Mind the Gap… A Case Study about Cross-functional Collaboration between Teams in Game Development

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Abstract

Game development today is a complex process that differs from traditional software development by presenting unique challenges stemming from a multidisciplinary structured process, including teams from multiple fields, such as art, sound, programming, design, human factors and more. This, together with the growth of the industry during recent years has increased the need for a more efficient cross-functional collaboration and understanding between these teams.

This study focuses on the collaboration and understanding between two distinct teams, User Research (UR) and Development in order to try and shed some light on an emerging challenge of a gap in understanding that exists between the two fields. A case study was conducted at an established game company in Sweden, where a UR team was closely observed and analyzed. The results of this study showed that the issues and practices could be grouped into three different areas, Process, Communication, and Understanding that affected each other differently. Where a majority of the issues found often related to Communication and Understanding problems.

The findings provided a glimpse of the gap in understanding in a game development process and what problems it can entail and what the possible solutions could streamline the process. However, in order to fully understand and fill this gap more thorough observations during a longer period of time is required.
Sammanfattning

Spelutveckling idag är en komplex process, som skiljer sig från traditionell programutveckling genom att den presenterar unika utmaningar som härstammar från en multidisciplinär strukturerad process. Som inkluderar teams från många olika fält, såsom konst, ljud, programmering, design, mänskliga faktorer och många fler. Detta tillsammans med utvidgning av industrin de senaste åren har det skett ett behov av mer effektivt tvärfunktionellt samarbete och förståelse mellan dessa team.

Denna studie fokuserar på samarbete och förståelsen mellan två specifika team, User Research (UR) och Development för att försöka belysa den uppkomna utmaningen av en klyfta i förståelsen som existerar mellan de två fälten. En fallstudie gjordes på ett etablerat spelföretag i Sverige, där ett UR team noggrant observerades and analyserades. Resultaten från studien visar att problem och praxis kunde grupperas i tre olika områden, Process, Kommunikation och Förståelse där var och en påverkade varandra olika, där majoriteten av de identifierade problemen ofta relaterade till Kommunikation och Förståelse problem.

Upptäckterna gav en skymt av klyftan i förståelse som finns i en spelutvecklingsprocess och vilka problem den kan medföra samt vilka möjliga lösningar som skulle kunna effektivisera denna process. Dock, för att få full förståelse över denna klyfta och hur man kan skulle kunna fylla den så behövs en mer noggrannare studie över en längre tid.
ABSTRACT
Game development today is a complex process that differs from traditional software development by presenting unique challenges stemming from a multidisciplinary structured process, including teams from multiple fields, such as art, sound, programming, design, human factors and more. This, together with the growth of the industry during recent years has increased the need for a more efficient cross-functional collaboration and understanding between these teams.

This study focuses on the collaboration and understanding between two distinct teams, User Research (UR) and Development in order to try and shed some light on an emerging challenge of a gap in understanding that exists between the two fields. A case study was conducted at an established game company in Sweden, where a UR team was closely observed and analyzed. The results of this study showed that the issues and practices could be grouped into three different areas, Process, Communication, and Understanding that affected each other differently, where a majority of the issues found often related to Communication and Understanding problems.

The findings provided a glimpse of the gap in understanding in a game development process and what problems it can entail and what the possible solutions could streamline the process. However, in order to fully understand and fill this gap more thorough observations during a longer period of time is required.

Author Keywords
Cross-functional Collaboration; User Research; Game Development; Process; Communication; Understanding

INTRODUCTION
The game industry is a fast and continuously growing industry, with an increase on the global market by 13.3% and a value of 138 billion U.S dollars in the year 2018. This growth can be seen, not only on a global scale but also in smaller countries such as Sweden where there was a revenue increase of 17% in 2017 and has tripled during the last five years [34]. With this growth and the complex nature of game development comes challenges, especially in the area of communication and collaboration.

Game development today differs from traditional software development in many aspects [21]. Unlike most software application domains, it presents unique challenges in the form of a multidisciplinary structure where the typical process includes multiple fields such as, art, sound, programming, design, artificial intelligence, human factors and more [1]. This increases the need for efficient cross-functional collaboration and understanding between each discipline.

Cross-functional collaboration can be defined in different ways and there exist many concepts that encapsulate its meaning [23]. One definition that reflects the complexity of the game development process well, is the idea that people from different disciplines with various expertise pool together in order to accomplish complex tasks that cannot easily be dealt with by only one unit [13,4].

With this complexity, an increased interest in investigations of software engineering processes in game development has emerged, with the aim of addressing the challenges that follow. Where a consistent and prominent challenge showed to be communication, which typically resulted in the inability to translate between disciplines or misunderstanding problems due to not having the same vocabularies [21,1,17,22,14]. However, these studies have mainly focused on the overall process of development, from preproduction to production, to the end product. Little focus has been placed on the different individual teams and their specific roles and challenges within these processes.

User Research (UR) is one of the many disciplines involved in this process. It is an area that concerns the subjective nature of game development including user experience and understanding, which is an important and considerable aspect [21]. A game has to be more than just a software, it has to enthral the user, capture his or her attention and most importantly, it has to be fun [14]. Considering these aspects, together with the growth of the industry and the complexity of digital games today, a need for more expertise from fields such as UR has emerged.

