Mapping Time in Video Games

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ABSTRACT
Video games can position players in a specific time and space. This paper will argue that the experiences of both are closely interdependent. As a consequence, we need to re-evaluate our models of time in video games. The discussion will exemplify the suggested interdependencies of temporal and spatial experience. The result is a player-centered perspective towards time in game spaces.

Author Keywords
Time, space, virtual world, video game

INTRODUCTION
Why do we understand very complex temporal arrangements in video games with ease?
The following argument will investigate the role of time in video games. More precisely, it is an attempt on the mapping of time from the game state to the player's experience. It argues that games situate players not only in certain spaces or social networks but also into a certain timeframe. An interactive event unfolds over a certain period and in a certain place: it *takes time and place*. Players are engaged in both simultaneously. This engagement can only be understood if both notions are taken into account. Space and time are interdependent and this paper will attempt a combination of both to discuss time in video games.

First, the paper will give an overview over the diverse work on time in video games so far. It will break the existent approaches down into two, currently largely separate concepts. These are described as the 'formalist' perspective and the 'experiential' perspective. Then, it will concentrate on the element of space to connect the two and suggest a more inclusive new reference model. It will provide short sample analyses to illustrate how this combination works in practical studies.

TIME IN GAMES SO FAR
In games research time has been analyzed, among others, from a hypertextual perspective [13, 21], from a cinematic one [40], and based on semiotics [22]. The two main approaches that this essay will reference can be roughly divided into 'formalist' and 'experiential' approaches. The formalist approach sees time evolving in a reference between the game state and the play time. The existential approach is more driven by cognitive and emotional aspects and players' understanding of the game world.

Formalist Approach
Juul provides an immensely helpful analysis of time in video games. He distinguishes between 'play time' (= 'time the player takes to play') – and 'event time' (= 'time taken in the game world') [18]. He later adjusts this terminology to 'fictional time' and 'event time' [17]. Juul interconnects both time frames via 'mapping' that projects a player's time and action into the video game space. 'To play a game is to interact with the Game State'. [18]

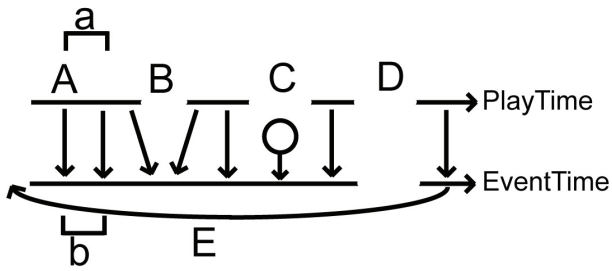

Figure 1: Mapping play time onto event time (Juul).

The various possible mappings outlined by Juul include direct mapping (A) during which play and event time are mapped directly onto each other; loading time (B) during which the player is disengaged but the event time can be presented as continuous; cut-scenes (C) during which event time continues but play time is interrupted; level changes (D) during which both times are undefined for the game; and back-referencing events (E) that point towards events in the past or back story of a game. The model is not completely conclusive. For example, it remains unclear how the (E) events 'outside the time that you can interact with' [18] relate to the other mappings. The example provided (the books in *Myst* [26]) uses only pre-defined and non-interactive game states independent from the dynamic changes of other projections. Nevertheless, Juul introduces a valuable concept in the mapping of different temporal frames onto each other.

Furthermore, Juul argues that variable speed can influence

the mapping of 'play time' and 'event time'. This describes the relationship of (a) and (b). He suggests that many action games (such as *Quake III: Arena* [12]) offer a direct 1:1 temporal mapping while in a game such as *SimCity* [41] the construction of buildings takes only minutes or seconds, which does not correlate with the months needed to build them in the physical world.

The model represents a helpful formalist perspective towards time in games but it provides little reference to time as it is experienced. Apart from a pointer to the concept of "flow" [10] it does not address how a player might understand time shifts in games nor does it discuss a player's changing attitude towards a certain game state. This is the domain of the experiential approach.

