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From Quarters Per Minute to Daily Quests and Seasons: Developer Perspectives on Temporal Design in Video Games

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Abstract

Time is central to how video games are played, monetised, and maintained – yet how developers understand and design for time is often overlooked. This study addresses that gap through twenty semi-structured interviews with international game professionals from AAA, Indie, Mobile, and Live-service studios. Using constructivist grounded theory, we develop a practitioner-informed grounded account of *temporal game design* as operating between organisational constraints, data infrastructures, and player engagement. We develop three core understandings informing this account: *temporal design across studio contexts* – how temporal priorities range across industry; *tools of temporal design* – the systems and metrics that collect and target player time; and *data-centered temporal design* – how temporal data informs game design. From this, we contribute four temporal design heuristics to help organise design decisions about how player time is structured and communicated in games and related attention-economy systems.

CCS Concepts

• **Human–centered computing** → Human computer interaction; Empirical studies in HCI.

Keywords

Temporal Design, Game Development, Player Experience, Constructivist Grounded Theory, Data-Centered Design, User-Centered Design, Dark Patterns, Time

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1 Introduction

Developer motivations, production values, and studio environments have long been central to game industry analysis, yet the temporal dimension of game design has not received the same level of attention. To capture this lacuna, we frame *temporal game design* as a practitioner-informed grounded account of how developers organise and design for the time of the player in games. We began this study by approaching temporal design broadly in the conventional, player-facing sense – how design can shape player time (through features, pacing, narrative, progression, etc.) [47][57][63][106]. However, through practitioner accounts, *temporal game design* emerged as a concept shaped by organisational pressures, software tools, and metric targets. In what follows, we use temporal design to refer to the player-facing structuring of time, and temporal game design to refer to this wider, mediated practice. We extend prior HCI work on system time and user time by shifting focus from player-facing systems and mechanics [17][81] to the developer practices through which temporal structures are produced. By engaging directly with industry professionals, we complement work on spatial and ludic dimensions of play – such as level design [65], challenge [27], and immersion [80] – with a temporal understanding of how player time is organised and negotiated in development.

To develop this understanding, we conducted semi-structured interviews with twenty professional game developers working across genres and studio contexts from Europe, the United States, Canada, and Australia. This sample included senior practitioners from major studios behind globally celebrated titles and franchises (some of whom held primary responsibility for those games). Participants were purposively recruited based on their professional experience in game design and provide design insight across the history of game development, from coin-operated arcade systems to contemporary Live-service markets. Analysis followed constructivist grounded theory [18], which asserts that data and theory are co-constructed through the researcher-participant relationship. This approach acknowledged both the expertise of developers and interpretive stance of the authors, allowing us to capture how game developers negotiate temporal game design.

From our analysis, we offer a grounded theory of temporal game design [18][19], synthesised from three core understandings:

- **Temporal Design Across Studio Contexts:** how temporal priorities are shaped by organisational pressures and competition.
- **Tools of Temporal Design:** the software and metrics through which developers collect and interpret player activity, functioning as both design resource and target.
- **Data-Centered Temporal Design:** how the temporality of play is structured to optimise retention, often at the expense of player autonomy.

To reflect the practitioner-informed construction, we refer to this contribution throughout the paper as a grounded account of temporal game design.



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These categories frame temporal game design as a situated practice shaped by organisational pressures and temporal infrastructures, revealing a tension between user-centered temporal design – structuring time around player autonomy and lived experience – and data-centered temporal design – structuring time around temporal metrics such as retention or session length. They also locate video games within a crowded attention economy, where titles compete with social media, streaming, and short-form video for player time. Our identification of *secondary* and *tertiary* games makes this explicit, showing how studios anticipate a game's viability within competitive media ecologies.

We provide two main contributions from this practitioner-informed study. First, we develop a grounded account of temporal game design as a practice-based mediation between organisational constraints, data infrastructures, and player engagement. Second, we derive four temporal design heuristics to help organise design decisions about how player time is structured and communicated.

2 Background

The following sections review how time, design, and user experience have been examined and addressed in HCI, game studies, and games industry research.

2.1 HCI on Time: From Clock Time to Designed Temporality

Löwgren and Stolterman argue that "digital artefacts are every bit as temporal as they are spatial" [61], a claim extended by Alvarez Igarzábal's framing of video games as *temporal artefacts* shaped through the player-system relationship [2], and by research that examines how games are continually reconfigured over time through the actions of players, communities, and developers [12]. Yet HCI has historically framed this temporality through clock time – the quantitative, standardised units that sit apart from social or natural rhythms [22][95] – focusing on optimisation, scheduling, and control [83][98]. Much work seeks to minimise waiting [96], map temporal rhythms of use [7][32], or synchronise interaction with system processes [52]. Even critiques such as Sarker et al.'s analysis of how calendars misrepresent everyday variability ultimately aim to improve prediction and system accuracy [87]. In parallel, research on latency, animation, rhythm, and progression [36][67][105], collectively show that temporality is not neutral but designed. This temporal design can be noted in Lundgren's vocabulary of "temporal themes" [63], Odom et al.'s temporal design probes, such as *Olly* and *Slow Game* [74], and satirical commentaries on designed systems [58].

Designed temporality can be further understood in prior HCI and game studies, which demonstrate that time can be treated as an explicit design material. Temporal design and related notions (time design [43][81], temporal structuring [48][88][112]) predate our use of the term and have been used since the early 2000s to describe how interfaces and mechanics pace interaction, structure sessions, and allocate user time. This includes work such as Lindley's [57] semiotics of time structure in ludic space, Ishizaki's [47] improvisational design of continuous digital communication, and Hildebrandt et al.'s [43] Time Design for interactive systems. Wei et al. [106] and Lundgren [63] also analyse temporal structures and themes in games and interactive artefacts. In 2016 Pschetz et al. [78][79] proposed Temporal Design as a research design agenda drawn from anthropology and sociology to challenge dominant narratives of time. More recent work continues the system- and player-facing lineage, examining moment-to-moment feel and pacing, how players remain involved over time, the politics of time in and around games, and exploitative or seasonal timing structures in Live-service play [5][13][42][76][77][81][88].

More recent studies in HCI have looked beyond novel temporal system design and UX optimisation to consider how time operates across timescales and culture. Nadal et al. [71] argue for macro-temporal analysis to understand that interaction is shaped not only by clicks or screen transitions but by adoption and use over months or years. This shift in temporal focus is echoed in studies of mobile and locative media, where play bleeds into daily routines and spaces rather than remaining a separate activity [109]. In a cultural critique of time and design, Taylor et al. [95] introduce the "situational when" – timing as a convergence of social, environmental, and cultural circumstances – arguing that temporal interfaces should consider relational cues (who, where, protocol, conditions) so communities coordinate on their own terms, not just by clock or calendar. These works align with a call from Rapp et al. [82][83] and Yildiz and Coşkun [108] for HCI to design temporal technologies that move beyond structure and control – enabling users to shape the pace of change, reflect on temporal direction, and share lived temporal experience through interaction. However, this relational understanding of time is not clearly reflected in how game platforms communicate temporal information or support how players evaluate games in everyday use. Prior work shows a disconnect between temporal communication and evaluation in games: time-related information in Steam marketing is sparse and inconsistently disclosed [15], while user review analysis shows that players consistently use temporality as an evaluative lens to reflect on past, present, and future play [16]. Building on this relational and experiential turn, we shift from describing how time is felt at the interface to analysing how game developers organise it as a design material in practice.