In result of this, user testing and user-centered design have become more common for creating digital games and there has been a recent advancement in the field with new tools, techniques, and methods [19]. However, there is a current lack of studies done on the processes and communication of and with UR teams in game development, thus making it an interesting area to investigate.

Case Description
UR is a field that is growing in the games industry today, but regardless it is still struggling to make its way into companies. It enters the field with the challenges of combining the subjectivity of Research with Development that
is not always appreciated or understood by other players in the industry.

One company that has embraced this field is the Swedish game developer and publisher, Paradox Interactive, where UR has been an active support department for many years. It consists of a team of seven dedicated people that take on multiple projects to help and support development and production teams in various ways.

Normally a UR team works together with a development team throughout the development of a game, in order to provide player insights on that specific game. For a company like Paradox, this collaboration becomes a bit different. Their role as both Publisher and Developer have allowed them to work on a multitude of different games with both external partners but also with their own development teams. Meaning that the projects that the UR team takes on can vary a lot, and as briefly mentioned communication and collaboration is difficult, adding a variety of stakeholders and games to understand for each project can make the task even more daunting.

The aim of this thesis is to explore this case of UR in order to obtain valuable insights on how the processes and communication practices look like for a team that encounters these two sides of development.

**PROBLEM STATEMENT**

This thesis was a research study with a focus on exploring the unfolding problems and challenges of cross-functional collaboration, between User Research and Development teams in a game development process. Problems and challenges that have created a gap in understanding between these two teams.

The goal of the study was to closely investigate this collaboration in order to obtain valuable insights on how the process and communication practices look like for a UR team, and how these insights affected the process, communication and understanding between these two teams. To investigate this, a set of three research questions were developed and formulated as followed:

- **What processes are the User Research team using and what phases are involved?**
- **What conflicts do the researchers & producers or developers experience in their communication, and how does it affect the cross-functional collaboration?**
- **What is the general understanding between the teams, and how does it differ?**

**Structure of Study**

Emerging from the three research questions above where three areas: **Process, Communication, and Understanding**. These three areas are closely related to the problems and challenges that have emerged with cross-functional collaboration in game development.

In order to understand the process of UR and how they collaborate and communicate with other teams, this study was built around these specific areas. How they connected and interplayed with each other was the focus throughout the study (see figure 1), and influenced many of the concepts described.

This upcoming Background chapter aims to provide and establish an understanding of these areas, and how they relate to UR and Development in order to give further context to the purpose of this study.

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**Figure 1. The three areas Process, Communication, and Understanding connect and interplay with each other.**

**BACKGROUND**

**User Research in Game Development**

UR in game development, also called Games User Research (GUR), is an interdisciplinary field of practice and research that has the aim of ensuring optimal quality of usability and user experience (UX) in video games. The field of GUR has recently become a core part of game development where its production revolves around providing evidence of what players experience in a game, by using multiple methods from different research areas including, psychology, human-computer interaction, game design and more [33]. Unfortunately, GUR’s integration has been far from smooth and has for over a decade struggled to find the recognition it deserves [7]. Two major reasons are at fault, one being that integrating GUR into a company is not always possible due to the size and budget of the company. The other is the fact that GUR only became properly formalized as a discipline within the last decade and there still exists concerns and misconceptions regarding the field and its practice [28,12].

These concerns and misconceptions have been unfolded and expressed in different forms such as; research can be seen as an unnecessary hindrance to development or UX research will restrict the creativity of a team that can in worst case scenarios caused direct aversion [12]. Usually, these issues stem from a gap that exists between development and research in the development process [6]. This gap mainly persists because of the subjectivity that the term “Research” entails and is perhaps not something that is strongly associated with the efficient and immediate applicability that a game development process has. Under-
standing GUR’s relevance in the game development process is essential for the industry’s success, due to the increased complexity of games we can see today and the steady increase of their target audiences and its diversification [8,7].

In game development, GUR can be seen as a strong vine that spreads amongst the majority of fields that represents the process and supports and provides evidence for each of them [7]. Thus, giving the field an extensive supporting role that interfaces with almost every other field and can be implemented in all of the areas in the development process. A typical GUR process is usually constructed of multiple steps, and can, in short, be summarised into four major phases (see Figure 2): gathering information, recruit participants, run user studies and deliver findings [25].

Figure 2. An illustration of a typical UR process explained in Games User Research [25].

Implementing this into the development process can look different depending on the company and its organization. Furthermore, because of the already complex process of game development [2,25] there exists a strong emphasis on a process that can be well integrated. There are a few examples of what researchers in the field have done to try and integrate research into the development process. One of the bigger players in the field, Electronic Arts (EA), incorporated research into their production pipeline by creating a UX process that could effectively be synchronized with their development process [29]. Which in turn also created a synergy between the research and development. The User Research Process Manager at Ubisoft Entertainment, David Tisserand, highlights in the book, Game User Research, which is well-established within the GUR industry, that having a well-defined process is equally important for both researchers and developers [25]. A good process can inherently lead to good workflow, ensure the quality of work and results, and can help other teams understand the work of the researchers.

Cross-functional Collaboration and Communication

From the above discussion, it can be concluded that having a well-defined process is one important piece of the puzzle, but in order to fully integrate such a process, there is a need for finding a good process of communication and collaboration between the two fields, research, and development. Many of the successful attempts, which could be seen in the EA case, have been successful thanks to good communication and collaboration between the teams in the two fields, and similarly, failed attempts have been because of the lack of it.

