User Studies – A Strategy Towards a Successful Industry-Academic Relationship

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ABSTRACT
Game industry-academic relationships are traditionally related to technology development and education, but more research-oriented partnerships outside of direct technology development and education are forming. With these types of partnerships come stumbling blocks that must be resolved for successful outcomes. Meanwhile, user-oriented research is becoming an essential component in game production due to its utility in guiding the quality of game products. Academia can help inform user studies, which calls for industry-academic partnerships. This opportunity has enabled and stimulated the collaboration between Simon Fraser University and Bardel Entertainment in Vancouver, British Columbia. This paper discusses the importance of game industry and academic collaboration, current opportunities, and strategies based on the SFU-Bardel partnership. Two in-progress projects are detailed: developing novel user testing methods and guidance on design through navigation analysis and playtesting sessions.

Categories and Subject Descriptors
A. General Literature [**GENERAL**]: Conference proceedings

General Terms
Documentation, Design, Performance, Management, Human Factors, Measurement, Standardization, User Experience

Keywords
Industry/academia collaboration, game design, evaluation, focus groups, playtesting, metrics, navigation, user studies

1. INTRODUCTION
The game industry and academia typically face a major impasse—academia cries out, "Why aren't you listening to us?" and industry replies, "What are you saying?" [18]. Fundamentally, game industry and game academia have contrasting concerns—the game industry is interested in return on investment, while game academia explores all games and aspects of games [1]. When partnerships do form, it is usually in the name of education—industry provides internships and academia provides future employees. Additionally, partnerships form for direct technology development. Occasionally, a research-related industry-academic collaboration occurs. Such collaborations are not easy, however. These collaborations need to be fueled by an established trust and understanding of both industry and academic motivations for conducting research. Industry partners need to be aware of the requirement for academics to publish and contribute to their field, which means sharing information that companies may see as proprietary. Conversely, academic partners must understand industry's need for return on investment and applicable research [18]. Different understandings of the role of "research" between industry and academia must be managed with common goals for success. Within the industry, research is predominantly used to improve product profitability [3, 4, 5], which must be understood and translated into the industry-academic partnership so that both industry and academic missions are met.

Importantly, industry and academic partnerships are useful for technology growth. Public research institutions such as universities are capable of addressing blue skies research, which an industrial partner would not be able to justify in the highly competitive game industry [18]. Such partnerships support innovation and facilitate university-industry relationships [4, 33]. In an investigation of the economic impacts of university-industry collaborations in the science and technology sectors, Berman [4] found that such relationships speed knowledge and product transfer and lead to an increase in industrial research, reducing lag times by up to seven years.

Collaborative relationships can be diverse, ranging from consultancy and educational partnerships (such as cooperative research centers or science parks) to contractual relationships [27, 10]. Partnership activities include co-authorship on publications, applied research, curriculum impact, as well as patents, licenses, and spin-off companies [2, 31, 32]. All of these various forms of collaborations may be explored.

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Simultaneously, with competition in the game market on the rise, the game industry is constantly looking for ways to improve game design and development processes [19, 22, 30]. One such way that has emerged during the past decade is the application of user-oriented game testing, which is gradually becoming an important component of the production process. Companies such as Electronic Arts, Microsoft, Square Enix Europe, Ubisoft, Zynga, BioWare, Atari, and Blizzard Entertainment have dedicated user experience researchers and interaction designers on staff. These individuals are responsible for integrating users in the design and development process, either directly or indirectly, and consider their interests and needs, as well as how the users interact with the games and how to fine-tune the user experience.

Given the history of user-experience research within the academic sector, which spans over two decades, the potential for industry-academic partnerships is readily apparent, and this is reflected in the increasing number of partnerships [11, 37, 41]. In addition, smaller studios do not have the manpower or budget to allow them to devote time to this task, as Daniel James, CEO of Three Rings, has alluded to [conversation]. Other companies, although large, may not have the necessary expertise in-house, which has led Microsoft to establish the Game User Research labs [30]. This presents an opportunity for industry and academic collaboration.

