Computer Games and Canada's Digital Economy: The Role of Universities in Promoting Innovation

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PROJECT PERSONNEL

Sean Gouglas is an Associate Professor and Director of the Humanities Computing program at the University of Alberta and Director of the Visualisation and Information Technologies in the Arts (VITA) Research Studio. He is the principal investigator for this report. <sean.gouglas@ualberta.ca>

Jason Della Rocca is the senior consultant of Perimeter Partners, a Montreal-based game consultant company, and the former executive director of the International Game Developers Association (IGDA). <jason@perimeterpartners.com>

Jennifer Jenson is an Associate Professor of Pedagogy and Technology at York University and is president of the Canadian Game Studies Association and co-editor of *Loading...*, the Journal of the Canadian Game Studies Association. <jjenson@edu.yorku.ca>

Kevin Kee is the Canada Research Chair of Humanities Computing and an Associate Professor in the Department of History and the Centre for Digital Humanities at Brock University. <kevin.kee@brocku.ca>

Geoffrey Rockwell is a Professor of Humanities Computing at the University of Alberta and Senior Director of the Office of Interdisciplinary Studies. <geoffrey.rockwell@ualberta.ca>

Jonathan Schaeffer is Vice-Provost (Information Technology) of the University of Alberta, University Professor of Computing Science, Canada Research Chair, and iCORE Chair in gaming artificial intelligence. <jonathan.schaeffer@ualberta.ca>

Bart Simon is an Associate Professor of Sociology at Concordia University and Director of the research centre for Technoculture, Art and Games (TAG) in association with the Hexagram Institute for Research/Creation in Media Arts and Technologies in Montreal. He also sits on the executive board of the International Digital Games Research Association (DiGRA). <simonb@alcor.concordia.ca>

Ron Wakkary is an Associate Professor in the School of Interactive Arts & Technology at Simon Fraser University and principal researcher and board member of the Fluid Engage project, an international network of research and cultural institutions investigating open source and interactive technologies. <rwakkary@sfu.ca>

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EXECUTIVE SUMMARY

In 2010, Canada replaced the U.K. as the third-ranked computer games producer in the world, with projected annual revenues of more than $2 billion. Canada is a major contributor to the global interactive media industry. The development of interactive entertainment in general, and computer games in particular, is a critical engine of our present - and future - digital economy.

The diversity of video games and video game producers is remarkable, ranging from large studios that produce multi-million dollar titles to small companies that create distinct game assets to sole proprietorships that develop simple casual games. The key to the video game component of Canada's digital economy (given that the major game developers are foreign-owned) lies in supporting economic growth while encouraging innovation in the production of intellectual property and cultural capital.

Universities can play an important role in fostering creativity and promoting innovation in the video game industry, including in the development of Serious Games. Through a detailed assessment of university and college curricula, as well as a series of interviews with game industry executives and managers in Vancouver, Toronto, and Montreal, we identified barriers to and opportunities for collaboration between universities and game companies. These efforts should begin with the goal of building relationships rather than extracting licencing revenues.

The most important form of university to industry technology transfer is development of talented and skilled graduates and undergraduates. In the past, much of the relevant curriculum at the college and university level emerged from Computing Science and Engineering programs, and was technical in focus. Fortunately, universities and colleges now see the potential of the Humanities and Social Sciences to inform game development, and curricula are incorporating narrative, interactive writing, history, art, architecture, sociology, and psychology, as well as business-oriented courses that cultivate project management skills and team dynamics.

INTRODUCTION

As part of a SSHRC funded grant in the 1990s, Nick Dyer-Witheford studied the landscape of the burgeoning Canadian video game industry. In 2002, Canada ranked number six in the world in game production behind the U.S., Japan, Britain, Germany and France (Dyer-Witheford and Sharman 2005, p. 190). By 2010, Canada stands as the third ranked game producer in the world with projected revenues of more than $2 billion making Canada a valuable component in the global games industry and making video games and interactive entertainment a critical engine of Canada's present and future digital economy.

This staggering industrial growth belies a little known fact. Most of the video game revenue generated in Canada originates from foreign-owned game publishers like Electronic Arts (U.S.), Ubisoft (France), THQ (U.S.), and Eidos/Square-Enix (Japan). Canada has become an attractive location for foreign publishers, in part, because of generous tax incentives but also because of the clustering of talent and expertise in Vancouver, Toronto, and Montreal. Foreign-owned studios are a significant source of employment for Canadians trained in advanced skills for interactive media, entertainment programming, and new media design but the decisions and controls over content creation and ownership are not Canadian.