Finding a synergy and bridging the gap between research and development is a topic that has been discussed actively by experts in the field during industry related summits for the last few years [29,31,30]. Yet, even though there have been many studies done on processes in game development, as mentioned in the introduction, very little research has been done on the communication and collaboration between individual teams. The few ones that exist are mainly trials and errors conducted and presented by companies in the field and a more elaborate investigation of the area is important.

In respect to that, especially in a hectic and time constrained field that is game development, communication is not the easiest task to master. If we take a step back and look at it from a general psychological perspective, we can see that there are many different aspects that determine how it can unfold and be perceived. Where the hardest part lies in understanding each other. Communication can create new knowledge and construct a shared reality if the communicator and audience take each other into account [11].

Shannon and Weaver proposed a model of communication in 1949 where the communicator and the audience stand opposite of each other in a channel, and in between them, the channel can include ‘noises’, which can lead to problems in the communication process [26]. This model can be used and translated into any process of communication, but with one important aspect to consider, that it has to be a two-way street. In order to create new knowledge and a shared reality, there has to be a loop of mutual understanding. Especially when it comes to processes where the communicator and the audience comes from two different fields of knowledge. On a philosophical level, this idea creates an interesting parallel to the debates around Thomas Kuhn’s theory of scientific revolutions [15]. This is, however, a broad theory and exploring it further would be out of scope for this thesis, but an interesting perspective for future studies.

Johan Dorell and Björn Berg Marklund describe that a successful and impactful GUR is a dialogue between the two that is mutually constructive, hence the gap between research and development (see figure 3). They highlight that this system of communication is crucial and that the researcher’s ability to act as a conduit can dictate the system’s success [6]. This dialogue, similar to the process mentioned in the previous chapter, comes in various forms and are followed by different sets of challenges.

Figure 3. Illustration showing GUR’s importance to act as a conduit in the gap, explained by Johan Dorell and Björn Berg Marklund in Games User Research [6].

From the few available examples on the topic, we can find communication processes in different forms. This ranges from standard ways of communication through mail con-
versations and result deliverables, to more explicit forms with strategic kick-off meetings where researchers and developers meet to get a better understanding of each other’s needs, discuss results, and follow-up on meetings. However, there are many aspects that can influence these processes, aspects that have been a consequence of the existing gap between the two fields, whereas the most prominent ones have been, lack of trust, lack of involvement and integration and a lack of understanding [29,31,30]. What has been discussed in this section shows the importance of a mutual understanding among teams and how important it has been to tackle the emerging challenges in order to bridge the gap between research and development, and thus come one step closer to develop a successful cross-functional collaboration.

Understanding between Teams
The previous sections have explained and discussed two important puzzle pieces of the problematic phenomenon of the cross-functional collaboration between research and development. The third and last puzzle piece connects many of the aspects that have already been discussed and can be seen as the basis that lays the way for potential success. This basis, as we have discovered, is cracked in many ways. Where the key challenge lies in the lack of understanding between the teams. Since this challenge can be seen in more fields than just game development such as software development but also banking and retail [13], there has been an increase in research that tries to tackle this.

On a more company and organizational level, there has been research conducted on the topic of knowledge integration, which argues that an organization’s level of efficiency depends on the extent of existing common knowledge between teams, the level of coordination and structure [10,13]. Many of these aspects can be seen and compared with the challenges that have been discussed throughout this chapter, especially the lack of knowledge between teams. Extending the knowledge between the teams could lead to more efficient work and communication between them, which in turn could give way for GUR to gain the recognition it deserves.

There exist a few examples of potential factors that cause this lack of knowledge between the two teams, where the two most prominent ones are a lack of involvement and trust [31]. Since many organizations, for example, Microsoft [28] and Paradox Interactive, have a structure that separates the development and research team there becomes a gap in understanding between them. Where neither of the teams can feel complete involvement in each other’s processes. Lack of trust weaves into the lack of involvement and can be seen as a cause of not allowing the teams, or the members of the teams to get to know each other. Understanding what a specific team does and how they work can entail more trust and create more efficient collaboration and communication [29,32,31,30]. Delivery of results is another important aspect to consider when it comes to the understanding between the teams. GUR’s main purpose is to help developers understand how players are playing and experiencing their games. In most companies, this is done by the researchers creating and providing a report with a set of findings. Translating these findings, which are usually quite research and academia heavy to teams that might not be familiar with the structure or terminology can be a challenge. Therefore how such a report is articulated or presented can be crucial in terms of developers understanding its content and its potential value.

METHODOLOGY AND METHOD

Qualitative Research Approach
Due to the complex nature and process of cross-functional collaboration in game development, concerning how people work and act in a specific context a qualitative research approach was used [24]. Since the goal of this study was to dig deeper into this phenomenon to get a better understanding of the process and communication practices that a UR team uses in a process, qualitative research was especially suited because of its flexible nature for exploratory work. It offered a holistic and thorough approach [24], which allowed the author to answer the research questions by gathering insights from different perspectives.

To ensure the validity of this study and its results, multiple methods were used and data was collected from multiple sources and perspectives. Triangulating the data was done in order to obtain a deeper understanding of the studied phenomenon and reduce misinterpretations [16].

UR faces problems and can be affected by various factors as discussed in the background chapter. Using this approach allowed for a systematic way of effectively identifying what those factors were and how they affected the work for the UR department.

