# The imbalanced state of free-to-play game research: A literature review

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## ABSTRACT

As free-to-play games have increased their economic value, the research interest on them has increased as well. This article looks at free-to-play game research conducted so far through a systematic literature review and an explorative analysis of the documents included in the review. The results highlight an excessive focus especially on behavioral economic studies trying to maximize the player bases and profits, while other aspects, such as meaningful game experiences, cultural and societal implications, or critical review of the phenomena have been left in the marginal. Based on the review results, this article suggests four future agendas to reinforce the lacking areas of free-to-play game research.

## Keywords

free-to-play, freemium, games, literature review, research agendas

## INTRODUCTION

The game industry has changed. Revenue models have shifted from retail products to service relationship between the publisher and the customer (Sotamaa & Karppi 2010). The industry has grown due to changes in the business models and the consumption of games. By offering the game for free, games can reach wider audiences, and by offering in-game content for a fee, companies can still generate considerable income. This revenue model called free-to-play represents one of the most notable forces of change in the game industry.

After reaching economic success, the free-to-play revenue model has anchored itself deeply and substantially in the game ecosystem. The model has influenced both the way games are developed as well as how they are consumed. To understand the full importance and influence of free-to-play games, they should be studied from multiple perspectives and with diverse methodological toolkits.

The amount of research on the topic has been increasing, and the purpose of this article is to see how it has addressed the free-to-play game phenomena. This is done through a systematic literature review. The review scope was intended to offer a comprehensive picture of free-to-play game research at a point when some research has already been conducted, but it is still possible to examine the topic with an exploratory approach.

This is the first literature review on free-to-play game research to take such a holistic view. The descriptive approach allows for a more detailed view on what the research has already covered and how, and what areas are still lacking. After analyzing the state of free-to-play research, four important future research agendas are introduced.

## BACKGROUND

Free-to-play games are games that can be downloaded and played for free, but which include in-game purchases for extra content or other advantages. The roots of free-to-play games lie in South Korea and China, where they were used as a means to fight online piracy. The model quickly proved effective in the Asian-Pacific region due to its flexible pricing (Davidovici-Nora 2013) and spread to the West. One of the key reasons for the popularity can be traced back to social network games, and their arrival especially to Facebook (Mäyrä 2011). After the first success stories such as *Vampires* (Commagere & Olson 2007) and *Mob Wars* (Maestri 2008), the number of social network games skyrocketed, and Zynga published their hits *Mafia Wars* (2009) and *FarmVille* (2009).

As the free-to-play game industry has grown more popular and profitable, the games have received considerable coverage in press, concentrating on the economic success and the negative aspects of gameplay (Alha et al. 2014). Throughout the age of social network gaming, the games were often rejected by large parts of gaming communities and many game developers, and the free-to-play monetization model started to receive a growing amount of critique. Zynga was labeled infamous due to their aggressive monetization and revelations of a small minority of players paying for the majority of the games' revenues. Zynga's games were seen as taking advantage of players, creating simple yet addictive games that often copied other games and encouraged problematic gaming and spending habits (Alha et al. 2018).

Another, even more remarkable peak for the model occurred during the rise of mobile games. The Apple and Android platforms provided new avenues for free-to-play games while the popularity of social network games started to decline. This has escalated to a point where almost all top-grossing apps on mobile use the free-to-play model, from which majority are games (Alha et al. 2016). The success of the model has allowed it to spread to most platforms and genres, including influencing the design of games using other revenue models (Davidovici-Nora 2013).

Although free-to-play games have moved from social networks especially to mobile and PC platforms, their origin is still visible. While many of the games use less aggressive monetization mechanics and have evolved from the earlier generations, the attitudes towards the games are still influenced by the times of Zynga (Alha et al. 2014, Alha et al. 2018). The problems are still evident in games where the developers make most of their money from a small number of players.

There are problematic aspects regarding fair play as well. If in-app purchases give an advantage to paying players, the game can become pay-to-win and thus unfair (Lin & Sun 2013, Alha et al. 2018). Both paying and non-paying players should be important for the developer. While the paying players bring the actual revenue, ultimately it is the non-paying players who create the feeling of community (Sotamaa et al. 2011, Tyni et al. 2011).

From the developers' perspective, competition is fierce and the same games and game companies dominate the charts for profitability (Nieborg 2016). Designing free-to-play games has its own challenges, as the monetization model has to be integrated as part of the gameplay. The design of free-to-play games is strongly metrics-based, which means the developers deduce from data which gameplay features or items are the most popular and lucrative, and then choose in which direction develop the game. When looking at the statistics, developers may easily pursue faster revenue instead of trying to create better experiences and lasting interest (Alha et al. 2014).

## REVIEW PROCEDURE

The review procedure followed a five-step framework described by vom Brocke et al. (2009): 1) Definition of review scope, 2) Conceptualization of the topic, 3) Literature search, 4) Literature analysis and synthesis, and 5) Research agenda. The scope was introduced in the Introduction chapter, while conceptualization was done in the Background section.