2.2 From Designed Temporality to Dark Patterns

If HCI has shown that time can be designed to support reflection, rhythm, and cultural variation, it has also revealed time's capacity to be weaponised through design. This can occur through temporal dark patterns – design strategies that manipulate how time is spent, withheld, or sold. As Gray et al. [39] argue, these tactics shift the benefit from user to developer, echoing Brignull's [10] original framing of interfaces "crafted to trick." In HCI, these manipulations have been documented across systems and platforms. Gunawan et al. [41] found dark patterns in 105 digital services while Di Geronimo [35] showed 95% of Android apps employed temporal manipulation – from persistent, scheduled notifications to obstructive exit flows. Moving beyond singular feature analysis, Mathur et al. [64] classify a family of harms: account deletion made slow, attention captured in recurring loops, and renewals structured to delay exit.

Game design research adds further complexity, as Zagal et al. [110] introduce dark game design patterns to describe gameplay

systems that intentionally cause negative experiences for players. Here, temporal design can be considered exploitative when systems "take more or less time than players expected," in effect cheating players of their time. Systems such as grinding (doing the same task over and over to make progress), appointment play (designs that ask players to return at specific times), and pay-to-skip (paying real money to avoid waiting or doing a task) all manipulate how player time is structured and valued. However, Zagal et al. [110] note that perception and intent matter – repetitive or time-bound mechanics are not inherently exploitative, and while players may infer coercion or structure, they rarely know the designer's actual intent. Moreover, dark patterns are not always the result of malicious design; they can emerge from business models, genre norms, or systemic pressures, even when unintended.

While the above studies recognise the presence of temporal dark patterns, they remain system-focused – built from audits, typologies, and interface analysis. There is still limited insight into how developers themselves approach these systems: how manipulation is justified, normalised, or resisted in practice. Sparrow et al. [94] in their study of multiplayer ethics, highlight how such tensions are experienced by industry professionals as challenges negotiated across functionality, revenue, and community management. Understanding temporal manipulation therefore requires attention not only to the interface but also to the organisational and ethical conditions of development. As Lukoff et al. [62], Birk et al. [8], and Mathur and Mayer [64] argue, confronting manipulative design requires not just identifying harmful patterns, but understanding how they take shape across platforms, workflows, and intentions. We build on this work by identifying how developers approach temporal design linked to retention, pacing, and monetisation, and how, if at all, these uses of player time are framed as ethical or unethical in practice.

2.3 Temporal Categorisations of Games and Play

Since Juul's [48] assertion that time is a non-optional consequence of play, research on temporality in games has developed through a range of frameworks that explore how time is designed, structured, and experienced. Keogh & Richardson [51] describe *background games* where actions continue in real world time between sessions – mirroring *idle games* (minimalist systems in which waiting itself constitutes play [1]). Montola et al. [69] promote *pervasive games* that blur play and daily life, including variants such as dormant, ambient, asynchronous, seamless, and persistent worlds. There are also industry recognised categories being *lifestyle games* (games designed to become part of a player's routine [46]) and *black hole games* which absorb disproportionate attention and time [6]. Carter et al. [17] maps gaming modalities onto six rhythms of engagement – from cyclical or non-cyclical bursts, to pausable, slow, timed, or passive play – identifying how games structure activity across sessions. These rhythms of engagement form part of what Carter et al. [17] call *screen ecologies* – environments in which multiple media, platforms, and titles coexist and overlap in a player's routine. Zagal and Mateas [111][112] distinguish four *temporal frames* – real-world time, gameworld time, coordination time, and fictive time – to show how different logics of time operate simultaneously. More recently, Gopinath and Holopainen [37] propose a *timeplay framework* that targets player agency, distinguishing adaptive, strategic, ethical, and reflective uses of time. Finally, the *holistic framework of temporal play* developed by Byers et al. [13] integrates earlier approaches by situating *game time* (design structures), *play time* (player rhythms and practices), and *affected time* (external socio-temporal conditions) as an interconnected system.

These temporal categorisations offer useful ways to analyse players, design, and time – whether by mapping system structures or proposing research-led interpretations. Yet few draw on developer accounts of practice, intent, or constraints. With the partial exception of Zagal and Mateas [111][112], these frameworks tend to operate in isolation – stand-alone arrangements rather than cumulative contributions to a shared understanding of time in play. The result is that we have vocabularies, modalities, frames, and typologies – but little refinement or theoretical build-up over time. Ultimately, these accounts remain academic interpretations of play and design, not frameworks that emerge from or reflect professional development and industry practice. We know far more about how researchers interpret temporality than how game developers design it in practice – a gap our interviews begin to address.

2.4 Industry and Design Perspectives on Time

In game development, time is not just a consequence of play – it is a material to be designed, measured, and monetised. From the short bursts of coin-operated arcade systems to the persistence of Live-service titles, temporal design has always structured how gameplay unfolds [53][73]. Analysis of the games *Tomb Raider: Underworld* [120] and *Kane & Lynch: Dog Days* [123] demonstrate how metrics such as checkpoint timing and session length are used to identify difficulty and classify players [28][29][91]. Aki Järvinen, then creative director at Digital Chocolate, described how retention was tracked through "day 1, day 7 and day 30" returns and by measuring session length and frequency [89]. As Seif El-Nasr et al. [89] summarise, temporal data underpins both progression design and retention strategies. In an industry analysis, Ball [6] notes that average playtime has risen due to a shrinking but more engaged player base, and developers now compete for time across fewer, highly active users. Market reports also indicate that nearly half of global playtime is spent in games over six years old, underscoring the dominance of established titles [72].

In freemium games (free to access but reliant on monetisation), time functions as a shared currency. Losi [60] (then lead designer at Scopely), detailed how time-to-collect analytics were used to pace resource systems and align content production with consumption. Monetised boosts and pay-to-skip mechanics – while often labelled dark patterns [113] – are frequently justified as ways to "respect" player time. Sanusi [86], (then UI/UX designer at Frontier Developments), stressed the importance of communicating tradeoffs (cost to skip benefit), arguing for ethical design and using metrics as tools for improvement, not manipulation. Live-service design (games designed for long-term engagement through continuous updates) also uses temporal design to structure both engagement and challenge. Howe [45] (then Creative Producer at Owlchemy Labs), called time the "core currency" of live games and warned against event schedules that overwhelm players. Her team instead built "habituated cycles" that balanced return and rest, similarly, Hodent [44] stresses the importance of designing for breaks, not just for

retention. Blaine [9] (then Principal Technical Designer at Bungie), described how *Destiny 2* [119] uses expected completion times and datafied profiles of player response times to shape difficulty, while also supporting time-poor players through solo play modes.