Case Study Research Approach
One of the methods used in this study was a case study, which is a method that can be referred to as "an inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly defined evident” [27]. In order to obtain a concrete and deep comprehension of how a UR team work and communicate in a real-life context [20], this study used the case study method as its main approach, to explore and collect data relevant to the research questions.

The research was conducted at the game developer and publisher Paradox Interactive, as mentioned in the introduction chapter, together with their UR department. The researcher’s role at Paradox is to provide insights on player behaviors and opinions to the other teams and is done by the researchers taking on projects related to different areas. These projects typically vary in tasks and research area and can range from, creating market research surveys, analyze
reviews for player opinion reports, to conducting specific playtests for a game.

The projects that were focused on in this study were mainly the playtest projects, these projects had a similar structure to the process explained earlier, with the slight difference of only focusing on three phases, Gather Information, Run User Studies and, Deliver Results. In addition to the playtests themselves, these projects involved internal meetings between researchers, external meetings with stakeholders and members from production and development teams.

The author worked closely together with the UR team over a period of three months, and during this period three main methods were used for data collection. Ongoing projects were observed, which allowed for an in-depth understanding of the UR work process and communication practices with other teams. Face-to-face interviews were conducted with researchers from that team that gave insight into more personal views on the process and practices. To get another view of the situation a focus group with two project producers was conducted. In addition to these methods, previous UR projects were reviewed and analyzed which provided information on how the department had worked in the past, and how that differed from how they worked today. These methods will be described in more detail in the next section, ‘Data collection’.

Data Collection
Observations
Observations of the playtest projects were conducted throughout the study in order to gain more contextual knowledge of the working environment of the UR team. This mainly included informal and formal meetings with clients, stakeholders, other researchers, playtests and debriefing sessions. In order to remain as unobtrusive as possible, the observations were done by the author taking part in the different phases as a silent observer, and the data collection consisted of taking fieldnotes [18].

To support the observation process an observation guide was created that included a set of potential factors to look for and use as guidance. These factors were separated into two sections;

Contextual related factors - Including questions such as; Team size, duration, experiences, and subjectivity.
Communication-related factors - Including questions such as; Subject expertise, documentation, and form of communication.

This was done with the purpose of making it easier for the author to separate the two factors in order to identify potential correlations when analyzing the data.

Interviews and Focus Group
In order to gain detailed information about how the different processes and practices were perceived and understood, individual semi-structured interviews [3] were conducted with three researchers from the UR team and one with the team’s manager. To support the semi-structured interviewing process an interview guide with a formal set of questions was prepared by the author. The guide contained both closed and open-ended questions and was divided into four sections: (i) Background, (ii) Project & Process, (iii) Communication, and (iv) Understanding. The use of an interview guide allowed the author to collect data in a consistent and unbiased manner.

The questions in these sections were related to the studies research questions and derived from a more general view. Each question was designed to seek background information about the participant, and encourage them to think back at a project that they had worked on, what it entailed, what their process was, how they had experienced the communication with other departments, teams or clients, and also how they believed their work was understood.

All participants participated voluntarily and before each interview session the participants were verbally informed about the purpose of the interview and how the data would be treated. Besides the questions mentioned above the author occasionally added additional questions if it felt necessary, these questions were mostly probing questions in order to understand the answer better. The duration varied between 40-50 minutes and each session was audio recorded and later transcribed and analyzed.

Since all of the projects that the UR team work on included communication with a production team, a focus group was conducted with two producers. The purpose was to avoid biased answers from the researchers but also to gain a different viewpoint of the processes and practices used. To get a broader viewpoint the two producers had been chosen because they had worked on different projects together with the UR team. The focus group was conducted in a similar way as the interviews, and a similar but slightly altered interview guide was used. The questions were divided into the same four sections but instead encouraged the participants to talk about experiences they have had with the UR team during the projects and how they felt that they understood the work and results that the researchers provided.

Data Analysis
The data analysis consisted of two consecutive phases. The first one being a Grounded theory coding phase and the second one a Visualization phase.

Grounded Theory Coding
The Case study approach was followed by techniques from Barney Glaser and Anselm Strauss’s well established Grounded theory method, which involves the construction of theories through methodical gathering and analysis of data [9].

In order to generate a theory about the UR team’s process and communication practices, grounded theory coding was used to analyze the collected data. This is a commonly used method that allows a researcher to conduct data collection
and analysis simultaneously in an iterative process. In order to explore and make sense of the gathered data by constructing analytic codes and categorizing them. It gives the opportunity to advance theory development during each step of the data collection [24,5].

The coding process consisted of two phases. First an initial, more open phase followed by a focused, more selective phase [24]:

- **Initial Coding** - This involved a close reading of the data and identifying categories, properties, and dimensions.
- **Focused Coding** - This involved using the most significant or frequent initial codes to sort, synthesize, integrate, and organize the data.

**Initial Coding Phase**

All the collected data was transcribed and manually recorded into a coding sheet developed by the author. This coding sheet consisted of a matrix that organized and sorted the data into specific sections. This allowed for an overview of the data during both coding phases. This coding phase involved assigning codes to various notations from the observations and quotes from the transcript, i.e. raw data, to classify and categorize them. These codes consisted of a set of requirements, chosen by the author, that represented three of the sections in the coding sheet;

**Importance Scale** - A color scale that indicated the notations relevance to the research questions.

**Memo** - A small text in the form of a question, comparison, action or data exploration [24] that showed the data’s possible conceptual connections.