Scopus was chosen as the database for the literature search, as it indexes a wide variety of relevant journals, conferences, and book chapters. To get as complete a collection of related documents as possible without getting too many unrelated hits, the search words included "game*" (to cover both *game* and *games*) and "free-to-play" or "freemium" (to include both terms commonly used to refer to the free-to-play model). To find documents that included the topic in a relevant way, these words were set to be included in the title, abstract, and/or the keywords. The query was targeted at journal articles, conference papers, and book chapters. The time frame was set to include all the documents published in 2018 at the latest. The final query used on Scopus was thus:

TITLE-ABS-KEY ((game*) AND ((free-to-play) OR (freemium))) AND PUBYEAR < 2019 AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ch"))

The final search was conducted in May 2019 and resulted in 116 documents. From these, 1 document was removed as a duplicate, 2 documents due to the full version being unavailable, 2 documents due to the paper being written in a language other than English, and 2 documents for being non-academic documents.

The abstracts of the remaining 109 documents were examined, and in this process, 13 documents were removed for being false hits. This included documents that 1) included the phrase "free to play" in a meaning different from a revenue model, 2) included "free-to-play" as a keyword despite not discussing it in a relevant fashion in the document, 3) referenced freemium connected to something other than games, 4) mentioned free-to-play model in the abstract as a reference or a side note, but did not discuss the model further, and 5) discussed a free-to-play game, but not its free-to-play nature in any relevant manner. In addition, 4 documents were removed at this phase due to there being more than one similar paper by the same authors. In these cases, the later and more extensive journal publications were included.

In the end, 92 documents were included in the actual review process. These were coded by publication year, publication type, data type, method type, subject area, and country. Publication type, data type, and method type were retrieved from the documents themselves, while the rest of the data was collected from Scopus. This descriptive data is introduced in the Results chapter.

Due to the manageable volume of the documents, it was possible to take a qualitative approach to the analysis. Therefore, each document underwent a textual analysis based at least on its abstract and conclusion, and categories of research topics were formed based on this analysis. The results are described in the Exploration of the research sub-chapter.

Finally, four research agendas were identified from the synthesis of the previous research, focusing on the research areas that are lacking and require more attention from the field. These agendas are introduced in the Future research agendas chapter.

## RESULTS

### Descriptive data

Figure 1 shows the annual number of publications. While the first paper is from 2009, a slight increase in research happens in 2011, after social network games had risen into popularity and the model had gained more attention. In 2014-2015 the research increases substantially, which coincides with and after the free-to-play model had reached success on mobile platforms.
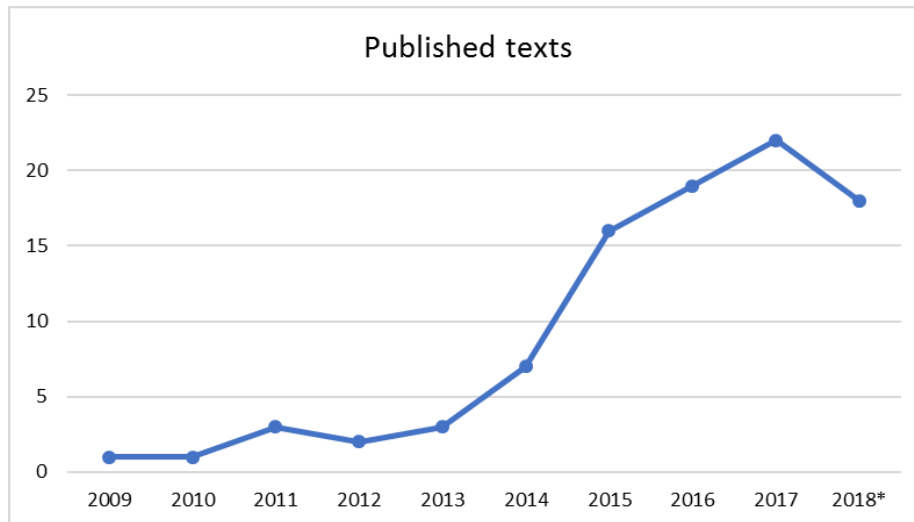


**Figure 1:** Included texts by their year of publication. *Due to possible delays in publication and adding entries to the databases, the number of studies at the time of the data-gathering process might be proportionately lower than in other years.

The division of document types can be seen in Table 1. The included documents are divided roughly equally between journal and conference papers, while only four book chapters were among the documents. The data and analysis methods are listed in Table 2, which shows an emphasis on the quantitative methods over qualitative and mixed methods and log and survey data over, for instance, interview and game analysis data.

| Document type | Frequency |
|---|---|
| Full journal articles | 46 |
| Full conference papers | 32 |
| Book chapters | 4 |
| Short conference papers | 4 |
| Extended abstracts | 2 |
| Work-in-progress | 2 |
| Workshop papers | 2 |

**Table 1:** The document types of the included documents.

| Data type | Frequency | Method type | Frequency |
|---|---|---|---|
| Log data | 25 | Quantitative | 44 |
| Survey data | 24 | Qualitative | 15 |
| Interview data | 11 | Mixed methods | 5 |
| Game analysis data | 4 | | |
| Research articles | 4 | | |
| Forum posts | 2 | | |
| Psycho-physiological data | 2 | | |
| Game magazines | 1 | | |
| Financial data | 1 | | |