Experiencing Time and Space

The experiential perspective towards time in games tries to describe a player's comprehension of temporal situations in games. Instead of a mapping formula it describes cognitive and emotional involvement.

Aarseth identifies a "negotiation time" that comes to live in the repeated playing of a certain game event during which a learning of the event space and time is acquired by the player [1]. He interconnects the learning process of the player and the temporal development, which opens up a third level of temporal progression: that of a player's advancement through the game world. Aarseth specifies this process of understanding further into event pairs of aporia and epiphany that provide for a structured dynamic in the experience of time in games. Somehow the player learns the spatial-temporal and other conditions of the game world between aporia and epiphany.

Looking further into the parallels between spatial metaphors and time, Mylov concentrates specifically on the (projected) body and resulting temporal conditions [28]. He is aware of the relevance of the spatial behavior for time: 'Dynamic space is a unit of temporal and geometric dimensions. Movement makes time emerge from the experience of space.' [28] More precisely, he argues that the body axes in space are not only relevant for spatial navigation but also for temporal alignment.

Linguists have long noticed the parallels between the way we describe and think about bodily movements and temporal change [19, 39]. We "move forward" into the future, or "look back" at things past. Two correlating concepts of how the spatial metaphor is applied to our understanding of time are the moving-ego-perspective and the moving-time-perspective. The moving-ego-perspective sees the body as the active entity moving through time. It is expressed in statements such as "I move forward in time" or "I leave the past behind me". The moving-time one see the objects of the world as approaching the body and is at work in sentences such as "Christmas is approaching fast" or "my 30 birthday has passed". These basic metaphorically mappings recur in most languages analyzed so far. Even diversions from this mapping – found, for example, in the Aymara language – remain spatially defined, albeit with a different mapping [32]. The role of space in our understanding of time is so strong, that our spatial behavior influences our comprehension of temporal conditions and can switch us from an ego-moving to a time-moving-reference and back. Boroditsky proved that even purely imagined spatial behavior can have this effect [4]. Her results indicate that we do not need a bodily presence in a certain space to be influenced by the (projected) movement through this space in our perception of time. A mental projection is sufficient. Exactly this is the situation in video game spaces: we project movement into a virtual space. Not surprisingly her findings have been discussed for Virtual Reality systems [28] as well as games [2].

Alloway/ Ramscar/ Corley tested Boroditsky's results in a game setting and concluded – like Boroditsky for real environments – that 'although spatial experience can influence temporal thought, this influence can be over-ridden by explicitly thinking about space, suggesting that people's conceptual representations of space and time are functionally separable from their embodied experiences of space and time' [2]. We can prime players to conceptualize time independently from their physical embodiments. For a video game this separation is triggered by the interface and the presentation of the virtual bodies and their relationship in space. In games this focus is provided, for example, by the camera [29]. Through this focalization games can prime players into specific spatial and temporal perception. If a game player's concept of time can differ from the embodied experience then this questions the idea of uncritically mapping play time onto event time. Time as experienced quality remains connected to space but 'explicitly thinking' about it can make the timeframe more complex. Time becomes more malleable than the original formalist view suggests.

Figure 2: *XIII*; four different event times framed in one image.

XIII [3] includes multiple frames that, like comic novels, tell an event over time and are framed in certain panels that overlay the main game view. At the same time, players stay in continuous control of the main character. Players have no difficulties understanding the situation although the temporal conditions are different from panel to panel to game world.

Another example is found at the end of *Prince of Persia: The Sands of Time* [25]: following the pre-defined plot the player may arrive at the final game situation in which the whole fictional in-game time is reversed to a different beginning. This reversal of time in the game's pre-defined narrative seemingly eradicates all actions in the fictional world that the player undertook to solve the game. Davidson states that 'It's a wonderful moment of frisson as you realize that your time with the game (around 10-12 hours of playing) has been whirled away within the context of the story. And this moment has some poststructuralist, self-reflective facets as well.' [11] These facets are understood and only then enjoyable through the more flexible timeframe provided by continuous spatial conditions and complex yet legible presentation.