In 2010, SFU continued an existing collaborative relationship with Bardel Entertainment—an animation and game development studio based in Vancouver, British Columbia—to develop a play-focused game metrics system for virtual worlds. Bardel was selected as a partner for the game metrics system because they are developing an environmentally friendly themed virtual world for youth titled *TokiWorld*. The purpose of game metrics systems in general is to collect quantitative information about processes associated with game development, performance of support structures and servers, and players of specific games [27]. Within user-oriented testing and research, the latter category is used. In the Bardel-SFU project, the purpose was to collect telemetry data on the behavior of game players within and outside the game environment, for example, interactions between the player avatar and virtual objects/characters, or their behavior on game forums or in relation to micro-transactions [11, 24]. Game metrics associated with gameplay (gameplay metrics) form a highly detailed, objective, and quantitative supplement to the mainly qualitative/semi-quantitative and subjective methodologies utilized for user-testing games and evaluating player behavior [30]. In the process of developing the metrics system, researchers at SFU collaborated with Bardel Entertainment staff on gathering the requirements for the system and developing specific analyses, for example via playtesting sessions and navigation analysis, with the aim of improving *TokiWorld*'s entertainment value (user experience) and usability for the players in the target audience. In this collaboration, the SFU team gained the development of new methodologies for user studies, the opportunity to evaluate these methods and methodologies in practice, and exposure to the industry, while Bardel gained assistance with their metrics system and analyses that inform the design of *TokiWorld*.

The paper is divided as follows. The first section of this paper describes prior work of industry-academic collaborations giving examples of existing collaborations. The paper then explains the approach taken for the SFU-Bardel collaboration. With this context, the paper details two specific collaborative projects that emerged from this collaboration, specifically developing novel user testing methods and guidance on design. The process, results, and future work of the collaboration are described. Finally, the collaboration is reflected on, discussing lessons learned and any changes to the joint projects and possible future processes. The SFU-Bardel collaboration points to challenges, strategies for success, and outcomes of an industry-academic relationship.

2. PRIOR WORK

To date, the game industry's collaborative interactions with academia have been primarily centered around education [36]. While research collaborations between game companies and academic institutions are still relatively rare, academic take-up of industry-related research questions, and general cooperative research planning between industry and universities around ill- or widely defined research problems have contributed to growth and innovation in the field. Government and foundation funding, as Swain notes, are the primary funding sources for game research, with corporate funding for university game research typically restricted to large industry players with "established research arms" such as Microsoft, Google, and Motorola [36].

Most game companies did not pursue research relationships with universities due to a lack of knowledge of academic game design and development research. For larger companies, such as Electronic Arts and Activision, etc., the ability to innovate and solve problems utilizing their in-house talent has limited the need for external research partnerships [36].

If bench-level inter-organizational collaboration remains a relatively new arena for participation between game companies and potential academic associates, it is also one of the most dynamic partnering contexts, particularly given the growth of dedicated game design and development programs at leading research institutions, globally. Opportunities for game industry and academic partnerships include both education as well as research oriented collaborations, with diverse ranges of support types and organizational models.

2.1 Types of Collaborative Relationships

In addition to the innovation, diffusion, and transfer benefits that result from research connections between academia and industry [3, 12, 28, 33, 35], the "organizational dynamics" of university-industry partnerships have been the subject of recent attention [3, 28, 31, 32]. Perkmann and Walsh [31] advocate strongly for the creation of "actual *relationships* between universities and industry – rather than generic *links*" [31], towards strengthened innovation.

The National Science Foundation [28] notes that while resource donation in the forms of funds or equipment can provide flexible benefits; such generic resources do not promote the kinds of partner interaction that are available through more embedded and formal collaborative research relationships [28].

2.1.1 Research Partnerships

There are different crosses between academic and industry work. For example, some game researchers make use of commercial technologies and existing game platforms to develop extensible systems, innovative add-on applications, and tool sets, as well to investigate global issues such as user modeling and design typologies. Examples of these include CaveUT [20], ELE [13], and Kovacs et al.'s work [26].

The development of the CaveUT software, which supports immersive virtual reality installations, and is based on the Unreal Tournament game engine, is a working example of an informal, cooperative research venture [20]. The CaveUT system supports fully immersive virtual reality integrated with game engine interaction features and behavioural or artificial intelligence systems for art-based VR installations and immersive interactive storytelling. CaveUT's virtual reality interface for the Unreal Engine allows game designers to take advantage of engine benefits such as asset libraries and support for content creation, while providing support for immersive displays [20]. CaveUT demonstrates an inventive extension and application of an existing commercial technology for academic research purposes with informal assistance supplied by Epic Ltd. through Jacobson's PublicVR non-profit venture.