**Table 2:** Data and method types in empirical documents.

Figure 2 shows a heavy concentration of the research in Europe and North America. This is especially noteworthy, seeing as there are substantial differences in the free-to-play game market between the eastern and western societies (Page 2012). Therefore, the research mostly portrays the western free-to-play model.
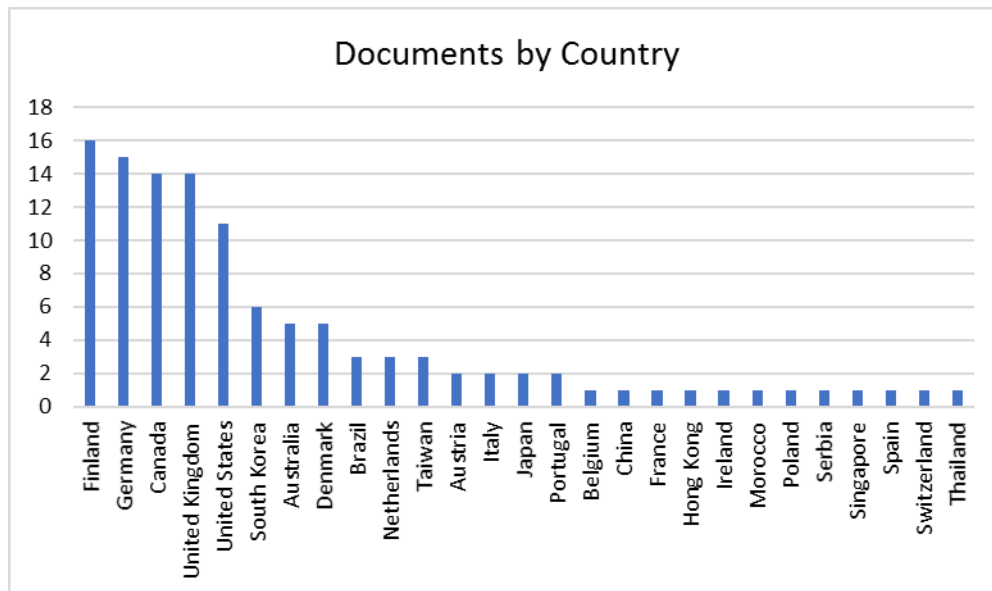


**Figure 2:** Included documents by country.

The division of the subject areas of the documents is shown in Figure 3. Computer Science is included in 43.8% of the documents, while Social Sciences and Arts and Humanities are represented in 8.5% and 6.5%, respectively.
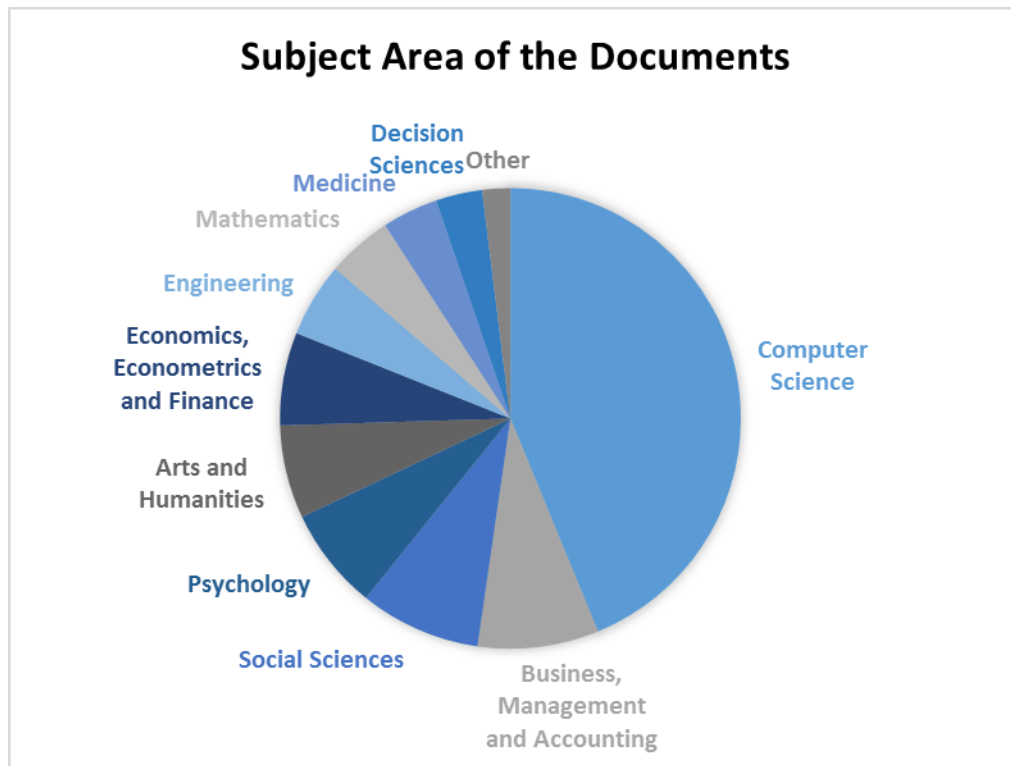
**Figure 3:** Included documents by their subject area.

