

An Empirical Study of Early Access Games on the Steam Platform

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Abstract “Early access” is a release strategy for software that allows consumers to purchase an unfinished version of the software. In turn, consumers can influence the software development process by giving developers early feedback. This early access model has become increasingly popular through digital distribution platforms, such as Steam which is the most popular distribution platform for games. The plethora of options offered by Steam to communicate between developers and game players contribute to the popularity of the early access model. The model is considered a success by the game development community as several games using this approach have gained a large user base (i.e., owners) and high sales. On the other hand, the benefits of the early access model have been questioned as well.

In this paper, we conduct an empirical study on 1,182 Early Access Games (EAGs) on the Steam platform to understand the characteristics, advantages and limitations of the early access model. We find that 15% of the games on Steam make use of the early access model, with the most popular EAG having as many as 29 million owners. 88% of the EAGs are classified by their developers as so-called “indie” games, indicating that most EAGs are developed by individual developers or small studios.

We study the interaction between players and developers of EAGs and the Steam platform. We observe that on the one hand, developers update their games more frequently in the early access stage. On the other hand, the percentage of players that review a game during its early access stage is lower than the percentage of players that review the game after it leaves the early access stage. However, the average rating of the reviews is much higher during the early access stage, suggesting that players are more tolerant of imperfections in the early access stage. The positive review rate does not correlate with the length or the game update frequency of the early access stage.

Based on our findings, we suggest game developers to use the early access model as a method for eliciting early feedback and more positive reviews to attract additional

new players. In addition, our findings suggest that developers can determine their release schedule without worrying about the length of the early access stage and the game update frequency during the early access stage.

Keywords early access games · computer games · Steam

1 Introduction

Every year, 70% of the software development projects do not deliver the expected product [19], despite the expenditure of \$275 billion on software development projects in the U.S. alone [18]. The failures include total failures, time and budget overruns, and unmet user requirements [19].

In order to prevent the problems of overrunning budget and time, and to better meet the user requirements, a *public beta-release* release strategy is commonly used by software developers. As early as in 1984, a “pioneer edition” of the WordVision word processor for the IBM PC was available for early customers to purchase [29]. Microsoft launched “Office Insider” program in late 2015, which allows customers to get early access to the latest Office features and provide feedback [13]. Another example is the game Minecraft. Available since 2009, Minecraft stayed in public beta until 2011 [33]. As the sales of the public beta version increased, its developer was able to quit his day job to work on Minecraft full-time [31]. During the beta stage, Minecraft raised over \$33 million from the public beta sales while accumulating over 1.8 million players [35].

Inspired by the successful application of the public beta release strategy in games such as Minecraft, Steam, the dominant digital game delivery platform, started to offer game developers the opportunity to release their games as public betas in March 2013. These so-called “Early Access Games” (EAGs), allow customers to purchase the public beta version of a game while developers continue working on the game using the raised funds. Developers of EAGs receive crucial feedback and bug reports directly from their target community, while players have the opportunity to be the first to play new games and get involved with games as they evolve. Hence, as declared by Steam, early access is “*the way games should be made*” [46].

The early access model made a name for itself through several successful games, such as the *DayZ* game¹. The multiplayer survival-based game reached 400,000 sales during its first week as an EAG, according to its developer Bohemia [11].

However, the benefits of the early access model have been questioned as well. For instance, the *Spacebase DF-9* game² abandoned the early access stage unexpectedly as the funds raised during that early access stage were not sufficient to continue the development process. As a result, many promised features were left unimplemented, disappointing many players of the game. The game received 77% negative reviews [47]. Shortly after abandoning the early access stage and terminating the development, twelve employees were laid off including the programmer and project lead [23]. The developer stated that all funds raised during the early access stage went

¹ <http://store.steampowered.com/app/221100/>

² <http://store.steampowered.com/app/246090/>

into the development of the game, but that eventually the studio was spending more than it was making [38].

Along with the aforementioned failure of the early access model, the debate of whether early access is as good as expected has been raised. One year after the release of the Steam Early Access Release Platform, Walker [49] calculated that only 25% of the EAGs have left the early access stage. Recently, Allen [2] manually investigated the first 50 released EAGs and warned people that the early access model may be “a ticking time bomb”, as the development of 32 (64%) of the first 50 EAGs is either abandoned or inactive. Allen states that the early access model currently has a bad reputation and is leading games to a “Development Hell”, and calls for a systematic in-depth study of all EAGs to examine the opportunities and risks that lie behind the early access model.

In order to get a better understanding of the impact and limitations of the early access model, we conduct such an in-depth empirical study on EAGs on the Steam platform. The study aims at providing developers with the characteristics of the early access model, the degree of interaction between developers and players of EAGs with the Steam platform, and the tolerance of players of the quality of EAGs. Additionally, based on these results, we provide suggestions for developers to make best use of this novel release strategy. In particular, we address the following three research questions (RQs):

RQ1: What are the characteristics of the early access model?

Currently, 15% of the games on Steam use the early access model. The early access model tends to appeal mostly to individuals or small studios for releasing their indie games. However, using the early access model is not a guarantee for collecting enough funds to continue the development of a game.

RQ2: How do developers and players of EAGs interact with the Steam platform?

Developers update a game more frequently during its early access stage. Players post less reviews, however players have more discussion posts in the early access stage.

RQ3: How tolerant are players of the quality of EAGs?

Players of EAGs tend to be more tolerant of the quality of a game during its early access stage. While players tend to post less reviews within the early access stage, 89% of EAGs receive an equally or more positive review rate in their early access stage. In addition, developers do not need to rush into releasing their games, as the tolerance of players does not correlate with the length of the early access stage.

Paper Organization. The rest of the paper is organized as follows. Section 2 provides the background of our study and discusses related work. Section 3 explains our study methodology. Section 4 presents the results of our study. Section 5 discusses several additional interesting insights that we came across during our study. Section 6 discusses threats to the validity of our study. Finally, Section 7 concludes the paper.

2 Background

This section describes the Steam gaming platform, the mechanism of Steam’s early access release platform, the differences between crowd-funding and early access, and the related work.

2.1 Steam Gaming Platform

Steam is a digital game distribution platform developed by Valve Software. Over 8,000 games are distributed through Steam and the platform has over 161 million active players [15]. The Steam platform consists of two major components: the Steam Store and the Steam Community. Players can purchase and download games through the Steam Store and interact with other players and game developers through the Steam Community.

After playing a game through Steam, players are able to post a review for that game on its Steam Community page. Different from most application distribution platforms, e.g., mobile app stores, instead of the star-rating mechanism, players are asked to provide their overall feeling for the game: “Recommended” (i.e., a positive review), or “Not Recommended” (i.e., a negative review). Additionally, each review can be upvoted as “helpful”, “not helpful”, or “funny” by other players. The positive review rate ($\frac{\# \text{ of recommended reviews}}{\# \text{ of all reviews}}$), and the reviews that are upvoted most as “helpful” are displayed on the Steam Store to advise potential customers.

In addition to the review mechanism, the Steam Community provides a discussion forum for each game in which players and developers can communicate. The forum of a game can have a variety of subforums that are created by developers. By default, a forum contains two subforums that are created by Steam, which are *General Discussions* and *Trading*. The *Trading* subforum is specifically for players to trade in-game properties, such as rare weapons, while *General Discussions* normally contains threads regarding bug reports, suggestions, questions, etc.

The Steam Community also provides functionality for developers and journalists to publish news updates for games on so-called channels. In general, developers post announcements about game updates to one or more channels, e.g., to the *Product Update* channel. Because it is mandatory to install the latest game updates for players of a game on Steam, developers may opt to update their game silently. Nevertheless, in order to keep players aware of the latest news about a game, developers tend to post news updates whenever a new update is released.

2.2 Steam Early Access Release Platform (SEARP)

The SEARP was launched on March 20, 2013, with 12 game titles available initially [51]. The platform allows developers to release unfinished, yet playable games, so-called *Early Access Games* (EAGs). By purchasing an EAG, players are allowed to download and play that game in its current state and as it evolves, even after the game leaves the early access stage.

