

Communication and Knowledge Management Strategies in Video Game Design and Development: A Case Study Highlighting Key Organizational Narratives

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Abstract - This paper summarizes and contextualizes a case study that presents data from interviews conducted over a period of three months within an independent game design and development studio. The study discusses how the studio is organized and how employees perform typical tasks and interface with management. The research focuses specifically on communication and knowledge management practices employed by the organization and articulates key stories that represent the challenges of working within a workplace that spans both creative and technical disciplines. These stories add to our knowledge of technical and professional communication in game development and provide us with important information about engineering communication practices in multidisciplinary environments. The paper also discusses the tools, technologies, and documentation strategies used by game development professionals to communicate and work through difficult problems.

Index Terms - Video games, engineering management, knowledge management, narrative, case study, hybrid teams

INTRODUCTION

The video game industry offers rich spaces for technical and professional communicators to explore as examples of “symbolic-analytic” professional work environments [1]. Much has been written over the last decade about the potential of video games for teaching and learning in the 21st century [2], [3], [4], [5], but the actual workplace engineering and communication practices that lead to these products and projects are still understudied.

This is unfortunate because game development studios serve as fascinating objects of study for exploring the

connections between various types of engineering communication. For example, artists must effectively communicate with engineers in order to develop effective strategies for combining their 2d and 3d artwork with the engineers’ programming scripts. Likewise, engineers need to know about the aesthetic sensibilities of levels, worlds, and characters in order to develop the backend technologies and interactive programs that make sense within those contexts.

One interesting characteristic of the video game industry that enables us to explore these connections in more detail relates to its use of knowledge management practices, another largely unexplored territory in that area of software engineering. A software engineering firm’s main asset is its intellectual capital rather than material resources or extensive manufacturing facilities [6]. Similarly, technical communication can be considered a unique discourse of science, engineering, and industry [7]. As a result, we can apply strategies and methodologies from technical and professional communication to learn more about the complex interdisciplinary connections made between the communications of various types of employees in the game development industry.

For example, in independent video game development studios, effective knowledge management strategies that form connections between disciplinary areas of expertise are highly valued. When such strategies are in place, hybrid teams working across multiple projects can effectively communicate with other teams and individuals within the studio, leading to improvement in productivity and efficiency within the organization. While these tactics are sometimes difficult to explicitly articulate, stories can help us to better understand the ways in which these practices connect engineering professionals to one another and to their managers and teammates.

NARRATIVE KNOWLEDGE MANAGEMENT

Narrative approaches to understanding communication and KM have previously been documented and employed in a variety of industrial contexts including banking [8], government [9], healthcare [10], insurance [11], sales [12], and technology repair [13]. While academic research focusing on narrative in the engineering professions is relatively scarce, storytelling has proven to be an effective and engaging way of communicating ideas about the engineering profession through both fictional and non-fictional accounts as well as through debriefing scenarios and post-task analyses. Stories recount typical problems encountered by scientists and engineers in specific fields [14], [15], [16], [17] and tell tales of technical and professional communicators working in their disciplines [18]. Stories are able to capture in detail the complexities and nuances of engineering work, often providing additional insights about the human factors that intermingle with environmental, technical, and mechanical components.

METHODOLOGY

Following strategies of organizational case study research [19], [20] and incorporating techniques from narrative studies used in technical and professional communication [10], this research attempts to help the professional communication community better understand the communication and knowledge management practices of a game design studio. The specific research questions are as follows: (1) what strategies and technologies are used to facilitate communication and knowledge management within the organization, and (2) which stories and experiences articulate the unique nature of communication and KM within the games industry?

To explore these questions, face-to-face interviews were conducted with fifteen employees over individual one hour sessions and a number of observations were conducted during informal and formal group meetings. Since this case study follows a narrative approach to understanding knowledge management, scripted interviews were used as a guide, but organic variations in conversation were both anticipated and encouraged during interviews.

Interview questions were divided into non-narrative and narrative categories. Non-narrative questions were designed to solicit background information about the employee, his or her duties, and his or her communication and knowledge management strategies. Narrative questions were designed to prompt employees to elaborate on these strategies and provide specific examples of these tactics at work in specific circumstances.