## Exploration of the research

### *Disengagement and retention*

A relevant portion of the documents concentrate on predicting and decreasing disengagement and churn, the act of customer abandoning a product entirely. In free-to-play games, most new players leave already during the first days, so predicting and preventing early customer churn is important (Milošević et al. 2017).

Many of the reviewed documents examined the best ways to measure, predict, and prevent churn. Castro and Tsuzuki (2015) proposed a frequency analysis approach to predict churn. Lee et al. (2016) created a model for predicting churn in free-to-play games, tested in a mobile free-to-play role-playing game. Lee and Yang (2017) proposed a method for optimizing live service on mobile free-to-play games. The method was evaluated in a free-to-play role-playing game, showing that it can improve retention.

Hadiji et al. (2014) used live data from multiple games to model and predict player churn. They developed and presented a prediction model with a machine learning approach which would not rely on design specific features. Similarly, Xie et al. (2015) aimed to reach better generalizability in predicting player disengagements.

Runge et al. (2014) focused on predicting and preventing churn for high-value players in casual social games. Giving free in-game currency did not significantly affect the churn rate or monetization of the players. Personalized push notifications worked better in a study by Milošević et al. (2017), who employed early churn prediction and prevention, and were able to reduce churn up to 28%.

Lebres et al. (2018) studied the reasons for player drop-out in a free-to-play massively multiplayer online game, showing that latency and performance issues and game

fairness were the most relevant drop-out factors. In a study by Wu et al. (2009), continuance motivation had a strong impact on players' stickiness intention. In a study by Ross (2018), different definitions of retention were examined, and their ability to predict monetization tested with 51 free-to-play mobile games.

## In-app purchases and purchase behavior

According to Hanner et al. (2015), existing models of predicting purchase behavior from other similar domains do not function well in mobile free-to-play games and should be redesigned. This call has been answered as in-app purchases have gained a lot of attention in free-to-play game research, and many models have been created to best predict purchase behavior.

Already in 2010, Lee et al. (2010) used a General Bayesian network to look at users' intention to spend money on in-app purchases. Park and Lee (2011) explored the value of virtual items in free-to-play games by modifying the theory of consumption values. The authors then developed a new construct based on the modified theory. Chou and Kimsuwan (2013) studied factors affecting purchase intention in a free-to-play game in Thailand. Perceived enjoyment value, monetary value, and promotion programs were found to have significant positive influence on the purchase intention. According to a study by Ernst (2018), there is a negative correlation between patience and spending money on in-app purchases, while in a study by Jang et al. (2018), psychological needs of autonomy and relatedness were positively and competence need negatively correlated to making in-app purchases.

Looking at the differences between paying and non-paying players in social casino games, Gainsbury et al. (2016a) found that paying players were more likely to be younger, male, speak a non-English language, and have a university degree. Paying players were more likely to be more engaged and play more frequently, and were more motivated by social interaction in the games. In a similar study, Kim et al. (2017) found that paying players reported significantly higher levels of impulsivity, rewards sensitivity, and problem gaming severity, but not competitiveness.

Shi et al. (2015) examined the relationship between social dynamics and purchase decisions of free-to-play social game players. The authors found that both formal social groups within the game and informal social connections influenced purchase decisions. Contrary to this, the results by Drachen et al. (2018) in casual mobile games indicated that social activity did not correlate with becoming a paying player. The authors speculate that social features are relevant in predicting customer lifetime value in games where the social interaction is deeper.

Using competing risks approach, Chen et al. (2017) studied the relationship between paying hazard, the point where a player starts to pay for the game, and quitting hazard, the point where player quits the game. According to the authors, understanding how various aspects of customer behavior contribute to these hazards helps to predict the actions and influence them.

Voigt and Hinz (2016) predicted customer lifetime value from initial purchase information. Customers who made a purchase early, spent a significant amount of money on the initial purchase, and used credit cards to purchase credits, represent higher lifetime values. From the dataset, only 1% of the user base accounted for almost 85% of total revenue, and the authors stress the importance of identifying these high-potential customers as early as possible. In a study by Hanner and Zarnekow (2015), the authors deduced three hypotheses for purchase behavior, which were then confirmed: 1) the probability for conversion decreases over time before the user starts playing since the launch of the game, 2) the probability of the user's

retention increases with every purchase made, and 3) the amount of money users are willing to spend increases with every purchase. Sifa et al. (2015) used two prediction models, from which one predicted whether a player will become a paying user, and the other the number of purchases that will be made, while Kim et al. (2018) used social features and machine learning algorithms in link prediction in free-to-play mobile games.

Hamari (2015) studied why people buy virtual goods in free-to-play game services. The results show that enjoyment of the game reduces the willingness to buy virtual goods while it increases the willingness to continue playing. Continued use then has a positive prediction on purchase intention. Attitude towards virtual goods and peer attitudes strongly increase purchase intention. According to Hamari et al. (2017b), dimensions of service quality positively predict the continued use intention, but not the willingness to make in-app purchases.

Dew and Ansari (2018) developed a model-based approach to understand and predict user spending patterns. The data was visualized for easy interpretation. Bertens et al. (2018) created a machine-learning recommendation system for free-to-play games that offers purchases to players who might be most inclined to spend money.