There is also a human interpretation of satisfactory time in temporal design that is absent in empirical analyses of systems or features. Griesemer [40] (then Gameplay Design Lead at Bungie), explained how *Halo 3*'s [118] sniper rifle reload sequence was designed to avoid "haptic boredom" – adding a pause to amplify impact and tune rhythm to player perception. Whereas Yeung [107] noted that *Braid*'s [124] rewind system worked both as a player-facing mechanic and a development shortcut for solo production. Interface design reinforces these logics: HUD-based systems in *Dark Souls* [122] sustain tempo while pausing menus create deliberate breaks [54].

These cases illustrate how temporal design is deeply entangled with commercial pressures, ethical considerations, and data-driven practices. Yet this understanding is pieced together across roles, studios, and formats – emerging less as a unified framework than as a set of shared but uneven concerns in practice. In response to this, we sought developer accounts to pull those pieces together, revealing the production-side influences that shape player temporalities.

3 Method

To unearth industry-relevant perspectives of temporal design, we conducted twenty semi-structured interviews with game professionals from AAA, Indie, Mobile, and Live-service studios across Europe, the United States, Canada, and Australia. Participants drew on decades of industry experience, shaped by the formation and evolution of contemporary game development, including contributions to high-profile titles across major franchises and platforms. We selected constructivist grounded theory (CGT) [18] for analysis given that temporal game design is an underdefined and undertheorised area of game development. CGT offers systematic yet flexible guidelines for generating concepts from empirical data and is well-suited to studying phenomena that are not yet clearly defined [21][55][93][100]. Following Charmaz [18], this approach assumes that data and analysis are co-constructed, allowing us to attend closely to how developers articulate how they organise, negotiate, and operationalise time in their design practice. This project received ethics approval from the Office of Research Ethics and Integrity at the University of Melbourne (project ID: 27862).

3.1 Sample

Due to the title of 'game developer' encompassing many distinct roles and skills [101], this study captured a range of perspectives to better understand temporal design, including quest designers, narrative directors, gameplay programmers, UX leads, and studio founders. Eligibility required professional, paid experience in digital game development, though analogue or tabletop makers with relevant digital experience were also included. All participants were anonymised due to risks tied to NDAs, professional consequences, and fan/community visibility.

To capture organisational variation, the study included professionals from the below studio contexts:

- **AAA studios:** large, publisher-backed teams producing big-budget titles.
- **Indie studios:** smaller, independent teams emphasising creative autonomy.
- **Mobile studios:** teams creating games for smartphones and tablets.
- **Live-service studios:** studios managing ongoing titles that rely on constant updates and events.

These contexts are not mutually exclusive – for example, *Fortnite* [121] is both an AAA and a Live-service game – but they offer a useful framework for distinguishing between commercial priorities and team scale.

The recruitment strategy targeted a global developer base, including outreach to non-Western regions and studios. However, most participants were based in Europe, the United States, Canada, and Australia – a distribution likely shaped by industry concentration in these regions and the use of English as the interview language. Structural conditions such as layoffs [84], precarity [49], and scheduling conflicts also constrained availability. Although approximately half of those contacted identified as women, only two ultimately participated. No formal refusals cited safety concerns directly, but the cold-contact nature of recruitment – combined with the visibility required to discuss internal practices – likely contributed to non-response. In one case, a prospective participant initiated internal clearance via HR but was unable to proceed within the study timeframe. These patterns reflect structural constraints common to industry research: access is uneven, visibility is not equally safe, and speaking publicly about workplace practices may carry reputational or professional risk. Prior work documents how women and marginalised developers face disproportionate harassment, doxxing, and online abuse when they participate in industry discourse [70]. The final sample thus reflects both diversity and limitation: perspectives across major studio contexts and roles were included, but the data remains largely Western and male.

3.2 Recruitment

Recruitment combined purposive, convenience [30], and snowball sampling [56]. Outreach was conducted via email, LinkedIn Premium [59], and public channels such as blogs, social media, and personal or company websites. Participants were identified through professional visibility, including appearances at industry events such as the Game Developer Conference (GDC) [34] and Gamescom [33]. This emphasis on visible, often senior practitioners means the accounts presented here speak to practices around some of the most widely played and commercially significant games across studio contexts and video game history. These methods reflect established approaches in qualitative games research, where gaining access to participants is often complicated by industry secrecy [75], employment precarity, and production schedules [11]. Participants were contacted between March and late April 2025.

Table 1: Participant demographics, industry experience, and studio contexts.

	Pseudonym	Shaxx	Zavala	Cayde	Redrix	Saladin	Ikora	Oryx	Osiris	Uldren	Calus	Taniks	Crota	Rhulk	Mithrax	Saint	Skolas	Joxer	Rasputin	Shin	Eris
Demographic Information	Gender	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	F
	Region	EUR	EUR	USA	USA	USA	USA	USA	USA	USA	USA	USA	EUR	AUS	AUS	AUS	USA	AUS	USA	USA	CAN
	Years in Industry	10+	15+	6+	20+	25+	3+	45+	15+	24+	31+	15+	12+	35+	10+	17+	14+	16+	24+	18+	11+
Industry Experience	Design	○	○	○	•	○		•		○	•	•	○	○	○		•	•	○	•	○
	Leadership	•	•			•		○	•	•	○	○	•	•		○	○	○	•	○	•
	Analytics						○		○							•					•
	Engineering		•	•	○			•				•	•		•	•			•		•
Studio Context	AAA	•	•			•		•	•	•	•	•	•	•			•	•	•	•	
	Indie (Small)	•	•	•	•	•	•	•			•	•	•	•	•	•		•	•	•	•
	Indie (Large)	•	•		•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	
	Mobile	•	•	•	•		•	•			•	•	•							•	
	Live-Service	•	•		•	•			•		•	•	•				•				

* Note: ○ = Current/most recent role; •= Prior role. Current studio contexts have been de-identified to protect anonymity.

3.2.1 Participant Profiles.
Table 1 presents participants' pseudonyms, current roles, demographic information (gender, region, years in industry), industry experience (Design, Leadership, Analytics, Engineering), and previous studio contexts. Studio contexts were coded as AAA, Indie (small [<10 staff]), Indie (large [>10 staff]), Mobile, and Live-service. As Keogh [49] notes, game developers often "wear many hats," and this versatility was reflected in the diverse experiences participants drew upon when discussing temporal design. Character names from *Destiny 2* are used as pseudonyms to avoid generic or culturally homogeneous placeholders while maintaining anonymity. Table 1 depicts not only participants' current or most recent roles but also the breadth of their professional histories, as many had worked across multiple sectors and specialisations.

We have deliberately limited identifiable details such as exact job titles or current employers to protect anonymity. Participants were anonymised not only to satisfy ethical requirements but to minimise reputational or professional risks tied to NDA breaches or internal disclosure. Many held senior or lead roles and had shipped high-profile titles across major franchises, platforms, and regions, giving them both direct and vicarious oversight of temporal design approaches from arcade-era systems through early single-player narrative games to contemporary Live-service markets. As a result, the sample leans toward practitioners whose views carry influence beyond their immediate teams. Given the specificity of some roles – especially when linked with regional or platform-level experience – even high-level descriptors can risk de-anonymisation. We acknowledge that this emphasis limits the granularity of role contextualization.

