Dataset of Video Game Development Problems

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ABSTRACT

Different from traditional software development, there is little information about the software-engineering process and techniques in video-game development. One popular way to share knowledge among the video-game developers’ community is the publication of postmortems, which are documents summarizing what happened during the video-game development project. However, these documents are written without formal structure and often providing disparate information. Through this paper, we provide developers and researchers with grounded dataset describing software-engineering problems in video-game development extracted from postmortems. We created the dataset using an iterative method through which we manually coded more than 200 postmortems spanning 20 years (1998 to 2018) and extracted 1,035 problems related to software engineering while maintaining traceability links to the postmortems. We grouped the problems in 20 different types. This dataset is useful to understand the problems faced by developers during video-game development, providing researchers and practitioners a starting point to study video-game development in the context of software engineering.

KEYWORDS

Dataset, video game, postmortem, development problems

1 INTRODUCTION

Video games are a profitable industry [6] for big companies like EA1 and for indie developers2 brave enough to face a competitive endeavor3. Successful games are plenty, although they usually come at a price. Indeed, video-game development is known for its management problems [7, 13], which translate into large numbers of issues in the final products. For example, 80% of the top 50 games sold on Steam4 need critical updates [5].

Video games form also a competitive market in which knowledge is the main weapon against competitors. The lack of information about the process, the techniques, the game engine used for games are but a few examples of how hard it is to understand video-game development. This lack of information also prevents new developers (and even veterans) to avoid common problems by learning from previous mistakes.

One source of information about video-game development that is public are postmortems. Video-game postmortems are documents that summarize the developers’ experiences with the game development, written often right after the game is launched [13]. These documents are usually written by managers or senior developers [2]. They often include five sections either about “what went right” and “what went wrong” during the game development.

- “What went right” discusses the best practices adopted by developers, solutions, improvements, and project-management decisions that helped the project.
- “What went wrong” discusses difficulties, pitfalls, and mistakes experienced by the development team in the project, both technical and managerial.

Thus, Postmortems offer an “open and honest window into the development of games” [13]. However, these documents are written without formal structure and often providing disparate information, in particular with respect to the software-engineering of the games. Consequently, complete, trustful information about game development is hard to find, which limits the number of studies about games from the point of view of software engineering. Yet, we believe that most of software-engineering problems could be mitigated if developers had information beforehand.

Through this paper, we propose a curated dataset describing software-engineering problems in video-game development. We compile a large set of information about problems in game development related to software engineering. We analyze 200 postmortems from the Gamasutra Website5 and collected 1,035 problems. We categorized these problems into 20 different problems types and provide a structure to store this information. The dataset is available in the following page: https://github.com/game-dev-database/postmortem-problems.

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2Electronic Arts report from October 2019 shows $3.8 bilions of revenue (http://bit.ly/2LA7us1).

3It is hard to define the concept of indie developer. Generally they are small, self-funded companies that create games on a small scale. Out of scope of this paper but related is the essay: http://gamesstudies.org/16/01/articles/gardagrabarczyk.

4There are many examples of successful indie games, one of them is “Stardew Valley”, written by a single developer in the span of four years, which made him millionaire in one day after launch [10].

5Steam is a video-game, digital, distribution service platform available at https://store.steampowered.com/.
The paper is structured as follows. Section 2 discusses papers that used video-game postmortems as a knowledge base. Section 3 describes how the data was gathered. Section 4 presents how the metadata is organized. Section 5 shows the results of the database. Section 6 concludes the paper with future work.

2 GAME DEVELOPMENT PROBLEMS

Callele et al. [2] analyzed 50 postmortems from the Game Developer Magazine and investigated how requirements engineering is applied in game development. They grouped “What went right” and “What went wrong” in the five categories: (1) pre-production, problems outside of the traditional software development process; (2) internal, those related to project management and personnel; (3) external, those outside of the development team’s control; (4) technology, those related to the creation or adoption of new technologies; and, (5) schedule, those related to time estimates and overruns. They concluded that project management is the greatest contributor to the success or failure in video-game development.

Petrillo et al. [7] analyzed 20 postmortems from the Gamasutra Website, searching for the most common problems, which they compared with traditional software problems. They concluded that (1) video-game development suffers mostly from management problems instead of technical problems; (2) the problems found in video-game development are also found in traditional software development; and, (3) the most common problems are related to scope, feature creep, and cutting features.

Kanode and Haddad [3] used postmortems to discuss the challenges of traditional software engineering in video-game development. They reported differences between game development and traditional development and concluded that video-game development must adopt and adapt software-engineering practices.