Salminen et al. (2018) studied the effects of currency conversions in laboratory settings. Multiple conversions did not make the players more willing to spend money, but on the contrary made them more cautious. Players were most willing to pay to unlock new game content. Rietvield (2018) studied how much money players were willing to spend on a game depending whether it was assumed to be free or paid. Participants were more willing to pay more when they thought the game was premium, and were willing to spend more time playing it.

Hamari et al. (2017a) formulated a study instrument to explore concrete motivations to make in-app purchases. The purchasing reasons converged into unobstructed play, social interaction, competition, economic rationale, indulging the children, and unlocking content. Flunger et al. (2017) examined previous research on purchase motivations and introduced seven strategies for developers to implement. Based on the results of the literature review by Hanner (2016), the research has been shifting from usage intention to purchase intention. Hanner further notes that contrary to expectations, these two are not usually studied together.

### *Advertising and free-to-play games*
Burns et al. (2016) studied how in-game advertisements affect retention and created a model that could be used to measure user-level retention. By examining 21 free-to-play mobile games, the study discovered only a weak relationship between in-game advertisements and retention. The paper claims to stand in opposition to the shared presumption that in-game advertisements would have a strong negative influence on in-game behavior.

Mehrtens et al. (2018) formed a methodology to develop cluster data into sensible and homogenous segments to help game designers and consultants to identify variables and create automated decision-making algorithms to optimize in-game advertising, while Murray and MacIsaac (2015) modified the Sethi model to reach more accurate means to find optimal advertising strategies for free-to-play games.

Dheandhanoo et al. (2017) utilized data analytics of gameplay metrics to track an advertising campaign for a mobile free-to-play card game. By comparing the metrics before, during, and after the campaign, the authors were able to provide recommendations to improve future marketing campaigns.

Luna and Golightly (2017) compared free-to-play and advergaming strategies, and studied how they influence the enjoyment of mobile games through GameFlow (see Sweetser and Wyeth 2005). Both strategies can cause disruptions, which were seen as negative by the players, yet usually tolerated. Advergaming was preferred over free-to-play as it did not break the continuity of the game.

When compared to studies on in-app purchases, studies on advertising are still in a small minority, even though most free-to-play companies at the moment get their main revenue from advertising instead of in-app purchases (Nieborg 2016).

### Best practices for the industry
In addition to disengagement, in-app purchases, and advertising, several documents tried to uncover other best practices for game development. Seidl et al. (2018) analyzed when and how game developers should transform a game from pay-to-play to free-to-play, while Voigt and Hinz (2017) researched when launching new game servers in free-to-play massively multiplayer online games is advisable. Burger et al. (2016) analyzed match histories and statistics to develop models that could reduce latency in a multiplayer online battle arena game. Civelek et al. (2018) researched and gave guidelines for optimal strategies for pricing and game challenge level in monopoly and duopoly settings on the free-to-play mobile game market.

Xie et al. (2016) tried to solve the problem of predicting player behavior in cases where the player class distribution is biased. Gagné et al. (2012) developed a system to visualize player actions inside a casual free-to-play real-time strategy game. The system helped the developers to understand how players learned the game and how they played it. Saas et al. (2017) clustered player activity data in two free-to-play games to find patterns of player behavior to evaluate game events and game-business diagnosis. This data was then transformed into visualization to help intuitive interpretation of it.

Drachen et al. (2017) discussed the need to develop a common understanding of the key concepts of free-to-play mobile games. As the field is young, there is a lack of shared knowledge, understanding, and terminology. They suggested formation of stylized facts for analytics of the field. In order to achieve this, the authors call researchers to work towards clear definitions and assessing, evaluating, and building empirical evidence.

Moirn et al. (2016) examined the effect of game tutorials on casual and hardcore players in a free-to-play game. The results indicate that casual players need tutorials, and their presence improves purchase and continuous use intentions. However, for hardcore gamers the tutorial conditions caused no differences.

Harviainen et al. (2018) organized workshops with users and key stakeholders of free-to-play games to find alternative pricing models for them. The players optimally wanted a hybrid model that allows for various options. The participants reported that their motivation to pay was rather to reward the developers for good design instead of acquiring more content or play more easily. Feltwell et al. (2017) described a provocative augmented reality game concept inspired by and possibly critical of Pokémon Go. The idea included capturing the likeness of homeless people from their real environment with face-recognition technology.

### Industry studies
Only a few of the studies researched game companies and their practices. Koskenvirta and Mäntymäki (2015) studied how small and medium-sized free-to-play game companies use game analytics at a time when the understanding of and research on

game analytics were still lacking. The results showed that analytics are central to freemium game development and are used to assist design, reduce risks when launching new games, and to communicate with investors and publishers.

Vanhala and Kasurinen (2016) studied and compared five game companies based on how they understand their customers. Mobile game companies did not provide their players as many possibilities to build their virtual identity as those creating console or PC games. The article further compared customer-focused development and customer-driven development.

### *Free-to-play model characteristics*
Some of the studies tried to uncover the free-to-play characteristics, either by examining the games or their features. Tyni et al. (2011) performed a close reading of *FrontierVille* (Zynga 2010) to reveal the characteristics of free-to-play social network games and to function as a starting point for studying social network games.