3.3 Data Collection

Data was collected through recorded Zoom [114] interviews and detailed manual note-taking, with dialogue automatically transcribed. Transcriptions were manually reviewed and cross-checked against session notes, with initial coding beginning during this review process. Interviews averaged one hour in length, acknowledging the time constraints of professionals, and followed a semi-structured format that ensured consistency while leaving space for open-ended reflection. This approach ensured consistency across interviews while allowing flexibility for participants to shape the direction of the conversation [23], and has been successfully applied in games research, where experiences and perspectives may vary [14][26][50][85][94]. Participants received the interview questions in advance, allowing them to prepare their experiences and manage any confidentiality boundaries. Interviews centered on open-ended questions that initially focused on player-facing systems and temporal structures – such as how playtime is designed, measured, and managed across development contexts. These included: "How is the time of the player valued or considered, in any dimension of game development?", "What temporal data do you collect?", and "What challenges does your studio face in managing playtime?". Interviews were conducted between March and late April 2025.

3.4 Analysis

Constructivist grounded theory (CGT) [18][19] was selected as the analytical framework to support an interpretive, iterative process grounded in participant accounts. CGT has been used in HCI games research to explore uncertainty [55], communication mechanics [100], player confusion [20], and environmental storytelling [93]. Rather than imposing predefined categories, CGT treats analysis as a process of meaning-making developed through sustained engagement with the data.

Initial coding was carried out by the first author through repeated close readings of interview transcripts and notes. The early interviews were guided by our initial, player-facing understanding of temporal design. This first analytic pass remained deliberately broad and exploratory, generating a wide range of fragments spanning organisational constraints, team dynamics, production

rhythms, pacing decisions, analytics practices, and tensions between experiential aims and commercial pressures. Analytic memos were written throughout this process to capture emerging tensions and relationships. As analysis progressed, focused coding was used to compare and cluster these fragments and to test emerging interpretations against both later interviews and earlier transcripts. Revisiting the early interviews revealed that player-facing temporal structures were repeatedly framed by participants as outcomes of wider production-side negotiations – including studio values and commercial targets. Through this iterative cycle, focused coding did not merely organise categories but actively reshaped what we understood temporal design to be. *Temporal game design* came to be theorised not only as the deliberate structuring of player time in systems and mechanics, but as a practice-based arrangement through which player temporalities are made and negotiated within development contexts. At this point, fifteen interviews had been conducted and recruitment was ongoing. Guided by theoretical sampling, additional participants were selected from less-represented studio contexts and development roles to test and extend these emerging patterns. Recruitment continued until new interviews no longer introduced substantially new concepts, indicating theoretical saturation. By the conclusion of the twentieth interview, focused coding had stabilised into three higher-level categories that structure our grounded theory of temporal game design: *Temporal Design Across Studio Contexts*, *Tools of Temporal Design*, and *Data-Centered Temporal Design*.

In line with Charmaz's [18] evaluative criteria for quality CGT, the resulting synthesis of categories aimed for credibility (ensured through depth, reflexivity, and co-author validation via cross-referenced coding and analysis), resonance (by closely aligning with participant language and experience), originality (by developing a grounded theory of temporal game design based on developer perspectives), and usefulness (by offering insights applicable across roles and production contexts). While this synthesis constitutes a middle-range theory [19] of temporal game design, we instead present the contribution as a grounded account of temporal game design. This label better reflects the practice-based construction and keeps the contribution accessible to both game professionals and academic audiences.

4 Findings

Temporal design – in the context of game development – refers to the design of systems, features, and mechanics within a game that shape player time [47][57][63][106]. This includes how play is paced (through narrative or mechanics), how long sessions last (from explicit timers or engaging play), when content is released (in-game access or the release of subscription content), and broadly how progression and sustained engagement are designed. Temporal design is not primarily concerned with time-in-development – such as crunch (periods of prolonged or intense overtime often associated with project deadlines), scheduling, or production deadlines – though these behind-the-scenes pressures were communicated by developers to be inseparable from how time is ultimately presented to and felt by players.

When we asked developers about these player-facing features, their accounts consistently moved beyond a list of mechanics. Across AAA, Indie, Mobile, and Live-service studios, they described a layered set of practices, constraints, and tools through which time is produced and negotiated in development. We use *temporal game design* to name this broader, practice-based arrangement: the mediated work through which studios translate organisational pressures and temporal infrastructures into player-facing temporalities.

We organise our account of temporal game design around three interrelated categories: *Temporal Design Across Studio Contexts* – how temporal priorities are shaped by organisational pressures and competition; *Tools of Temporal Design* – the software and metrics through which developers collect and interpret player activity, functioning as both design resource and target; and *Data-Centered Temporal Design* – how the temporality of play is structured to optimise retention, often at the expense of player autonomy.

4.1 Temporal Design Across Studio Contexts

"There is only actually one true God in game design, and that is time" – Zavala.

Developers from across studio contexts generally described temporal design as an intuitive practice that is not often formalised as part of game development. It was shaped by habit, precedent, and commercial expectations more than by any clear system or guideline. Temporal design elements in documentation were inconsistently spoken of or outright dismissed. Rasputin spoke to the perceived obsolescence of documenting temporal targets noting, "The minute I write it, it's out of date." Teams also avoided documentation due to perceived legal risk. Shin explained, "The issue is, especially in big companies… if you have any ethics documentation, as you put it, you create legal liabilities." Some studios introduced explicit timing targets to counter these points, speaking to internal accountability across teams. "Instead of me saying your mission is too long, I'm saying your mission is longer than you said it was going to be," said Osiris, in a rare example of documented temporal expectations. Notably, ethical or harm-based considerations were largely absent from these accounts. The only clear exception came from Virtual Reality (VR), where Eris explained that levels were scoped to reduce simulation sickness, citing research on the risks of prolonged headset use.

Nevertheless, temporal design was often first considered in relation to scope – how long a play experience should take, and what that duration signals to players. Teams typically estimated campaign or session lengths early in development, aiming to meet audience expectations or match competitor titles. For developers on sequels or long-running franchises, past titles and competitor games set benchmarks to be met. "You know that the last game had 20 hours" Shaxx explained, "You don't want to go under that. If anything, you want to go over." However, this process varied across studios and genres:

"Depends on the project. I know I've worked on games where, say, the length of the story mode was written into the original contract. So, like, it was there before a single line of code had been written. I've also worked on games where we shifted things around a lot." – Osiris.

Developers are also often forced to commit to playtime upfront for grant and publishing applications where estimated hours become part of pricing and planning:

"So, for total playtime, we're trying to push for that pretty early on… This is, in part, tied up with grant and publishing applications. There are external forces, stakeholders that are expecting to know that information because that's going to impact pricing." – Eris.

Time is not just scoped but continuously negotiated across teams and studio types. In Mobile and Live-service games, short-term actions and long-term retention are both key considerations in session design:

"We politely call it the Starbucks test… what can a player do in a couple of minutes that moves them forward… and then also, at least once per day, something more substantial… that's session design." – Calus.