Towards a Combination

The formalist approach allows a strong positioning of the player into a certain interactive situation. As they are transported to a new temporal location players are situated in (or at least in relation to) a certain game time and game space. But once the players arrive at this spatio-temporal location their experience of the game's timeframe can still vary widely. As the discussion of the experiential approach has shown, these variations can be triggered by spatial behavior and priming. Because space is so important in both approaches it is suggested as a connection point between both models. Space can serve as architectural structure element and temporal conditioning.

Order and Space

Spatial continuity does not imply temporal realism but consistency. Rarely does a game mimic physical spatial behavior in a 1:1 mapping into the game space. Most game heroes can run faster, jump wider, and fight quicker than their human counterparts. The reason why their actions remain accessible is their continuity. They move faster *all the time* or at least at the *expected time*. Thus, the mapping of 'play time' onto 'event time' is not one of the same measure but one of a continuous and reliable quality. It is the reference to the projected virtual body and its reliable spatial behavior preserved through the consistency of a game's spatiality that demonstrates this quality. The experience of space and its continuity, thus, becomes a cornerstone in the discussion of time. One discipline that realized this connection and provides useful references is architecture.

Architectural space is time-dependent because it relies on the fragmented reception of parts of a spatial structure that cannot be perceived in its totality by the observer at once. A visitor can experience a larger physical space, such as a house or a city, only over a period of time – usually in the form of movement. A path, for example, that structures and restricts basic movement can be understood by architectural theorists as 'a fundamental existential symbol which concretizes the dimension of time' [31]. Architecture understands that time is connected to an experience of the space, to the effect of the body in space, and how it moves through it. Le Corbusier stated that 'An axis is perhaps the first human manifestation; it is the means of every human act. The toddling child moves along an axis, the man striving in the tempest of life traces for himself an axis. The axis is the regulator of architecture.' [8] Time can be a distance in dependency of movement along this axis. This does not conflate spatial with temporal progress but calls for a connection between the two in the discussion of the experience of time.

Not unlike a good tour guide knows a city's layout and traffic patterns, an experienced *Quake III* player is aware of the spatial conditions in the game. That is why an expert can navigate the same game space much faster than a new player. The player who masters the space gains a spatial and temporal advantage. Not surprisingly, level designers adapt to the architectural principles and see distances as elements of timing. During the creation of the seminal de_Dust map for the *Half Life* [36] mod *Counter-Strike* the designer, Dave Johnston, adjusted the map's timing through spatial positioning: 'I had been playing with the timing - when each of the teams would meet in the middle, and who would reach the main bomb site first. (…) I moved the CT spawn positions closer to the centre of the map - a distance which, when running, took about 2 seconds to cover - so the CTs would arrive at the hallway 2 seconds earlier than before.' [16]

Figure 3: de_Dust plan view; start points for Counter-Terrorists (CT), Terrorists (T), target zones (A) (B).

Johnston instinctively recognized space and movement as time-structuring conditions in game worlds.

Changing Temporal Conditions

On the formalist side, temporal structure is implanted in a game through conditional relationship depending on the game state. Insofar, the mapping model opens up the toolbox of temporal analysis developed by Genette. Referring to Metz, Genette distinguishes between *story time* (the time of the diegetic storyworld) and *narrative time* (the time of the narration) [14]. He describes three different ways of temporal structuring between the two layers, namely *order*, *duration*, and *frequency* of events. For now, the argument will concentrate on the *order* of events and try to trace this temporal condition in games.