In the context of the global marketplace for game publishing this may hardly matter, but increasingly game developers around the world are concerned about decision-making in the industry being driven by short-term market considerations. Many argue that a business and development model that favours vertically integrated large scale global publishers is neither economically sustainable, nor a stimulus for technical, economic, and cultural innovation. The promotion of a diversified, independent gaming economy in Canada that lacks such vertical integration may refocus attention on innovation rather than immediate economic return.

The key to Canada's digital economy, therefore, is to sustain economic growth while encouraging cultural innovation in the video game industry. The diversity of video game and video game technology producers is remarkable, ranging from studios that produce multi-million dollar titles to individual companies that produce distinct game assets to sole proprietorships that create simple (yet often addictive) casual games.

This report describes the state of the computer gaming industry in Canada, the game design cycle, and a detailed discussion of the game development process with a specific focus on the Montreal game industry. This report also examines university courses and curricula in game design and game study, including those that involve public/private partnerships in teaching and research on gaming.

The report identifies areas for greater collaboration between universities and video game companies and the barriers that prevent the same. Outside of recommendations

directed to university administrators, faculty, and students, this report does not make formal recommendations. Rather, the report offers points of consideration for industry leaders and public policy makers.

The Social Science Humanities Research Council commissioned the report to assist a discussion with the Federal government on Canada's digital economy. The report was commissioned on 1 August 2010 with a deadline of 1 December 2010.

METHODOLOGY

Data gathering:

For industry statistics, two research assistants performed an informal census of video game companies listed in online directories. The directories used in this census were CanDevs (www.candevs.ca), IT News Link (itnewslink.com), and GameDevMap (gamedevmap.com). The census used information available on company websites and from the directories themselves. As a result of logistical and time restrictions, we gathered only publicly available statistics and did not contact companies for additional information.

For information about post-secondary institutions, we gathered qualitative and quantitative information on the current state of post-secondary education in Canada from program information published online by the individual institutions. The research was divided regionally (British Columbia, the Prairies, Ontario, Quebec, the Maritimes, and the North) and lists of universities, colleges, specialised private programs, and CEGEPs were compiled using online resources, such as the Canadian Information Centre for International Credentials. The official websites from each institution were analysed for courses, programs, specialisations, and special projects dealing with all aspects of gaming and game design. We compiled descriptions of relevant courses, degree and certificate programs, specialisations, and minors for all institutions in each region and the results were categorised as focusing exclusively on training for the gaming industry, offering individual courses in game design or game studies, or specialising in technical aspects of game design.

Interviews:

In the Fall of 2010, we interviewed professionals in the computer game industry in three cities: Vancouver, Toronto and Montreal. These professionals are active in the video game industry either as freelancers or at companies in the roles of game designers, producers, vice-presidents, business directors, or other senior roles. The interviews were open-ended, with a script of questions that moved from the game development process to the types of employees needed for that process to the types of skills for which they are looking. We then asked questions about the opportunities for university–industry research and teaching partnerships. We field tested the questions with industry personnel in Edmonton, however those responses were not included in the study.

Jason Della Rocca, senior consultant at Perimeter Partners, a Montreal-based game consultancy company, and the former executive director of the International Game Developers Association (IGDA), served as an industry contact and helped set up the interviews in all three locations. Twenty-five interviews in total were conducted over three weeks in late October and early November 2010: nine in Vancouver, eight in

Toronto, and eight in Montreal. In each city, the interview team included one member of the research team and one research assistant. They interviewed each participant for one hour or more in either the participant's workplace or a public meeting space. Each conversation was audio recorded and extensive notes were taken by the research assistant during the interview. All participants signed consent forms in accordance with the Arts, Science, and Law Research Ethics Board standards at the University of Alberta and chose whether the entire conversation or parts of the conversation would be attributed to them, or if they would prefer to remain anonymous. In the end, we decided to make all responses anonymous, providing only a general description of the person's position and company.

Graduate research assistants compiled data from the three interview sessions using a modified content analysis methodology to parse out current trends in sought after skills, attitudes towards academia, barriers to collaboration with universities, opinions on current educational options for people wishing to enter the industry, and other common themes. Results presented in this report are a synthesis of the three major centres for the gaming industry in Canada and are representative of the various types of industry players.