In session-based AAA titles, Taniks spoke to a guiding principle "to keep the disc in the tray as long as possible… ideally, we want them to play it, but the longer that they don't uninstall it is always good too." The goal is to make the game part of a player's life for months if not longer. In contrast, Indie developers like Mithrax described looser practices – using "ballpark" estimates to inform content length, adjusting scope based on feel and feasibility rather than fixed targets. Saint echoed this flexible approach in Indie studios, noting, "At every studio that I've worked at, time and temporality isn't actually an element of design that is considered in and of itself – it is always a consideration nested within another concern." Rather than responding to external retention pressures, Indie developers positioned time as a creative concern – one that could be intentionally shaped around respectful, player-centered experiences.

Even where time was not formalised as a standalone design pillar, developers expressed strong, often competing views about its role in shaping player experience. While AAA and Live-service studios often treated time as something to maximise through retention strategies, Indie developers emphasised creative agency in crafting shorter, more deliberate experiences. Temporal values also created friction across disciplines. Narrative and quest designers described long-standing conflicts with production leads over pacing. Saladin joked, "If I tried to pitch a 5-minute cut scene, they would murder me, and they would never find the body." While humorous, the comment underscored how temporal design often exposes tensions between creative teams and production hierarchies – an internal tension mirrored by external challenges. Across all contexts – from Indie to AAA – developers acknowledged that time was not just a design concern, but a competitive one.

"If you want some of somebody's time, it is a knife fight in a phone booth," – Calus.

Player attention is increasingly contested, and designers across platforms recognised they were not only designing for play but competing for time. As Calus remarked "I'm competing with every other piece of entertainment available on that device which in 2025 is a fucking lot." Subscription services such as Netflix and short-form media – specifically TikTok – were described as the biggest threat, offering both quick bursts of engagement and the potential for long, unbroken scrolling sessions. This competition was especially felt in Mobile contexts as Joxer noted that Mobile games must deliver value in short, repeatable bursts "on the train, on the toilet, during a break." This framing of time as currency fed back into design decisions: if time is the player's investment, then wasted time through poor or unengaging design becomes its own penalty – and, in a crowded attention economy, a reputational risk:

"The number one penalty in games is time lost… we don't really have any other major way to penalise you, because the only thing you're putting in is time." – Shin.

4.1.1 *Temporal Design Between Ethics and Exploitation.*

While some developers avoided value judgments, others described how ethical considerations of time were shaped by organisational role and studio position. From management perspectives, temporal design was often treated as a tool to serve monetisation and retention priorities. Zavala, speaking from senior experience, was blunt: "If anything, they're secretly passing formulas of how they can milk you for more time and money. The ethics in Free-to-Play are essentially non-existent."

Uldren took a non-moralising stance, emphasising that industry trends are shaped less by ethical judgment than by commercial viability: "If there is a pattern that generates revenue, then other people will copy that pattern until players get tired of that pattern." He traced a lineage from contemporary monetisation models to early Facebook freemium games, and further back to 1980s coin-operated arcades – all systems that directly commodified time. Arcade games sold access in short bursts, measured in quarters per minute, while Facebook titles like *Mafia Wars* [127] turned time into a resource to be rationed, though Rhulk argued this was in fact a "tax" on player time:

"Was that a dark pattern of like, hey, you're going to die after three lives, and you've got to put another quarter in? Anybody playing the games back then wasn't thinking that way – it was like, this is fun, I can't wait to put another quarter in. That's value for my money." – Uldren.

Developers reflected on how industry language around temporal engagement has shifted over time, even as the underlying goals have remained largely unchanged. Saladin observed, "They used to call it the addictive loop. But nobody says that anymore." The phrase, once popular in game design discussions, has been largely retired – not due to a change in practice, but due to increasing discomfort with its optics and ethical implications. Daily challenges, weekly lockouts, or seasonal events were described as neutral tools to sustain rhythm, even as "exit points" that signal it is fine to stop for the day. By contrast, monetisation tied directly to time pressure – such as limited-time offers, pay-to-skip mechanics, or early-access fees (which Shin dismissed as "pure extortion") were considered exploitative, adding no value beyond artificial scarcity:

"If you're telling me that I essentially need to, almost mandatorily, spend three hours per day in a game to complete a set of objectives before they go away forever, it immediately leaves a bad taste in my mouth… and it feels intentionally designed to be manipulative." – Cayde.

Yet some developers pushed back on the idea that time-based mechanics are inherently unethical. Calus, for instance, acknowledged that temporal gating "does play on certain cognitive biases, right? Sort of fear of missing out," but resisted blanket condemnation. For Calus and others, the ethical line lay not in the use of time limits per se, but in the intent behind them – especially when players were misled or pressured into making decisions.

4.2 Tools of Temporal Design

"There's really nothing we don't cut by time." – Taniks.

The tools specific to temporal design include analytics platforms, telemetry systems, and data infrastructures that allow developers to track, model, and respond to player behaviour over time. *Analytics* software (used to process behavioural data into visualised metrics) and *telemetry* (the automatic collection and transmission of in-game player activity data) were described by developers as standard, widely adopted infrastructure – not novel or experimental. These systems feed into *data warehouses* (large-scale platforms for storing and organising telemetry data for querying and analysis), which support downstream tools such as *dashboards* and *visualisation layers* (interfaces that surface time-based metrics like session length and retention curves). However, many developers outside of analytics or engineering admitted limited knowledge of the specific tools in use. Redrix listed third-party platforms such as Amplitude [4], Mixpanel [68], Unity Analytics [102], Datadog [25], and Metabase [66] as common because they provide infrastructure for collecting, storing, and visualising player telemetry. As Calus identified, "Only the largest companies bother building in-house at this point… the third-party packages are really robust." Larger studios usually sent their telemetry into data warehouses as Osiris explained, "Snowflake, Databricks, Redshift, I mean, all different games use their own thing, but it's usually stored in some version of that." [3][24][92] Shin explained that many analytics features now come built into the main game engines: "You'd be surprised how much comes inherent… with Unity and Unreal" [31][103].

Even with access to sophisticated analytics tools, developers often encountered boundaries in how temporal data could be interpreted and applied. Although their Indie studio used Amplitude, Ikora noted that the design culture wasn't deeply engaged with interpreting temporal data. The only time-based metric tracked was overall session length, despite her interest in more granular insights, such as time spent in different in-game spaces. This reflected a broader pattern where available telemetry wasn't always analysed in ways that aligned with design needs. Zavala, speaking from a Mobile design perspective, cautioned that "dashboards… use medians or averages… the interesting stuff doesn't happen in the median, it's in the distribution curve."

"Time of engagement is a very, very deliberate activity and definitely, part art, part science… shit works sometimes, and it don't work other times." – Calus.

4.2.1 Metrics.

Temporal metrics in games cover everything from moment-to-moment combat pacing to the long-term retention curves that sustain business models:

"We track everything… everything from time to kill, to how much time you're spending in the game, to how long you're sitting idle, right like how long it takes you to actually get a match." – Shin.