Figure 1. CaveUT 2004 player interaction with Unreal Tournament across multiple screens. [Photo credit: http://planetjeff.net/ut/CaveUT.html]

Other engine uses for innovation-based, exploratory academic research work include Seif El-Nasr, et al.'s [13] intelligent lighting system (Expressive Lighting Engine) integration into Unreal Tournament 2003 using the Unreal 2.0 engine; and Kovacs, et al.'s [26] integration of "Loop and Schaefer's approximation of Catmull-Clark surfaces" algorithm into Valve's Source game engine. Several papers were co-authored with Valve researchers as part of a cooperative partnership with Kovacs' New York University research team.

Cooperative relationships for metrics research have been developed between the IT University of Copenhagen, Danish Design School, and IO Interactive (Square Enix Europe division) [28, 38]; as well as between Intel and Technische Universität Darmstadt in Germany [34]. IO Interactive's collaboration with the IT University of Copenhagen [28, 38] included the development of a gameplay metrics system to support game production and testing processes. The goal of the collaboration was to show how quantitative player behavior data, collected into large datasets, could be mined for context-specific user behavior patterns to assist game design, development and user research for interactive entertainment [28]. In addition, Intel and Technische Universität Darmstadt's [34] research group partnered to investigate a general event notification solutions approach for online behavior analysis based on real-time observations, dynamically defined metrics and visualization strategies for collected data. Event stream visualization was co-researched to support developers and operators in identifying bottlenecks and making runtime analysis easier.

Joslin's metrics and visualization research, sponsored by Microsoft [22, 23], has advanced a framework for online game-play visualization processes [23] intended to improve quality assurance game testing phases. With a specific focus on data capture and visualization for real-time monitoring for MMORPG game production and testing, a user-centered data logging framework for gameplay visualization systems was developed by Joslin [23]. Joslin's work is intended to support game developers by creating a model whose implementation would be able to collect data and respond to specific questions asked by members of the design and development team [23]. Joslin's approach takes into account game development workflow, and presents four interfaces for accessing the event information required from the game: in-situ, aggregate, programmer, and player [23]. Funding for Joslin's exploratory research was provided by Microsoft Research Asia, and a working system is indicated as future work.

Formal partnerships, in the arrangement of collaborative research agreements, are generally close, interactive relationships, taking up a well-defined problem [28]. While difficulties for academics include restrictions on publication of research findings, which can impact the growth of their academic reputation, increases in funding as a result of research links to industry interests have tended to outweigh the disadvantages. There are several examples of such partnerships between the game industry and academia. The game studio hub, Research Triangle Park in Raleigh-Durham, North Carolina, has a long historical association with North Carolina State University (NCSU Digital Games Research Center), UNC-Chapel Hill, and Duke University. Game companies located in Research Triangle Park have established NSF and DARPA funded research collaborations with NCSU and UNC-Chapel Hill for the creation of new games technologies [7].

NCSU's Digital Games Research Center [29] has particularly strong formal research connections to the local Research Triangle Park game industries. In addition to a Centre advisory board composed of game industry professionals, formal cooperative research and development agreements are managed through the Digital Games Research Center's "Corporate Members" program, which opens access to the Center's research results to industry members, and provides assistance to industry for licensing of DGRC produced software, resource exchanges, and drafting of memoranda of understanding for pursuing shared interests [29]. The NCSU Digital Games Research Center's Liquid Narrative Group has a strong industry collaboration research record, and receives research sponsorship from Epic Games and Microsoft Research, in conjunction with the National Science Foundation to support the group's activities.

In Canada, the National Sciences and Engineering Research Council of Canada's Cooperative Research and Development Board (NSERC-CRD) provides formal funding schemes for university-industry paired research, and has been a successful innovation stimulus, and knowledge and technology transfer program. In 2006, for example, Vancouver, BC's Koolhaus Games received an NSERC-CRD grant in partnership with Simon Fraser University's School of Computing Science, for innovative and exploratory collaborative research into semi-automatic video motion capture. Koolhaus Games' collaborative research relationship with Simon Fraser University has continued with MITACS grant support.