DISCUSSION

A. Industry

1. Overview: The State of Play in Canada

Canada has a robust video game industry with an estimated 14,000 employees coast-to-coast and $2 billion in revenues. In addition to several large publisher-owned studios, Canada has a large number of small, yet successful, companies. Many of these companies produce top quality titles that are distributed through independent channels such as Facebook, Xbox Live Arcade, and the Apple App Store. The Entertainment Software Association of Canada (ESAC) reports that there is an average of fifty-seven employees per firm (ESAC Essential Facts, 2010). With a good number of large firms (500+ employees) existing in Canada, this statistic may be slightly misleading as there are a wealth of very small studios with two to ten employees.

The ESAC's "Essential Facts" report, newly updated for 2010, provided an overarching look into the health of the Canadian video game industry. While the high-level information provided by ESAC is useful, the nature of the industry changes rapidly. Our figures differ from those in the ESAC report, which also differ from those in the 2008 Canadian Interactive Alliance (CIAIC) report, which also differ from hose in the report from TECHNOCompetencies regarding Quebec. We do not presuppose that any report is fundamentally correct, or more correct, than any other when applied to the state of the industry in late 2010. Part of the problem stems from the definition of game company, as some reports have broader criteria than others.

As such, the information that we gathered is complementary, rather than contrary, to the ESAC report. In our recommendations, we encourage a publicly funded study of the sector with collaboration from Statistics Canada, Revenue Canada, and an appropriate business analyst.

Industry Overview by Region

In total, we found 307 companies spread throughout Canada. In comparison, ESAC reports 247. The discrepancy might be attributed to the amount of time elapsed between our census and ESAC's. These companies include developers, publishers, distributors, and other multimedia companies that are involved in the industry. They range in size from single employee companies to large corporations that employ thousands. The vast majority of these companies are Canadian owned (85%). However, the companies that are owned by foreign parent companies are by far the largest in size. In other words, the Canadian-owned companies tend to be small to mid-sized independent game studios.

We found that geographically, the Canadian video game companies are concentrated in three provinces: British Columbia (31%), Ontario (35%), and Quebec (21%). The remainder of the industry is located in the Prairies (7%) and Atlantic provinces (6%).

British Columbia

Approximately ninety-four companies of various sizes ranging from large multinationals to single employee companies reside in British Columbia. The vast majority of companies are small, independent, Canadian-owned businesses. The industry is centralised in and around the metro Vancouver area; however, there are development studios scattered elsewhere in the province such as Victoria.

The majority of small companies create their own original IP. These companies often find success publishing their games through independent channels such as the Apple App Store and Xbox Live Arcade rather than through large publishers. While these smaller companies are plentiful, they are little-known companies that are often ignored by mainstream media.

British Columbia has a healthy share of medium sized companies, which often develop middleware, or are contracted by larger studios and publishers. Often times, these larger studios and publishers are foreign. While these small to medium companies are successful, the companies with the largest economic impact are not Canadian owned (eg. EA Games, Koei, Take Two, Radical, Relic).

Historically, the region has mostly grown organically via an "acorn" model, with most current studios having been seeded by EA's presence in one way or another. Note that EA purchased Distinctive Software in 1991, to form EA Canada.

Prairie Provinces

The video game industry in the prairie provinces is limited, with only twenty-two companies listed. Out of these three provinces, there are arguably only two large video game companies: BioWare (Edmonton) and GamesCafe (Calgary). BioWare is a developer that is now owned by Electronic Arts while GamesCafe runs an online casual games portal. In Saskatchewan, the video games industry is either non-existent or simply under-represented by the sources that we consulted. Two small development studios were listed by the three sources. Manitoba has a budding industry of smaller developers. A dozen or so companies ranging from one-man operations to studios with a few dozen employees were listed by our sources.

While the prairies have few mainstream successes of which to speak, it is important to highlight the powerhouse that is BioWare. Founded in 1995, the studio has produced global successes based on renowned IP, such as Star Wars and Dungeons & Dragons. As noted above, BioWare was purchased by EA in 2007. Despite the presence of such an

"oak tree," the region has not enjoyed the seeding needed to form a cluster of companies similar to what happened in British Columbia.

Ontario

The video game industry in Ontario has 106 companies listed by our sources, again ranging from one person operations to very large development studios. Many of the largest, including Capcom, Disney, Electronic Arts, Koei, Rockstar, and Ubisoft have offices in Ontario, although none of these companies are Canadian owned.

There is a large community of small developers. A number of these companies, including Metanet, Capybara Games, and Queasy Games, have developed highly successful original IP marketed through channels such as Xbox Live Arcade and the Apple App Store. These developers and others have created a hotbed of independent game development in and around the Toronto area. There is also a large number of medium to small sized developers that carry out contract work for large clients.

