

# Working methods and structure of commercial digital games: A survey into German game development

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**Abstract.** The German game industry is facing significant challenges and demonstrates a clear need for innovations that allow it to compete internationally. Such innovations could be driven by a potential change in project management approaches, which have historically been necessary gamechangers for enabling sustainable and resilient software development practices. This paper reports on a survey about the working methods and structure of commercial digital games developed in Germany.

## I INTRODUCTION

The German game industry is characterized as overwhelmingly young, but still sizeable. Projections done in 2022 estimated the size of the German game industry at 786 businesses developing and publishing games in Germany, with an estimated 11.242 employees [1]. The average age of a business is seven years with every second business having been founded less than five years ago. Seven out of ten businesses have less than ten employees. An analysis by [2] raises concerns over the rising number of national game studios acquired by international groups. Having to compete with better founded and more experienced international businesses puts Germany's local game companies in a tough spot. It stands to reason that this current business climate is going to exacerbate existing issues of project management, such as crunch [3, 4]. Necessary innovations could be driven by a potential change in project management, which has historically been proven to be a gamechanger for enabling sustainable and resilient development practices in the wider software industry [5, 6]. A regional study of Hamburg's game developers, one of the leading cities in German game development, found that the sharing of knowledge between firms is a crucial strategy for game development companies, and concluded that there was a demand for the exchange of know-how on a scale beyond the convenience of spatial locality. As such a nationwide survey into German game development was conducted. Its goal is to provide an openly accessible, scientifically grounded basis for future research by exploring the working methods and structure of commercial digital games developed in Germany.

## II RELATED WORKS

[7] and [8] provide an overview of relevant research into game development practices. [9] laid out a foundation based on the Goal-Question-Metric approach by [10], as well as additional guidelines in [11, 12, 13, 14, 15, 16]. [9] found that a majority of Austrian game companies had small staff sizes of two to four team members, who wouldn't be served well by following the advice laid out in US-centric literature of the time, which assumed much larger staff sizes. Process methods were largely found to be flexible, with a majority of studios making use of Scrum.

Agile techniques were therefore identified as an area of high interest in game development.

[17] conducted a survey about the agile methods and practices of Finnish development studios. To that end they obtained a dataset of Finnish game studios from two national game developer associations. They chose to exclude studios with a staff size less than five "based on an assumption that work in very small studios is not well organized and may apply more or less ad hoc ways of working" [17]. The Finnish game industry was found to be similar to the Austrian one, with 75% of studios having existed for less than five years, and half of them having 15 or less employees. A majority of companies worked on multiple projects and largely made use of Scrum, with some also incorporating techniques from other frameworks such as Lean, Kanban, and XP. [17] also took note of the use of individual Scrum meetings, finding that for each of them between 25% and 44 % of respondents reported no use at all. Planning and feedback meetings were neglected compared to daily standups, which was the only practice consistently used throughout all development phases. The reported levels of agile use, and the use of individual practices were less frequent than those reported by the general software development survey conducted in Finland. The authors closed by concluding that further research into the customizations and deployment of agile methods and practices could lead to better matching the needs of the game industry.

[18] conducted a similar survey for the game development industry of New Zealand. It sought to explore the usage of different methodologies directly and explored how well a studio's perception of aligning to a prescribed practice matched up with their actual development practices. The survey was advertised through an e-mail campaign, as well as through various social media channels. The authors chose to make use of periodic reminders to increase awareness and response rate within the sample population. They implemented the same inclusion criterion as [17], requiring participating studios to have a staff size of five employees or more. Of the 10 studios that answered questions about their methodology use, 100% used Scrum, 50% used Kanban, and 33% used Feature Driven Development. In line with the findings by [17] most studios used Scrum during production, and many

also used Scrum during the other phases of development. In regards to levels of Scrum use, all studios but one were found to be consistently overestimating their level of adherence to Scrum practices. Only seven of eleven studios made use of daily standup meetings and regular retrospectives. Some of the deficiencies in adherence to Scrum were attributed to a different understanding of the product owner role, as well as the changes implemented by studios to better adapt Scrum to game development specific work. These results were found to align with previous findings about New Zealand’s software developers, as well as previous surveys in other countries targeting game development practices. The researchers suggested that more research into the decision making process of game development studios was needed.

### III SURVEY GOALS

The main goal of the survey was to explore the working methods and structure of German game studios. In order to better contextualize the results, they were made comparable to previous research findings. Additionally, the research itself was documented and preserved in the full text of an associated master thesis to enable future researchers to analyze the same data set, conduct the same survey, and be able to question the same sample. This should lower the barrier for repeated research, and allow for a more in-depth critique of research findings. As the nature of video game research is still largely exploratory in nature [8, 19], a redesign of existing surveys was considered another goal. This redesign was based on a number of findings synthesized from previous surveys, post-mortem analysis of finished game projects [20, 21, 22], and best practices for project management [23].