Non-narrative questions included questions asking employees about their job titles, the groups or divisions they worked in, their direct supervisors, their average

daily activities, and the types of tools and data used to complete these activities. In addition, the non-narrative questions asked respondents to characterize the types of audiences they interacted with and to describe the mission of their organization as they understood it. Finally, employees were asked the percentage of time they worked independently versus in teams or group scenarios.

The narrative questions were story focused and designed to prompt interviewees to contextualize work practices within larger circumstances. Sample narrative-based questions guiding the elaboration portion of the interviews included targeted questions such as these:

- Tell me about when you first came on board, and how you were taught how things get done around here. What was most helpful to you?
- Tell me about a situation in which you had to seek help from others.
- Tell me about a failure you experienced or a situation in which you did not perform as well as you would have liked. What did you learn from that experience?

Interviews were conducted by the author in a conference room on site at the studio. The interviews were recorded and additional written notes were taken during each conversation. The recorded audio interviews were later transcribed using *Express Scribe Pro* software. For the stories printed in the results and discussions section of this paper, conversations were edited to remove speaking tics (umm, uh, etc.) and more clearly convey the main ideas. No significant edits changing the substance or meaning of any stories were made.

At the end of the interview, the employees were each provided with an opportunity to provide additional information that they felt might be useful given the subject of this study. That catch-all question was phrased as follows: "At this time, I'd like you to share any additional interesting stories or memorable moments, of your choosing, that provides insight as to what it is like to do your job, or provide insight into the knowledge management or communication practices of this organization." Employees were also encouraged to think in more detail about their communication and knowledge management practices and send in relevant thoughts later by email. Only one employee took advantage of this option, but it yielded some interesting and important insights, discussed later in this paper.

In addition to employee interviews, various examples of professional documentation such as company background sheets, promotional materials, and organizational charts were also acquired and reviewed. This data provided additional information about the company's background, organizational layout, and business strategy.

DESCRIBING THE CASE

Research was conducted over a period of three months at n-Space, an independent game development studio in Orlando, Florida. At the time of review, n-Space employed approximately 50 employees, twelve of whom were engineers. n-Space has been in business for twenty years, a significant accomplishment in the volatile business of game design and development.

n-Space employees are structured into hybrid teams assigned to particular projects. Figure 1 shows one small slice of the organizational chart. In this scenario, an overall project manager supervises a team of artists and engineers. These individuals focus on building a game concept or prototype that will later be presented to the larger group at an all-hands meeting that may only occur once every few months. Since this particular team only contains a few artists and two engineers, the employees here are likely working on a smaller project, such as a social media game or a conceptual prototype that may or may not end up moving forward in later stages.

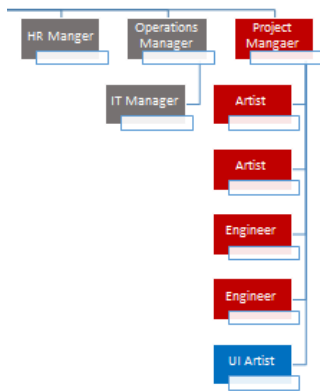


FIGURE 1: ORG CHART SLICE (MINOR PROJECT).

In contrast, Figure 2 reveals a more complex team that exists in n-Space's organizational chart. Here, it is clear by the number of employees working together that the group is working on a more complicated game project. However, the general layout and structuring of the team is similar, with various types of expertise structured around some internal leadership.

Also notable in this second glimpse into the organization of the studio is the fact that expertise and skills are now indicated in a more specialized fashion. For example, artists here are divided into focused categories such as environmental artists, character artists, technical artists, and visual effects artists. Similarly, designers are classified as game designers and level designers and engineers have senior and junior distinctions noted.

Lastly, there are specialized leadership roles indicated in this secondary organizational chart. In addition to an overall executive producer and director of design, there are also roles for directors of design, narrative, audio, art,

and technology. There is also an individual employee serving as a high level project manager to keep the group organized and ensure major milestones are met and the projects remains organized and on schedule.