Toronto has evolved the most vibrant independent game scene in the country. There is a local creator society, yearly game "jams" (i.e., two day development competitions), and camps all nurturing the independent community. Despite this informal incubation of talent and innovative content, the Ontario government chose to aggressively pursue Ubisoft to serve as their "anchor tenant," luring them with a $260+ million tax incentive package.

Quebec

The industry in Quebec has fewer companies engaged in the game industry, despite having roughly the same headcount as BC. A total of sixty-five companies appeared in our census. The larger studios in Quebec include EA, Gameloft, Eidos, Funcom, Ubisoft, Behaviour, THQ, Beenox, Frima, and Warner Brothers. This is quite a high proportion of large studios relative to the total number of studios listed.

The remaining companies listed in our Quebec census include medium to small sized independent companies that find success marketing their games through independent channels or carrying out contract work for one of the larger studios. As a result of the strong presence of large studios, these smaller companies tend to skew towards web and mobile platforms. There is also a strong middleware and game-engine sector that facilitates game technology and development. These technologies appear to be aimed at the larger companies that can afford the licensing costs.

Although there are now many top-tier companies in Montreal, Ubisoft garners a great deal of attention in the province. In the mid-nineties, Ubisoft was looking to expand from its home base in France and gain a foothold in the North American market. With commonality of language, they started discussions with the Quebec government and

were offered a tax incentive of 37.5% credit on labour costs. Over the years, Ubisoft steadily expanded the studio to its present size of 2000 employees, and has produced multi-million selling game series such as Prince of Persia, Assassin's Creed, and Splinter Cell.

Other local companies took advantage of the incentives to grow alongside Ubisoft. After several block-buster hits, Montreal's Ubisoft studio attracted the attention of Electronic Arts, who were motivated to open a nearby studio to gain access to the abundant talent in the region. As more successes came, other studios followed and kicked the clustering effect into high gear. To clarify, Ubisoft served as an "anchor tenant," the success of which attracted other large studios to invest in the region. Unlike the effect of EA in British Columbia, Ubisoft has yet to seed many offshoot studios.

Atlantic Provinces

The industry in the Atlantic provinces is small and comparable to the industry found in the Prairies. The Atlantic provinces seem to lack any large anchor developers, although HB Studios and Long Tails may serve some similar functions. The majority of companies in the Atlantic provinces are independent development studios who release on independent channels such as Xbox Live Arcade and Apple App Store. For example, Other Ocean Interactive has delivered multiple highly successful games (based on licensed IP such as Super Monkey Ball and Mortal Combat) through independent channels. While the various provincial governments are aggressively pursuing the game industry, no province has yet to fully benefit from clustering effects. Ironically, the Maritimes' fiercest competition may be other provinces in the region, competing to lure companies from one to the other.

2. Overview: Building Games

The Development Cycle

Understanding the game development cycle is key to understanding how universities may contribute to promoting innovation and Canadian-owned intellectual property. The typical retail game development project consists of four major phases: conceptualisation, pre-production, production, and post-production. Figure 1 provides a rough illustration of the above phases of a game's development. The label on the vertical axis can simultaneously represent the cost of a project and the headcount requirement, given that labour represents the overwhelming majority of expense in game development.

