# Enhancing Social Exergames through Idle Game Design

Jennifer Villareale
Drexel University
jmv85@drexel.edu

Robert C. Gray
Drexel University
robert.c.gray@drexel.edu

Anushay Furqan
Drexel University
anushay.furqan@gmail.com

Thomas Fox
Drexel University
Seafordtbf@gmail.com

Jichen Zhu
Drexel University
jichen@drexel.edu

## ABSTRACT

This paper recognizes idle games as a promising direction for exergames and other games designed for behavioral change. Based on a survey of 11 popular idle games, we extend existing literature by identifying the common core gameplay loop (active participation, inactive progress, and return reward) as well as the design patters used to support the loop. Furthermore, we propose an initial approach to extending idle game patterns to social exergames, focusing on improving player adherence.

## KEYWORDS

Exergame; Games for Health; Idle Games; Design Patterns

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## 1 INTRODUCTION

Approximately two-thirds of the U.S. adult population is affected by overweight and obesity [16]. An increasingly popular approach to address this problem is exergames [6, 12, 14]. While exergames can have positive impacts on physical activity (PA), maintaining player engagement with exergames for an extended period is an open problem [12, 20]. *Social exergames* use players' social interactions and gameplay to increase players' motivation for PA and can potentially lead to a more active lifestyle [1, 6, 7, 12]. However, adherence remains a problem [12]. Inactive or absent players in multiplayer *social exergames* may demotivate active players to continue playing. We propose to examine the prominent qualities of idle games to address this problem.

A recent emergent game genre gaining popularity is idle games. These games design for player absence, and successful idle games have demonstrated their potential to engage players for an extended period. Since waiting can be part of play [2, 8, 11], the low demands of idle games makes it possible to incorporate regular gameplay into players' daily schedule [10, 11, 19]. For these reasons, researchers hypothesized that idle games could facilitate behavioral change [2].

However, there is a lack of understanding of how idle game design can be used in games for behavioral change, especially exergames. To the best of our knowledge, no game has been developed to explore this direction. More fundamentally, we do not yet have sufficient knowledge of the design space in order to incorporate physical activities in idle games. While idle games have received the attention of games scholars, most scholarship around the topic centers on defining the unique qualities of idle games compared to other genres [2, 8, 11, 18]. In this paper, we aim to develop a further understanding of how to design idle games by examining their core gameplay loop. In particular, we identified three key phases of the gameplay cycle: active participation, inactive progression, and rewarding return. Based on an analysis of 11 popular idle games, we identified design patterns commonly used by designers to support this gameplay loop. Furthermore, we propose our initial approach for designing idle *social exergames* by using these design patterns for behavioral change.

## 2 RELATED WORK

A significant amount of research has been conducted to understand how to design exergames for the general population [13, 21] and their impact on players' PA [6, 12, 14]. However, player engagement with exergames for an extended period is an open problem [12, 20]. Compounding this problem, *social exergames* (i.e., games leveraging multiplayer social interaction to motivate increased physical activity) suffer from a snowballing effect where inactive players can negatively impact the gameplay experience of active players and thereby lead to more dropouts [25]. We find various attempts to address the problem of adherence in exergames in prior work, including intrinsic motivators such as positive and negative reinforcement [12], social play [5, 6, 12, 22], game mechanics such as "micro goals" and "free play" [5], feature updates [24], user models [23], and AI agents [25]. However, the problem of adherence and long-term engagement persists. This paper proposes a new approach by investigating idle games, a game genre that is relatively new and particularly under-studied in the field of serious games, as a potential solution to this problem.

The scholarship around idle games, a genre including those referred to as "clickers" [9] and "incremental" games [18], has been relatively limited. Prior work defines idle games as those that support long absences [18], progress with minimal to no interaction from players [2], and where the majority of play happens in the


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background [11]. The length of player inactivity and active play may vary among different types of idle games, and games offering active play mechanics often provide incentives to encourage players to leave and later return, creating a cycle of play and non-play [11]. We consolidate these definitions in this paper to define idle games as games that focus on and design for player inactivity or "idleness."

Researchers have identified the potential for idle games to support a balance between gameplay and daily activities because the waiting mechanic, an intrinsic part of idle games, encourages players to leave the game and embark on their daily activities [2, 10, 11, 19]. We believe that this balance makes idle games a particularly suitable game genre to incorporate with regular physical activities and into players' daily routine for an extended period of time. Although the synergy between idle games and behavioral change interventions has been identified broadly [2], very little work has been done on explicitly integrating idle mechanics into exergames. In our work, we surveyed 11 modern idle games to identify common game design patterns. To our knowledge, this is among the first investigations into the idle gameplay loop to identify the specific design patterns around it. Additionally, we develop a design approach to incorporate these idle game mechanics into exergames toward improving player engagement and adherence.