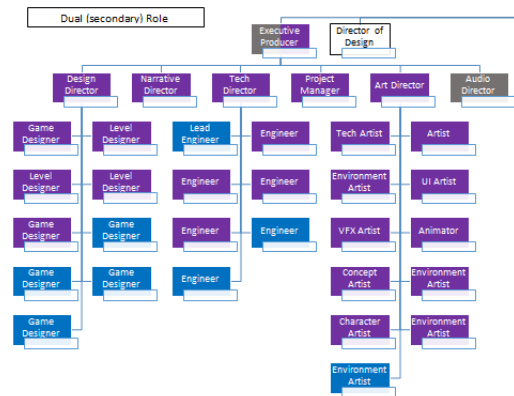


FIGURE 2: ORG CHART SLICE (MAJOR PROJECT).

The high level administration of n-Space is shown in Figure 3. A CEO and president head the executive team in charge of the entire studio and directors of art and technology can move between various game design clusters and assist with complex issues as needed. These managers serve in “floater” positions in that they float between projects as needed to help with specialized problem solving.

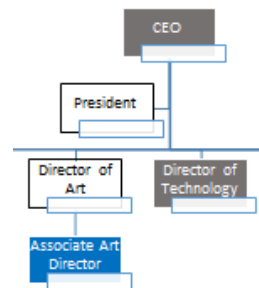


FIGURE 3: ORG CHART SLICE (EXECUTIVE STRUCTURE).

In terms of personnel, the employees at n-Space are divided into roughly equal numbers of engineers, designers, and artists. There are a handful of people working in administration and human resources. Almost all employees outside of human resources administration are male, but there is one female designer and manager on staff. Gender diversity in game design and development is a significant problem that has been well documented and discussed in the literature. For instance, the International Game Developers Association (IGDA) noted in 2005 that only 11% of surveyed game developer employees were female, with most working in human resources rather than design or development roles [21]. A later survey in 2014 [22] noted that this percent had increased slightly, to 22%,

but this is still a significant minority of the game design and development workforce.

Like many studios, there have been both lean years and very busy years at n-Space. The company began with seven employees. At its height in 2008, when the game design industry was booming, the studio employed 122 employees. Since n-Space is an independent studio that focuses solely on game design and development, there are a limited number of opportunities for generating revenue. If players are not buying games directly from the studio or publishers are not financing new projects to be developed by the studio, income stops flowing.

In the next section, results from employee interviews are described and discussed within the context of engineering communication in the game design industry. For the sake of space, only portions of the interviews are reprinted verbatim. The selected excerpts provide glimpses into the lives of working engineering professionals within the game design industry and highlight particular facets of professional engineering communication within this domain.

RESULTS

Results are discussed in three primary sections. First, in order to better understand the roles of engineers within the organization, stories are provided that were compiled in response to questions in which employees were asked to describe their job responsibilities and their relationship to management. Next, stories highlighting specific ideas about conflicts and constraints on the job are discussed. These help to clarify the specific knowledge management challenges encountered by the studio. Finally, story excerpts that illustrate examples of situations in which ideal outcomes were not achieved are discussed. These stories highlight not only examples of perceived information breakdown within the organization, but they also show how the studio adapted and reconfigured itself in response to less than optimal project outcomes.

The stories discussed here are not narratively complete, due to space limitations. Each story will not have a clear beginning, middle, and end, for example, nor will every story fragment give us a complete sense of the story's primary character, his or her major actions, or the causal or temporal conditions which surrounded those actions. Nor will the environment in which those actions took place be fully explained. However, the stories were captured in a more holistic interview process which did indeed give a fuller sense of plot, character, and environment within the context of the organization. Here, however, we can see glimpses into these broader stories that surround n-Space employees in their everyday professional lives.

I. Job duties and responsibilities

Interviews reveal early on that primary job duties, particularly for more senior employees, do not fit into neatly separated buckets of responsibility. Engineering management in particular seems to vary broadly depending on the particular type of project on which an employee focuses. This response from an engineer who was asked to describe job responsibilities was typical of others in the organization:

I'd say on this project I'm about 90% engineering and about 10% managing the other engineers. On the other projects, I was more 50/50. Sometimes, it even got to the point where it was almost 100% managing. Around four years ago, I'd say about six different Nintendo DS titles were going on at the same time, and I was managing all of them at the same time, so I could do very little actual engineering or programming for them because I was doing nonstop answering questions and nonstop helping the different producers do what they have to do, and I was kind of mediating all of that. I guess I'd rather be programming, but the management thing is fine too. I don't mind doing it.