Lewis and Whitehead [4] used two previous papers [1, 12] to identify problems in games and whether/why these could be of interest to the software-engineering research community. They highlighted some areas to explore further and differences between games and traditional software.

Washburn et al. [13] analyzed 155 postmortems, identified some characteristics and pitfalls, and suggested good practices. They reported the following main problems: obstacles (37%), schedule (25%), development process (24%), and game design (22%).

Politowski et al. [5] extracted development processes from 20 postmortems. They concluded that the majority of the game industry uses agile instead of the waterfall method. In their next work, Politowski et al. [9] used 55 postmortems to create a recommendation system for new video-game projects using previous mistakes and good practices.

These previous papers used postmortems to analyze video-game development, in particular Petrillo et al. [7] and Washburn et al. [13]. We extend these papers with more methodical approach and study a larger number of postmortems. We study postmortems from the point of view of software engineering using an iterative approach, which we summarise in the following section.

3 METHOD OF ANALYSIS

We designed the process of analysis to be iterative where the data keeps in constant evolution as we add and refactor the data each new iteration. Figure 1 shows the steps performed to analyse the data from the postmortems.

We start by randomly picking 20 postmortems from the Gamasutra Website between the years 1998 to 2018. Next, each author reads the postmortems, focusing on the “What went wrong” section and using a coding technique from Grounded Theory [11]. Each author identifies all the problems reported by the postmortems, extracting quotes and grouping similar problems, based on the previous literature definitions [7, 13]. Previous definitions were used to create a catalog of problems, which contains problem types, problem groups, and descriptions. We add each new problem type absent from the catalog with its description.

In the next step, we discuss the findings, review some doubts, and analyse the correctness of the catalog. Any change at this point, on the catalogue or on the list of problems, results in an updated version in both documents. We reiterate this process until it reaches saturation: until no more new type of problems appears.

To keep the distribution of the postmortems read by year balanced, eventually we chose specific postmortems to analyse instead of randomly picking them. Also, not all postmortems are relevant for this study as they might not have useful information regarding the development process. When that happens, we discard the postmortem.

4 METADATA OF THE DATASET

The catalog of problems is a document listing the possible problems we could find while reading the postmortems. We started building it using problems’ types we gathered from the literature and we update it during during the postmortems analysis.

The catalogue document is updated for every new problem type we end up discovering. The authors review each new problem type and reach to a conclusion. The final version of the document contains 20 different types of 1,035 problems divided in three groups.
Table 1 shows the final version of the catalog where a Problem Type is a index to define the problem which has a short Description and belongs to one Problem Group.

Table 1: Catalogue with the video game development problems identified from the postmortem analysis.

| Group       | Type               | Description of the problem                                                                 |
|-------------|--------------------|--------------------------------------------------------------------------------------------|
| Design      | Documentation      | Not planning the game beforehand, not documenting the code, artifacts or game plan.       |
| Tools       | Any problem with tools like engines, APIs, development kits, third-party software, etc. |
| Technical   | Problems with the team code/assets infrastructure.                                      |
| Testing     | Any problem regarding the testing.                                                       |
| Bugs        | When there are too many bugs in the game/engine, any failure in the game design or technical issues. |
| Prototyping | Lack of or no prototyping phase nor validation of the gameplay/feature.                   |
| Management  | Unrealistic Scope  | Planning too many features that end up impossible to implement it in a reasonable time.     |
|             | Feature Creep      | Adding unplanned new features to the game during its implementation.                       |
|             | Cutting Features   | Cutting features previously planned because of other factor like short deadlines.          |
|             | Delays             | Problems regarding any delay in the production.                                            |
|             | Crunch Time        | When developers continuously spent extra hours working in the project.                    |
|             | Communication      | Problems regarding communication with any stakeholder.                                     |
|             | Team               | Problems in setting up the team, loss of professionals during the development or outsourcing. |
|             | Over Budget        | Project cost more money than expected.                                                     |
|             | Multiple Projects  | When there is more than one project being developed at the same time.                      |
|             | Planning           | Problems involving too much time planning/scheduling or the lack of it.                    |
|             | Security           | Problems regarding leaked assets.                                                          |
| Business    | Marketing          | Problems regarding marketing/ advertising.                                                |
|             | Monetization       | Problems with the process used to generate revenue from a video game product.             |

To store the problems gathered from postmortems we defined a data model which Figure 2 shows in UML class diagram. Each Postmortem has a Game which has a collection of problems. Each Problem has a Type and Group. Also, the Game must have: a Platform [1-3] (PC, Console, Mobile), a Genre [1-12] (Action, Adventure, RPG, Simulation, Strategy, Puzzle, Sports, Platformer, Shooter, Racing, Roguelike, Running), and a Mode [1-3] (Single-player, Multi-player, Online).