The SEARP provides developers with early access sales and distribution mechanisms. The developers of EAGs have the freedom to determine when to move a game out of the early access stage. In addition, developers have the freedom to increase or decrease the price of their game at any time. Players are aware of the risk that a game may be incomplete, buggy, or unfinished when purchasing an EAG. All reviews posted during the early access stage of a game are tagged as “early access review”, hence they can be distinguished from the reviews that are posted after leaving the early access stage.

2.3 Crowdfunding vs. Early Access

Crowdfunding is the practice of funding a project or venture by raising small amounts of money from a large number of supporters, typically via the Internet [10]. Many games use a type of crowd-funding model called “Reward Crowdfunding” to support the game development costs, by which the developers pre-sell the product to launch the project without incurring debt [7].

There exist similarities between the crowdfunding and early access model, as both models raise funds by selling products before their completion. However, the differences between early access and crowdfunding are worth noting. Although many crowd-funded games promise to offer access to alpha or beta versions of the game, no playable version usually exists during the initial crowd-funding campaign. All Steam EAGs offer an immediately playable version of the unfinished game to customers. However, in both models paying customers take the risk that they may never see a final release of the game.

It is worth noting that in order to minimize the risk, Valve (the company to which Steam belongs) tightened the SEARP rules for developers on November, 2014, stating that SEARP is “meant to be a place for games that are in a playable alpha or beta state, are worth the current value of the playable build, and the developer plans to continue to develop for release” [52]. The newly added rules include “Don’t launch in Early Access if you can’t afford to develop with very few or no sales” and “Make sure you set expectations properly everywhere you talk about your game”, which seem to directly target the failure of the aforementioned *Spacebase DF-9* game, a month before releasing the new rules. We further discuss the learnt lessons from the *Spacebase DF-9* game failure in Section 5.

2.4 Related Work

In this section, we discuss prior research related to our study. Most of the work that is related to our study focuses on early releases in software or on user involvement in software development.

2.4.1 Mining Digital Distribution Platforms

Most of the work about mining digital distribution platforms focuses on mining mobile app stores. Martin et al. [30] survey the field of app store analysis within a soft-

ware engineering context. They observe an increasing size of the studied app samples and a diverse set of techniques and applications in app store analysis, highlighting the health and future potential of the field.

Mining data from digital gaming platforms is an area that has been gaining attention recently. In our previous work [24], we study urgent updates of popular games on the Steam platform. One of our major findings is that the update strategy that is chosen by a game developer affects the number of urgent updates that are released. Chambers et al. [5] analyze two years of game traffic on several gaming platforms, including Steam. They demonstrate the difficulty of providing enough resources at launch time of a game and they show that gamers are extremely difficult to please.

Several game blogs explore the potential risk of SEARP. Walker [49] points out that only 25% of the EAGs are released as a full game (by November 2014). Allen [2] manually goes through the first 50 games released on SEARP, and finds that 20 games (40%) have not had an update in the last 3 months (as of November 2nd, 2016).

Our work re-examines most claims in the aforementioned game blog posts with a newer and larger dataset, and explores the topic with more depth and greater rigor.

2.4.2 Beta Releases in Software

Several studies regarding the perpetual beta (i.e., where the product is developed in the open, with new features added on a monthly, weekly, or even daily basis) in software have been done. O'reilly [34] points out that one of the fundamental changes in the software release cycle in Web 2.0 is the use of the perpetual beta in which users are treated as co-developers. Ullrich et al. [45] states that the perpetual beta increases the value a user gets from using the service. Developers using the perpetual beta release model are interested in feedback and are open to suggestions.

Al-Ani et al. [1] find that traditional software development models either impose too tight (i.e., costly and infeasible) or too loose (i.e., not efficient) restrictions on user participation in the development process. They suggest a continuous form of participation is the most efficient form of participation. Maalej et al. [28] propose a continuous and context-aware approach for communicating user input to engineering teams.

Our study is one of the first to study beta releases (i.e. the early access model) in games.

2.4.3 Interaction between Users and Developers

Several studies on interaction between users and developers exist in literature. One of the topics is about the participatory design in games. Jacobs et al. [17] distinguish two forms of participatory design between players and developers that are commonly implemented: direct participatory design (connecting with a small number of highly active players) and silent participatory design (silently log all actions from all players). Jacobs et al. use the example of Facebook games that are developed by the Zynga company to show that these two forms can be implemented in a perpetual beta. However, Jacobs et al. warn that once the game development is centered around player

Table 1: Dataset description

# of games	8,025
# of EAGs	1,182
# of current EAGs	786
# of former EAGs	396
# of news updates	104,236
# of release notes	38,249
# of EAG news updates	31,916
# of EAG release notes	16,780
# of reviews	12,338,364
# of early access reviews	1,564,574
# of discussion posts of former EAGs	801,128

feedback, in the end, the game environment will become unbalanced as players only design the game from a player perspective (wanting what is scarce in the game).

Löwgren et al. [27] claim that participatory design is a mutual learning process between users and designers and it is not only users participating in design, but also designers participating in use. Taylor [42] explores relationships between players and developers of massively multiplayer online games (MMOG). Löwgren et al. state that *“at the heart of games is a complex negotiation between what the player might like to do and what they must or should do.”*

Other examples include user involvement in software development. Kujala [20] conducted a study of the benefits and challenges of user involvement. The study claimed that user involvement generally has a positive effect, especially on user satisfaction. However, the role of users must be carefully considered, as developers and users tend to have difficulties in communicating, and user groups may have conflicts.

Damodaran [9] provide guidelines for user involvement in the system design process. Gallivan et al. [14] proposed a process model that delineates the four stages of communication between users and software developers, and advised researchers and practitioners on how to leverage the potential benefits of user participation, rather than take the benefits for granted.

The early access model has a potential to improve user involvement in game development. This paper makes an initial step by exploring how users and game developers interact with the Steam platform.

3 Methodology

This section introduces the methodology of our empirical study of EAGs. We detail how we extract and process data. Table 1 presents the description of our collected dataset. Figure 1 gives an overview of our methodology.

3.1 Collecting Basic Game Information

We develop a customized crawler to take a snapshot of all the 8,025 games that are available in the Steam Store on March 7th, 2016. We collect the title, developer, pub-

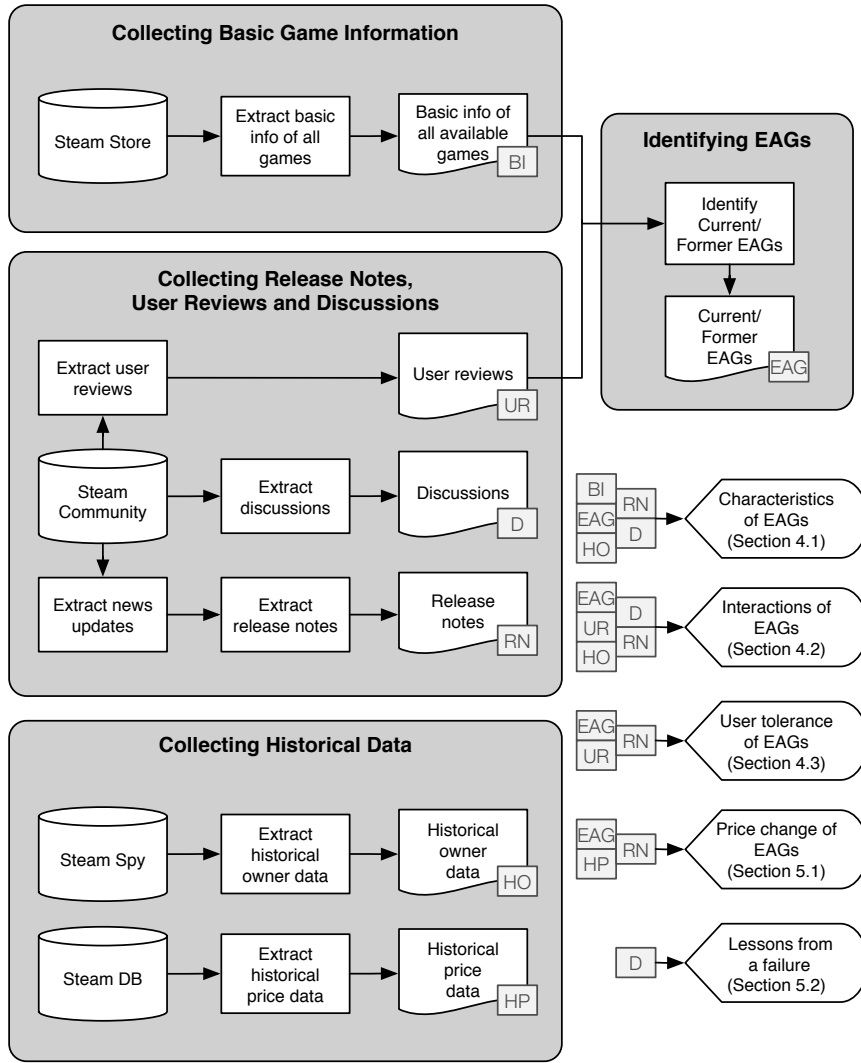


Fig. 1: Overview of our study

lisher, tags, genres, and current early access status (i.e. whether the game is in the early access stage or not) of each game. The tags of a game are specified by its players, while the genres of a game are specified by its developer.