In addition to management workload challenges, the casual atmosphere of a game design studio can also be troublesome in that organizational culture is not always transparent to new hires. Enthusiastic new employees may overstep boundaries as they are used to working independently rather than in a team. Many have found ways to improve practice within the organization once these types of situations occur. One employee provided a story highlighting precisely this issue:

Many years ago, we hired an eager and excited engineer straight out of school. Within the first couple of weeks, there was a scandalous incident where he rewrote another engineer's system (AI navigation, if I recall correctly) behind his back without asking. This was problematic because, for one, engineers take ownership of the systems they work in - they are gardeners and protectors of their acreage. Any substantial changes to a system need to be discussed with its owner(s). Two, functional and trustworthy code was replaced with untested, possibly bug-ridden code, and three: An opportunity was missed to discuss the system's original design, and the proposed improvements. Both engineers could have advanced their own knowledge and expertise. Communication of more-specific expectations and more oversight should have been in place on the new engineer.

Other interviews supported the finding that duties and responsibilities varied depending on job title. Similar stories confirmed that areas of opportunities for improvement emerged when communication was not

initially clear about work boundaries. Other challenges were also identified from subsequent interviews. Several of these are discussed in the next section.

II. Organizational challenges of conflict and constraint

As a key focus of this study is identifying organizational narratives dealing with problem solving, employees were prompted specifically to discuss the conflicts and constraints they experience on the job. Much conflict has to do with technical limitations involved with the game projects and the often chaotic circumstances in which game design unfolds. Interviews revealed sources of constraint aligned along three different themes: constraints of internal resources (e.g., time, personnel, or technology), constraints of interdisciplinary work practices (e.g., interfaces between hybrid professionals working together on teams), and external constraints (e.g., external market conditions surrounding the industry).

Internal resource constraints typically revealed themselves in discussions surrounding time, work styles, or technology. Projects being cancelled, which happens frequently in the world of game development, was a common problem that many employees had experienced at this studio or in prior work for other studios. However, many employees noted that they had developed strategies for maintaining productivity even in these types of challenging circumstances.

Asking for help is a skill that is critical for success, particularly since so much knowledge is specialized and there are likely to be problems that one person's deep technical knowledge will help with. This goes both ways, of course, in that an employee asking for help in one scenario will likely be providing help in another. One engineer in a leadership position recounted this story:

If something doesn't go the way that you think it should go, I may have to jump in on a project and take it back over and finish it, because of the position I'm in. Any time something does not go right, I will work through it until we get it right, or call for help, if necessary, for that too. That's part of what helped me work up through the ranks too, is that, you know, some people and some engineers may sit in a corner and spend hours spinning their wheels, and as a lead you have to recognize that and know that those people are doing that and make sure you go over and help them. But, on the flip side of that, I was never that type of person who was going to sit there and spin my wheels. I was gonna ask for help. I may have thought it was a stupid question when I was new in the industry, but it's certainly not something I think is a stupid question now, because that's how you learn.

Video games are complicated to design and build because they incorporate technical complexity with creative design and multidisciplinary decision making.

They must also be designed and delivered within an aggressive timeline. One engineer describes the complexity space of the game design process in terms of these interrelated constraints:

Constraints range from technical issues to team dynamics and milestone schedules. The amount of time and the amount of content needed frame those things do not always match up. In terms of the technical constraints, we're constrained by things like performance. We're constrained by the engine that we're using. The engines come with strengths and weaknesses. We're also constrained by the design of the code and the complexity of it, and that's directly proportional to the complexity of the game. Depending on the earlier technical decisions that we've made, we can make our lives easier or a lot harder down the line. You know, my motto that I've learned through a lot of years is just keep it simple. Like the simpler your code base is, the simpler your solution, the easier your life is going to be down the road.