At the micro level, the design of battles and encounters is measured in seconds: *time to kill (TTK)*, *time to death*, *reload durations*, and *recharge windows* structure how intensity and downtime alternate in encounters. Designers also use *respawn timers* and *death downtimes* to regulate frustration and rhythm, while *time between checkpoints* defines how much players risk losing if they fail. Even traversal and exposition are timed, such as *time from spawn to encounter, w*here level layout directly establishes pacing. Demos are similarly bounded by a temporal hook, with many studios aiming to capture the player within 15 minutes.

Interface and interaction layers add another dimension to temporal tracking, with developers measuring *animation resolution times* and even monitoring how quickly players skip cutscenes or tutorials. Onboarding metrics also include *time to first input/tap*, *time to understand a mechanic*, *tutorial step intervals*, and the percentage of onboarding time spent playing versus reading. These feed into *First-Time User Experience (FTUE) completion times* and *drop-off rates*, as well as the broader *install/patch/launch-to-first-playable window*, which captures friction before play even begins.

At the session level, metrics capture how players structure daily engagement. *Session length* varies by platform – numerous short bursts on mobile versus fewer, extended sessions of four to five hours on PC or console. Teams track *sessions per day*, *minutes per day*, and *inter-session gaps*. These behavioural patterns feed into broader retention models such as *day-N retention* (*D1, D3, D7, D14, D28, D30, D60*), which forecast player engagement. These are complemented by aggregate measures such as *Daily/Weekly/Monthly Active Users (DAU/WAU/MAU)* and *churn rate*. *Churn* refers to the timing at which players stop playing altogether, marking when retention drops into permanent lapse.

Progression and monetisation metrics extend temporal measurement further. Designers analyse *completion times* for missions, quests, and entire games, as well as *cohort splits by engagement time*. Commercial metrics are also explicitly time-bound: *time to first spend*, *offer dwell time* (how long an offer sits before click), and *pinch-point timing* (how often ads appear). Revenue is then aggregated through *Average Revenue per User (ARPU)* and *Average Revenue per Paying User (ARPPU)*, often indexed against *real-time gate durations* such as *energy timers* or *pay-to-skip hours*.

Finally, temporal attention extends to peripheral spaces: *time spent idle*, *time spent in menus/UI* (loadouts, stashes, inventories) and *loading screen time*. Even satirical or cultural measures, such as *time to penis* (how quickly players build suggestive shapes), indicating the growing flexibility in how time is measured and used in design.

Alongside analytics, developers consistently described intuition as central to early temporal design. Projects often began with rough estimates about session length and play frequency – what Zavala called the "Holy Assumption":

"The number of times they play, and the number of minutes that they'll play per session, that core assumption drives every decision you make from then on." – Zavala.

Designers relied on repeated play to identify where pacing or rhythm "felt wrong", as Taniks put it, with adjustments often made well before formal testing. For smaller studios, intuition was a practical necessity – "working more on gut," as Skolas explained – but even in larger teams, it was treated as a cultivated design sensitivity. Joxer and Uldren both framed this not as guesswork, but as informed judgement grounded in experience: "We've all played them ourselves… we just kind of get a feel for that." Intuition was not seen as opposed to data, but as a parallel and iterative process – one that shaped design in early stages before metrics formalised time as performance.

While metrics such as session length, day-N retention, DAU/WAU/MAU, churn, and time-to-first-spend were identified across accounts as industry baseline indicators, the infrastructures that produced and surfaced them did not. Participants described everything from bespoke in-house telemetry and studio-specific dashboards, to off-the-shelf analytics suites and platform-embedded reporting, alongside protected or opaque measures that could not be fully shared. This mix of shared baseline metrics and different tool setups identifies temporal measurement as effectively everywhere in practice, but rarely in a directly comparable form. Rather than reducing this to a uniform schema of overlaps and goals, we keep the metrics in prose to show how shared temporal targets travel through very different systems of access and interpretation.

4.3 Data-Centered Temporal Design

"We're working backwards from a number." – Saint.

Developers described a shift toward temporal design practices increasingly structured around data-driven goals. This *data-centered temporal design* refers to the structuring of gameplay to ensure that player behaviour aligns with – and contributes to the achievement of – predefined temporal targets, such as daily active users, session frequency, or day-N retention. Player time is treated as a variable to be optimised, and game systems are designed to guide behaviour toward target outcomes. This shift was particularly felt by developers with Live-service, Mobile, and Free-to-Play experiences, while Zavala critiqued the spread to AAA "full-price titles operating on Free-to-Play logic". In many cases, repetitive tasks were added not to improve gameplay, but because data showed that more time plus occasional rewards could increase spending. What used to be pacing is now a tool for driving purchases.

Crota described a "traction-first" greenlight process in which time-based indicators – early retention rates, TikTok performance, Steam wishlists – determine whether a project proceeds at all. As he put it, the cancellation of a Free-to-Play AAA title "wasn't about quality – the retention data just wasn't there." For developers, this marks a shift in how projects are evaluated: if the numbers don't predict engagement, the game doesn't ship. This shift also impacts how players understand value. Saint argued that the industry had "trained" players to equate length with worth:

"I think it's a fucking curse, gamer perception in regard to time and perception of value. I think it's so insanely distorted the metrics of how gamers perceive and value video games. And I think we've done it to ourselves. We've trained them all. It's not like this is all their fault. Marketing. The way that we've marketed video games for decades has put us in this predicament." – Saint.

Even those uneasy with the dominance of metrics acknowledged their pervasiveness. Many developers advocated for a more balanced, data-informed approach. As Skolas warned, "you have to be very cautious about outsourcing human judgment to the data as the driver." Yet few denied that metrics now shape design outcomes across genres. Retention curves, session lengths, and daily active user targets are not just insights, but design constraints calibrated to extend time-on-task. Only Oryx described resisting this shift entirely – not by ignoring it, but by making deliberate career decisions to avoid it:

"I've seen it get more purposeful and metered, but I've kind of avoided that in my career, because I just don't enjoy it. I've had the luxury of following what I enjoy and not necessarily having to do what the corporate bosses say." – Oryx.

Developers described this shift as informal but deeply felt – shaping how time is structured, how projects were greenlit, and how success was defined. Shin noted, "If you can imagine it, we're tracking it," and Uldren agreed, even if the data is "more than anybody could ever look at," its logic remains persuasive. It may not govern everything yet, but data-centered thinking is becoming a dominant force in aligning temporal design with commercial strategy.

4.3.1 User-Centered Temporal Design.

Despite the broader industry shift toward data-centered design, many developers articulated an individual value for user-centered temporal design – an approach that prioritises the player's experience of time, rather than optimising time as a metric:

"Keeping in mind this tenet of respecting anyone's time – but player time, specifically – is something that's going to be reciprocated and noticed." – Eris.

Here, time is not treated as a resource to extract, but as an aspect of experience to be respected. Consideration of user-centered temporal design includes the user's rhythms, responsibilities, and choices as core design concerns, even when such values run counter to commercial logic. Other developers pointed to the need for flexibility, particularly for players with limited or irregular availability. Taniks argued for structures that allow players to step away "because of a distraction that happens in real life" without penalty. Cayde praised *Helldivers 2* [116] for making past seasonal content accessible. Mithrax called for features that help returning players recall goals and reorient after time away. Conversely, Oryx appreciated *Candy Crush's* enforced breaks as "dosage" – a deliberate pacing tactic to regulate play which Ikora also acknowledged in *Animal Crossing* [125]. "We treat time like dosage," said Oryx. "You can overdose the player on content." In these accounts, time was not just a quantity to fill, but a substance to be administered with care.