Table 2: Release note for the *Team Fortress 2* game

Title	Team Fortress 2 Update Released
Channel	Product Updates
Date	12 Oct, 2015
<p>An update to Team Fortress 2 has been released. The update will be applied automatically when you restart Team Fortress 2. The major changes include:</p> <ul style="list-style-type: none"> - Fixed a client crash related to the contract menu. - Fixed an issue where some players could not use some of the crafting recipes - Running in textmode now places the client in insecure mode - Updated the localization files 	

3.2 Collecting Release Notes, User Reviews and Discussions

In order to study the update frequency of games, we use the accompanying release notes that are posted on channels in the Steam Community. We use the process described in our previous work [24] to extract release notes from the channels. We briefly describe the process below.

Although the Steam Community provides developers with a special channel named *Product Updates* for release notes, we observe that many release notes are posted on other channels, e.g., *Community Announcements*. To avoid missing any release notes, we extracted all news updates on all channels for all games. We observe that the channels for online magazines that review games are irrelevant to release notes, and official game blogs that cross-post patch notes are redundant. Hence, we only keep the release notes that are posted on the *Client Updates*, *Product Releases*, *Product Updates* and *Steam Community Announcements* channels for further analysis.

All news updates posted on all the Steam Community channels of a game are aggregated in the “Related news” page of the Steam Store³. These news updates include information such as game announcements, promotions, and release notes. Table 2 shows an example of a release note for the *Team Fortress 2* game⁴.

We extracted all 104,236 news updates for all available games on March 7th, 2016 using a custom-written crawler, and perform the following steps to extract release notes from all news updates.

1. We keep all news updates that are posted on the *Product Release* or *Product Update* channel.
2. We remove all news updates of which the title does not contain the words *update*, *release*, *patch*, *hotfix*, *change log* **OR** a version number.
3. The news updates that remain, together with the news updates from step 1 are considered as release notes.

We identified 38,249 release notes for all 8,025 games. In order to validate the precision and recall of our extraction steps, we manually analyze a statistically representative sample of 383 news updates (95% confidence level and 5% confidence interval, taken from 104,236 news updates for the studied games). The precision is

³ E.g., related news for the *Dota 2* game: <http://store.steampowered.com/news/?appids=570>

⁴ <http://store.steampowered.com/app/440/>

calculated as $\frac{\# \text{ of correctly identified release notes in the sample}}{\# \text{ of identified release notes in the sample}}$, and the recall is calculated as $\frac{\# \text{ of correctly identified release notes in the sample}}{\# \text{ of release notes in the sample}}$. The manual analysis shows that our extraction steps have a precision of 89% and a recall of 87%.

We extract all the reviews for each game from the Steam Community. There are in total 12,338,364 reviews across all supported natural languages. We also extract all the threads from the discussion forums on the Steam Community for all EAGs that have left the early access stage. We extract discussion posts for EAGs that have left the early access stage only, because doing so allows us to study the difference in interaction between players and the Steam platform through the discussion forums within and after leaving the early access stage. We extract the discussion posts (i.e., a message by a user or developer) from all the subforums except for the *Trading* subforum, because the discussion posts in *Trading* do not contain player feedback, but discuss trades among players. In total, we extract 801,128 discussion posts.

3.3 Identifying EAGs

Because Steam does not provide a list of EAGs, we use the following approach to identify them.

3.3.1 Current EAGs

If a game is currently in the early access stage, its Steam Store page would explicitly state that this game is an EAG. We use the existence of this statement to identify games that are currently in the early access stage. These games are in the remainder of this paper referred to as current EAGs.

3.3.2 Former EAGs

Because the Steam Store does not explicitly identify games that have already left the early access stage, we use the existence of early access reviews (i.e. reviews with the “early access review” tag) to get a minimal indication of whether the game used the early access model at some point. The identified games are in the remainder of this paper referred to as former EAGs.

3.4 Collecting Historical Data

We extract the history of the number of owners since March 20th, 2015 for all games from Steam Spy [15], a third-party project which continuously monitors the Steam platform. People own a game when they buy the game on Steam, in retail and then activate on Steam, or when they receive the game through a promotion or as a gift [15]. Different from owners, the players of a game are people who play the game during a specific time range. Hence, the number of owners is not necessarily the same as the number of players in a day. However, as we only use the number of owners in our study, we use players and owners interchangeably in the remainder of this paper.

Due to the large quantity of data that is collected from the Steam platform, the crawl cannot be done instantly. In fact, the crawling process started on March 7th and ended on March 19th, after which the number of owners' data was crawled from Steam Spy on March 20th. We use the data from both sources up to March 7th to ensure that we study the same time frame for all games.

As often happens in the game industry, all the data needed to track sales figures on Steam are not publicly available. Nevertheless, Steam Spy estimates the number of owners of a game [36]. The method uses information from user profile pages on the Steam Community, which shows the games that a user owns. Theoretically, by crawling the profile pages for all users, we can calculate the accurate ownership statistics. Practically, with about 172 million users (and growing every day) on Steam, it is hard to have the computing power needed to churn through all profile pages in a timely manner. Steam Spy randomly crawls a representative sample of user profile pages to estimate the number of owners. To be more accurate, Steam Spy uses a three-day rolling sample to generate the final reported numbers of owners, i.e., every day, the data from three days prior are replaced by newly-crawled data. About 1,700,000 randomly-selected profiles are crawled every three days.

We also extract the price history since November 27th, 2014 for all games from the Steam DB project [37], another third-party project that monitors the Steam platform. We use the price of a game in U.S. Dollar in our study.

4 Early Access Games (EAGs)

This section presents the results of our empirical study on EAGs.

4.1 RQ1: What are the characteristics of the early access model?

Motivation: We study the characteristics of the early access model. As few previous studies have focused on the early access model in the game industry [2, 49], it is essential to have a general understanding of the current status of the model. The results that are described in this section motivate the remainder of our paper.

Approach: We analyze the popularity of the early access model by studying the number of games on the SEARP and the number of owners of EAGs. We plot the proportions of games that are released as EAGs by each developer. In addition, we calculate the length of the early access stage, and study the drivers for short and long early access stages.

In order to get the length of the early access stage of each game, we manually check the release notes for each game and identify the release notes that describe the availability of the game on Steam and the game leaving the early access stage. We use the number of days between the publication dates of these two release notes as the length of the early access stage. As mentioned in Section 2, it is not mandatory for developers to publish these release notes. We were able to identify 227 out of 396 games which have both release notes for entering and leaving the early access stage. We use R and Python for our statistical analysis.