**Theme** - A notion that connected the data to one of the three core themes, User Research Workflow Process (URWP), Operational Factors (OF), and Understanding. These three themes are connected to the papers three main areas (see figure 1), and each set of connected data can be seen as key aspects.

**Focused Coding Phase**

The second coding phase involved changing and adding categories to the collected data, sorting the most significant and frequent initial codes in order to develop the most salient categories and conceptualize definitions and assess the relationship between them [5]. Each initial set of codes were thoroughly analyzed by the author to identify any similarities, differences or patterns. This was done multiple times until no further categories could be found. The focused codes were then grouped and organized into categories and clustered together with a specific theme. These clusters generated a set of conceptualizations, in the form of issues and practice that showed how the cross-functional collaboration was affected. These clusters will be thoroughly explained in the upcoming result chapter.

**Visualization**

The second analysis phase consisted of visualizing the generated conceptualizations for specific projects into *Project Models*, in order to strengthen and make the findings more comprehensible. In total, three Project Models were created and they all represented the different phases of on-going projects that the UR team at Paradox worked on during the time of the study. The three different projects chosen were all Playtests that varied in character and had different clients and production teams, in order to make the results as representative as possible.

The models were structured based on the typical process of a UR playtest project at Paradox and consists of three columns, each representing one of the process phases (see figure 4). Where the *Gather Information* phase mostly included meetings with stakeholders, the *Run User Studies* phase included the playtest of the game and the *Deliver Results* phase consisted of providing feedback to the stakeholders.

![Figure 4. An example of a Project Model, showing the three process phases and the symbols indicating issues and practices theme and positive/negative (green/red) effect.](image)

The symbols in the cells indicate a set of issues or practice related to a specific theme, and the color of the symbols indicates that they either have a positive or negative effect. The models were developed by the authors for the sole purpose of this study.

- ![ ] - Practises/Issues that relate to the *User Research Workflow Process* theme
- ![ ] - Practises/Issues that relate to the *Operational Factors* theme
- ![ ] - Practises/Issues that relate to the *Understanding* theme

This approach provided a visual representation that explained and highlighted the specific issues and practices found in the clusters and pinpointed them in the work process of the UR team.

**RESULTS**

In the focused coding phase of the analysis, ten categories were identified, where each category is connected to one of the three main themes (see Table 1). During the analysis phase, a simple pattern emerged that shows how the three main areas, *Process, Communication, and Understanding* were connected and interact with each other. The same pattern can be seen between the different categories, and with this structure, an interesting finding appeared.

Almost all the categories from the Operational Factors (OF) and Understanding theme interplay with each other in a two-way connection and the same can be seen between the
User Research Workflow Process (URWP) and Understanding categories. However, between the URWP and OF theme there is only a one-way connection, meaning that the process can have an impact on the Communication, but there is rarely an impact the other way around. This indicates that, even though the process that the UR team have is significant and plays a big role, the major problems lies within communication and understanding, and how they interplay with each other. Which is in line with the hypothesis of this study, that there is a gap in understanding between research and production. This is presented more clearly in Figure 5.

Table 1. Each set of theme and accompanied category consists of a cluster of issues and practices that generates a conceptualization of how the cross-functional collaboration and understanding was affected between the teams.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational Factors</td>
<td>Involvement &amp; Engagement, Communication, Context &amp; Structure</td>
</tr>
<tr>
<td>Understanding</td>
<td>Articulation &amp; Structure, Expertise &amp; Expectations, Common Knowledge</td>
</tr>
</tbody>
</table>

As mentioned in the method chapter the focused codes were grouped into categories and organized into clusters. These clusters contain a specific set of observations done by the author and notations from the interviews and the focus group that together entail different conceptualizations. These conceptualizations show how the cross-functional collaboration between research and production, in its three areas, Process, Communication, and Understanding is affected. Each category in the clusters are linked to one or more of the categories found, and similar to how each category was connected the same pattern was found between the clusters. Below follows a summary of each cluster, including the most prominent findings within each category.

Clusters – Themes and Categories

User Research Workflow Process

Process Constraints, as seen in Table 1, consists of issues that have affected the processes of the UR team. The prominent issues found were that for some projects the researchers did not have access to the right physical equipment for playtests, which either stalled the process or hindered them from conducting a specific test. Researchers also often had to wait for deliverables from the development team, such as builds of the games they were testing, and similar to the above issue this caused a delay in the process. Getting information about this process was also hindered by the researchers having restricted access to developers, who are placed behind an intermediary, usually a producer, which in turn lead to inefficient communication.

Process Tools are tools that have helped the UR team in their processes and communication. These tools consist of templates and modules used for writing results which created an efficient process for the researchers to quickly deliver understandable results. Documentation that illustrates ideas and decisions made in meetings was used in some projects as a helpful tool for both researchers and producers. They were often used as transcripts that were later developed into mind maps used to describe playtests, which allowed for efficient communication and understanding.