### IV CHANGES TO EXISTING SURVEY PRACTICES

As the majority of game studios in Germany had small staff sizes [1] it was decided to include any studio regardless of size. The survey was also designed to include all types of game workers, as previous surveys had only focussed on development and testing professions. A request for sharing the survey internally was to be included in the initial contact e-mail and restated at the end of the survey. This served to enable insights into how different professions would see the same project. Use of remote work was another topic of interest due to the recent impact of COVID-19 on the game development workforce [24, 25]. Finally it was decided to rephrase existing questions about management frameworks and their usage to find out how game workers themselves characterized and viewed the projects they work on. In addition to these changes it was also decided to include a request for interviews at the end of the survey. Interviews have been proven to compliment survey research by enabling deeper insights and contextualization of the data collected [26].

## V SURVEY POPULATION

Germany has an official game industry association in *Game* [27]. *Game* provides a publically available list of German game studios in the form of a data set that anyone can add to [28]. A spot check of the data set confirmed that it contained both established bigger studios, as well as smaller indie developers, and recent startups. An additional search for participants on social media similar to [26] and [29] was considered, but rejected based on a lack of control and an inability to easily replicate findings. As such the data set provided by *Game* was used as the sole source for the candidate search. The data set contained entries for developers, publishers, service providers, public and educational institutions, and an “other” category designed for press contacts, industry events, and e-sports organizations. The list is uncured, which means potential misclassifications were very likely. In order to keep the data preparation step within a reasonable time span and provide clear criteria for inclusion, it was decided to only make use of the developer and publisher entries. The survey would make use of snowball sampling by asking candidates to directly share the survey with their coworkers, which should result in a more diverse population of game workers.

A total of 882 entries were checked for a number of criteria. Each entry had to have an active online presence in the form of a website and e-mail address, and to actively work in commercial digital game development. Solo developers were excluded from participating as well, as the general criteria did not apply to them. All together a total of 222 entries were rejected and 660 studios and publishers were contacted. *Game* has done projections on the number of publishers and developer studios making games in Germany at the start of 2022 and estimated their number at 786 [1]. Comparing this number with the final number of contacted companies shows that a majority of the German game industry was included in this population. If a sufficient number of respondents were to be achieved the results could reasonably be assumed to generalize to Germany as a whole.

The entries were further split into a German and English speaking category, based on the language used on each entry’s website, as well as their e-mail address. The survey and its associated communication documents were designed bilingually to reduce the risk of misunderstandings for native German speakers. 466 entries were noted as preferring English communication, while the other 194 were noted as preferring German.

## VI SURVEY STRUCTURE

The survey was designed following internal guidelines from the Hochschule der Medien (HdM) and [11, 12, 13, 14, 15, 16]. Feedback on the survey and associated materials was provided by 5 personal contacts who speak both English and German on a daily professional basis. Three of those contacts had a back-

ground in game development and provided input on the length of the survey, as well as its contents through their perspective. Two contacts had a background in information management and gave feedback on the general design and goals of the survey questions. Both of the supervising professors at HdM were consulted as well. The HdM also provided the necessary infrastructure for sending out e-mails and conducting an online survey through the use of *LimeSurvey*. The survey ran for a span of four weeks, from 28th of February till 31st of March. The initial contact e-mail was designed to drive engagement by being concise and clearly laying out the purpose and advantages of answering the survey. Keeping ethical guidelines in mind, one reminder was sent out at the halfway mark, as engagement had significantly dropped off by then [30].

Unlike prior surveys the participants were encouraged to provide information about themselves and not just about their work. The focus was on capturing factors that might influence the answers given in later sections. Closed-ended questions in the form of ranges or buckets were not used where the distribution of the data was either unknown or had little to no prior research findings. This way the shape of the data could first be determined, and then presented in a manner granular enough to preserve anonymity without losing important features. Allowing participants to not provide an answer was done in order to discourage the filling in of wrong information, which would skew the data. The questions were as follows:

(1) One factor that had been discussed in prior literature but not yet explored in practice is the experience of the people working on a project. Experience touches on a number of complex factors that make up the different forms of knowledge an individual can draw on [31]. Assessing all the factors that influence a project member's decision making process alone would be an entire survey's worth. As such, a question was designed to gather the experience a participant has had professionally working on digital games. Caution has to be taken when interpreting the results. The factor "time spent working" alone does not reflect the total relevant experience a participant possesses.

(2) The number of concurrent projects had previously been assessed on a studio level. Asking the question on the level of individuals allowed for determining if experience plays a part in the number of simultaneous projects a game worker is part of, among other factors.

(3) The job and therefore project roles an individual holds were taken as the last individual factor to observe.