In traditional media such as books and film the order of the story-world events can be arranged in different ways (for the following see a combination of [5, 14, 23]). (A) stands for the reference event in the *story time* (e.g. a specific film scene) and (B-n) stands for a second event. In terms of *narrative time* (B-n) always follows (A) but in the *story time* the relationship can be more complex:

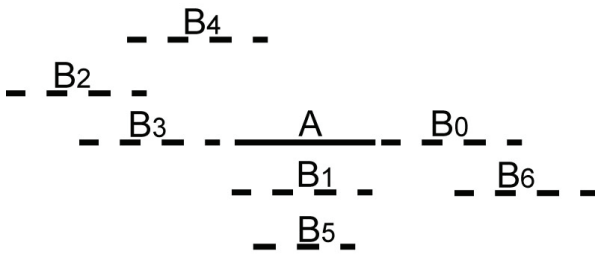

Figure 4: Temporal relationships between events (A) and (B-n).

Temporal connections can be continuous, with one event (B-0) following the other (A). However, narration can also overlap events, create ellipses between them, distort the relation between them, or let them happen simultaneously. With the available complexity of temporal conditions in games, these arrangements start to become available.

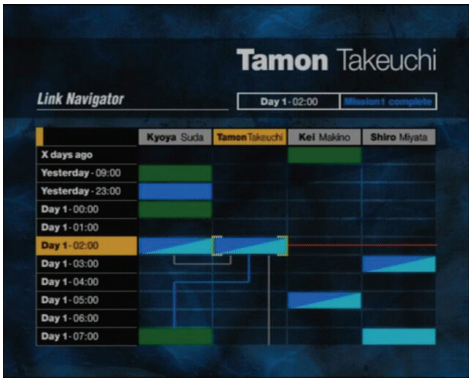

Figure 5: *Siren*; link navigator showing a range of events.

The survival horror game *Siren* [38] grants the player access to a range of different characters and jumps between temporal locations that ultimately add up to a kind of time map of interconnected events. Players slowly reveal the underlying setting through mastery of the game levels and exploration of individual temporal snippets. These scenes can be accessed in a link navigator that assembles all available situations into a kind of copy of Genette's model as seen in Fig. 4.

All scenes in *Siren*'s link navigator are situated in the same game world and often share spatial properties when characters meet each other. Because the designer wanted to make sure that the game setting would remain a closely-knit network of interrelating events, the temporal condition in *Siren* had to be pre-fabricated and cannot be influence by the player. Other games can provide some access to the timeframe.

Changing Experience of Time

In *Prince of Persia: The Sands of Time* the access to the timeframe is a central part of the game play. The game grants players limited control over time. They can freeze, slow down, or reverse time. The game spaces and their presentation stay consistent while their timeframes change. The game not only allows players to control the speed of the mapping between play and event time but most importantly, it allows for a return to a former event time. The corresponding game state was co-shaped by the player and not only by the designer (as in the (E) mapping *Myst* example above). The player can "rewind" the event to a past situation to allow for another attempt and correct the interaction. Rewinding is an interactive event itself, continuous in space and presentation. This feature is immediately understood by a player although it constitutes a significant complication of the interaction with the game state. Not only does the event time return to an earlier state but the time reversal means that players interact with a certain game state knowing its immediate future conditions . The player plays with her own knowledge about the game state and the order of sub-events such as character or game world behavior.

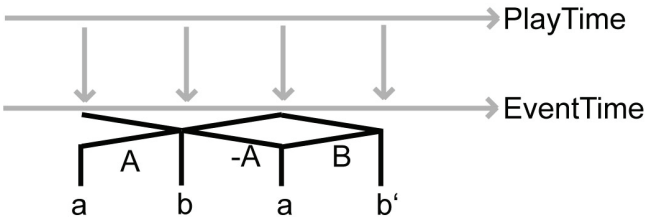

Figure 6: *Prince of Persia: The Sands of Time*; time reversal.

If the player plays an event (A) and chooses to reverse the action (-A) she technically returns to the same starting

event time (a) in the game. The reversal is part of the game play and happens without interruption of the play time, space, or presentation. A second event (B) can unfold. But the player's knowledge of event (A) always overshadows interaction in (B). During their previous attempt players learned the spatio-temporal condition and now they can adjust their interaction. Because the spatial setting remains continuous, alternative interaction can be planned and applied. Players can correct their performance in *Prince of Persia: The Sands of Time* and master a challenge they might have failed before.