Process Steps are steps and phases in the UR team’s processes that either helped the team in a positive way or created issues that hindered them. The most prominent steps found for this category were; for each project, the UR team assigned a lead researcher, which created an easier way for communication and were appreciated by both teams. The main step observed for each project was external and internal sync meetings, where both teams had the opportunity to get a better understanding of each other and the project. For some projects, the researchers worked embedded within either the development or production team, which often resulted in a synergy between them and allowed the researcher to adapt the process more accordingly to the needs of that team, which in turn created a smoother process, communication, and understanding. Issues found were, a lack of pilot testing playtests, a seldom-used phase but mentioned as an important one by almost all researchers. There was sometimes a problem for the researchers to get a hold of stakeholder when it came to feedback meetings, which resulted in an ad hoc communication process and inefficient understanding. However, both producers mentioned that they appreciated these feedback meetings.

The Work Environment category consists of practices and issues in the environment surrounding the process that has affected the UR team. The positive practices found were that researchers worked in close proximity to each other and that they often could observe playtests from their own desks, which allowed for efficient process and communication. One issue that was observed was that the UR team did not have enough space for conducting bigger playtests. Which, when conducted caused a noisy environment for both researchers and participants. This usually led to the UR team outsourcing playtests to other companies, which created ad hoc processes and affected expected outcomes.

Operational Factors

The Involvement & Engagement category consists of practices and issues that affect the involvement and engagement of researchers and developers or producers in their collaboration. The issues found within this category were that during the process of a project the researchers sometimes did not get enough information from the production team and a lack of active and iterative communication existed. This resulted in researchers not feeling involved in the entire
process and got the feeling that they are only being perceived as, quoted by one of the researchers, an “Opinion machine”, which in turn could cause a lack of trust and understanding in the long run. Issues related to the aforementioned are the lack of feedback the researchers get from production and the lack of direct contact they have with developers. Which lead to researchers not fully understanding how their work affects the process that can, in turn, create a lack of engagement and inefficient communication. The positive practices found that create efficient communication and understanding between the teams, are embedment and sync meetings that were mentioned in the Process Steps category.

In the Communication category, there are issues and practices that have affected the communication between the UR team and the production team in both positive and negative ways. The issues found were that requests from production could sometimes be unrefined and vague without meaning or explanation behind them, leaving researchers having to probe for more information. From the interviews the lack of documentation from meetings was mentioned, where one producer felt that important information such as the number of participants, sometimes disappeared and caused misunderstandings. Another prominent issue found was the researchers concerns about the lack of articulated feedback they got from production, which usually resulted in confusion and frustration. The identified practices that create efficient communication were the openness for discussion and the appreciation of the researcher’s expertise.

The Context & Structure category consists of issues and practices that relate to the structure and context around the communication between the UR and production team. The issues found during the interviews were, the unfamiliarity that teams have of each other’s processes, where some production teams don’t know what UR can offer or researchers not being able to give accurate information to the accurate stage of development, which in turn creates inefficient communication and understanding. Positive practices in this category include the idea of involving UR related expertise, such as UX designers in order to create a better understanding for the production team, which had been done for a few projects already.

Understanding The Articulation & Structure is a category that consists of practices that relate to how the UR team can affect the understanding of results. The most important practices found were the researcher’s efforts for creating an efficient understanding of results by having a standardized structure for all of their reports, which also allowed for an efficient process for the researchers. This was appreciated by both developers and producers, whereas they almost always were presented with a similarly structured report. An issue mentioned was that sometimes the results were not explained enough and could thus be interpreted in different ways, which could lead to misunderstandings.

Subject Expertise & Expectations, this category consists of practices and issues that have affected the understanding and expectations between the UR and Production team. The
most prominent issues found in this category related to concerns from the researcher's side of a lack in response from producers when not understanding results, which closely relates to the lack of articulated feedback mentioned in the Communication category. However, during the focus group, the producers expressed that they have had problems understanding some results, such as diagrams and severity connections during some projects. Further issues found were a difference in understanding between production teams which results in an ad hoc process for the researchers. Prominent practices found were the reliance towards the researcher's expertise, which gave them an opportunity to act as trusted advisors.

The Common Knowledge category consists of issues and practices that relate to the general understanding and knowledge that exists between the UR and Production team. The prominent issues in this category relate to the unfamiliarity between the teams, as mentioned in the context & Structure category, and also the inarticulated feedback from the production team mentioned in the Communication category. These issues, in this sense, was found to be an underlying cause for the lack of understanding, where not having a full understanding of each other causes inefficient processes and communication.

Project Models
To better visualize the conceptualizations discussed above and the project processes of the UR team, Project Models were created of three projects. Where two were external ones, i.e. working with external developers and one was in-house, i.e. working with Paradox's in-house development team. The projects are illustrated in models, explained in the method chapter that contains and highlights the specific issues and practices found in the conceptualizations, and where in the process they occur.

External Project One
This was a project with the goal of conducting a playtest of a game in development. The project was conducted over a period of four weeks and included two researchers and one producer as main actors.

Gather Information
This phase consisted of a sync meeting between the researchers and the lead producer, and as can be seen in figure 6 above it shows a positive trend of practices. For this phase, the producer was well-prepared which allowed for open and thorough communication between the two parties. This, in turn, led them to understand each other, and the project well. Additional to this, both parties had their own documentation that was looked through and discussed and turned in to a shared document with the goal of the study. This created an efficient process for the researcher to later develop a Mind map of the playtest, which outlined the focus of the playtest. However, throughout the project, the researchers had restricted access to the developers and were not allowed to contact them directly without the producer’s approval.