(4) As some studies profitted from being conducted within an individual company or limited geographical area [26, 31] asking where participants were working was intended to provide insights into particularly cooperative regions for research.

The main part of the survey was about each participant's last worked on game project. This design was

chosen to encourage answers about more recent work, which was assumed to be more relevant and better kept in mind than older projects. It was decided to only ask questions about one project, even if an individual currently worked on multiple ones. This was done to keep answer times within reasonable limits. The inclusion of a "don't know" option was motivated by research indicating that clearly delineating between a lack of knowledge and a desire not to answer allows researchers to draw conclusions about the level of knowledge potential groups of survey participants possess. A high amount of people answering "don't know" might also indicate problems with the design of the survey, especially if the participants had roles associated with the knowledge that is being asked of them.

(5,6) Questions about the team structure and number of people within a team have so far been largely absent from existing research. This absence has to be remarked upon because management literature stresses the importance of applying methods to teams of reasonable sizes [23, 32]. "Reasonable" being a team size for which processes don't take up excessive time, e.g. a daily progress meeting in a big project team, and one in which team members can collaborate best. If the intended sizes for a certain method are exceeded, it is typically advised to break teams down into subteams, so as not to gradually lose the advantages a method relies on for organizing work in an effective manner. As no studies on the team structure of game projects exist, the question was formulated based on research findings from traditional software development, as well as literature on game development practices. An "other" option was introduced as to not restrict participants into predefined categories.

(7,8) The topic of collaboration is another extensive research area, whose close study would go beyond the scope of the survey. It was decided to focus on initial questions about the use of remote and hybrid work scenarios, as they provide a first impression of the variety and distribution of the types of collaboration found within game development. A second question about the work on-site percentage was only shown to participants that selected both the "on-site" and "remote" working option for the first question. Once more, care has to be taken when interpreting the results of these questions. The percentage should not be used as a direct indicator for how game work is generally distributed, but rather as an assessment tool for how the percentages themselves shape up. It was deliberately designed to oversimplify a complex topic in favor of obtaining a rough first impression that respondents could intuitively answer in a quick manner.

(9,10) The next set of questions was similar in design to previous research by [18]. It sought to explore the adherence to Scrum practices, which have been found to be overwhelmingly in use in game projects. Due to the large survey population, the focus on surveying

individual game workers, and in keeping reasonable time restrictions for the survey, a new questionnaire design was necessary. Utilizing the insights from [18] and available literature on best practices, a simplified two question design was created. A list of meeting types and associated examples was compiled from [23]. It was decided to assess if the findings by [7] could be replicated by checking which types of meetings were neglected compared to others. Best practices recommend conducting all the meetings on a regular basis throughout all the phases of a project, and documenting them well [23]. It was assumed that a majority of participants were likely to be able to tell accurately if these practices were being followed.

(11, 12) The final two questions of the survey were intended to find out more about the way that game workers characterize the development process of a game project. One addressed the different ways development can be done, which is informed by post-mortem analysis of development work [21]. Work is expected to be done largely in parallel on a feature level, in order to best make use of all available resources. Similarly, work on bigger projects that necessitates engine modifications, custom pipeline development, etc. would be expected to be done in parallel layers to the development of the game itself. The final question asked how individual game workers understand that process within the nomenclature of management methods. The nomenclature and descriptions were taken from and combined with the empiric findings of [22] and [20]. Unlike prior surveys this question was designed as a multiple choice question, which was intended to paint a clearer picture of how game workers perceive these processes. To this end there was also an “other” option provided, which would allow game workers to provide a deeper understanding in their own words, as well as give additional context to their process if necessary.

After answering all questions the participants were redirected to a final page that thanked them for their participation and reiterated the requests for snowballing and interviews.

## VI PARTICIPATION RESULTS

A total of 51 complete responses were obtained. A further 30 participants did not complete the survey. In compliance with data protection laws, partial answers were not taken into account. As no partial participant answered more than the first or second question at most before quitting, this represented no substantial loss in answers. One of the 51 complete responses was removed from the answer set, as the answers belonging to that response made clear it was not about a commercial project. The variety of answers and answer times leads to the conclusion that each remaining complete response was given by a different company. This means that roughly 13% of the contacted com-

panies started the survey, and that 63% of them, or 8% in total, completed the survey successfully.

## VII DATA PROCESSING

The completed answers were processed by manual means with Microsoft Excel and XLSTAT, and by automated means using Python and R. Charts were created using Excel, XLSTAT, and the Python “Seaborn” and “Plotly” packages. Chart colors were taken from [33] in order to make research accessible for color-blind and vision-impaired individuals. It was decided to make the research results themselves available to encourage use and further research by others. As such, the data processing step not only consisted of coding data but also of added anonymization steps where needed. This was a procedure all participants had been informed about and explicitly consented to prior to starting the survey. Sensitive numeric information, such as experience, number of projects, and team sizes, was turned into ranges based upon splitting the available data in quartiles or in half. This preserved the approximate shape of the data without revealing individual values.