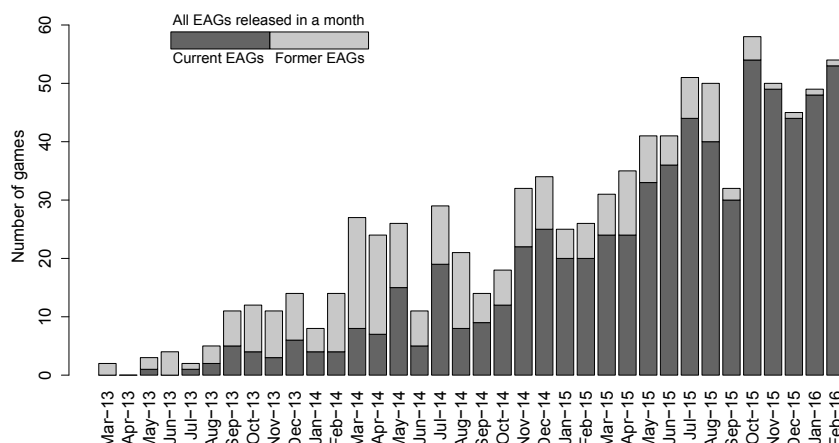


Fig. 2: The number of EAGs that are released since the start of the SEARP. The darker part represents the number of EAGs that are released in that month that are still in the early access stage at the time of our data collection. The lighter part represents the number of EAGs that are released in that month that have left the early access stage at the time of our data collection.

Findings: 15% of the games on Steam make use of the early access model and its popularity is growing. Of the 8,025 games that are available on Steam, 786 games are current EAGs, and 396 games are former EAGs. As a result, 1,182 (15%) games are or were making use of the early access model.

Figure 2 shows the popularity of the early access model. The figure clearly shows that there is a growing trend of popularity in the use of the early access model. With 64 games released on the Steam early access platform in 2013, and 485 games newly available through early access in 2015, the model shows a 660% increase in the absolute number of releases.

The increasing trend in popularity is confirmed by Figure 3, which shows the ratio of the number of EAGs that are released each month and the total number of games that are released in that month. The ratio increases from approximately 0.05 to 0.20 in early 2016.

25% of the EAGs have more than 48 thousand owners, with almost 29 million owners for one of the studied EAGs. Figure 4 shows the distribution of the number of owners of EAGs. A considerable number (62%) of the EAGs has been available for less than a year, leading to a median number of owners of 11,270. Moreover, 25% of the EAGs have more than 47,950 owners, with 43 (3%) of the EAGs having more than 1 million owners. The most popular EAG, the *Killing Floor 2* game⁵ has 28,878,959 owners.

⁵ <http://store.steampowered.com/app/232090/>

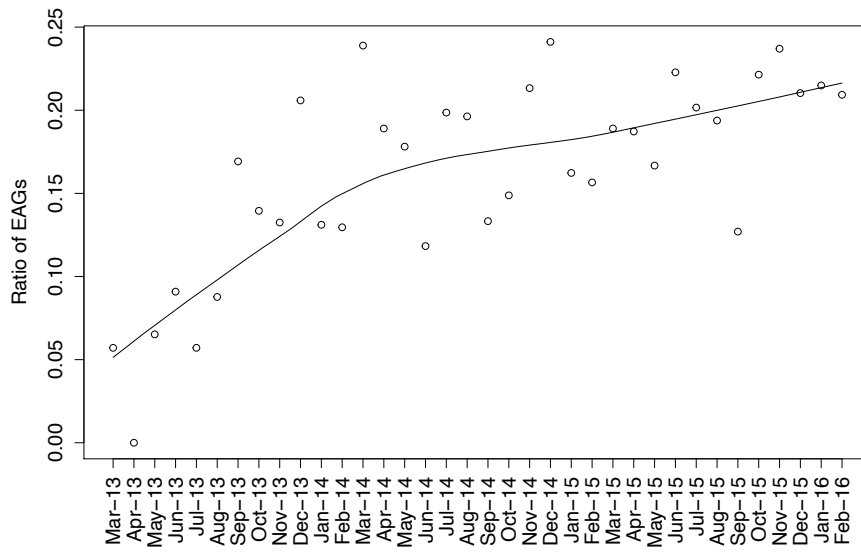


Fig. 3: The ratio of the number of released EAGs each month and the total number of games that are released in that month. The smooth curve is computed using a Local Polynomial Regression Fitting [6].

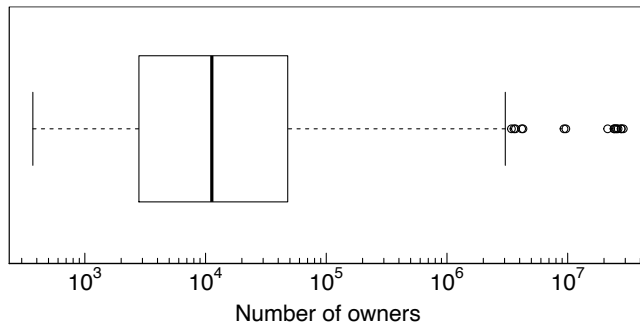


Fig. 4: Distribution of the number of owners of EAGs.

34% of all EAGs have left the early access stage. This number can partly be explained by the recency of an early access release. However, EAGs from 2013 do not have a considerably higher percentage of leaving the early access stage. Only 162 (50%) of the 322 EAGs that were available before 2014 have left the early access stage. Hence, customers are taking the risk that an EAG will possibly spend a long time in development (or that the game will even fail to leave the early access stage eventually).

Table 3: Top 10 genres for EAGs and non-EAGs

EAGs			Non-EAGs		
Genre	# of games	%*	Genre	# of games	%*
Indie	1,046	88.49	Indie	3,863	56.45
Early Access	783	66.24	Action	3,246	47.44
Action	752	63.62	Adventure	2,859	41.78
Adventure	499	42.22	Singleplayer	2,123	31.02
Strategy	403	34.09	Casual	2,003	29.27
RPG	363	30.71	Strategy	1,663	24.30
Simulation	348	29.44	RPG	1,318	19.26
Multiplayer	322	27.24	Simulation	1,173	17.14
Singleplayer	296	25.04	Multiplayer	1,084	15.84
Casual	231	19.54	Puzzle	906	13.24

* Note that these percentages do not add up to 100% as developers can assign multiple genres to their games.

Walker [49] has conducted a similar calculation in 2014, and obtained a percentage of 25% instead of 34%. We contacted Walker and he kindly provided a list of games that were studied in his article on early access games. After comparing our dataset with his list, we found that only 266 of the 366 games in his list were available on Steam at the time at which we collected our data. Hence, one possible explanation of the 9% growth is that in the past two years some EAGs were removed from the Steam store. Therefore, these games were no longer available at the time that we collected our dataset.

88% of the EAGs are indie games, indicating that most EAGs are developed by individual developers or small studios. Table 3 shows the top 10 developer-defined genres for EAGs. For both EAGs and non-EAGs, indie games are the largest genre. However, only half of the non-EAGs are defined as indie games, while 88% of the EAGs are indie games.

To the best of our knowledge, there is no official definition of what an “indie” game involves. We use the universal definition as concluded by Stern [40]: “A game that is both (a) developed to completion without any publisher or licensor interference, and (b) created by a single developer or a small team.” We assume that games classified under the “indie” genre on Steam follow this definition.

To validate this definition, we extract 4,927 unique developers from the basic information of all 8,025 games and count the number of games that are released by each developer. Figure 5 shows the relation between the number of games and the percentage of EAGs that are developed by the same developer. When calculating the percentage of EAGs, we manually filter out the games that are released before March 20, 2013 (i.e., the start date of the SEARP), the games that are re-released back to Steam, and the games that are content packs for existing games, as logically these games did not have the chance to be released as EAGs. The developers that do not have any game released after March 20, 2013 are also not shown in the figure. Figure 5 indicates that, as developers release more games, the percentage of EAGs decreases, indicating that EAGs are mainly developed by individuals or small studios with less games.