Gruning (2013) performed a textual and structural analysis of the social network game *FarmVille 2* (Zynga 2012) with a focus on the values available in the digital objects within the game. The virtual items that have no in-game use value could be valuable only for their rarity and to construct identity. However, the game's lack of community undermined this potential.

Evans (2016) examined three mobile free-to-play games and how they monetize the impatience of players. The article discussed the apparent open access of free-to-play games, which is then commercialized and monetized. Evans calls for the attention of game studies to be directed towards examining the relationship between commercial motivation and game design, and for media and cultural studies to consider the social, cultural, economic, and political implications of impatience.

De Medeiros Filho et al. (2018) created a framework of free-to-play games acquisition, monetization, and retention (ARM) strategies comprising of 45 elements, 8 subcategories, and 3 main categories. These elements were seen as helpful when designing free-to-play games, but could also aid research of ARM strategies in games. Davidovici-Nora (2017) expanded the ARM components to include free-to-play e-Sports dynamics by going through *League of Legends* (Riot Games 2009) as a case example.

### *Heuristic evaluation*
Paavilainen et al. (2015) examined playability problems in social network games in two studies including heuristic evaluations, and found and confirmed domain-specific playability problems originating from the design characteristics of social network games: boring gameplay, click fatigue, interruptive pop-ups, friend requirements, spammy messages, and aggressive monetization. New heuristics for evaluating free-to-play games were presented by Paavilainen et al. (2018).

Petersen et al. (2017) created a lab-based mixed methods approach to evaluate the onboarding phase in free-to-play mobile games. By combining physiological measures and self-reported proxy measures, the authors evaluated these research techniques, finding physiological measures to be a valid method to evaluate mobile games when supported with qualitative measures. In another study related to the same data and methods, Thomsen et al. (2016) uncovered ten onboarding design heuristics for free-to-play mobile games.

## Free-to-play games and gambling

The connections between gambling and social casino games have been studied on several occasions. Namely, concerns that social casino games could work as a gateway to gambling games and further on to gambling problems have been raised.

Kim et al. (2014) studied the migration to gambling with a longitudinal survey for casino game players that had not previously gambled online. After six months, 26% reported having migrated to online gambling. The only found predictor for the migration was engagement in micro-transactions. In another study on migration, Gainsbury et al. (2016b) found that social casino games increased gambling for some, and the most commonly reported reason for the transition was the desire to win real money and gain more excitement. In an exploratory study by Gainsbury et al. (2014) with 10 social casino game players, social casino games were described as a safe activity, possibly a substitution for gambling, while they might have a problematic impact for some at-risk players.

In a literature review, Wohl et al. (2017) concluded that while some people will migrate to gambling games from social casino games and a small portion of those people may develop gambling problems, this transition was not inevitable or unidirectional. Social casino games may have positive consequences as well, such as functioning as a proxy for gambling for disordered gamblers.

Kinnunen et al. (2016) examined and compared the use of money between free-to-play games and gambling games through an interview study. While gamblers separated play money from other money, for free-to-play gamers the money was concerned as the same as used for other recreational activities. The separate framing could protect players from problematic use of money, and money management could become relevant to free-to-play game players, as well.

## Experiences and attitudes

Vázquez and Consalvo (2015) studied fairness and cheating in social network games through an online survey study. According to the results, players often dismiss the seriousness of social network games, and thus cheating was either not needed or not a part of gameplay expectations. Paying money to advance in the game was already seen as an accepted mode of playing and not considered cheating. Social network games intertwine into their platform, as sometimes the formal rules were seen to be determined by Facebook, sometimes by the game's code.

Lin and Sun (2011) examined whether the free-to-play model has an influence on play experiences and attitudes by analyzing two game discussion forums in Taiwan. Free-to-play games were considered inherently unfair by some, as they divide players into paying and non-paying player sub-groups. Non-paying players may suffer from boring and restricted gaming experiences and might never have the possibility to beat the paying players, while getting something through paying might also decrease the fun of the game and make achievements feel less real.

Paavilainen et al. (2013) interviewed Finnish Facebook users about their perceptions and experiences with social network games. Facebook games were regarded more as single player games with a social twist than truly social. The games managed to provide a wide spectrum of playful experiences for different needs, while also suffering from their design characteristics. Interviewees were reluctant to pay for them and saw in-game purchases in a negative light. In a similar study on free-to-play games in general, Alha et al. (2018) studied paying players and their attitudes and experiences. Early free-to-play games were seen considered poor and exploitative, while newer, better game experiences had made interviewees feel more positive about

the model. Spending money on free-to-play games was not seen as negative, but had instead become a normal activity.

Paavilainen et al. (2017) studied player experiences in *Pokémon Go* (Niantic 2016), a location-based free-to-play game, through a qualitative survey study on positive and negative characteristics of the game. Positive experiences were related to movement, sociability, game mechanics, and brand, and negative experiences to technical problems, unequal gaming opportunities, bad behavior, and unpolished game design. Surprisingly, the augmented reality features, safety issues, or the free-to-play revenue model did not receive considerable feedback.