Answers about job roles were split into individual jobs, translated to English where necessary, and standardized. Afterwards a manual clustering process was used to group the job roles by broader job categories. Each job was assigned a dominant job category and if a category had at least five participants it was considered significant enough to be studied in terms of its relations to other questions. If a category had less than five associated participants it was folded into an “Others” category. This threshold number was chosen to provide a balance between the preservation of distinct categories and their share of total participants. The final job categories were as follows: Board members, Producers / Managers, Developers, Game designers, Artists, and Others. Additionally, a “Lead positions” category was added for Developers, Game designers, Artists, and Others. This was done to allow a finer distinction between participants that had leadership experience in these roles and those that did not. Allowing other researchers access to answer sets including geographical location was considered too sensitive and therefore omitted from the final data set. Custom answers by participants were paraphrased and clustered where possible, and otherwise omitted.

## VIII FINDINGS

Findings about job roles were used to further differentiate the findings of experience and number of concurrent projects. The number of job roles was found to be effectively categorical in nature. 25 participants had one job category. A further 16 participants were part of two job categories, and a final four participants were part of three job categories. The most overlap was found between Board members and Producers / Managers, as six participants specified jobs

belonging to both. Developers also overlapped with Board members and Producers / Managers with four participants having named jobs belonging to these category combinations, as well as three participants being both Developers and Artists. Three people worked as Game designers, as well as in other roles that didn't make up a high enough percentage to be their own distinct category. In terms of overall distribution half of all participants, or 25 out of 45 participants who provided an answer to this question, were responsible for the upper management at their company. Nearly a third of participants who answered the question belonged to Producer / Manager and Developer roles. This is nearly as much as the number of Game designers, Artists, and Others combined. Of the 30 jobs belonging to Developers, Game designers, Artists, and Others, eight were Lead positions. In total 39 out of 45 participants who answered the question had jobs associated with a higher level of responsibility and management duties as they belonged to Board members, Producers / Managers, and Lead positions.

Experience in working on digital games in a professional capacity of all participants spanned from one to 35 years. The average participant had 11,35 years of work experience, a number that is inflated by the high amount of experience a small number of participants possessed. Given the small sample size and unknown distribution of experience within the German game industry, these high experience individuals should not be treated as outliers, but kept in mind when interpreting these findings. The standard deviation from the mean is 7,71 years. The *Shapiro-Wilk test* showed a significant departure from normality, with  $\alpha = 5\%$ ,  $W(50) = .92$  and  $p = .003$ . As such the empirical rule must not apply. Given the wide range of the standard deviation compared to the range of the data itself, no meaningful observations could be achieved using the Bienaymé-Chebyshev inequality probability distribution guarantees, as nearly all data falls within 2 standard distributions. Given the sample size and irregular distribution, quartiles were preferred over k-means clustering to establish a framework of concrete comparison numbers along the graphical representation of data in Figure 1.

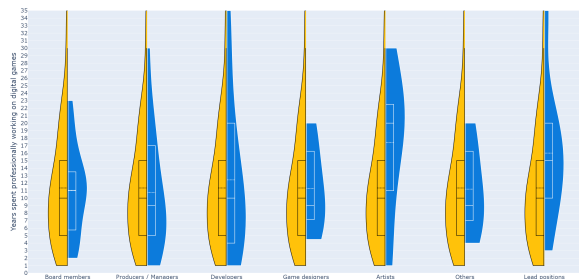


Figure 1: Distribution of participants' professional work experience by job group

Half the participants had less than 10 years of professional work experience with digital games. The bottom

25% had less than five years of work experience, while the top 25% had more than 15 years. The category of Board members shows a lower average due to the highest experience individuals not belonging to this category. The median and 1st quartile values are one year higher compared to the same values of all participants. The average and median participant belonging to the category of Producers / Managers had less working experience than all participants, while the upper 25% had slightly more at 15,75 years. Developers were made up of both the least and highest experienced individuals. The lowest 25% of participants belonging to this category had the least experience out of all job categories at below 4,12 years. This trend reverses for the upper 25% which had the second most experience out of every job category. Game designers had a much smaller span of experience compared to other categories with the lowest 25% having below eight years of work experience, while the median is below nine years of experience. Given that only five participants specified a role belonging to this job category, this finding should be treated more cautiously than the findings of job categories with a higher amount of participants. Artists had the highest mean out of all job categories at 17,42 years. Three artists had more than 20 years of experience which was the highest concentration of high experienced participants compared to the overall number of participants belonging to a job category. The overlap between Artists and Board members, and Artists and Producers / Managers has to be taken into account when interpreting these findings. The findings for the Others category appear almost similar to the findings on Game designers which is due to the high amount of overlap between these roles. Participants in Lead positions outside of dedicated Producer / Manager and company stewardship roles had noticeably higher values than the aforementioned categories. The value of the 1st quartile is double that of all participants and four to five years higher than that of Board members and Producers / Managers respectively. This trend continues for the median and 3rd quartile with the latter having an even wider gap of 4.25 to seven years with a reversed order of Producers / Managers and Board members.