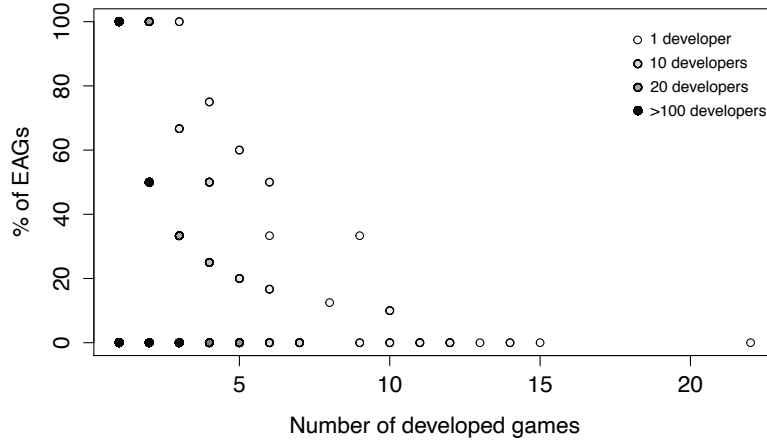


Fig. 5: Relation between the number of games and % of EAGs that are developed by the same developer (darker dots represent a larger number of developers with that relation)

Table 4: The number of EAGs per development studio

Number of EAGs	Number of Studios
0	3,814
1	1,062
2	41
3	9
4	1
Total	4,927

Table 4 shows the number of EAGs per development studio. Table 4 shows that most studios have zero or one EAGs.

Most former EAGs have spent less than a year in the early access stage. Figure 6 shows the distribution of the length of the early access stage for former EAGs. 160 of 227 (70%) former EAG spend less than 365 days, i.e. a year, in the early access stage, with a median of 225 days. The longest early access stage record, 929 days, is kept by the *Prison Architect* game⁶. We manually check the discussions between developers and players on discussion forums in the Steam Community of games that are more than 800 days in the early access stage, and identify the following reasons as claimed by developers for the long length of the early access stage:

1. A lack of developers in the team, or a lack of funds to hire developers for the team (*Grim Dawn* [32]).

⁶ <http://store.steampowered.com/app/233450/>

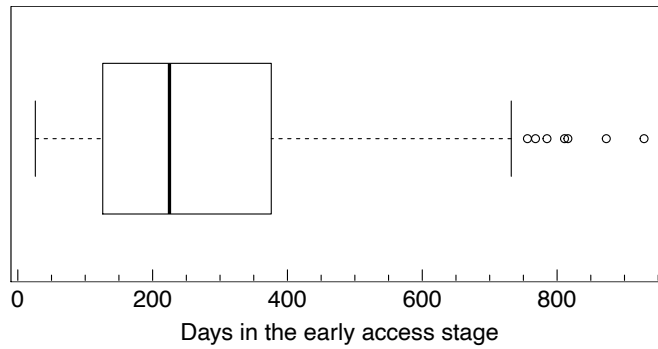


Fig. 6: Distribution of the days in the early access stage for former EAGs.

2. A lack of experience or specific skills by the developers (e.g., UI art) (*Under-rail* [25], *Grim Dawn* [32]).
3. Difficulties of estimating the full budget, which causes the delay of hiring more developers (*Grim Dawn* [32]).
4. A refusal to launch the game until it reaches a very high standard with which the developers themselves are satisfied (*Edge of Space* [21, 22]).

In addition, we manually check the release notes of the ten EAGs with the shortest length in the early access stage. The developers of two of such games give the reason for the short length of the early access stage, while the other eight EAGs do not give a reason. The developers of the *Parcel* game⁷, which only stayed in the early access stage for 26 days, stated that they had gone over budget and that the early access model failed as a funding channel for them [41]. The developers of the *RONIN* game⁸, which spent 34 days in the early access stage, explained that the game had already been tested by beta testers, other developers and third-party testing studios, and their goal was to perfect the game by using the honest feedback that is gathered in the early access stage [48].

Currently, 15% of the games on Steam use the early access model. The early access model tends to appeal mostly to individuals or small studios to release their indie games. However, using the early access model is not a guarantee for collecting enough funds to continue the development of a game.

4.2 RQ2: How do developers and players of EAGs interact with the Steam platform?

Motivation: One of the major benefits of the early access model for developers is that it is possible to get early feedback on a game, for example, through reviews

⁷ <http://store.steampowered.com/app/316080/>

⁸ <http://store.steampowered.com/app/274230/>

that players post on the Steam platform. As early access players should be deeply involved in the development process as claimed by Steam [46], we expect to see a stronger interaction of players with the Steam platform in the early access stage of a game. In addition, we expect that developers post more updates for an EAG, as they are improving the game (for example, based on the feedback that they acquire from user reviews).

Approach: We compare the average review rate ($\frac{\# \text{ of reviews}}{\# \text{ of owners}}$) within the early access stage and during the entire lifetime of a game. In addition, we compare the discussion participation rate ($\frac{\# \text{ of posts}}{\# \text{ of owners}}$) within and after leaving the early access stage. We use the average review rate and the discussion participation rate to capture the interaction between players and the Steam platform. Furthermore, we calculate the update frequency ($\# \text{ of days between adjacent release notes}$) within and after leaving the early access stage. We use the update frequency to capture the interaction between developers and the Steam platform.

Because of promotional actions on Steam, the number of owners of a game can decrease. For example, there is a type of promotion named “free weekends”, which temporarily offers certain games at no charge. Players who get a game on a “free weekend” would only own the game for a limited time. However, these temporary owners are able to review a game as well. Hence, we use the highest number of owners that is observed during the early access stage and the lifetime of a game for our analysis.

We use the Wilcoxon signed-rank test to compare the metrics within and after leaving the early access stage. The Wilcoxon signed-rank test is a paired, non-parametric statistical test of which the null hypothesis is that two input distributions are identical. If the p-value computed by the Wilcoxon signed-rank test is smaller than 0.05, we conclude that the two input distributions are significantly different. On the other hand, if the p-value is larger than 0.05, the difference between the two input distributions is not significant.

In addition, we calculate Cliff’s delta d [26] effect size to quantify the difference in the distributions of the metrics. We use the following threshold for interpreting d , as provided by Romano et al. [39]:

$$\text{Effect size} = \begin{cases} \text{negligible}(N), & \text{if } |d| \leq 0.147. \\ \text{small}(S), & \text{if } 0.147 < |d| \leq 0.33. \\ \text{medium}(M), & \text{if } 0.33 < |d| \leq 0.474. \\ \text{large}(L), & \text{if } 0.474 < |d| \leq 1. \end{cases}$$

Findings:

63% of the EAGs update more frequently in their early access stage. The beanplot in Figure 7 shows the distribution of the update frequency during and after leaving the early access stage. A beanplot shows the density plots for two distributions side by side so that they can be easily compared. In general, developers update their game more frequently in the early access stage, with a median of 11 days between adjacent updates in the early access stage. The number of days between releases after leaving the early access stage increases to 15 days. The Wilcoxon signed-rank test shows that the difference between the two distributions in Figure 7 is

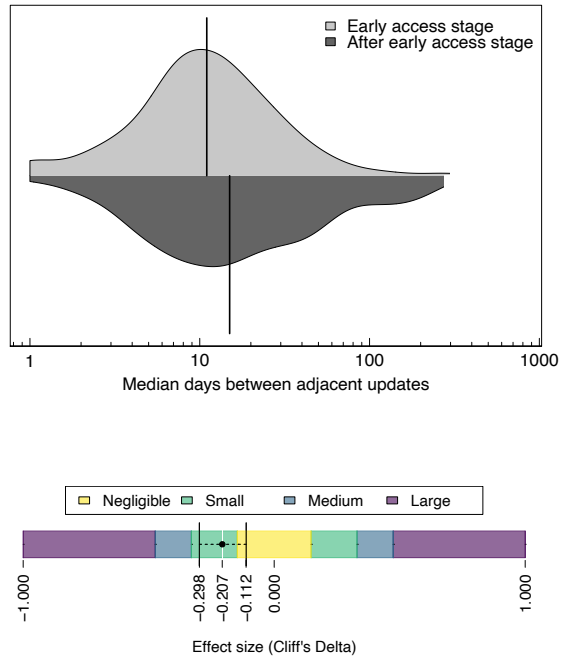


Fig. 7: Distribution of the update frequency (measured as the median number of days between adjacent updates) during and after leaving the early access stage for all EAGs (the vertical line shows the median of each distribution). The figure below the beanplot shows Cliff's Delta effect size (-0.207) and its confidence interval ($[-0.298, -0.112]$). The colored areas represent the thresholds that we used to interpret Cliff's Delta.

significant ($p\text{-value} = 5.833e-10$) with a small effect size (Cliff's Delta = -0.207). We calculate that almost two third (63%) of the EAGs have a higher update frequency in their early access stage, and 3% of the EAGs have the same update frequency in and after leaving their early access stage.