Other developers echoed this concern for how time is felt moment-to-moment, especially in multiplayer settings where delays can quickly become frustration. Rhulk noted the evolving standard for turn-based play, especially in multiplayer contexts:

"Modern standards have pushed towards short turns and engaging people through other people's turns... in digital play – especially with strangers – long waits are agonising. Turn-based multiplayer has to be fast or it just doesn't work." – Rhulk.

Redrix praised adjustable animation speeds and others noted features that gave players more control or autonomy over time, such as asynchronous modes, optional daily goals, or open-ended structures. Rasputin mentioned UI prompts like "You've been playing for 3 hours now, maybe you should go outside" as helpful reminders rather than hard constraints. Saint praised *Diablo IV's* [117] real-world clock presented in the UI, calling it "One of the best things I've seen recently," for helping players track real and in-game time simultaneously – avoiding casino-like temporalities. These systems aimed not to enforce play limits, but to preserve player agency through awareness and positioned temporal features as ways of supporting how games fit into everyday routines, recognising that not all titles aim to be a player's primary experience.

Despite the competitive attention market, many developers expressed fatigue with the logic of lifestyle and blackhole games built to monopolise attention. Saint argued, "I think we need to do more of that as an industry to build in healthy ways to disincentivise players for playing for longer than you know is healthy." Taniks spoke to the need for designers to consider whether their game is meant to be a primary experience – one that pressures multi-hour weekend sessions – or a secondary or tertiary experience that fits into the gaps of a player's day. Yet Eris reflected:

"Most of the games that we're making are not even meant to be a second or third game. They're meant to just be like a diversion... which I mean, maybe there's not space for that anymore. Maybe that's why our industry is in the position it's in." – Eris.

Developers also pushed back on the assumption that more hours equate to more value. Games like *Portal* [126] and *A Short Hike* [115] were cited as examples of concise, complete experiences. As Rasputin remarked, "I'd rather have a tight 10 hours I finish than a 200-hour thing that just peters out." Overall, developer reflections show that user-centered temporal design still persists in individual considerations and is grounded in care, flexibility, and player autonomy – even when commercial models push in the opposite direction. While not always easy to implement, these values remain central to how many developers imagine ethical and engaging play.

5 Discussion

This paper offers a grounded account of temporal game design as a situated development practice. Drawing on twenty developer interviews across AAA, Indie, Mobile, and Live-service contexts, temporal design in games is both a structured and subjective practice – shaped by organisational constraints and the scarcity of player time. While our early interviews approached temporal design as a set of player-facing features, analysis showed that these features are outcomes of a practice-based mediation in which studios organise, measure, and negotiate player time. Temporal game design constitutes a broader, historically situated yet informally codified set of practices and design priorities. It spans mechanics, tools, and metrics – and the way these are mediated has clear implications for player temporalities, including retention-driven pacing, coercive engagement loops, and grind.

Together, the three categories developed in this study – *Temporal Design Across Studio Contexts*, *Tools of Temporal Design*, and *Data-Centered Temporal Design* – outline the grounded account of how temporal game design operates in practice. Across these categories, we show that temporal game design varies across studio contexts, where playtime targets are set through market positioning, production scope, and expectations about what counts as a worthwhile experience. Temporal decisions are mediated through tools and metrics that translate player activity into design resources and targets while remaining unevenly understood across roles. Third, these pressures and tools increasingly converge in data-centered temporal design, where retention targets shape pacing, progression, and re-engagement, even as user-centered commitments to autonomy remain active points of negotiation.

Building on these three categories, we articulate four temporal design heuristics that translate our grounded account into design prompts. Although derived from games, these heuristics speak to wider attention-economy systems – including social media and entertainment apps that similarly compete for time.

5.1 Temporal Design Through the Lens of HCI

In HCI, studies frame time through optimisation, latency, and synchronisation [98][83][52], while game studies propose typologies of temporal play based on scholarly interpretation rather than design practice [13][111][112]. There is also work that treats time as an explicit design material [43][47][81] and cultural concern [78][95]. However, both approaches primarily examine time as an interface or player experience outcome, rather than investigate the production practices that determine how time is translated into design decisions. While Rapp et al. [83] call for broader models of temporal analysis, our interviews show comparable temporal logics already operating in development practice, shaped by commercial targets and player expectations. Data-centered temporal design mirrors HCI's optimisation traditions inside game production. Developers described player time as a measurable resource to capture, oriented by retention targets and forecasting models, alongside efforts to reduce dead time and player disengagement. This metric-led structuring aligns with wider critiques of datafication in HCI and highlights how temporal experience is standardised, monitored, and optimised across digital systems [97][104].

Alongside this data-centered optimisation, our interviews surface an ongoing, sometimes uneasy, user-centered counter-orientation. Developers repeatedly emphasised the need to respect time as a limited, lived resource – not merely a metric to be managed. In its most intentional form, this aligns with what we describe as *user-centered temporal design*: the deliberate structuring of time in games in ways that prioritise player autonomy and flexibility – rather than using time to optimise retention. This orientation echoes a growing body of HCI work that privileges temporal experience over temporal measurement. Concepts such as *reflective time* [74], *macro-temporal perspectives* [71], and *the situational when* [95] each seek to reposition time as relational, contextual, and designed. Developer reflections on pacing, attention, and rhythm – from *A Short Hike*'s [115] gentle progression to *Diablo IV*'s [117] real-world

clock overlay – demonstrate how such principles are already embedded in commercial games, often without formal terminology. These are not prototypes or speculative provocations; they are live systems deployed at scale, refined through both data and design intuition, yet limited by a lack of creative freedom in commercial contexts.

5.2 Temporal Design and the Ethics of Player Time

Our findings reveal a spectrum of ethical orientations in temporal game design – from approaches that centre player autonomy and experiential value, to those guided more explicitly by behavioural metrics like retention and daily engagement. These are not mutually exclusive: even user-centered temporal design often incorporates data to inform decisions, just as metric-driven systems may still aim to deliver satisfying play, yet the distinction matters. When player time is primarily treated as a variable to optimise, temporal game design shifts from supporting experience to managing behaviour – reframing play as a means to an end. This instrumentalisation echoes ethical concerns raised in both HCI and game studies and highlights the tension between experiential goals and commercial imperatives [90].