The average number of concurrent game projects was at 2,6 with a 2,2 standard deviation. As expected the Shapiro-Wilk test showed a significant departure from normality, with  $\alpha = 5\%$ ,  $W(50) = .64$ , and  $p < .001$ . Figure 2 shows that the distribution of values is largely bottom-heavy with the vast majority of participants partaking in four projects or less. There is a significant jump in the number of concurrent projects up to the maximum of 10 projects, which was reported by multiple participants. Analyzing the number of concurrent projects worked on by each job category provides insights into which groups of participants reported these higher numbers. Board members, Producers / Managers, and Artists all have a maximum value of 10

projects. Given the small number of participants in the Artist category and an overlap of two participants having roles belonging to both the Board member job category as well as an Artist role, it seems reasonable to conclude that 10 concurrent projects are an outlier for Artists that should not be taken into account. The highest number of projects for Artists that were not Board members is two concurrent projects. This is consistent with the quartile findings that put 75% of Artists at one project and 25% at more. This makes Artists and Developers the groups of people that had the least amount of concurrent projects for the most part. Developers had a slightly higher maximum of 3 concurrent projects, but also had more participants at 14 people belonging to the category, including once more some overlap with the Board member role. Notably, the median for all job categories except Game Designers and the Others category is the same at two concurrent projects. Game designers and Others reported similar numbers for the median and third quartile, that are higher by one and two projects than their peers, although the small number of participants and some overlap with other roles might be to blame for distorting these findings. Lead roles reported a maximum of 4 projects, although the distribution was overall consistent with the Developers, Game Designers, Artists, and Others categories that in part belong to the Lead roles category. As such it might once more be related to overlaps more so than any strong indication on its own. Notably the Board member and Producer / Manager roles had the same distributions of quartiles as the overall data set, with Producers / Managers having a lower 3rd Quartile by one whole project. This indicates that the multiple reports of a very high number of concurrent projects are in themselves a special case and not the norm for these categories. Overall the data appears very sparse at higher project numbers, diminishing the potential validity of conclusions drawn from them. The wider bases of one to four projects, with a more even distribution that centers around two projects and tapers off gradually as the number of projects increases appears to be the main insight that can be gained from interpreting the available data.

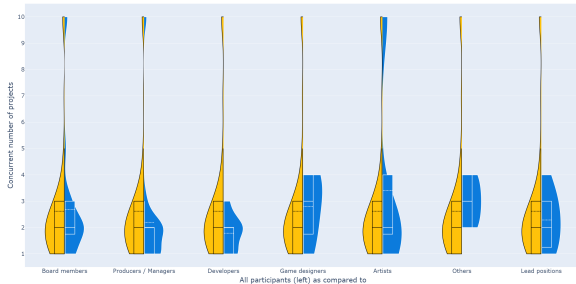


Figure 2: Distribution of participants' number of concurrent projects by job group

Experience and number of concurrent projects were analyzed for correlation using the two-tailed Wilcoxon

signed-rank test. Results indicated that there is a significant large difference between the first answer set and second answer set with  $\alpha = 5\%$ ,  $Z = -5.8$ ,  $p < .001$ , and  $r = -0.8$ . Experience also compared to the concurrent number of job roles where answers for both were available. The results indicated that there is a significant large difference with  $\alpha = 5\%$ ,  $Z = -5.8$ ,  $p < .001$ , and  $r = -0.9$ . The number of concurrent projects was also compared to the number of job roles, once more indicating a significant large difference with  $\alpha = 5\%$ ,  $Z = 3.1$ ,  $p = .002$ ,  $r = 0.6$ . As such, no correlations were found between any of these data sets.

The federal state specified by most participants was Bavaria which was selected by 10 participants, followed by Baden Württemberg, Hamburg and Northrhine-Westphalia at six participants each. Berlin, Hesse, and Rhineland Palatinate were chosen by five participants. The only federal states to not have been selected at all are Bremen, Mecklenburg Western Pomerania, and Thuringia. One participant specified that they were working outside of Germany and one other participant preferred not to answer the question. Four participants chose more than one of the Länder. The combinations were as follows: Berlin and Brandenburg, Bavaria and Baden-Württemberg, Baden-Württemberg and Northrhine-Westphalia, and Northrhine-Westphalia and Hesse. With the exception of Baden-Württemberg and Northrhine-Westphalia all of these combinations are from federal states that directly border each other.