## 3 LEARNING FROM IDLE GAME PATTERNS

To understand how idle games can be useful to exergames, we selected 11 popular idle games and analyzed their core mechanics and gameplay loop patterns. We found that players in these games repeatedly cycle through phases of active and inactive play, a fundamental component of player experience in idle games.

### 3.1 Methodology

To understand their potential application in exergames, we first explored recurring patterns in idle games. We conducted app store searches of popular idle games based on rankings. Among them, we selected games frequently mentioned in academic publications such as [2, 15] to identify a set of exemplary games for our analysis. This process led to a selection of 11 idle games, including *Abyssrium*, *A Dark Room*, *Candy Box*, *Clicker Heroes*, *Cookie Clicker*, *Cow Clicker*, *Eggs Inc.*, *Farmville*, *Realm Grinder*, *Swarm Simulator*, and *Tap Titans 2*. Next, we played and analyzed these games [4] via a close reading approach [3]. A recurring pattern that emerged from our analysis was the unique gameplay cycle of idle games.

### 3.2 The Gameplay Cycle of Idle Games

The main characteristic of idle games is that they are designed around the idea that the player will leave the game regularly. Because of the frequent break, we found that players of idle games experience the repeating *gameplay cycle* from 1) active participation, to 2) departure from the game (inactive progress) to 3) return to the game (via return rewards). In most of the 11 games we surveyed, a typical player goes through this cycle dozens of times in a day, across multiple days.

Idle games are unique in terms of the flexibility they provide around daily activities. By accommodating frequent breaks between active participation sessions, idle games create low-demand experiences that allow for the player to be as active or inactive as they choose. By allowing for variable play frequencies, this repeating gameplay cycle can prevent burnout while still motivating players to return to the game. These qualities may lend themselves well to integrating exergames into players' daily routines and to sustaining the long-term engagement necessary for behavioral change.

To better understand how successful idle games support the above gameplay cycle, we further analyzed our set of 11 games using the following questions: 1) What kind of active participation does the game require of the player? 2) What kind of idle actions does the game complete when the player is away? 3) What kind of techniques does the game use to encourage the player to return?

### 3.3 Active Participation Patterns

Active participation refers to the gameplay actions a player takes while playing the game. Compared to other game genres, game mechanics in idle games need not only to provide engaging gameplay at the moment but also to set the foundation to entice the players to return after an absence. A common mechanic in many idle games, especially those in the "incremental" subgenre, is managing resource accumulation and spending resources to upgrade the efficiency of that accumulation [17]; however, this is not a requirement of the genre. Out of the 11 idle games analyzed, all of them use some form of resource management mechanic where players must build and balance resource production rates and costs. For instance, in *A Dark Room*, the player needs to carefully determine what type of materials should be produced given the number and types of builders available. Though resource management games typically require repetitive actions, we believe that the strategy-based mechanics they present work particularly well to offer both short-term and long-term rewards and motivate players to return to check their progress. While this type of micro-level grinding may be off-putting to players of other game genres, it provides reasons for idle games to automate these actions while the players are away. Additionally, resource management games have built-in difficulty progression curves; as the number of resources grows, the task of balancing them becomes increasingly difficult.

The games we analyzed varied in the complexity of their resource management mechanics. For example, *Realm Grinder* is significantly more complex than *Clicker Heroes*. Where *Clicker Heroes* has a more straightforward dynamic in which the players purchase new heroes to increase damage against enemies, *Realm Grinder* requires a significant amount of effort to identify new builds and unlock new features deeper within the game.