While prior research has mapped temporal dark patterns at the interface level, our findings reveal how such systems are considered and contested by developers within the constraints of studio culture and industry pressures. Developers saw themselves not as passive executors, but as practitioners whose values and design instincts still shaped decisions – even when working within commercial or data-driven constraints. Many described their work with care for players and a strong sense of craft – a love of design but also of video games as a medium and for their own source of entertainment. Temporal systems were often framed not as manipulative by default, but as tools that could support habit, mindfulness, or meaningful session boundaries. At the same time, participants acknowledged the thin line between pacing and pressure, and the difficulty of maintaining that balance. Particularly in Live-service and Mobile ecosystems, where return play is engineered through systems such as daily quests and login rewards. While such features are often linked to dark patterns [64][110], developers often emphasised that the impact of these mechanics depends on how they are used – not the feature itself, but its purpose and implementation. These same mechanics could steer players into coercive loops or, in other contexts, be framed as supporting healthy pacing and routine [45] [86]. Rather than positioning themselves as either guardians or manipulators, developers articulated a more situated role: responsible not for controlling players, but for designing systems that respect player agency. These systems then are not inherently "crafted to trick" as Brignull [10] first defined. Instead, it is as Gray and Chivukula [38] argue, that ethical design complexity is rarely reducible to individual intent or isolated choices; rather, it is "continuously mediated by the designer through the lens of their organisation, individual practices, and ethical frameworks". Sparrow et al. [94] similarly emphasise the complexities toward ethical game design in practice and player response. From our findings, we verify the complexity of perceived manipulation in temporal game design, revealing it as a site of negotiation between ethical intent, commercial constraints, and intended player experience.

5.3 Temporal Design as Market Strategy

While earlier sections examined how developers negotiate time as a design material and ethical concern, our findings reveal how temporal game design also functions as a core market strategy. In a saturated entertainment ecosystem, developers are not only designing gameplay but competing for players' time. Studio pressures and data infrastructures shape this competition by positioning games within, and often against, the time scarcity of everyday media life, influencing not just pacing or scheduling but when and how games demand attention. In this sense, temporal game design reflects a broader shift from competition over platforms or genres to competition over attention. Put bluntly, the console war is over; the attention war has begun. Games now compete directly with streaming platforms, short-form video, and social media – specifically TikTok [99] – for player time. Across studios, temporal game design has become a survival tool – aligning play around daily routines, marketing cycles, and seasonal calendars. Cooldowns, login rewards, time-limited quests: these are not just features, but temporal anchors engineered to insert games into the rhythm of everyday life.

Developers also spoke in terms that reflect a shift from a ludic categorisation of play to the rise of temporal genres such as *black-hole games*, *lifestyle games*, and *forever games*. Building on these categories, our study reveals *secondary* and *tertiary games*: titles intentionally designed, or commonly experienced as non-primary play. These games are not the main focus of a player's attention but instead occupy peripheral moments or interstitial gaps between higher-commitment experiences. In this sense, Keogh and Richardson's *background games* [51] describe a waiting-based ludic role that becomes ambient in everyday life – a phenomenon later echoed in discussions of idle games – whereas secondary and tertiary games describe a temporal, design-oriented category that can include background, indie, and even AAA titles. This temporal genre allows developers to articulate design intent, while further work is needed to determine whether players adopt these terms to understand how games fit within broader routines and screen ecologies.

These categories align with broader shifts in media use identified by Carter et al. [17], who describe how players navigate *screen ecologies* by engaging in *multi-gaming* across multiple registers of attention. Their analysis of players layering slow-paced strategy games with quick Mobile titles underscores how games are already embedded within overlapping temporal rhythms. Our findings reveal that developers are not only responding to these screen ecologies but are increasingly designing for them – producing games that anticipate their position as secondary or tertiary experiences within a player's broader media routine.

5.4 Temporal Design Heuristics

Our three categories of temporal game design also surface a set of recurrent tensions – user-centered vs data-centered logics, retention vs respect, primary vs secondary roles – that can be articulated as temporal design heuristics to help organise design decisions about how player time is structured and communicated. Although these

heuristics are derived from games, they speak to wider attention-economy systems – including social media and entertainment apps that similarly compete for user time.

- **Treat player time as a resource, not only a metric:** Temporal metrics such as session length and day-N retention are useful, but they should trigger questions about who benefits when they increase, and where added grind or stretched progression starts to undermine experience. Here we ask designers to acknowledge player time as a finite, lived resource with real opportunity costs, and to factor that directly into temporal design decisions.
- **Make temporal expectations explicit:** Expectations about session length, log-in cadence, event duration, and reward permanence are often implicit or buried in patch notes and marketing prose. Making these time expectations clear in onboarding, UI, and in-game communication helps players align system rhythms with their own schedules and reduces the ambiguity on which some temporal dark patterns rely.
- **Design for exit and re-entry, not only retention:** Metrics often favour continuous engagement, but players' lives are discontinuous. Building meaningful stopping points, "you are done for today" moments, catch-up paths, and reorientation tools treats breaks and returns as normal, and incorporates them into how progression and scheduling are planned.
- **Acknowledge intended role and capacity for engagement:** Games can sit on a spectrum from lifestyle "main" titles to secondary or background experiences. Attending to where a game is likely to sit on this spectrum – and the amount of time and attention it can reasonably ask of players – supports temporal design choices that respect constrained player time while maintaining sustainable engagement in crowded screen ecologies.

These heuristics translate our grounded account into a set of design prompts for temporal design that align with HCI work attending to situated and experiential temporalities of interaction and use [71][83][95][108]. These prompts draw attention to which temporal values are being prioritised, how expectations about time are communicated, and how game rhythms are situated within players' everyday routines and screen ecologies.

6 Limitations & Future Research

While this study offers a grounded account of temporal game design from developer perspectives, we recognise that limitations shape its relevance to other contexts. The sample, though diverse in role and studio type, was geographically concentrated in Europe, the United States, Canada, and Australia and overlooks relevant insight from other regions such as Africa and Southeast Asia. Future work should address this by expanding regionally and including non-English-speaking studio contexts. While developers often speculated on player experience, these insights were drawn from professional knowledge and experience rather than direct user feedback. Future research should investigate directly how players experience and respond to temporal game design.

Developers recruited for this study came from AAA, Indie, Mobile, and Live-service backgrounds, yet more detail is needed on how temporal game design works within each of these studio contexts. Retention strategies in casual Mobile games, for example, may differ from those in big-budget online titles, even when they use the same tools and metrics.

Finally, we echo the call by Sparrow et al. [94] to engage more deeply with game developers as established practitioners of digital design. The video game industry offers rich, experience-driven insights into core HCI concerns – not only in ethics and community governance, but in how time, attention, and interaction are structured through design practice in digital systems.

7 Conclusion

Temporal game design, as described by our participants, is the everyday work of turning organisational pressures, data infrastructures, and design intentions into concrete structures for player time. Drawing on a constructivist grounded theory analysis of twenty interviews with experienced developers – many in senior or lead roles across AAA, Indie, Mobile, and Live-service studios – our account traces how targets for engagement and retention travel through tools and metrics into pacing, progression, and scheduling. We also show how these same systems become sites where user-centered commitments to autonomy and care are negotiated against commercial demands. This paper makes two contributions. First, it develops a grounded account of temporal game design as a practice-based mediation between organisational constraints, data infrastructures, and player engagement. Second, it offers four temporal design heuristics to help organise design decisions about how player time is structured and communicated. These contributions position temporal game design as a practical resource for HCI work on time, datafication, and dark patterns, and as a lens for examining how digital systems organise user time.

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