The Canadian research network, Mathematics of Information Technology and Complex Systems (MITACS), supports mathematics science centered university-industry collaborative

research through funded partnership initiatives. The MITACS Accelerate program is a managed internship program, which connects industry with Canadian universities towards supporting graduate and post-doctoral knowledge transfer from the university to industry. The MITACS Accelerate program has been particularly supportive of collaborative games research and has funded, or is currently funding, research partnerships between Electronic Arts and Simon Fraser University for game evaluation methods; Ubisoft and Université Laval for mobile game research; Credo Interactive and Simon Fraser University for rapid prototyping systems research for games; Radical Entertainment and Simon Fraser University for research in game object parallelization; and Next Level Games and the University of British Columbia for research in active learning of hierarchically parameterized policies.

Collaborative research agreements, as noted above, are rather rare as there are many problems and obstacles to establish such agreements from both the industry and academic side, including trade-offs between sometimes opposing mandates (including intellectual property issues, research questions, and resource allocation). However, there are few examples of such cooperative relationships already established where contributions from industry may take on a variety of forms including in-kind contributions in the form of commitment of time, resources or assets, or cash contributions, such as sponsorship. On the academic side, such collaborations often result in co-authored papers or presentations. As an example, The University of Alberta formed a more formal relationship with BioWare leading to the development of ScriptEase [6], a visual toolset for scripting complex AI interactions in the creation of Neverwinter Nights game mods. Funded by IRIS, NSERC, ICORE, and Bioware, the ScriptEase project has generated a set of extensive publications, and is a popular add-on for the Neverwinter Nights Aurora toolset, with ongoing player community engagement and user module development.

2.1.2 Educational Partnerships

Industry impact on university teaching and research practices is found in industry representation on program advisory boards, and through affiliate partnerships and research centre participation and sponsorship. In addition to informal uses of engines to develop innovative tools by researchers, and sponsored research partnerships formed to investigate specified industry-based research questions, there are several examples of university-industry relationships to develop and enrich course and program curricula. For example, the instructors of University of Alberta's Computers and Games course (CMPUT 250) teach game design through the use of BioWare's Neverwinter Nights game engine. BioWare representatives informally participate in the core curriculum development and delivery by providing feedback on student projects. The University of Alberta's full spectrum partnership with Bioware, which includes research (ScriptEase) and education domains, shows the potential of external partnership opportunities to meet both industry and academic interests.

Informal practices such as industry-student mentorship and industry participation on curriculum advisory boards can have formalized transformations, resulting in sustained and directed collaborative research relationships, such as those that exist between the University of Alberta and BioWare; Singapore-MIT GAMBIT Game Lab [15] and Ubisoft; the University of Southern California's GamePipe Lab [39] and Konami; DigiPen's [8] collaboration with Nintendo; Full Sail University's [14] research relationship with Helios Interactive; and Vancouver's Centre for Digital Media [5] partnerships with Electronic Arts, Disney Interactive, Radical Entertainment, and Microsoft.

DigiPen's unique historical collaboration with Nintendo America, and the games industry, more generally, includes relationships that span both educational and research domains. Industry professionals assist with annual curriculum review, as well as provide support for DigiPen's in-house tool and student game development. The University of Southern California's GamePipe Lab, additionally, hosts Demo Days, which allow students to present final projects to an industry audience to collect feedback and promote networking opportunities for the students.

Research-based and education oriented collaborations between industry and academia can be facilitated by looking to government or foundation support bases for funding potential partnerships, as well as seeking creative options such as mentorship and advisory participation from industry members. Additionally, and perhaps most importantly, as Swain [36] emphasizes, both industry and academia must foster and gain an understanding of each other's work and research culture to ensure a successful relationship.

3. The SFU-Bardel Collaboration

Collaboration between academia-industry, in SFU's experience, has usually been initiated by a need in the industry and a match with a research program usually identified by two people, an academic and an industry person, who usually have a very good relationship with one another. This kind of relationship is always built on trust.

In 2007, Dr. Seif El-Nasr, Assistant Professor at SFU, and Ms. Mah, Vice President of Interaction at Bardel Entertainment, identified several needs for Bardel Entertainment that matched the SFU EMIIE Lab's research program and goals. These included two research goals: (1) developing new techniques for narrative and drama within virtual worlds, and (2) developing new methods for playtesting through conducting focus groups and playtesting within Bardel's newly developed virtual world, *TokiWorld*. These two goals are research goals as well as industry needs, and thus established a great opportunity for collaborative research and development.