An example of the dataset structure is shown in Table 2. In this case, the game “Baldur’s Gate II” from 2001 was analyzed and the entry shows a problem regarding “Testing”, which belongs to the “Production” group. The quote relates the problem to a non-modified version taken from the postmortem.

We began storing the data using JSON format following the structure described in Figure 2 and validated using JSON Schema. Later we migrated the data to a table format (.CSV) where each entry (line) refers to a problem. This makes the data easy to be analyzed with scripts, specially in R language.

5 DATASET ANALYSIS

The dataset contains 200 video-game projects ranging from 1998 to 2018. There are, in total, 1,035 problems with its respective quotes. The median of problems by title (video game) is 5 and the median of problems by year is 48. Figure 3 show the problems by group: management and production problems are the most common with around 45% each while business issues sum up to 10%.

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6https://www.json.org/json-en.html
7https://json-schema.org/
Table 2: Example of the dataset structure with one entry.

| Column   | Value                                                                 |
|----------|----------------------------------------------------------------------|
| Title    | Baldurs Gate II – The Anatomy of a Sequel                          |
| Year     | 2001                                                                |
| Source   | https://www.gamasutra.com/view/feature/131493/baldurs_gate_ii_the_  |
|          | anatomy_of_a_.php                                                   |
| Name     | Baldur’s Gate II                                                    |
| Platform | PC                                                                   |
| Genre    | RPG Strategy                                                         |
| Mode     | Multi Single                                                        |
| Group    | Production                                                          |
| Type     | Testing                                                             |
| Quote    | Because of its immense size, Baldurs Gate II was a testers nightmare - |
|          | this was compounded by the fact that we didn’t do enough testing    |
|          | as areas were being developed. Baldurs Gate II contains roughly      |
|          | 290 distinct quests - some of these are very small (20 minutes long) |
|          | while others are quite large (a couple hours in length). Each quest  |
|          | needed to be tested both in single player and multiplayer modes.    |
|          | The main lobby of the Hall of Wonders. During testing we adopted a  |
|          | very sound task and bug tracking method introduced to us by Feargas |
|          | Urquhart, the Director of Black Isle Studios and Chris Parker and   |
|          | Doug Avery, our Black Isle producers (all of whom helped the      |
|          | project in many different ways). We put a number of white-boards    |
|          | in the halls of the testing and design area and listed all of the   |
|          | quests on the boards. We then put an X next to each quest. We broke |
|          | the designers and QA teams into paired subgroups - each pair (one   |
|          | tester and one designer) had the responsibility of thoroughly      |
|          | checking and fixing each quest. After they were certain the quest   |
|          | was bulletproof, its X was removed. It took about 2 weeks to clear  |
|          | the board (on the first pass).                                     |

Figure 4 show the distribution of the problems related to each type. Design, Technical, and Team problems are the most frequent with 35% overall. Problems with Planning, Tools, and Marketing are the next ones with 23%; Communication, Testing, and Feature-Creep problems 15%; Cutting-features, Bugs, and Scope 12%; Delays, Crunch-time, and Monetization 9%; Documentation, Budget, Prototyping, and Multiple projects 8%. Only two problems are related to Security.

Regarding the platforms, the projects are mainly for PC, with 787 problems, followed by 475 Console problems, and 254 Mobile problems. 90 problems are related to multi-platform projects, that is, PC, Console, and Mobile.

The dataset is hosted in a open repository on Github. This allows anyone to access and contribute by using the pull request feature. We decided for this approach to allow the contribution to be reviewed before being accepted. The contributor can also add to the catalog of problems and other meta-data like game platform, game genre, and game mode, allowing the dataset to keep evolving overtime. Lastly, this dataset is related only to postmortems problems, that is, things that “went wrong”. Our plan is to also implement good practices gathered from the “what went right” postmortem section in the future.

Figure 4: Number of problems related to each Type.

Future works include (1) keep updating the database as more postmortems appear; (2) include other types of sources as, for example, technical blog posts and conference presentations like Game Developer Conference – GDC; (3) expanding the database by using the “What went right” section to gather good practices instead of problems; and (4) make a larger comparison with the common problems in traditional software development.

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6 CONCLUSION
We presented a database of video-game development problems gathered from 200 postmortems. The database contains 1,035 problems categorized in three 20 different types. It fills the gap between video-game development and software developers by providing a larger and more trustful information about video-game development problems. It thus provides a starting point for new researchers and practitioners to understand and propose solutions to video-game development problems.
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