### Addiction and problematic playing habits
The critical research approach to free-to-play games is typically connected to problematic playing habits. The connection between free-to-play games and Internet Gaming Disorder (IGD) was examined in a study by Dreier et al. (2016). From teenagers who played free-to-play games, 5.2% were classified as suffering from IGD. These players displayed higher psycho-social symptoms and higher degrees of perceived stress than non-problematic players. They also applied dysfunctional coping strategies more frequently and spent more money on games. ARPU (average revenue per user) was significantly associated with IGD.

Junior Ladeira et al. (2016) studied the effect of mobile free-to-play games on the well-being of children in Brazil. The authors state that free-to-play games that present high levels of escapism might be critical to the formation of experiential value. Regulation and public policies for games were called for to prevent children's dependence on games in relation to social life and compulsive consumption.

Gainsbury et al. (2017) found that playing and using money on social casino games was significantly positively correlated with symptom severity of problematic social casino game use. Soroush et al. (2014) studied the relationship between in-app purchases and self-control in *Candy Crush Saga* (King 2012), a casual free-to-play mobile game. The premise of the paper was that when facing frequent frustration and purchasing decisions in a free-to-play game, people with limited self-control may deplete this resource. Authors found that lower levels of self-control are correlated with money used in the game, but not with time played, addiction, or problematic playing habits.

### Culture, society, and politics
Cantallops and Sicilia (2016) studied how an important narrative event in a free-to-play multiplayer online battle arena game League of Legends affected the use of related champions and the motivation to learn about them. While the impact on champion usage was not statistically significant, the event did increase the motivation to read and learn about the champions, story, events, and optimal builds for the game, influencing the players' game literacy.

Nieborg (2015) used theories of multisided markets and critical political economy to study *Candy Crush Saga* and its relation to connective platforms operated by Google, Apple, Facebook, and Amazon. The way players share game-related posts on the host platform generates value for the game, and King has managed to successfully repurpose and integrate their gameplay into social media, mobile platforms, and their business model. In the symbiotic relationship between the game and the platform, the game adds value for Facebook by offering games directly on their platform and by providing revenue through advertising. Nieborg calls attention to the long-term political implications and sustainability of the free-to-play business model.

Page (2012) examined the Chinese free-to-play massively multiplayer online game *Zhengtu* (Zhengtu Network 2006) through classical Chinese philosophy. The game allows power over other players through in-app purchases, making it pay-to-win, a feature often frowned upon in western free-to-play development. Page notes that unlike western gamers, Chinese gamers see their game selves more as an opportunity to improve their holistic selves instead of creating alternative selves. Similarly, the boundaries between the real and the virtual are not similar in Chinese philosophy to what they are in the West. Page stresses that it is important for researchers to consider the history and culture of the population when studying online behavior, and not to assume western gamers as the default player type. Heimo et al. (2018) looked at the free-to-play business model through Aristotelian virtue ethics. They claim that looking through this lens, free-to-play games can offer shortcuts to personal character development when paying to be better instead of improving oneself, possibly leading to laziness and passive lifestyle.

Möring and Leino (2016) discussed games always being a product of their time and influenced by economic, political, and cultural history. Free-to-play games are introduced as a prime example of our neo-liberal society, where players invest time and effort to develop skills when it is uncertain whether they will be of use or not. The authors note that game studies discourse still regards games as a romantic form of liberalism, while the neo-liberal capitalistic view might be better suited for the task.

In a critical take on the free-to-play model, Nieborg (2016) pointed out how data tracking and collection create privacy issues. Furthermore, the free-to-play market is now dominated by a few net advertisers who have the means to spend enough on player acquisition to keep their dominant position.

## *Free-to-play model in other application development*

As free-to-play games have become successful, other games and game-related developers have started to look at them as examples. Especially studies related to games with a purpose have examined how to harness the attraction of free-to-play for the purpose of learning or improving something. Georgieva et al. (2015) and Meftah et al. (2017) studied the free-to-play model to understand the important features of the model that could then be used in serious games. Callaghan et al. (2014) and Madge et al. (2017) used game analytics tools and metrics previously used by the freemium industry to measure engagement in a serious game setting. In addition to serious games, Ketola (2014) presented how measurements used and refined in free-to-play games could be applied in software architecture decisions.

Games have also been developed with free-to-play mechanics in mind. Alanikula et al. (2014) described a game created to teach players about environmental education, where the money from in-app purchases went to charities devoted to the same issue. Dergousoff and Mandryk (2015) replaced in-app purchases with tasks that could be used in crowdsourcing, while checking whether the quality of the performed tasks was as good as in a laboratory setting. Dunwell et al. (2015) included energy mechanics commonly used in social free-to-play games and replaced paying with performing healthy tasks. Similarly, Dziedzic (2016) replaced in-app purchases with microwork and Mees et al. (2017) with math-based mini-games. While most studies use free-to-play as a positive example of how to improve other games or experiences, Dubbels (2016) discusses free-to-play experiences as unwanted in relation to gamification, noting that gamification should facilitate an immersive experience for the user instead of requiring tedious repetitive activities.

## FUTURE RESEARCH AGENDAS

The review shows that quantitative studies on player behavior are well covered, and while further research on these topics is still needed, there are other areas that are left without much attention. Free-to-play games form such a major phenomenon that it needs to be studied from multiple perspectives; especially humanities and social sciences need to be involved. Future research agendas that arose from the review are introduced below.