The SFU team developed several proposals around these two topics. In 2008, they were granted a MITACS grant to explore the development of efficient and novel cooperative playtesting methods for testing and evaluating the cooperative play component of Bardel's *TokiWorld*. This project funded three graduate students who explored different HCI and playtesting methodology and conducted several studies to develop guidelines for effective and engaging co-operative game play mechanics. This collaboration resulted in two contributions: (1) a CHI paper published in 2010 and (2) a set of design lessons for Bardel to use when redesigning *TokiWorld*.

In year 2009, SFU's EMIIE Lab group received another pool of funding under NCE-GRAND, National Center of Excellence, GRAND (Graphics, Animation, and New Media) headquartered in Vancouver, British Columbia. The funding sealed the

relationship with Bardel Entertainment and secured more funds to support two research goals: (1) the development of novel user testing methods for evaluation of virtual worlds, and (2) the development of new knowledge for better designs of virtual worlds given users' previous gaming experience, habits, and tastes.

From an industry perspective, the project was very attractive because a byproduct of this research would be conducting user studies on *TokiWorld* and developing a list of changes that need to be resolved from a design perspective. This established a good motivation for the Bardel team to work with the SFU team because this relationship subsidizes their budget by having a team of experts run their evaluation and playtesting, and thus they don't have to hire an expert user testing team. On the academic side, the SFU team gains a pool of data from real-world user studies that can be used in various ways. Further, the game metrics system applies not only to *TokiWorld*, but also virtual worlds in general, which makes the project very appealing to industry at large.

Since the end of 2009 till now, SFU's EMIIE lab team has worked on several projects tied to this funding. To give the readers a better understanding and more detail on such collaborations, we will discuss two sub-projects currently funded by NCE-GRAND. These projects establish both industry and academic contributions.

3.1 Collaboration By Developing Novel User Testing Methods

The use of game metrics to monitor and evaluate player behavior in digital games is fairly widespread in the games industry today, although the use is as yet most commonly associated with evaluating the behavior of users as customers and players in persistent world games [27].

In essence, log data on player-game interaction (from button-presses to in-game actions) are collected, and the low-level data refined to game metrics (e.g. total playtime), in order to evaluate behaviors [16, 21, 25]. However, methods developed by the industry and tools are generally considered proprietary [18], and therefore rarely publicly available. This meant that when the Bardel team wanted to take advantage of player behavior monitoring from the onset of the development cycle (rather than as an ad-hoc or post-launch strategy), expertise was needed from people who had previously worked with game metrics. Rather than hiring an expensive consultancy company, an academic partner provides a much more cost-benefit competitive alternative to obtaining the necessary expertise. Conversely, from the perspective of the SFU team, the game metrics data combined with the opportunity to evaluate and develop new methods for playtesting within an actual product, *TokiWorld*, formed a powerful research incentive – very few research groups have access to this kind of detailed behavioral data, which can be used for research oriented towards psychology of gamers, social science based research on virtual world behaviors, understanding users' experience and preferences, and adaptive gaming [9, 24]. Also, the development of novel methods that include the use of data mining and visualization techniques on such metric data presents a very new and innovative research direction. This in turn enabled SFU to develop the original research funding application.

Player-oriented game metrics, such as login time analysis and money transactions, form a source of business intelligence relevant to a variety of stakeholders within Bardel, notably content- and system designers, community management, marketing, management and user-research/QA. On the SFU side, different team members were interested in applying the data to different research problems. In general, the presence of multiple stakeholders increases the probability of a new system having too many requirements to be feasible [40]. This meant that care had to be taken during the requirements gathering phase of the project, with several meetings across the two involved teams and internally in each team.