Another common constraint experienced by employees was in regards to the particular interfaces between hardware and software systems. For example, another engineer noted during his interview that he considered constraints primarily in regards to specific hardware or Application Programming Interface (API) limitations. APIs are interesting from a professional communication standpoint because they express the capabilities of more complex software operations through specific routines, protocols, and tools. In this sense, APIs can be shared among developers in order to encourage the development of additional tools and software that rely on similar underlying technologies. So, for example, many users working with online mapping software will interface with Google Maps data using the Google Maps API, just as social media developers can integrate with Facebook functionality by using the Facebook API. In game development, the APIs defined by developers can be a source of frustration since not every function or feature will be provided through the API interface and a good deal of game development occurs at a low level, dealing with issues such as memory management and the file system, for example. It is understandable, then, when an engineer notes API design as a typical source of constraint.

III. Dealing with Setbacks

In regards to "when things went wrong" prompts, engineers consistently bring up stories of project cancellations. A key theme, however, is that those engineers who have been most successful have found ways of translating these setbacks into opportunities. Some have used the failures as learning moments and others have developed technologies for projects that

ended up being cancelled that they were able to then use on future projects. One engineer explains the emotional toll project cancellations take while also acknowledging the opportunities for learning and reframing perspectives:

I've been through projects being cancelled before. You know, it's something I've prepared for in my personal life as well, because in game development you cannot count on any sort of stability. And so you kind of have to insulate yourself personally and financially maybe in some cases to account for that risk. So yeah, it does suck that the project got cancelled and it was basically a year of my life, but I'm also kind of an engineering geek. Even more so than a lot of other developers, I think. So even working on projects I don't even like as a game player, there was a lot of really interesting engineering work done on it and for me that can be my own personal little heaven. And so this, the project that got cancelled, we got to do a lot of cool engineering work and work with the Unreal engine for the first time. So I don't see it as time wasted at all. I remember back, oh geez, it was within the first two or three years of working at n-Space, we had worked on a project for maybe a year and a half and it got cancelled and that was really upsetting to me at the time, because that was felt like I have put you know like myself into this project and it was just like somebody was stabbing me. But you know, with those experiences come new perspectives.

DISCUSSION

Further analysis of interview data revealed that the game design industry definitely offers some interesting communication and knowledge management challenges. Many of these challenges are unique to the discipline given the particular deliverables being produced and the types of design that must be done to produce those deliverables. In this section, some of those specialized issues are explored in more detail using some guiding themes and some additional stories from studio employees.

I. What are some examples of specialized communication tasks within the video game industry?

Although the independent games studio deals with many of the same communication challenges that other engineering firms face, there are also some specialized communication challenges that deserve mention. One is the video game concept pitch, a critical communication challenge that ultimately solicits funding from producers to finance game design and development work. One engineer describes how this communication task can involve different stakeholders, depending on the context. When asked about how pitches work and who does the pitching, he explained the process as follows:

Usually it's the studio creative director. Basically he and the president are highly involved, as is the CEO. Typically we'd have a designer or an associate producer also helping the creative director, you know, put together these things. Let's say, these other publishers say, "Hey, I want to make X type of game. Give me a request for a pitch for this type of game." And you would go back to the team and then he'd work with a select number of designers, producers, and artists, to put together a pitch. If it's more of an internal idea, then that that's much broader. Anybody involved in the studio can come together, and we've done that in the past where we'll have meetings that work like this ... here's pitch ideas that we'd like to see internally be developed, or pitched to external ones. When the publishers know they want a game designed around a commercial IP [intellectual property], then it's less of a full studio involvement of deciding what to pitch for them, and more of a closed select group of people to get the idea together.

II. How do engineering professionals with different technical backgrounds communicate and solve problems?

One of the most insightful stories I collected during my interviews offered this anecdote as an example of the challenges of communicating with employees from different technical backgrounds:

One of my all-time worst afternoons was the result of an inability to translate between two disciplines. On one particular game that was based on a movie, I was tasked with making the character walk up and down stairs. I worked with our environment artists to settle on a standard stair size, so that we would only have to create a single stair-climbing/descending animation set that would work everywhere in our game. From the animation team, I was working with a highly-experienced animator who was new to game development—all of his experience was in feature films. The animations had to be created in a very technical manner so that the character's feet would match the stairs, and would be loop-friendly so that she could climb any number of steps. I made the assumption that given those constraints and the stair dimensions, an animator should be able to nail them down. But this is one case that is specific to interactive games that a film/TV animator would never have encountered. After receiving a couple of animation sets that didn't line up with the stairs (blowing an important deadline), I ended up at the animator's desk trying to explain what we were trying to do and the technical requirements of the animations. We both got frustrated and heated, and argued loudly. Eventually, his lead stepped in and they worked the issues out. This could have been avoided by having a quick "kick-off"