Run User Studies
When looking at the playtest part of the project the researchers started with the constraint of not having access to the right equipment which created an inefficient process of having to obtain that, together with not having the time conducting a pilot test of the game. On the positive note, the researcher did not have to wait long for the playable build of the game, which allowed them a few days of playing in order to familiarise themselves with the game. During the playtest the researchers were able to observe from their own desks, which allowed for an efficient process and an unbiased atmosphere for the participants.

Deliver Results
This phase began with internal sync meeting between the researchers, in order to check that they were on the same page so that the results were accurate and structured similarly, to make them more understandable for the producers and developers. The result of this was positive where the producer provided positive and somewhat articulated feedback to the researchers. The feedback informed the researchers of how the results had been shared with development and the future steps that would be taken. The feedback also expressed the producer's appreciation of the project and that she had understood and learned a lot, which would be applied to future studies. This shows that good communication can lead to common knowledge. However, the producer asked the researchers for feedback on her own part in the collaboration and was given a vague and unarticulated answer.

External Project Two
This project also had the goal of playtesting a game in development, it was conducted over a period of approximately five weeks and consisted of three researchers and one producer.

Gather Information
As can be seen in figure 7, this project started off on a negative note with a few issues. This phase consisted of a sync meeting where the producer was unprepared and gave very
vague descriptions of what he wanted the researchers to do. The researcher had to probe for more information which the producer was still unsure about and could not provide efficient information. This resulted in inefficient communication and understanding between the two parties, and a little frustration from the researcher side. Furthermore, with this lack of information and lack of direct contact with the developers, the process of developing the Mind Map that outlined the playtest was stalled.

**Run User Studies**

Besides the unfortunate start of this project the playtest phase was mostly positive. The project had three researchers on it, which allowed for an efficient process when it came to playing the build for the playtest. Each researcher was able to play and get familiarised with the game early. One of the researchers were in a junior position which resulted in the team having more internal sync meetings than usual, in order to get everyone on the same page. This allowed them to communicate and understand each other well. However, having three researchers on the projects allowed the project to be of a bigger scale. This created an inefficient process due to the lack of space when conducting interviews with the participants and lead to it being very noisy in the playtest lab. Which in turn created a biased environment that could have affected the results.

**Deliver Results**

Similar to the first project this project included thorough internal sync meetings between the researchers, in order to structure the results accurately. The feedback of the results was positive and opened up for an interesting discussion between the researcher and producer about the results, but also about starting to involve a UX-designer to future projects. This discussion created a good communication between the two where both expressed that the involvement of further expertise would lead to better understanding.

**In-house Project**

In contrast to the projects above, this project was conducted in-house with a production and development team from Paradox working on a game developed by the studio. The goal was to conduct a playtest of the game. The project was conducted over a period of five weeks and included two researchers, a UX-designer, a Game-designer, and a Producer as main actors. The lead researcher on the project also worked embedded with the development team during the entire project.

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**Figure 8. This model shows a majority of positive practices throughout the phases of the project, where the only issues found were process related.**

**Gather Information**

Because of the fact that the researcher was able to work embedded with the development team this phase was well-prepared and planned. Similar to the first project, this one also included sync meetings, both with the producer and the UX-designer, which allowed the researcher to establish efficient communication early on. With this extra set of expertise of a UX-designer that had previous experience with UR resting, and the embedment allowing more time and access to iterate ideas more easily, the understanding between the parties became more profound. With this understanding and access to time and people, the researcher was able to iterate through and create an efficient Mind map that outlined the playtest. However, no other documentation was created.

**Run User Studies**

The playtest part of this project was in its majority positive with only one downside (see figure 9), being that the project was on a tight schedule which allowed no time for the researcher to conduct a pilot test. Waiting for the playable build for the game did not hinder the process of this project. What was mainly being tested could be found on previous builds and new content, which was a new UI, was solved by the researcher having access to pictures and direct contact with the UX-designer that had created the UI. Being embedded also allowed the researcher to ask about the build and be kept in the loop during the entire process and when the build was finished the researcher got a run-through of it by the developers.

**Deliver Results**

The writing of the results for this project became inefficient for the lead researcher due to the secondary researcher being occupied with other things and could not help as much as needed, which lead to the lead researcher having to do the majority of the work. However, the structure of the results had been planned and requested by the developers beforehand, which lead to the results being appreciated and well understood by both production and development. This clearly unfolded with the fast positive and articulated feedback the researcher received, which was thoroughly expressed via e-mail and later discussed in the feedback meeting.

**DISCUSSION**

The purpose of this study was to investigate the cross-functional collaboration between teams in game development and the gap in understanding that exists between Research and Development. This was done through a case study and close investigation of the collaboration and communication between UR and Development. With the attempt to fill the gap in understanding by mapping out the potential difficulties and pitfalls in the UR team’s process and communication practices.
The study was built around three areas, Process, Communication and Understanding, and doing this helped to clarify the findings. The approach made it easier to categorize and pinpoint issues and practices related to the cross-functional collaboration between the two teams, on both a more broad and specific level. The broader view made it easier to compare the study findings with the challenges recognized in the industry and gave more insights of how they connect to each other. Whereas the specific level provided a more detailed view of the issues and practices, what they entailed and where in a process they could be found.

This chapter discusses these two levels and the reasons for, and speculations around the findings within them. The section will also discuss the strengths and weaknesses of the methods used and how they affected the study and results.