During the meetings, we found that there was a substantial overlap in the metrics proposed by the SFU team and the Bardel team, such as correlating shopping behavior with the temporal dimension of play. The telemetry data needed to answer the joint questions formed the initial set of requirements for the data gathering. Building on this list, the SFU team defined the basic and derived requirements the metrics data needed to fulfill. This generally included identifying the telemetry data that were needed to answer a given higher-order question. For example, answering: "What are the preferred locations of the players in the game?" requires tracking of the spatio-temporal placement of the individual players, which can cover several different variables, including playerID and timestamps. The list of game metrics gradually grew through these iterative discussions with the involved stakeholders. The list of required metrics were ordered in terms of priority, as well as with an eye for the constraints imposed by system structure/architecture and available resources. Throughout this process, the development benefited from the diverse expertise of the two teams. The requirements process also involved playing vertical slices of the game to locate variables that would be interesting to track, extracting information from the main game design documents, and testing different solutions using mock-ups. The SFU team found that despite efforts to create a comprehensive list of variables to track and how to do this during a design/early development phase, new variables will appear when vertical slices are playable and users interact with the game. Prioritizing metrics becomes simpler, because it is apparent where there are holes in the system.

The final list contained 24 high-order metrics. The system currently contains four overall categories of metrics (with flexibility to add in more as required): Forum metrics (user activities outside of the game world); World metrics (user interaction with the game world and players therein); Navigation metrics (spatio-temporal placement of the player, with cross-correlation to even-based metrics); and Mini-game metrics (variables related to the numerous mini-games embedded in *TokiWorld*).

Following the definition of the basic parameters of the system, the Bardel team went to work on developing the necessary code, database- and server infrastructure. A new series of meetings were run to further develop the requirements for the front end of the system, notably to enable data management, analysis, visualization and reporting. Visualization and reporting systems also had to meet the requirements of different stakeholders. For example, they needed to be able to provide fast, aggregated views on the data for management or design, and more advanced analyses for the involved academics and community managers.

Rather than developing a reporting tool from the ground up, Jasper Server platform was selected. This is an open-source platform, which can be freely modified. This enables both partners to add in features they require in the future. Throughout this process, the stakeholders were in communication about which features that were more important than others, what their particular needs were, and use-cases developed. One of key novel features currently being worked on are interactive heatmaps.

The process of developing the front end is ongoing, however, the core lessons learned from the development of the metrics system were that in addition to bringing on board more expertise than would have been financially feasible for either partner, a substantial advantage of the collaboration was that it effectively cut down on the development costs of the system for the collaborators.

3.2 Collaboration By Guidance on Design

Another goal of the SFU team's side of the collaboration was to establish new design knowledge as a contribution to the research community. For Bardel, the goal was to understand users better and improve *TokiWorld*'s design. Thus, we used the *TokiWorld* as a case study, which resulted in several game design recommendations to the Bardel team. One such area of recommendations is the *TokiWorld* navigation system.

To analyze *TokiWorld*'s navigation system, the SFU team performed an expert evaluation [26] of the virtual world in its beta phase. The core idea was to utilize the varied expertise of the SFU team and its international collaborators to elicit expert feedback on the navigational aspect of *TokiWorld*'s design and validate or confirm the knowledge through a case study within Bardel. At the time of testing (late 2009) *TokiWorld* had just one area of the game completed (Vancouver), the expert feedback concluded for example that it is easy to get lost in the environment, because of its many connectable points between areas of relatively small geographical size, and an unstructured map (Figure 1).

Figure 1. *TokiWorld* presents an unstructured Vancouver map and many connectable points. It is easy to get lost in this area.

In addition to the evaluation conducted by the SFU team, a series of playtesting sessions were conducted with 31 youth from the target audience of *TokiWorld*. The participants had problems finding in-game locations, such as the Hair Salon, Store, and where to start Mini-Games. Participants reported that they did not know what to do or where to go in the virtual world. Also, despite the fact that *TokiWorld* has an overview map, most of the participants could not find this map, because they did not understand the icon on the screen.

In the first meeting after the playtesting session, the Bardel team stated they were aware of some of the identified issues related to navigation. They reported that some modifications will be made in *TokiWorld*. Subsequently, a navigation expert from the SFU team was tasked with further analysis of *TokiWorld*'s navigation system and reporting on the located issues and potential solutions. During the process of developing the report, regular meetings between *TokiWorld*'s game designer and SFU's expert were held. These meetings were essential to inform the researcher what could not be changed, what was planned, as well as what was done but not yet released to the public.