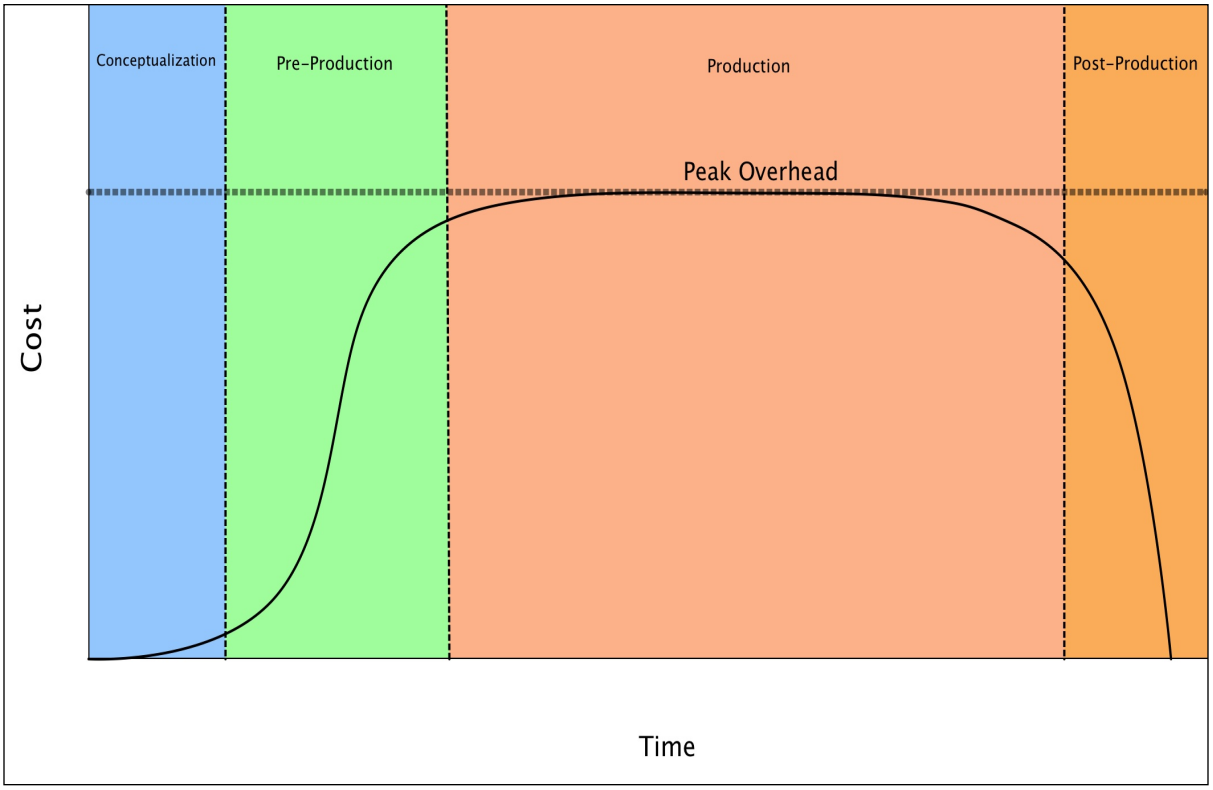

Figure 1: The Game Development Cycle

Conceptualisation

During the conceptualisation phase, a small core team explores the initial concept for a game. During this phase, emphasis is on experimenting with possible game mechanics, visual styles, and story/character elements. The team is not expected to produce content or code that will ship in the final game, though they are likely to produce rough prototypes and concept art. The key is to keep the team small and nimble, and work with tools/processes that are agile and promote experimentation.
Since the conceptualisation phase is intentionally light, the cost and talent demands are at the lowest point in the project. Most studios will have a "stage gate" process that will approve (or kill) a project it moves to the next phase.

In our interviews, designers described game ideas arising from any number sources:

- *Licensed intellectual property (IP) from another company*. It is common for game studios to be commissioned to develop a game that is tied to a movie or some other media. In such cases, the original concepts are drawn from the IP.
- *Customers*. Many studios will develop games for other companies, even when there is no pre-existing IP. They might develop for a cell-phone company that wants games for a new device, for example.
- *Market.* Some publishers analyse the market and look for opportunities to exploit.

- *Character*. One designer described how they will develop a compelling character who will appeal to their audience and then flesh out the other characters and story around that hero.
- *Story.* One company invests heavily in the development of a compelling story around which they build the game.
- *Gameplay mechanic.* Another company that has developed successful mobile games told us that they start with a simple, but fun, game mechanic. They try to get something playable first and then work out the backstory and characters.

As many interviewees stated, however, ideas are cheap - execution is everything. Despite the relatively low cost of this stage of development, companies usually limit the number of teams working in the conception phase.

Pre-production

Once a game hits pre-production, the team starts adding talent (and expense) to the project. The goal is to establish how the team will build the game envisioned during conceptualisation once they enter the full production phase. The focus is on determining the optimal production pipeline (e.g., level design, art and animation creation, etc). Most studios will exit pre-production once they have created a "first playable" or "vertical slice" of the game (often a single level or mission that encapsulates the overall gameplay experience) and a stable production pipeline to consistently achieve the same results.

Production

The production phase is where the game is actually made. This is typically the longest and most costly phase, as a team ramps up with enough talent to meet their (usually) tight deadline. On retail console games, production can last from twelve to thirty-six months, with a peak team size of 200+ developers. The end result of the production phase is a finished game ready to go to market.