Due to the different levels of knowledge players experience event (A) and (B) differently although, in principle, they describe the same 'fictional time' within the game world. To describe a player's learning process Laurel introduced the 'flying wedge' [20] that clarifies the gradual development of the player behavior from the possible, via the probable towards the necessary. The above outlined time reversal in *Prince of Persia: The Sands of Time* skews this wedge because thanks to the added knowledge players do not return to a former state (a) but instead know more about the probable behavior. Along the timeline of Laurel's wedge their entry point moves forward towards (a'), (a''), et al.

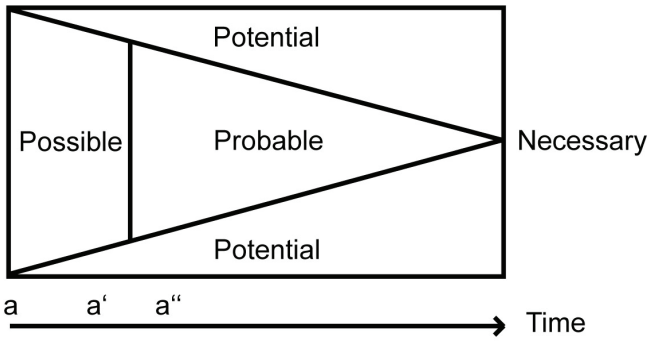

Figure 7: Laurel's "flying wedge" with added return game states (a) (a') (a'').

This provides a low level explanation for the changes in 'negotiation time' as suggested by Aarseth [1]. Players can experience the repeated event (B) in *Prince of Persia: The Sands of Time* as shorter than event (A) because their knowledge of the game world is bigger. Because the game space remains continuous this shift remains legible and the knowledge remains applicable.

Conclusion

This paper looked at the mapping of play time onto the time in the game world. It argued that the connection between the two can only be understood if one includes the element of space and spatial experience in the equation. Thanks to the continuity of space the timeframe is freed to explore new configurations. This approach steps beyond the mechanical mapping of ergodic participation and game state change. Instead, space and spatial comprehension (e.g. as provided through the virtual camera) can be seen as the canvas through which the player understands time. Such a combination strives to unify the player's comprehension of the gaming situation. The comprehension of events in time and space points into the direction of narrative.

The focus of much research in traditional narratology lies on temporal or causal connections. One tradition interprets narrative as 'the semiotic representation of a series of events meaningfully connected in a temporal and causal way' [33] and focuses on the 'chrono-logic' of narratives [7]. The other looks at stories as embedded in spaces such as 'narrative landscapes' [34] where spatial progression and story progression are interconnected [6]. The same dualism is found in the discussion of fictional worlds in video games. On the one hand, models refer to conditional networks from basic 'linkmeshes' [9] to advanced AI-behavior [24]. On the other hand, scholars suggest embedding the structure into the game space instead and talk about games as 'narrative architecture' [15], wherein structure is infused through the spatial design and the player's progression through it. A key element of this principle is the quest [30, 37]. One element of quests is the mastery of spatial progression over time, often connected to a growth process. The argument here suggests a growing complexity of time in video games and would point to the – yet unproven – thesis that temporal conditions of quests in game worlds can become more complex the more advanced their game worlds and their presentation becomes.

We understand complicated temporal constructions in video games because we understand their spatial relationships. This perspective questions existent temporal mapping in video games and supports player-centered game analysis and design. It also helps to explain – and thereby ultimately to generate – more complex temporal situations. We can deal with these complex temporal settings in video games because of our spatial understanding. As the examples indicate, the temporal conditions can become rather complex as long as the continuum of the game space consolidates the situated play.

To answer the question on *why* this connection is so dominant the argument has to point to the work in psychology that deals with spatial perception and recognition (e.g. [27] or [35]). This outlines, once more, the importance of the interface and the presentation of the event and its spatio-temporal conditions. The role of the interface was mentioned but still needs a lot more

attention to allow for necessary future research on the player's experience.

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