughly enjoy it. Individuals in movement-induced trance states and experienced meditators can also achieve a state of flow. Flow can still be experienced in games like *Proteus* or *ETS2MP*, just like it can be experienced in an assembly line.

Fig. 9 – The Graveyard [12]

A further example of boredom in video games is *The Graveyard*, in which players take control of an elderly woman walking through the titular location. The game is played in the third-person perspective and consists in walking down a straight path until reaching a bench where the woman can sit down. Due to the advanced age of the character, who needs the help of a cane to stand and walk, players can only navigate the space very slowly. The quiet

[11] My translation. The original German review reads: "Super um mal abzuschalten und einfach ein bisschen auf der Autobahn unterwegs zu sein. Besonders cool wird es, wenn man eigene Radiosender einbindet mit Musik die einem gefällt. Dann macht es richtig Spaß..." Retrieved from https://store.steampowered.com/app/227300/Euro_Truck_Simulator_2/ (October 14, 2019).
[12] Image source: http://tale-of-tales.com/TheGraveyard/ (November 13, 2019).

environment is presented in black and white, and there is really nothing else to do in it other than walk. Once players reach the bench, the woman sits down and a song starts playing. During the song, the woman gives her last breath, and the game ends. Here, once again, a player seeking for the stimulation of the fear structure will likely be bored. But the game uses the contrast to fast-paced, action-packed games to shift the attention from what we are doing as players to other aspects of the fiction. The game underscores death and can thus stimulate reflection on that topic itself, help players put their own lives into perspective, or think about their relation to the elderly members of their families. *The Graveyard* risks boring players to induce a contemplative state. And even if the player does get bored and starts thinking about time, the point of the game is not lost. On the contrary, by inducing boredom and making players think about time, the game brings them closer to the theme at the center of the experience: the end of someone's life.

Fig. 10 – Cart Life [13]

Anxiety can also be a desirable state in certain games in which flow is practically unachievable. *Cart Life* is an example of this type of game. It puts players in the shoes of one of three street vendors: Melanie, Andrus, and Vinnie. Each of them has a different small business (a coffee cart, a bagel shop, a newspaper stand) and has to care for someone else (a kid or a pet) or deal with an addiction. The job of the player is to manage their lives and balance their material and emotional wellbeing. This is how Ben Moore summarized the game in his review for Game Trailers (Internet Archive 2013):

"Though there are small differences, each job is similarly repetitive. Day in and day out your customers ask for the same things and complain in the same way. While it isn't fun, the monotony of the tasks is authentic and relatable. Whether it's grinding coffee beans by mashing arrow keys or folding newspapers by typing short phrases, the soul-crushing work will soon have you begging for respite.

Yet daily walks to school with Melanie's smart daughter provide enough motivation to put the apron back on. Together you'll talk of the existence of boys and how dumb school can be. Such grounded characters allow you to find pieces of yourself in the people you control. They're weak, hungry, and tired, but also courageous, persistent, and hopeful. You're not out

[13] Image source: https://hofmeier.itch.io/cartlife (November 13, 2019).

to save the kingdom or escape irradiated monsters. Instead, you simply want to be happy. Cart Life is a reminder at how tough such a simple goal can be."

Cart Life is likely to produce anxiety in players. This overarching emotional state is sometimes interrupted by brief moments of beauty or touching human connection between characters. The player might even enter a state of flow through trance-like repetition when performing the game's mundane tasks. But the overall sensation of stress looms on the player for most of *Cart Life's* duration, which likely leads players to experience the time spent with it as relatively longer than time with a game that is aimed at inducing flow states.

Conclusion

In conversations about games we typically focus on stylish graphics, immersive sound design, or engaging mechanics. We discuss if games are fun to play or not, or if their stories are compelling. We rarely talk about how our experience of time is affected by them. This might be because time is a phenomenon we take for granted, and it is one that is hard to describe as well. We mostly talk about time with relation to games when discussing how long games are, or if they are fast or slow-paced, or how much they absorb us and make us lose track of time. But our experience of time and hence the temporal aesthetics of video games are much more complex than that. Time perception underlies our interaction with video games and shapes our experience of them. Becoming more aware of the workings of time perception will lead us to a better understanding of the aesthetics of video games.

The above pages attempted to broaden our understanding of the experience of the *passage* of time in video games (one of many aspects of time perception). I started by outlining the state of the art of psychological research on the perception of the passage of time and duration estimation. The attentional-gate model provides a framework that makes sense of the empirical evidence on prospective judgements of duration—that is, those judgements made *during* the judged time period. The contextual-change model explains variance in retrospective judgements of duration as the result of memory load. The more information we have stored in memory with relation to a particular event that has already concluded, the longer we will estimate it to have lasted. Time estimations are modulated by arousal and attention. Arousing moments stretch in consciousness and seem to last longer both prospectively and retrospectively.

The main phenomenon associated with video games and time perception is that they make time fly by bringing players into a state of flow. This, I have argued is taken as an ideal for games to achieve. This is unsurprisingly the case, since the medium excels at eliciting flow, which is a highly pleasurable state. But this needn't be taken as the sole or ideal source of aesthetic pleasure that can be drawn from video games. Experiences that make time slow down can also be engrossing. In contrast to games that produce flow experiences, those that slow down time invite players to contemplate their virtual environments and reflect on the themes they explore. Needless to say, this is not a binary choice. A game can provide moments of exhilarating action and moments of calm reflection. How designers implement these sections determines how players experience the passage of time in video games.

The experience of the passage of time still remains to be fully understood and research on video games specifically is just getting started. The first section of this paper outlined an

incipient body of research on flow and time loss in video games. The second section was mostly a speculative attempt at inferring how games can make time slow down in consciousness. There is thus still much work to do in order to elucidate the effects of video games on this important aspect of our experience.

Games

BLOODBORNE, FromSoftware, PlayStation 4, 2015
CART LIFE, Richard Hofmeier, PC, 2010
CUPHEAD, StudioMDHR, PC, 2017
EURO TRUCK SIMULATOR 2, SCS Software, PC, 2012
MAX PAYNE, Remedy Entertainment, PC, 2001
PAC-MAN, Namco, Arcade, 1980
PROTEUS, Key & Kanaga, PC, 2013
THE GRAVEYARD, Tale of Tales, PC, 2008
VANQUISH, PlatinumGames, XBOX 360, 2010
WORLD OF WARCRAFT CLASSIC, Blizzard Entertainment, PC, 2019

TV Series

SEINFELD, THE CHINESE RESTAURANT (S2E11), David & Seinfeld, NBC, 1991

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