Post-production

Most retail game projects have a limited post-production phase, as the game has already been released. In some cases, games need a patch issued to fix a missed bug, or some extra content is provided. Note, this is dramatically different in the case of online games which are released as an ongoing service more than a boxed product. For those games, this phase would instead be called the "live" phase. During post-production, the team is scaled down dramatically as talent is no longer needed.

Mobile and social network game developers may follow a slightly different model, releasing a barely polished game (called a Minimum Viable Product), which is rapidly

iterated based on public feedback and game analytics. Popular features are then polished while unpopular features are dropped.

Addressing Resource Challenges for Project Phases

The typical phases of game development represent several challenges with which industry continues to struggle:

- *Rapid Ramp Up.* For large projects, it is often difficult to ramp up the headcount from the small handful during conceptualisation to the large army of creators needed during full production.
- *Rapid Ramp Down.* Conversely, studios will often shed headcount when a project hits post-production as it cannot sustain the expense of idle workers until the start of the next production phase.
- *Peak Overhead.* If a studio does not want to incur the friction cost of hiring and firing large batches of staff, then they must constantly sustain labour cost at the peak level (refer to "peak overhead" line in Figure 1). This introduces idle talent and wasted resources to the studio.
- *Jump to Production.* Managers are often overly eager to enter production and skip or shorten the initial phases of development. This may be valid for a simple sequel game where the need to "find the fun" is not critical, otherwise, this will be detrimental to the success of the project.
- *Only Shipping Assets.* Similar to the previous issue, managers are sometimes reluctant to develop content that will not ship in the final game. For example, early test prototypes, concept art, draft maps, etc, all facilitate the creation of the game and are critical to the early phases. However, these items are not directly present in the game itself.
- *Jumping Back.* Teams will often jump back and forth between phases, or progress to a later phase only to have management reset them to an earlier stage (aka "go back to the drawing board"). This often occurs when earlier phases are skipped/skimped and the team never quite settles on what game they are suppose to make, and how.

Most of the challenges in sustaining and growing studios rest with the question of how to manage the problem of "peak overhead." Indeed, not managing this issue can prove extremely costly and detrimental to established studios let alone less mature businesses and start-ups. As games are fundamentally fast-paced cyclical leisure commodities, there is greater risk in this industry with the marketing and sale of games. The core business and development challenge, therefore, becomes one of mitigating the costs of market failure while sustaining innovation in a competitive market place.

The "peak overhead" problem presents a fundamental challenge to game producers. While the production phase requires the largest investment, it is the prototype and pre-production phases where most of the innovation occurs. In order to maximise

employee resources, it can be seen as wasteful to spend too much time on prototype and pre-production projects and even the largest studios may be forced to favour multi-title franchise development that allows for a more or less steady production phase at the cost of new innovative IP.

In the context of the broader game development ecosystem, there are three identifiable strategies for mitigating the risk associated with the "peak overhead" problem while still allowing for innovation at the prototype and pre-production phases of development.

Strategy 1: Overlapping Cycles

As technology demanded larger teams and greater studio overhead, many single project studios struggled to stay in business. To overcome the cost-related challenges of the typical production cycle, studios would have multiple projects running concurrently, each at a different phase of development. This multi-project approach would allow management to shuffle talent from one project that was ramping down in post-production and place them on the next project ramping up during pre-production.