30 participants worked in one joint team. Two teams consisted of 10 to 20 members, while the rest was approximately evenly split between small teams of two to three members, and larger team sizes of four to 10 members. One participant did not provide the number of team members. The next biggest category chosen was “Several departments” which had been exclusively selected by 10 survey participants. The number of department members was provided by nine of them. Two departments consisted of 30 to 50 members, more than double the size of the biggest joint teams. The remaining seven departments were comparable in size to joint teams although slightly larger on average, with three being four to five members, and four counting six to 10 members. Joint teams with external members were chosen by four participants. Their numbers were comparable with and grouped in with other joint teams. Three of the teams consisted of two to three members, while one team consisted of four to 10. “Multiple feature teams” was chosen by three participants, and just as many participants chose “Multiple feature teams” in combination with “Several departments”. As their numbers were comparable they were also grouped together. Two teams were made up of three to 11 participants and belonged solely to “Multiple feature teams”. The other four teams were bigger than joint teams but smaller than pure departments with some overlap at 12 to 35 participants.

26 of 50 participants specified that they're collaborating both remotely and on-site. When asked about the percentage of time typically worked on-site they made use of the full percentage range from 1% to 100% with half the participants working less than 40% on-site. The distribution shows two distinct groups of people, one who prefers being on-site more than 75% to 95% of the time, and another one that prefers being on-site between 10% and 30%. A further 22 collaborated solely through remote means. Only two participants solely collaborated on-site. As no finer distinction was made these results should not be interpreted directly, but rather inform the interpretation of other answers in the survey, as well as possibly indicate trends that can lead to future research making more accurate assumptions, although the generalizability is assumed to be very limited as the sample size is comparatively small.

A majority of participants regularly conducts individual and general progress meetings, as well as meetings for planning and scheduling tasks. 38% of participants regularly held meetings for refining upcoming tasks, while 30% of participants regularly held meetings to reflect on the progress of work in recent times. Two participants did not provide an answer, while another four participants were not able to answer all questions and chose the "don't know" option for one to three categories of meetings. Only one of those participants had a job category not directly associated with the development of a game, as they worked in marketing. Another participant was purely a CEO, perhaps not being actively involved in the details of game development. The other two participants had a producer and lead role in game development, and would therefore have been expected to know this information. One theory would be that the "don't know" option was chosen for a lack of "not at all" option, indicating that the use of the provided meeting categories is not completely ubiquitous.

16 participants stated that they documented all meetings and meeting results, while two participants disclosed they did not document at all. These two participants worked in joint teams of two to three people, which was assumed to be an important factor for their answer. 31 participants, a majority, reported a partial documentation strategy. 23 of them chose to make use of the write-in field. This indicates a failure to properly categorize the complexity and dimensions of documentation approaches when designing this question, as the results are therefore rather vague. Four participants stated that they did not document the progress of individual team members. Two participants stated that they explicitly documented status meetings. Six participants made mention of issueracker and note taking systems as a means of documenting progress. One participant detailed taking notes with clients, as well as conducting post mortem surveys, and documenting career aspirations. Some participants made note of a

percentage, certain work documents, or "relevant findings" but did not further specify what exactly these categories entailed. The overall finding indicates that only a minority of participants document diligently, and that further research is necessary to find out more about documentation strategies and the motivations behind them.

A majority of participants chose to describe work on the project as a combination of categories with "Parallel work on multiple layers and on multiple features" being chosen by 26 participants, and "Parallel work on multiple layers, one feature at a time" being chosen by four of them. The most chosen single option chose the dimension of features, with 10 participants picking "Parallel work of multiple features". The next chosen single option was "Parallel work on multiple layers" by four participants, followed by "One layer at a time" by 3 more participants. Other categories were only chosen by a single participant and are further described in the master thesis.

When asked to characterize the development process, two participants chose to detail a bespoke development process, while one participant chose the write-in option to detail a Hybrid approach. That participant was folded in with the "Hybrid" category, which made up the biggest category, at 17 participants. The next biggest category chosen was "Iterative" at 14 participants. A combination of "Hybrid" and "Iterative" was chosen by two participants, perhaps to stress the importance of iterative processes over waterfall methods or an added importance of the former within the process, rather than being an indication of a failure to understand the Hybrid process category. The next three categories all mentioned Ad-Hoc processes with five participants choosing "Hybrid and Ad-Hoc", and four choosing purely "Ad-Hoc" and "Iterative and Ad-Hoc" respectively. A pure "Waterfall / Predictive" process was chosen solely by one participant.