meeting, with someone from each involved discipline present (engineering, environment artists, animators, design) so that any confusion or questions can be addressed up front. These kick-off meetings are standard practice now. The incident also motivated me to spend time looking at game development from the perspective of other disciplines, playing with the basics of the artists' and designers' tools, so it's easier to speak their language.

III. What software tools are used to manage knowledge and communication inside the studio?

In order to deal with these various constraints and maintain productivity, the company uses various tools to help improve communication and knowledge management. During the course of interviews over several weeks, the following software products are mentioned as essential communication tools within the organization: Microsoft Office Products (Word, Excel, Exchange, Lync, PowerPoint), Jira, and Mantis.

While most professional communicators are familiar with the capabilities of software within the Microsoft Office Suite and have experience using email programs such as Microsoft Exchange, the studio also uses Lync, a full-featured instant messaging program, extensively for internal communications.

Jira and Mantis may be less well known for professionals not working in software engineering. Jira, developed by Atlassian Software, is advertised as a project and issue tracking software product. The program supports tracking agile development methods [23] and plug-ins include specific features to keep track of the information relevant to that design practice. Examples include productivity charts and filters for choosing between various "sprints," or designed phases of project development that have been divided into different milestones. Mantis, developed by MantisBT, is an open source bug tracking tool released under the GPL.

IV. What specialized documentation practices enable engineers to deal with the chaotic nature of game design?

Despite a reliance on sophisticated software tools, it appears that some of the best strategies for dealing with communication and knowledge management have developed organically over time. One story in particular highlights how Wiki and outcome-focused documentation based on particular design challenges has been useful for the studio. Such a collection of documentation scaffolds learning with new technologies and enable a rapid pace of forward progress:

Last year, we started a new project using the Unreal Engine. It was a big challenge because no one at the studio had any technical experience with it. We started out with a small "tiger team" to blaze a trail into the engine and explore all the major systems that would be

needed to make our game possible. We've been developing and using n-Space's internal engine for many years - switching engines meant that all of the basic things that we were used to were now changed. But there are many features and debugging techniques that are common to any modern game engine. This includes things like "how to spawn a new game object," "how to print debugging numbers on the screen," "how to draw a simple line between 2 points," "how to fire off a particle system at a certain location," etc. Unreal has a lot of documentation, so it can take an engineer a *long* time to slog through all of it to hit all of the bases. We started a sort of "pocket reference" for these how-to's, putting them in a Wiki with source code, screenshots, and links to Unreal documentation pages where applicable. Each engineer (and a couple of designers) made contributions. As the project team sizes ramped up, it was extremely helpful in getting new engineers up-to-speed and productive. Condensing things into "how-to" gems and pooling them was a good approach.

CONCLUSION

This study provided an overview of communication strategies and knowledge management techniques used in professional communication contexts within an independent games studio. Results indicated that engineering management in independent game design is often variable depending on the type of project being managed. The organization studied uses a combination of specialized software tools and internally developed communication procedures to maintain an environment that is responsive to stakeholder informational needs and able to keep up with the rapid pace of development.

Key professional challenges within this space include navigating through problems resulting from different interdisciplinary technical backgrounds, understanding the scope of work and communication styles, and coping with cancelled projects. Unique communication tasks include high stakes specialized rhetorical exercises such as pitching game concepts to external funding sources.

Although access to specialized video game development communities is a challenge due to intellectual property issues, proprietary information, and the sheer busyness of employees, this type of case study, with an independent studio in particular, is worthwhile if viable partners can be identified and brought on board for the study. It is also potentially beneficial to the organization to have this type of assessment done by an outsider with no ties to the studio.

Game developers provide a fascinating group to learn from. This is especially true given the diversity of informational challenges and the speed at which game development must occur to keep pace with the consumer marketplace and gamer expectations. More research is

needed in this area to better document the communication challenges and opportunities for research.

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