Based on meeting notes and evaluation sessions, the expert developed a detailed report to suggest possible solutions to make the navigation process in *TokiWorld* smoother, improving the overall user experience. Communication between the SFU team and Bardel team was essential to define restrictions SFU had to face while evaluating the navigation system and writing the report. For example, because changes in the virtual world may involve many people in the company, SFU could not suggest changing what had been already implemented. The expert was aware that the environmental layout had to be the same. Consequently, the expert had to suggest changes that would not alter the connectable points. The expert could only suggest modifications that affect the art and visual communication. Hence, all connections between different places and all game elements such as non-players characters, buildings, and overview maps were kept the same to save time and money.

To give the reader a general idea of what recommendations were given to Bardel Entertainment, this paper discusses one example from the report sent to the Bardel team.

Due to navigation becoming a major issue within *TokiWorld*, the expert made several suggestions to implement signage in *TokiWorld*. In particular, in the playtesting sessions, youth reported they did not know what to do in the virtual environment or how to reach specific places such as the Hair Salon and the Store inside the Vancouver area. In addition, they also mentioned that the Vancouver area was complex and they didn't understand how parts of the map were connected.

In *TokiWorld* specifically, the SFU team realized that players need goals or directions to keep busy in the virtual environment. Thus, it is essential to provide signage. Signage helps guide novices in what to do, what things they may find, and where they can go. Also, signage helps expert users navigate faster so they will be able to easily find what they want and spend time doing those tasks instead of getting lost and frustrated.

Signage must be added particularly in areas that connect two or more environments. These areas are known as "nodes" or "connection points" and require users to make decisions about where to go.

The report suggests how to add signage in *TokiWorld* by changing only the graphics. Thus, the Bardel team does not need to spend time changing the environmental structure or changing connections between areas that are already implemented as

required by the company. Since Bardel has a skilled team of graphic designers, the expert was able to concentrate on the navigation system itself, suggesting areas where signage should be included. Meanwhile, Bardel's graphic designers are able to concentrate on the visual communication and style (colors, forms, size, etc.) that are appropriate for *TokiWorld*. Figure 2 presents suggestions of where signs could be added.

Figure 2. Two spots that can be used as a support to indicate directions.

The expert also reported that there should be integration among the elements that shape *TokiWorld's* scenario as well as changes in the graphics in regards to the amount of information on the screen. Following the completed report, the specialist met with *TokiWorld*'s game designer and walked through the problems and solutions. The game designer took this information to the Bardel team to implement changes. When another playtesting session is held, the expert will be able to see if there are any changes in participants' experience, thus contributing to scholarship on virtual world navigation.

This case study was also used to confirm the expert's knowledge and develop a theory around navigation through the playtesting reports and online survey responses from beta testers. This has stimulated several papers and areas for further research, and thus was a win-win collaboration between Bardel and the SFU team.

4. CONCLUSIONS AND PERSPECTIVES

Forming collaborative relationships between industry and academia is a difficult but useful process. While there are several collaborations formed through curriculum review, sabbaticals, teaching, and advisory board relations, as well as technology development such as 3D graphics rendering, forming a collaboration through research is very rare and much more cumbersome to develop. Concerns about proprietary knowledge and intellectual property rights, varying or contrasting motivations behind research, and different languages can all stand in the way of a successful relationship.

This paper presents a case study and reviews successful relationships between an industry company and an academic team around aims of user testing and HCI research within games. Further, in an effort to develop a metrics system for virtual worlds, the Bardel-SFU team also collaborated on playtesting sessions and navigation analysis. So far, Bardel has received applicable research in condensed reports written in an industry voice that informs the design of *TokiWorld*, while SFU has experimented with methods and methodologies as well as received user studies and related data for use in publications. Bardel and SFU have worked out a mutually beneficial relationship to share user studies while keeping user identities anonymous and respecting Bardel's timelines and resource allocation. Thus, this shows a successful win-win relationship that was formed between SFU EMIIE Lab team and Bardel Entertainment team that addresses concerns of proprietary knowledge and the development process.

The Bardel-SFU relationship is one example that can stimulate a win-win relationship between industry and academia, since Bardel understands SFU's research needs and SFU understands Bardel's return on investment needs. Perhaps it can be a start to establishing more trust between researchers and industry teams, thus promoting collaboration on other aspects of game research, such as tools development, use of theory to stimulate and shape the design process, and others.

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