## IX DISCUSSION

In order to further contextualize the survey findings, as well as to obtain a clearer picture of the German game industry in general, two additional interviews were conducted. The two interviewees were asked for consent to record their interview for the purpose of transcribing it. They were also provided with the list of questions in advance, which were as follows: "How does experience factor into your work?", "How did you learn the skills needed for your work?", "How do you handle problems during the development process?", and "Do the insights obtained from one project transfer to other projects?". These questions were intended to provide potential answers to the lack of any correlation between the work experience of participants and their other survey answers, as well as the low numbers of regular meetings reflecting on existing work, coupled with a general lack of insights on documentation strategies. Interviews were planned for a duration of



30 minutes, but were kept open-ended. This was done to facilitate a back and forth between interviewer and interviewees in order to more fully explore the insights provided by them. The interviews were conducted on the 19th and 21st of April in the interviewees' native tongue of German. The interviews were transcribed afterwards, following best practices described in [34]. The transcribed interviews were sent to the interviewees on the 24th and 26th of April. Interviewees were offered the possibility of appearing anonymously, and allowed to make limited edits to the transcription. The interviews are included as full transcriptions in the Master thesis. References to them are made as [i1] and [i2] respectively.

Question four identified the potential for localized research in the south of Germany, as nearly one third of all participants worked in Bavaria and Baden Württemberg.

"How are development teams working on commercial digital games in Germany structured" was answered by survey questions five through eight, and further contextualized by job roles. Question five showed that a majority of participants were working in joint teams of less than 10 people, while bigger teams tended to instead be organized into departments and feature teams. Team members overwhelmingly collaborate in hybrid and remote work scenarios, with a tendency to either work mainly on-site or mainly remote. The reality of remote working teams that aren't necessarily close together in geographical terms is reflected by [i2] whose studio consists of game workers from both Germany and Norway collaborating on shared game projects on a daily basis. The team of [i1] works completely remote, in part due to the Corona pandemic disincentivizing on-site collaboration. Question three shows that participating game workers have a variety of both general and specialized job roles. Participants involved with management roles tended to also hold another position, while asset production and coding roles were largely focussed on their specific job. This specialization is reflected in half the participants belonging to one distinct job category. The need for highly skilled specialized game workers is also reflected in the interviews with [i1] and [i2]. The variety of team roles did not correlate with any other findings. Further research is necessary to capture the complex landscape of today's game industries.

"Which types of frameworks, meetings, and artifacts are used in commercial German game productions?" was answered by survey questions nine through twelve, with additional context provided by questions one through three. On their own the most chosen answer categories for question eleven showed that a majority of participants characterize their game's development as parallel in terms of both layers and features. This way of development is corroborated by [i1]. Parallel work also makes up a majority of chosen category combinations. This indicates a majority development

model that should be researched further. Answers to question twelve lend themselves to the parallel dominated nature, as hybrid and iterative development processes made up the majority of survey respondents' answers. A notable number of participants chose to make use of the Ad-Hoc category to describe development processes. Statements by [i1] and [i2] indicate a certain volatility within the games market that reflects upon the game development process itself. While technological knowledge is a constant that can be grown through proven means, the betterment of processes is an area of constant work. Answers to question nine and question ten suggest that a lack of consistent documentation and meeting practices might be to blame. However, even in companies that heavily make use of best practices such as [i1] and [i2] a degree of uncertainty remains. Both interviewees strongly echoed the belief that the exchange of information is crucial for improving upon these areas. In both companies delays get compensated by reducing work and cutting down on less important features, rather than promoting crunch. [i2] stated that the development of self-published titles afforded a greater degree of freedom when it comes to milestones and deadlines. For her a well-planned budget should have enough buffer to compensate for delays, although she admitted that planning correctly had been a learning experience. In closing [i1] asserted that the everchanging nature of game development was another notable factor that made development hard, as the way games were made today was fundamentally different than that of games made 10 or 20 years ago.

The final research question was "How do the findings compare to previous studies done in other countries?". In terms of population size this survey was most similar to [26], but had a much smaller percentage of actual participants at 50 out of 660 studios. The total number of studios was higher than in previous studies, but the generalizability is much lower as participants only represented a small fraction of the total number of game studios in Germany. [9] categorized the Austrian game industry in 2010 to consist of two categories: 85% of the 13 surveyed studios were classes as independant with a staff size of one to four members. The other 15% had a staff size of over 15. 18 of the 50 respondents of the German survey had a staff size of one to four members in a joint team, and six had a confirmed staff size of more than fifteen members. The latter number is potentially higher as the total staff size was not a direct question within the survey, but could be derived from some of the answers to question 3. This puts larger studios at a comparable level, while the number of small studio sizes is at 36%. The largest percentage is taken up by midsized studios that have a staff size above four but below 15. This is more comparable to the findings of [17] in 2013 that half of the surveyed Finnish studios had a staff size of less than 15. Given that [17] excluded studios with staff sizes less than five, the