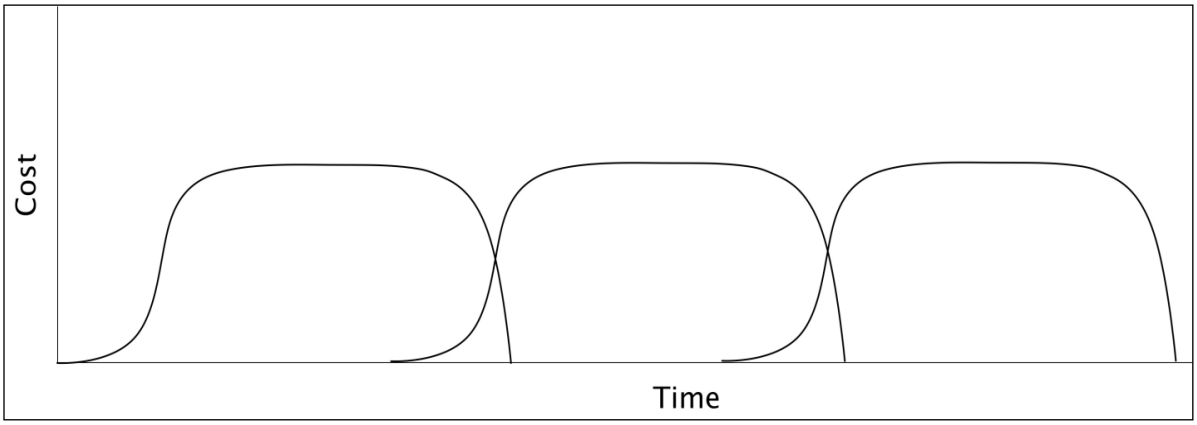

Figure 2: Overlapping Development Cycles

By overlapping project cycles, studios are able to minimise the idle talent and wasted resources (or dips between the humps as seen in Figure 2). Very large studios have over a dozen projects running simultaneously as a means to optimise the flow of talent and eliminate waste. Production cycle management in this system is extremely important and game producers have expressed a need for management employees (producers) with experience of the game development cycle as well as a broader sense of team management within and across studios. Most studios have evolved organisational models that sustain some level of overlapping cycles, but many producers have told us in interviews that these models are fairly *ad hoc* and unsophisticated from a management science point of view. The problem is even more acute for small and even mid-size studios trying to develop an overlapping cycle model.

It is evident in any case that as a result of the need to develop an organisational model for overlapping development cycles there continues to be an economic incentive towards vertical integration and economies of scale. In addition to growing a studio to the point where it can maintain multiple overlapping projects, the largest studios have sustained profitability by acquiring other studios and becoming *de facto* publishers (EA and Ubisoft are two such examples). In this larger and indeed global studio structure, talent and expertise may not only be shifted from project to project but also from studio to studio within the same corporate entity.

While this has been a dominant strategy for some time it has also led to some difficulty. In large multi-studio corporations the logic of vertical integration has arguably led to creative stratification in the industry, with certain studios being forced to produce only one franchise or one genre of game (an example of this is Bungie and the Halo franchise under the ownership of Microsoft; an association Bungie recently terminated by buying back company ownership and signing a ten-year contract with publisher Activision). This pattern of franchise development is point of concern for independents who wish to develop new, innovative IP. Hothead Games describes their company's origins as follows:

> Hothead Games was founded on a dream… a dream to release the same World War II Normandy beach game year after year. Sadly, someone beat us to that dream... everyone really, so we decided to make innovative games that would frighten would-be investors instead.

The disaffection of developers with large-scale publisher-centric business and organisation models has been growing for some time even while publisher acquisition and growth remains the dominant economic model in Canada (and in Montreal especially). It is worth commenting on the risks of this in the context of a Canadian digital economy strategy.

Implications

Employment insecurity. The overlapping cycles model does help companies justify employee retention over time but the discrepancy in employee numbers between prototype/pre-production teams and production teams is so large and cycle times are so constrained that most studios still rely on a large number of part-time staff at peak production period to make sure products get shipped on time. Not all these part-time workers can be shifted to other production phase projects and it is also not clear that any given employee will have the skills needed for another project at the right time.

Large percentage of foreign-owned IP. Canada has very few game publishers of its own and the vast majority of game development in the country is controlled by the largest foreign-owned developer-publishers (Activision, Electronic Arts, Ubisoft, Microsoft). The need for overlapping cycles favours multi-national economies of scale and global publishers with the capacity to start new studios, acquire new studios, or simply

contract third party studios to fill niches in an overall production strategy. This kind of climate may beneficially provide buy-out options for innovative and market savvy smaller Canadian studios but it does not favour the development of small to mid-size studios in general.

Creativity is tied to risk management. One of the biggest difficulties in the game industry overall is that budgets for what are know colloquially as "Triple A" titles (mostly console games and massively multiplayer online games) continues to increase while revenue share for these games remains more or less stable (with a few exceptions). The consequence of this is that even with an overlapping production cycle, large studios become more and more risk adverse as cost overhead continues to rise. This means that even if a studio is able to support more projects at the prototype and pre-production phase the actual number of "greenlighted" projects for production tends to favour the reproduction of past success rather than the promotion of new ideas that have not been market tested. Employees in these large studios who are encouraged to be creative (especially senior game designers and senior programmers) may find themselves faced with a management structure that cannot easily permit follow-through to the production phase.

Strategy 2: Geographic Clustering

While the development of organisational models for overlapping production cycles is largely left to individual companies to sort out in relation to the market, governments have been especially active in helping to mitigate the "peak overhead" problem. They encourage growth in the industry by implementing policy at all levels to encourage "geographic clustering" of the interactive media industry and the video game industry in particular.