### Agenda 1: Industry studies to understand the practice of free-to-play development

The research is currently heavily focused on models connected to the economic side of the industry. The studies especially concentrate on predicting and preventing player disengagement and on in-app purchases, while some studies focus on how to best track player activity or study the effects of in-game advertising. This focus is understandable considering the major economic value of the free-to-play industry.

However, while a significant number of the documents claimed to have successfully created new models or improved previous models to be directly implemented in the practice and have even made the tools easier to use by visualizing the results, there is not much knowledge as to whether and to what degree free-to-play companies actually use these models and methods. Only one of the studies looked at the use of analytics in game companies (Koskenvirta and Mäntymäki 2015).

To understand the practice of how free-to-play games are actually developed, we need to approach game companies and study their practices. As the free-to-play game industry is widely spread both in numbers and in platforms and game types, there is presumably a wide variety of practices involved in the creation of the games. There is a lack of studies understanding the current game development process altogether, and even less research considers free-to-play game development.

### Agenda 2: Qualitative studies to understand player experiences

The majority of the documents had quantitative data and methods, using either survey data from players or log data directly from the game provider or a service. This is connected to the focus of the studies in general, as these are typical methods in computer science, business, and economic studies.

However, to understand the experiences behind the quantitative data, we need to explore them from another angle. Solely focusing on analytical data and metrics can improve the retention and revenues in the short-term, yet might not always lead to better game experiences. This can hurt the sustainability of the free-to-play model in the long-term.

To delve deeper into the variety and meanings free-to-play games offer, qualitative methodological toolsets are needed. Some studies include player interviews as the main method (Paavilainen et al. 2013, Alha et al. 2018), and increasing the volume and target of these studies can teach us more about the reasoning and meaning behind the numbers.

### Agenda 3: Close readings to understand free-to-play game characteristics

Close readings and case studies of games such as Tyni et al. (2011), Gruning (2013), and Evans (2016) help to understand free-to-play games and how they work. As free-to-play games evolve and change quickly, we need to keep updating our knowledge of the most recent titles.

Most of the studies either concentrate on a specific platform or genre, while some address all free-to-play games as one entity. We still have little understanding of the differences between free-to-play game types, while the model continues to cover an increasingly wider variety of games and platforms. The gameplay and attitudes towards different types of games vary significantly. Close readings could reveal more about the common features of a fractured field of games. The need for understanding different business segments of different types of free-to-play games has also been noted by Flunger et al. (2017).

## Agenda 4: Studies to understand the meanings of free-to-play games in our culture, society, and politics

Free-to-play games are often regarded as an inferior or less serious mode of gaming (Paavilainen et al. 2013, Alha et al. 2018), and this might influence the researchers' motivation and will to study the games as meaningful objects or experiences. However, these games can provide meaningful experiences (Paavilainen et al. 2013), facilitate the formation of gaming communities, and help tie meaningful relationships (Alha et al. 2018).

Especially as free-to-play games represent a vast majority of the market and are played by wide audiences, their implications on game cultures and culture in general need to be studied. Games do not exist in a vacuum, and studies into free-to-play games intertwining with culture and politics such as those by Nieborg (2015) and Möring and Leino (2016) are especially important. At the moment, studies are also overwhelmingly concentrated on the western free-to-play world. Understanding the differences between free-to-play gaming cultures and taking these into account when studying free-to-play phenomena are crucial, as also noted by Page (2012).

While the free-to-play model has been criticized for its negative influences, only a few documents examined it from this viewpoint. In these cases, the focus fell on addiction and problematic behavior. The ethics of free-to-play game design were rarely brought up despite them being a major discourse in public discourse surrounding the games. As free-to-play games are popular and widespread, their impact on society can be considerable and grants closer inspection, both of its beneficial and detrimental aspects.

## CONCLUSIONS AND LIMITATIONS

This article has presented a systematic review on free-to-play game research. The review shows that the amount of research on the free-to-play model has increased, yet it is unbalanced in favor of quantitative studies examining how to predict or improve profitability. The review shows a lack of qualitative approaches and critical views on the model and its meanings for culture and society. Through analysis of the documents, four future research agendas were formulated: 1) Industry studies to understand the practice of free-to-play development, 2) Qualitative studies to understand player experiences, 3) Close readings to understand free-to-play game characteristics, and 4) Studies to understand the meanings of free-to-play games in our culture, society, and politics.

The review does not include all of the free-to-play research conducted so far. The search left out some of the key research, such as Lewis et al. (2012), Alha et al. (2014), and Kimppa et al. (2016). This weakness is at least partly due to Scopus, which while being wide in its inclusion of publications, emphasizes the natural sciences and engineering (Mongeon and Paul-Hus, 2016). In the future, this review can be expanded to provide an even more comprehensive and balanced view. This can be achieved in three steps: 1) Including more databases to resolve the Scopus bias, such as Web of Science, and databases especially important for game research,

such as DiGRA Digital Library. 2) Going backward by reviewing the citations from the resulted documents. 3) Going forward to identify documents citing the selected documents.

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