German games industry appears to have larger studio sizes on average. Numbers are further complicated by the involvement of external team members and publisher services. Comparing the makeup of development studios alone does no longer suffice to compare the developmental levels of modern game industries belonging to different countries. The development or adoption of more sophisticated means of comparison should be considered a priority by future research. [17] also made note of the number of concurrent projects at a company: “Five (25%) companies had only one project at a time, six (30%) companies two projects, three (15%) companies three projects, four (20%) companies four projects and two (10%) companies five or more projects.”. For this survey 14 participants (28%) worked on one project at a time, 20 participants (40%) worked on two, 9 participants (18%) on three, and 7 participants (14%) on four or more. As each respondent belonged to a different company and a majority was involved in Board roles and other management tasks likely to be related to all or nearly all projects at a company, these numbers do lend themselves to a limited amount of comparability. It appears that distributions have remained largely the same, although with a lesser amount of concurrent projects above three. Just like [17] no correlation between studio size and number of concurrent projects was found. [17] also observed that in terms of meetings *planning* and *feedback* meetings were neglected compared to daily standups. The findings in Section VIII show that refinement and retrospective tasks were practiced less regularly than daily standups, while sprint planning itself was practiced at similar levels. Comparisons to [18] show that standups were practiced regularly at similar levels, while game studios in New Zealand made much more use of regular retrospectives. Given the much smaller percentage of German development studios represented in this survey these comparisons have to be interpreted cautiously as well.

Additional limitations apply. CEOs and Board members in general were overrepresented in the data set and therefore impact the validity of findings when taking other job roles into account. Many questions were oversimplified, making results less meaningful. Data also appeared highly irregular at times, which coupled with a limited sample size, negatively impacted the number of observations that could be made with high confidence. Survey questions were not tested as thoroughly as prior research, and as such are likely to exhibit a number of deficiencies in their design. The use of convenience sampling further limits the importance that can be assigned to these findings. Some findings are also not based on an objective measurement but rather on the subjective opinion of individuals. It is unlikely that all survey participants shared a common understanding of the answers provided, which is going to result in some inherent variance. Further subjectivity could have been injected

by the research and interviews having been conducted by a single person. While feedback was incorporated, and best practices were followed, the decisions made on the design and interpretation of the survey was ultimately not a completely transparent process. Non-response bias and survivorship bias are also likely to have played a major role, as only currently active development studios were sampled, and a majority of them did not choose to respond. Question order and acquiescence bias were taken into account when designing the survey, but no formal measurements were made to safely conclude that participants were not influenced by these factors.

## X CONCLUSION

A first survey about the working methods and structure of the German game industry was conducted. It follows the same guidelines and general direction of previous research performed in other countries over the last 15 years. The structure of development teams and the types of frameworks, meetings, and artifacts were investigated through the lens of individual game workers at a variety of studio sizes. The change from studio to individual was informed by the findings and notable omissions of previous surveys, such as excluding non-developer roles, and smaller studio sizes. The changes made enabled new types of insights into the job roles and working methods practices within the German game industry, while preserving the ability to gather general information about an individual studio’s approach to game development. A first in this line of research, the survey design and process were documented. The results were made available to encourage more accessible, repeatable research. Key findings are comparable to previous research, such as a majority of participants working in a massively parallelized fashion with hybrid and iterative process management frameworks. The survey provided additional ways of understanding how game workers themselves experience these frameworks, and ascertained problem areas without tying itself to specific management practices. Documentation strategies and the regularity with which meetings, especially those reflecting on past work, were conducted, point towards potential deficits that were not solely explainable by modifications made to existing practices. The general landscape of game development revealed itself to be a complex area requiring a plethora of further research. While the amount of survey participants does not lend itself to greater generalizability, the survey results nonetheless fulfilled the goal of providing an openly accessible, scientifically grounded basis for future research. Additional interviews further contextualize the German game industry and show that the experienced problems are largely the same as in other countries. It is recommended that future research follows the same approach of designing surveys for all types of game workers, and to make use of multiple voices at

the same company to provide a better understanding of how different types of job categories understand and partake in the game development process. To that end it is also important to consider not only game development studios themselves but also the work done by publishers, third parties, freelancers, and service providers. Characterizing the interconnectedness of different companies collaborating on the development of a game could prove to provide key insights into the complexities of modern game development. As the understanding of the game industry in different countries evolve, so should the methods by which they are characterized. The fast, trend-based nature of game development demonstrates a clear need for researchers to consider the importance of repeated studies. The German game industry desires a greater exchange of knowledge that should be channeled into scientifically sound research. A symbiosis of game workers and researchers could accelerate research progress by encouraging a more organic approach to topic selection, driven by the needs of the industry itself. A variety of topics, such as the ties between the game industry and other creative industries, remain yet to be explored. Clearly there is much to do in the field of video game development research.

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