We inspect the update frequency of the EAGs that have a higher update frequency after their early access stage. 72% of these games have left the early access stage after 2015. A possible explanation for the update frequency being higher after leaving the early access stage is that the update frequency tends to be higher for a short-while directly after leaving the early access stage, because of a boost in new players or funds. After a while, the game tends to become more stable, resulting in a lower update frequency.

Figure 8 shows an example of the update timeline of the *Fight The Dragon* game⁹, a former EAG which has left the early access stage since December 2014. There exists

⁹ <http://store.steampowered.com/app/250560/>

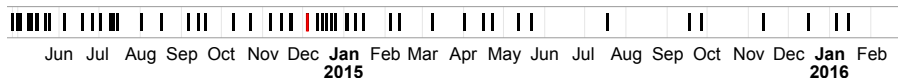


Fig. 8: Update timeline of the *Fight The Dragon* game (each line represents an update, and the date of leaving the early access stage which is Dec 4, 2014 is marked in red)

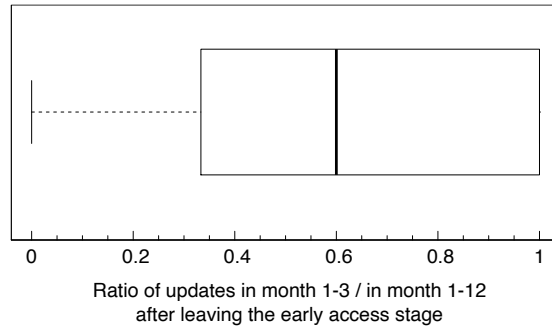


Fig. 9: Distribution of the ratio of updates within 3 months and 12 months after leaving the early access stage.

a clear difference between the update frequency in and shortly after leaving the early access stage and the stage after June 2015.

To support our explanation of a stabilizing update frequency, we further study the update timeline of former EAGs which have left the early access stage for at least a year. Figure 9 shows the distribution of the ratio of updates within 3 months and 12 months after leaving the early access stage. We calculate that for 29% of these former EAGs, 100% of their updates within 12 months after leaving the early access stage were released in the first three months. 51% of these former EAGs release 60% of the updates within the first three months.

65% of the EAGs see an equal or lower activity of owners posting reviews in the early access stage. Figure 10 shows the distribution of the average review rate during the early access stage and the lifetime. The Wilcoxon signed-rank test shows that the difference between the two distributions is significant ($p\text{-value} = 0.009$) with a negligible effect size (Cliff's Delta = -0.039), suggesting that users post reviews less often in the early access stage of a game than after leaving the early access stage. We calculate that 62% of the EAGs see an lower average review rate in the early access stage, and 3% of the EAGs see an equal average review rate in and after leaving the early access stage.

A possible explanation is that owners are aware that an EAG is still under development and not in its best shape. Hence, they prefer to give the developers more time to improve the game, and wait until the game leaves the early access stage to give their reviews, rather than judge the game in its unfinished shape.

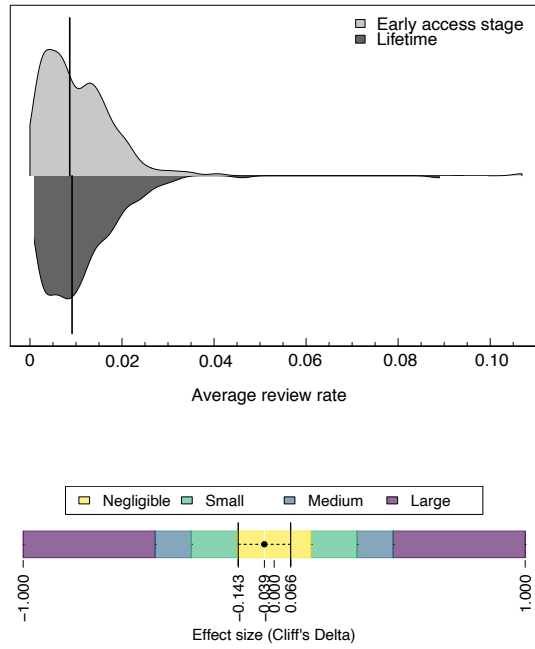


Fig. 10: Distribution of the average review rate during the early access stage and the lifetime for all EAGs (the vertical line shows the median of each distribution). The figure below the beanplot shows Cliff's Delta effect size (-0.039) and its confidence interval $[-0.143, 0.066]$. The colored areas represent the thresholds that we used to interpret Cliff's Delta.

81% of the EAGs observe an equal or higher activity on the discussion forums in the early access stage. Figure 11 shows the distribution of the discussion participation rate during and after leaving the early access stage. As shown in the figure, a game receives a median of 0.04 discussion posts per owner in the early access stage, which is twice as high as the median number of discussion posts per owner after leaving the early access stage (0.02). The Wilcoxon signed-rank test shows that the difference between the two distributions is significant ($p\text{-value} = 4.918\text{e-}16$) with a small effect size (Cliff's Delta = 0.304). We calculate that 66% of the studied former EAGs observe a higher discussion participation rate in their early access stage. 15% of the studied former EAG have a consistent discussion participation rate in and after leaving the early access stage.

The higher discussion participation rate in the early access stage supports the explanation that we provide for the finding that owners post less reviews in the early access stage. It appears that early access owners tend to provide their feedback in

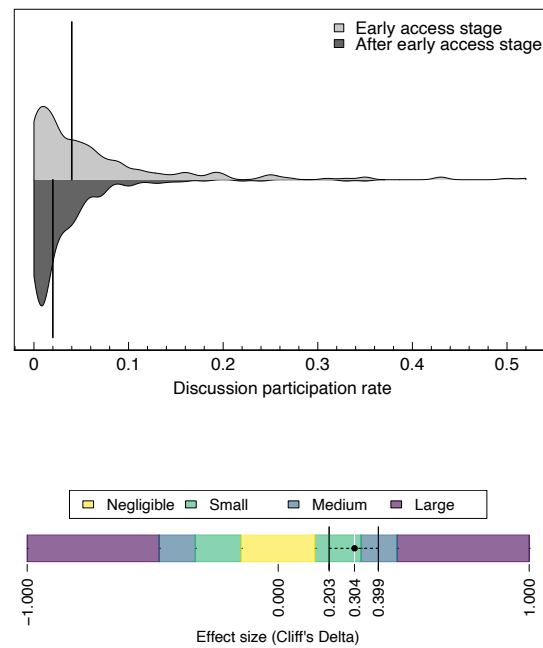


Fig. 11: Distribution of the discussion participation rate during and after leaving the early access stage for all EAGs (the vertical line shows the median for each distribution). The figure below the beanplot shows Cliff's Delta effect size (0.304) and its confidence interval ([0.203, 0.399]). The colored areas represent the thresholds that we used to interpret Cliff's Delta.

discussion forums instead of in reviews, which does not affect the positive review rate of a game.

For developers, the lower review rate and the higher discussion participation rate in the early access stage appears to be a double-edged sword. On the one hand, the lower review rate reduces the chances that a possibly buggy and imperfect version of the game leads to complaints in reviews, which might mislead potential customers after leaving the early access stage. On the other hand, it is difficult for developers to perceive and quantify how satisfied the owners are in the early access stage. Although the discussion forums on the Steam Community offer a place for developers and players to communicate, the posts normally only consist of concrete issues such as questions or suggestions, rather than specific, quantifiable sentiment as provided by reviews.

Developers update a game more frequently in its early access stage. Players post significantly less reviews but more discussion posts in the early access stage (all with small effect size).

4.3 RQ3: How tolerant are players of the quality of EAGs?

Motivation: EAGs are unfinished by definition. Although owners have access to a playable version of a game, the content of this version can be incomplete, the client can be buggy or the performance can be poor. Players are aware of the possible issues when they purchase an EAG. Because the reputation accumulated in the early access stage can impact the popularity of a game after leaving the early access stage, we study whether owners are more tolerant of the quality during the early access stage of a game.