**Connection between Themes and Categories**

The interesting finding in the category overview diagram presented in the result chapter (see figure 5), about the connection of the categories and themes, clearly shows that the UR process is rarely affected by the communication practices themselves. It indicates that the majority of problems related to the process do not stem from the communication solely, but rather the interplay between communication and understanding, which together affect the process.

Since these two areas interact with each other more intensely it could indicate that focusing on these problems would be more beneficial. As mentioned in [13] an organization’s level of efficiency depends on the extent of existing common knowledge between teams, focusing on this common knowledge and applying it on a team and project level could, in turn, create a more efficient process. This topic was reflected upon during the interviews, and one senior researcher suggested that understanding another team, how they function, how they make decisions and what arsenal they have and can work with could possibly result in better collaboration between the teams.

Even though this is an important aspect to consider, there are many other aspects that can influence both the process and collaboration. One of those is that the organizational structure of Paradox does not always allow for full transparency between teams, which can hinder the idea of teams getting to know each other. This is mainly due to the fact that Paradox has the role of both a Developer and a Publisher, which means that how they work with different teams varies depending on if the project is external or internal.

This impacted the result in terms of who the stakeholders were on the project and who the UR team were allowed to have direct contact with. Since the main communication was with a producer as an intermediary, the researchers would often times not get the full thoughts and ideas from the development team and were not allowed or encouraged to directly ask them. This was however very different from the in-house projects, where the researcher had access to almost everyone in the development team, which was seen in the second project model.

By digging deeper into the issues and practices and looking at the projects more closely the results showed that during the in-house project, the communication and understanding were more profound. Possibly due to the reason that a majority of the meetings and discussions in that project were with a UX designer, a person that could be considered to have more expertise in the field of Design and Research. This created a synergy between the researcher and the development and production team, a synergy that is very important to have when it comes to integrating research into a game development process [31]. In order to avoid putting UR in a bad light, where they can be considered as an annoyance instead of a trusted advisor.

Considering this, even though it might be difficult for a company like Paradox, having a producer as the intermediary for projects might not be the best option and could hinder this potential synergy. Producers are in charge of understanding information from a field that they are not proficient in, and could therefore, be considered being put in an unfair position, which in turn can put the UR team in a bad light. Having the producers in the background and including other experts would not only help the collaboration and understanding between the teams but also put less effort on both teams. Including, for example, UX designers in the process could help make UR’s deliverables more understandable and actionable for the production team, and at the same time allow the development team to be more involved.

**Method Discussion**

Looking at the chosen method for this study there are several factors that could have affected the results and improvements for future studies should be considered. One factor was the focus group with the producers, by only having one that consisted of only two may not have given a fair representation view from the production side of the game development process. Including more from different projects, both from Paradox’ internal development studio and external could possibly have provided a more nuanced answer from the participants. Additional to this, the fact that the author of this study represented the UR team might have caused the producers to not express their thoughts fully, together with the risk of being influenced by each other, which could have biased the results. In retrospect, due to the contrast between the projects, a one-to-one interview with each producer would presumably been more suited for this study, it could have opened up for more candor, and given the participants the opportunity to talk more specifically of their own projects. However, due to the stressful environment of game development and finding open times in the producer’s schedules were difficult, the chosen approach allowed the author to gather more participants for a single session.
Furthermore, considering Paradox’s divided role as developer and publisher and how this altered the different projects, there could have been a need for a more prepared focus on specific projects. Observing more projects and focusing more on the difference between them could have given more representative results of the UR team’s collaboration with production and development. Another suggestion would be to focus solely on either the in-house projects or external projects since they presented to be very different and is something that should be considered for future studies.

Beyond these factors the chosen method for this study felt appropriate, the method provided a concrete and deep comprehension of how a UR team works and collaborates with other teams in a real-life context [10]. Important to remark, however, is that a longer case study would presumably have led to different and more representative results.

Future Work
In order to fully fill the gap in understanding between research and development in game development more thorough observations during a longer period of time is required. This study provided a glimpse of how one company’s process and practices when it comes to research, which is not sufficient enough to make a solid case. Since different companies can have very different processes it is important, for future studies to consider more companies and teams. However, the results of this study do indicate that problems and difficulties in a UR process, and the collaboration with other teams, lies in the different areas, Process, Communication, and Understanding, and can affect each other in different ways. Thus, building on this approach could be useful for future studies, in order to gain a multitude of perspectives that could enhance the understanding of this gap, and how it can look for different companies and future research.

CONCLUSION
The goal of this study was to investigate the cross-functional collaboration between distinct teams in a game development process, in order to try and fill a gap in understanding between Research and Development. The study shows that the issues and practices can be grouped into three different areas, Process, Communication, and Understanding where they affect each other differently. Prominent findings were that a majority of the issues found often related to, and could be traced back to Communication and Understanding problems, where teams did not have enough knowledge of each other or were not allowed full transparency when it came to communicating with external partners. The result also showed that the collaboration between the teams was more profound during in-house projects compared to the external ones.

The study provided a glimpse of the gap in understanding in a game development process and what problems it can entail and what practices could be possible solutions for streamlining the process of this complex phenomenon. This glimpse and its associated set of information provide a small step in filling this gap and shedding light on UR’s role in game development, which hopefully opens up for further research in the field.

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