### 3.4 Inactive Progress Patterns

Inactive progress refers to the actions the game takes in the player's absence. As an essential characteristic of the genre, many idle games continue to progress even when the player is not actively playing it. What happens during this inactive phase may vary from game to game, but below we summarize the design patterns we observed in how the games are designed to progress without players. Some of the patterns discussed below can overlap, but by highlighting their differences, we aim to provide an in-depth look into how they may be useful.

| | | Abyssirum | A Dark Room | Candy Box | Clicker Heroes | Cookie Clicker | Cow Clicker | Egg inc. | Farmville | Realm Grinder | Swarm Simulator | Tap Titans 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inactive Progress Patterns | Timed Actions | | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| | Player Driven Auto play | | | | ✓ | | | | | ✓ | | ✓ |
| | System Automation | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| Return Reward Patterns | Highlighting State Change | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Time-Sensitive Content. | ✓ | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Halted Progression | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ |

**Figure 1: Inactive Progress Patterns and Return Reward Patterns in the 11 Analyzed Idle Games**

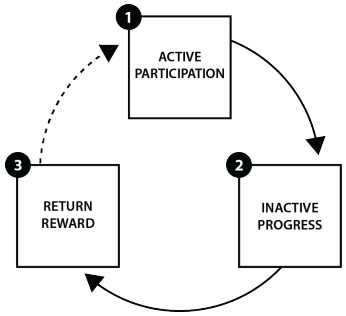


**Figure 2: Gameplay Cycle of Idle Games**

*3.4.1 Timed Actions.* Timed actions are player actions that take a non-trivial amount of time to execute or complete. In most of the games analyzed (Table 1) timed actions are a core feature, supporting the unique idle characteristics for "playing less" and "waiting to play." In the 11 games analyzed, we observed 6 to use timed actions to provide the player with core resources or the opportunity to carry out strategic decisions. For example, in *Farmville*, players plant crops that take a set amount of time to grow before the player can harvest them. The time needed for the plants to grow varies between 15 minutes to several days, and the significant waiting periods created by the timed actions encourage players to leave the game. At the same time, it incentivizes players to consider the combinations of timed actions that would maximize their rewards when they return. We found that timed actions are the foundation of how some idle games balance players' active participation and inactive progress. In some instances such as *Farmville*, timed actions also provide monetization opportunities for the game makers by allowing players to pay to shorten the wait time, but designers should still consider the value they provide in their affordance for player absence.

*3.4.2 Player-Driven Auto-Play.* Player-driven auto-play is a feature where players direct the game to perform specific actions on their behalf, including while they are away. In clicker idle games, for example, players need to click in order to gain a small amount of reward. Quite often, they need to click repeatedly for an extended time in order to make meaningful progress. Auto-play can automate the process and replace the repetitive clicking. For example, in *Realm Grinder*, a strategy clicker game about managing a kingdom, players can use an auto-play system for casting spells and tailor this system to perform future actions best suited for their realm. In our analysis, we find that auto-play makes it easier to ensure substantive game progress while players are away. It is worth mentioning that the auto-play feature is not typically available from the beginning of the game but is introduced over time as part of the game's progression. Auto-play not only advances the game during players' absence but is also used to scale up the difficulty of the game; it is frequently the device leveraged to evolve gameplay from low-level, repetitive actions to more strategical maneuvers that guide the player to new mechanics.

*3.4.3 System Automation.* Another idle game design pattern is a game state that continues working on behalf of the player without player input or activity. In many idle games, the game does not pause when the player exits but instead maintains, or gives the illusion to maintain, a persistent virtual environment in the background. For example, in *Swarm Simulator*, a strategic game about raising an insect colony, players generate resources even if the game is not open. In many cases, the game progresses in real time so that the resources or rewards generated are proportional to the time spent away. Based on our analysis, this pattern provides the player with a constant stream of resources and encouragement that they will have something new to look forward to regardless of the length of inactivity. The more the player waits, the more rewards they will receive. Though bearing some similarity to other inactive progress patterns, the focus of this automation is the system's persistence without the player presence or input. System automation may be particularly useful in games with multiplayer social interaction, such as social exergames, where the game environment runs in parallel to the player's life outside the game.

## 3.5 Return Reward Patterns

Return reward patterns include design elements that encourage players to go back to the game. These patterns are designed to

entice players to return to the game and resume active participation, allowing the gameplay cycle to begin a new iteration.

*3.5.1 Highlighting State Change.* When the player returns, the game often highlights how the game state has changed since the last time the player left. These state changes, often highlighted through visual cues, may include a newly accrued resource, a goal achieved through waiting, or even a narrative progression. For example, in *Realm Grinder*, players frequently unlock new buildings, factions, spells, and systems, and they are encouraged to return often to see what new content is available. *Cookie Clicker* presents a visual state change where the aesthetic grows increasingly sinister as players advance, generating curiosity for how the game may have changed since the last interaction. As shown in Table 1, rewarding players' return through highlighting how the game has changed is a return reward pattern used in all 11 games we analyzed.