Approach: We quantify the tolerance of owners of the quality of former EAGs within and after leaving the early access stage using the positive review rate of games ($\frac{\# \text{ of positive reviews}}{\# \text{ of total reviews}}$). The reviews of a game can greatly affect the will to purchase of potential customers as stated in Section 2. Hence, a higher positive review rate in the early access stage can lead to a higher popularity after the game leaves the early access stage. In addition, we calculate the correlation of the positive review rate, the length of the early access stage and the update frequency in the early access stage. We use Spearman correlation because the data is not normally distributed.

Findings:

89% of the EAGs receive an equally or higher positive review rate during their early access stage. Figure 12 shows the distribution of the positive review rate during and after leaving the early access stage. The Wilcoxon signed-rank test shows that there is a significant difference (p-value < 2.2e-16) with a medium effect size (Cliff's Delta = 0.454) between the two distributions.

We calculate that 88% of the former EAGs receive a higher positive rate in their early access stage, with a median positive rate of 88%, which is higher than the median positive rate after leaving the early access stage (69%). 1% of the former EAGs receive a consistent positive rate in and after leaving their early access stage.

As mentioned in Section 2, the positive review rate is used in the games' Steam Store page as the official indicator of the quality of a game. As a result, a higher positive review rate can greatly benefit the popularity of a game after it leaves the early access stage. The above findings suggest that games can receive more positive reviews when using the early access model. However, the higher positive review rate does not suggest that the early access model is a fix for low-quality games. More likely is the possibility that the people who buy EAGs are more tolerant of the unfinished status of a game. Another possibility is that the developers that use the early access model are good at keeping their players happy.

The positive review rate is not correlated with either the length of the early access stage or the update frequency in the early access stage The Spearman correlation between the positive review rate and the length of the early access stage is -0.06. The update frequency in the early access stage and the positive review rate have a Spearman correlation of 0.01. These findings indicate that neither the length of the early access stage, nor the update frequency in the early access stage are correlated with the positive review rate.

These findings suggest that developers can take time to polish their EAGs until they are ready to leave the early access stage, without worrying that the long length of the early access stage might decrease their positive review rate. In addition, devel-

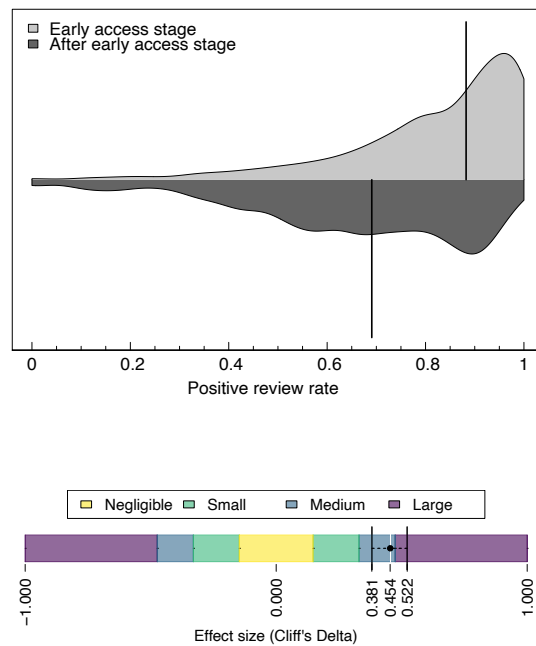


Fig. 12: Distribution of the positive review rate during and after leaving the early access stage for all EAGs (the vertical line shows the median for each distribution). The figure below the beanplot shows Cliff's Delta effect size (0.454) and its confidence interval ([0.381, 0.522]). The colored areas represent the thresholds that we used to interpret Cliff's Delta.

opers can choose the update schedule that best fits their development process during the early access stage, rather than rush to add more content and features.

Players of EAGs tend to be more tolerant of the quality of a game during its early access stage. While players tend to post less reviews within the early access stage, 89% of EAGs receive an equally or more positive review rate in their early access stage. In addition, developers do not need to rush into releasing their games, as it appears that the tolerance of players is not correlated with the length of the early access, though other factors might be at play, such as the budget and funding of their games.

5 Additional Interesting Insights

In this section, we discuss several observations that are worth noting and can lead to future work.

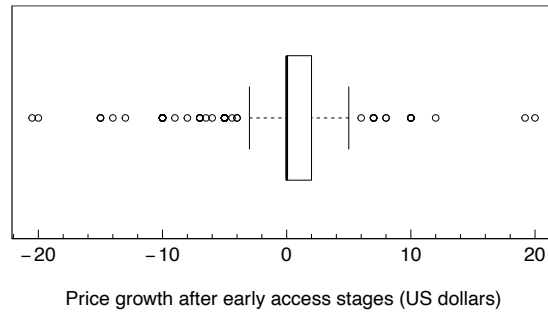


Fig. 13: Distribution of price changes.

5.1 The Price of a Game Within and After Leaving the Early Access Stage

As explained in Section 2, developers of EAGs have the liberty to change the price of the game at any point in time. Steam states that, depending on the “goals and the level of commitment and feedback” developers desire from early access players, they can start by offering a discount, or on the contrary, charge a premium [46]. Therefore, we consider the change of price as a reflection of the purpose of developers to use the early access model. We assume that developers ask a lower price in the early access stage when they aim to gather more feedback and use the low price to attract more players. On the other hand, when developers charge a higher price in the early access stage of their game, they tend to use the model as a funding source to support the development process of their games.

We compare the price during and after leaving the early access stage. Figure 13 shows the distribution of the price changes, i.e., we subtract the early access price from the price of the game after leaving the early access stage. 95 (24%) of the EAGs are free to play throughout their lifetime, including the early access stage. We remove them from the figure for better demonstration. 145 (48.3%) of the remaining former EAGs have the same median price within and after leaving the early access stage, while 91 (30.3%) increase their price and 64 (21.3%) decrease their price.

In addition, of the 64 games of which the price decreases, 6 (9%) become free to play after leaving the early access stage. We manually check the release notes of these 6 games to identify the reasons for making the game free to play after leaving the early access stage. We were able to find the reasons for making the game free for three games, while the other three silently become free. When the *Pool Nation FX Lite* game¹⁰ left the early access stage, developers divided the game into the basic free-to-play part and two optional packs which need to be purchased [8]. The developers of the *Bierzerkers* game¹¹, however, stated that it is the early access players who suggested them to make the game free, in order to build the base of the game. To

¹⁰ <http://store.steampowered.com/app/314000/>

¹¹ <http://store.steampowered.com/app/348460/>

reward the early access players, they each received all of the launch characters [3]. As for the *Cards and Castles* game [2], although developers did not specify the reasons of making the game free, they offered an early access bundle containing unique content to early access players and persuaded people to buy the game in the last two weeks of the early access stage [4].

For the free EAGs and the EAGs with a lower price in the early access stage, which represent 47% of the EAGs, it is likely that their developers focused on gathering early feedback from the community. The percentage is significantly higher than the EAGs which charge a premium for early access (16%), indicating that their developers aim at raising development funds. Although this is only one possible explanation for the change of price and developers might have several goals when using the early access model, the phenomenon suggests that the majority of EAG developers value the opportunity to elicit feedback more than the opportunity to raise development funds.

5.2 Lessons Learned from an Early Access Failure: the *Spacebase DF-9* Game

In this section, we discuss lessons learned from the the *Spacebase DF-9* game. Prior work (e.g., Washburn et al. [50]) discusses what went wrong and what went right during the development of a game, but no prior work focused on the failure of EAGs specifically.

The *Spacebase DF-9* game is developed by *Double Fine Productions*, an indie game development studio [12]. The game was available on the SEARP on October 15, 2013. On October 27, 2014, the game unexpectedly terminated the early access stage and released a final product that lacked many of the planned features. On November 21, 2014, twelve employees including the project lead were laid off. On December 16, 2014, an announcement was posted on the official technical support forums, stating that there were no further plans for patches and there was no team assigned to the project [16].

The abandonment of the game led to the disappointment of a large number of players. As a result, the game received 79% (2,598) negative reviews, and raised a debate between the players and the studio on the discussion forums of the game on the Steam Community [47].

The game is considered to be a failure of the early access model. In order to understand the reasons for its failure, and the lessons that can be learned for future EAGs, we manually study two threads on the Steam Community. One of the threads is posted by the studio [44] and the other thread is posted by the players [43]. Together the threads contain around 800 discussion posts. We identify the following lessons that can be learned:

Lesson 1: It is risky to use the early access model as the main funding source.

The reason for terminating the development of the *Spacebase DF-9* game, claimed by the studio, is that this project was started with an open ended-production plan, with the hope that it can progress similarly to some other early access-funded games.

¹² <http://store.steampowered.com/app/360730/>

However, the sales quickly became insufficient to support the development process. Although the developer put all the raised funds back into the development of the game, it turned out that the raised funds were not sufficient to fund a complete development team.

However, players argue that the developer should have considered the game as an investment, and that the profit would come after leaving the early access stage. They consider the funding of a game's development solely with early access sales to be *"irresponsible if not downright delusional"*. Some players even question the money management of the studio, although the studio later responded that it considered continuing development on a game that costs more than it makes to be bad money management.

Lesson 2: Do not release a game on the SEARP too early. A potential reason for not selling enough copies, posted by some players, is that the game was released into the SEARP too early, lacking content and features for players (*"basically nothing meaningful to do after 45 mins of playtime"*). The players suggested that, to ensure sales remain above made costs, developers should release the game in a more content and feature-rich state.

Lesson 3: State promises and plans clearly. The most obvious lesson that can be learned from the failure, as stated by the studio, is that it did not clearly indicate in the "original promise" which features were securely funded, and which portion of the game was dependent on early access sales. This point is supported by many players, who considered the original statement *"none of these features are set in stone"* to be too ambiguous and vague.

Lesson 4: When a game is abandoned by its development studio, the reputation of the studio as a whole can be damaged. Besides the anger towards the abandonment of the game, a large quantity of players are doubting the integrity of the studio, and claimed that they would never purchase any future game from *Double Fine Productions*. The players consider the abandonment of the EAG as betraying a long term commitment, as they purchased the EAG not for its current form, but for the potential it had. In addition, players were concerned about whether the studio would be capable of improving the development of future EAGs. The lack of introspection totally *"bankrupted the company by ruining the reputation"*, as said by players. It is worth noting that players stated clearly that they would not stop supporting EAGs or indie developers, but would specifically stop supporting this *"irresponsible"* studio.

Lesson 5: Communicate issues and changes to the promised plan on time. The studio claimed that they announced the situation and the decision to terminate the development rather than *"vanish quietly in the night"*. However, the players argued that if the studio could communicate with players immediately when trouble firstly came up, the players could have helped by recommending the game to friends and relatives, or even bought copies for them. It was the lack of communication of the troubles that the game was facing that killed this game.

The aforementioned lessons demonstrate that players get emotionally involved in the development of EAGs. One of the players posted that *"I am sorry that powers above you have closed your beloved project down, and I'm also frankly sorry that I don't get a finished product. This game could have been so amazing."*

Although the aforementioned lessons come from one game, they give an overview of realistic dangers that apply to EAGs. The main lesson that can be learned is that the player involvement should work in both directions. On the one hand, developers appreciate the feedback from the players of their game. On the other hand, developers should show appreciation of their players by communicating and actually involving them in the decision-making process.

6 Threats to Validity

This section presents the threats to the validity of our findings.

6.1 Internal Validity

A threat to the validity of our findings is that it is not necessary for game developers to publish release notes for a game update to one of the Steam channels. Hence, all numbers that we provide in this paper may be low estimates of the actual number of updates.

The number of owners used in our study are estimated from a representative random sample by Steam Spy. Although a three-day rolling sample is used to increase the accuracy, there can still exist a deviation from the actual number of owners. However, because the sales data is confidential in the game industry, this is the most accurate method to our knowledge to estimate the number of owners of a game.

We estimated the total number of games that are released in a month using the release date as advertised on the Steam Store page. This number is an estimation because developers are allowed to change the release date that is shown on the Steam Store page. We observe that for some games that exist before they are released on Steam, developers changed the release date to the real release date. We do not have data (reviews, discussions, price, etc.) between the real release date and the date that the game is released on Steam. However, we expect it is sufficiently accurate to be used to give a reasonable estimate of the number of games released in a month. Note that we used release notes to identify the date on which a game was released as an EAG, hence this threat does not affect the validity of our findings that are related to EAGs.

The learned lessons that we describe about failed games come from one game. However, at the time of writing, it is the only game for which the failure of the early access model has been explicitly documented. These lessons can be revisited later when documentation about the early access model for more EAGs becomes available.

As in all empirical studies, separating causation and correlation is a challenge in our work. While we cannot show that the early access model leads to more satisfied game owners, there exists a correlation between a higher positive review rate and the usage of the early access model. One possibility is that the type of game owner that buys an EAG is more happy in general than non-EAG buyers. Another possibility is that EAGs are only bought by more tolerant owners. Either possibility supports the findings that are presented in this paper.

We use the frequency of game updates as a proxy of interaction between developers and the Steam platform. We believe that this interaction is a rough estimate of how much developers care about the quality of their game. In this paper, we did not study whether updates are a direct response to user feedback. Future studies should investigate more closely the link between game updates and user feedback, for example, that is acquired through various avenues such as user reviews.

6.2 External Validity

In our empirical study, we studied the EAGs on Steam. The findings of our study may not generalize to other EAGs on different distribution platforms. However, as stated in Section 2, Steam is the largest digital distribution platform for PC gaming. Hence, the EAGs on Steam are representative for a large number of EAGs.

6.3 Construct Validity

We manually validated our approach for identifying release notes and found that our approach has 89% precision and 87% recall, as described in Section 3.

7 Conclusion

In this paper, we study the early access release model for games. Games that are released through this model, so-called Early Access Games (EAGs), are early versions that allow developers to raise funds for development or to elicit early feedback from players. In particular, we study the characteristics of 1,182 EAGs, the interaction between players and developers of EAGs and the Steam platform during and after leaving the early access stage, and the tolerance of players of the quality of EAGs. Below are the most notable findings of our study:

1. 15% of the games that are currently on Steam make use of the early access model. The most popular EAG has approximately 29 million owners.
2. EAGs tend to be “indie” games, which suggests that the early access model is used mostly by smaller development studios.
3. The percentage of players that review a game during its early access stage is lower than the percentage of players that review a game after leaving the early access stage. However, the average rating of the reviews is much higher during the early access stage.

In addition, we discuss several learned lessons from the failure of an early access game. The main learned lesson from this failure is that the communication between the game developer and the players of the EAG is crucial. Players enjoy getting involved in the development of an early access game and they get emotionally involved in the decision-making about the game.

Based on the findings that are presented in this paper, we suggest the following to developers that are considering the early access model for releasing their game:

1. If you have a small marketing budget, the early access model can help you to build a positive reputation, as players of EAGs tend to give more positive reviews. However, the early access model will not lead to more reviews to your game.
2. Although you can get a larger amount of concrete feedback in the discussion forum, that feedback is not explicitly linked to negative or positive feelings (as is the case with reviews), making it more difficult to quantify the feelings of your players in general.
3. Be aware that using the early access model as your main funding source is a risky strategy.

We believe that the findings of our paper provide a first step in helping developers better understand the pros and cons of the early access model.

While our findings do not suggest that using the early access model inherently leads to more satisfied players, there exists a correlation between EAGs and a higher positive review rate. One possible explanation for this correlation is that players who buy EAGs are friendlier towards developers. Another explanation is that developers that use the early access model are good at keeping their players satisfied. Either way, while the early access model is not a fix for low-quality games, the early access model appears to be a valuable tool for developers that want to improve their games by interacting with their players.

Future studies should use methods such as developer surveys, user studies, and controlled experiments to examine in more depth the causality between using the early access model and the satisfaction of both players and developers.

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