*3.5.2 Time-Sensitive Content.* Time-sensitive content refers to temporary opportunities for the player to receive extra resources, bonuses, mechanics, or other rewards during a specified time window. For example, players can earn twice the amount of resources if they return during a specific time in the game when a boost is activated. Based on our analysis, we find that this pattern may be designed to keep the game fresh and encourage players to return even after extended absences. For example, in *Cookie Clicker*, seasonal events occurring around major holidays with special challenges to complete. Participating in the challenges can unlock special upgrades to increase cookie production, and such events may encourage players to return to active participation even after extended absences.

*3.5.3 Halted Progression.* In some idle games, the progression of the main mechanics stops after a certain period of player absence, even though some resources still accumulate through timed action or auto-play. For example, in *A Dark Room*, while the players still accumulate building material while away, the main plot of the game does not advance until the players return to use them. In *Clicker Heroes*, players can engage an auto-play feature to send their heroes out to fight enemies while the player is away; however, if players leave for too long, their heroes will eventually reach zones that are too difficult and result in a reduction of earning potential. This halt in progression encourages players to return frequently to re-evaluate their approach to the game.

## 4 TOWARD IDLE SOCIAL EXERGAMES

To the best of our knowledge, there has not been direct effort to incorporate idle game mechanics into exergames or other games for behavioral change. We believe that our gameplay cycle and design patterns can be a useful starting point for increasing long-term engagement and improving adherence, which remains a frequent challenge in exergames [12, 20]. Below we offer our design considerations to other designers interested in exploring this space.

*DC1: How might we incorporate physical activity into the idle games gameplay cycle?* The first thing to consider while designing an idle exergame is how to include exercises and other physical activity (PA) in gameplay. Designing for inactivity in exergames can support a player's daily routines, which cycle between opportunities for active and inactive play. It is essential to consider how the time spent on PA fits the gameplay cycle of active and inactive play (fig. 2). Do players carry out their PA during the active participation phase or the inactive phase? The second thing to consider is how the player's real-world PA integrates into the gameplay. Does the player's PA convert to core resources? We suggest that the PA values should be closely tied to the core mechanics of the game, especially those involving return rewards so that players can feel vested and encouraged to repeat the cycle.

*DC2: How might we improve adherence through encouraging long-term engagement?* To increase long-term engagement, we propose using Timed Action (3.4.1) and Highlighting State Change (3.5.1) patterns within exergames. Incorporating a Timed Action provides the player with an opportunity for active participation (planning and decision making) and inactive progress (waiting for the result of the completed action). When linking the outcome of a Timed Action with a Highlighted State Change, we can encourage players to return to the game and resume active participation, allowing the gameplay cycle to begin a new iteration. This Highlighted State Change should link to a visual and game resource reward by providing the player with new content to consider and plan for the next cycle of inactivity.

*DC3: How might we mitigate the snowball effect in social exergames?* An open problem in social exergames is that when some players become inactive, they damage other players' experience and make the latter more likely to quit [25]. We believe that implementing player-driven auto-play (3.4.2) will successfully mitigate this snowballing effect. Auto-play can reassure designers that the game will remain motivating for every player despite their level of activity. We observed idle games such as *Realm Grinder* and *Clicker Heroes* successfully incorporate auto-play features and found that players were able to choose their preferred play style between active and passive play. By providing the choice to automate, exergames can become more flexible for the frequently inactive player, thus encouraging progression for all players. In extreme cases of inactivity, auto-play can intervene and automate actions on behalf of the absent player to ensure progression for the group.

We believe that the application of these patterns to multiplayer social exergames would allow for the type of lifestyle integration that the genre demands. Exergames can achieve this by facilitating repetition of the idle game player cycle and making room for occasional or frequent player absences while simultaneously motivating player return.

## 5 CONCLUSIONS AND FUTURE WORK

In this paper, we report our approach for enhancing social exergames through idle game design patterns based on a survey of 11 popular idle games. From our analysis, we identified the core gameplay loop in idle games and the design patterns used to support this loop. We further discussed our design guidelines for extending idle game patterns to exergames, focusing on the issues of improving long-term engagement and mitigating the snowball effect in social exergames. A limitation in our work is our small sample of games, and we encourage researchers to extend this knowledge with a larger sample and investigation into other idle game subgenres. For future work, we plan to design and evaluate one of the first idle

social exergames and evaluate its effectiveness on adherence and PA.

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