Vancouver, Toronto and Montreal are the three prominent game industry clusters in Canada, with the largest multi-national cluster in Montreal. The principle of clustering suggests a kind of inter-sectoral melting pot in which game studios coexist in close proximity with sources of well-trained employees (colleges and universities), cultural and artistic cross-fertilisation (galleries, film, theatre, festivals, etc.), and technological infrastructure (high speed networks, middleware firms, and support services). While there is a net benefit in terms of encouraging a "creative economy" in general and bringing further employers and higher-paid skilled employees to a region, it has also had the effect, at least in Montreal, of facilitating a high degree of horizontal movement of employees between studios.

From the point of view of a given game industry worker, a single project studio operating with the typical production cycle is a very risky proposition. In the industry, it has been a running joke that staff would send out CVs as soon as their project hit post-production in anticipation of a mass layoff. At least with larger studios and an overlapping cycle model, employees would more likely be shifted to another project rather than get fired.

Clustering helps further mitigate risk for employees since even in the event of being laid-off or only engaged part time with one studio there is a higher likelihood that one could pick up additional work at another. The clustering of studios in close proximity also means that employees are less likely to have to move their homes and families and it makes the notion of a career as a game designer, programmer, artist, or producer more sustainable and desirable.

The challenges with clustering, however, is that while it may mitigate the risk for studios and employees it also tends to enhance structurally the conditions of precarious labour that created it. Clustering does not particularly encourage individual studios to accept more risk or innovate with their managerial models, even though it offers a safety net for the less than efficient labour management practices of the studios. The cluster means that the best laid-off workers are likely to find work and stay in the region and thus be available more or less continuously. Clustering becomes an effective way to "park" employees in the cluster as a whole in this sense without incurring salary costs associated with the "peak overhead" problem.

From the workers' point of view this situation is most attractive for young male professionals who may even be able to support themselves for a time without work. As the employees age and move into family life, the stress and precariousness of the labour situation becomes more difficult to manage. This is especially true in the case of urban clusters with an increasing cost of living. Our research suggests that there are uncertainties in the clustering strategy that need to be analysed more fully especially in the case of the games industry.

Implications

Employee retention. Clustering facilitates the retention of game industry workers and even new growth but this may favour only the most skilled young unmarried men. It is not clear that the high job turnover rates typical of the Montreal game development cluster are conducive to the long term success and growth of the industry in this region.

Neutral to innovation. Clustering may not solve the problem of facilitating creative and innovative new IP as it merely helps to prevent an overall loss of employees due to the management of the "peak overhead" problem in individual studios.

Significant public costs. Clustering is expensive since it is targeted at the largest studios to make the most efficient use of government and infrastructural resources. Government clustering policy in Montreal seems to favour the attraction of a few large studios with potential employment pools of 100+ rather than numerous smaller studios.

Strategy 3: Promoting the Independent Game Development (IGD) Sector

The term "independent game" is used by developers mainly to describe a game that is released or published by the company that made it. In other words, it is a game that is not published through a third-party producer. Independence is a relative measure of a game developer's degree of creative and financial autonomy and control over the IP of their game. Independent game development is something of a precarious business for many of the reasons addressed in our discussion of the development cycle but recently there has been new enthusiasm for addressing the sustainability of small scale independent studios running no more than one to three projects at a time.

Beyond this, independent game development has become something of a social-economic movement amongst small-scale developers around the globe. The movement brings together experienced and established game designers, graphic artists, and programmers with students, entrepreneurs, player-hobbyists, and many others.

Independent game developers pride themselves on being more creative, more innovative, and more socially and culturally progressive than the large game publishers that dominate the market. While some equate the independent game movement with art house filmmaking, this is not quite accurate. Independent games are not, by definition, any less of a mass or public media than mainstream games. Also, increasingly diversified models of distribution have given independent game developers access to Hollywood-level audiences on more favorable terms than they might have when dealing with large publishers.

Based on our interviews, however, we have developed a somewhat broader notion of independent game development that spans creative and economic control on the one hand and cultural space of innovation on the other. The 'independent game scene' is a space of cultural mixing and production that exists in the interstices of a publisher-dominated corporate game culture; college and university programs in Computing Science, media arts, and design; and highly literate gamer cultures engaged in the 'serious leisure' of modifying and improving existing commercial games.

The difference between the independent game scene and clustering is that the object of game industry workers in a cluster is to move into employment for a larger studio whereas the object of independent game developers is to establish studios independent of the economics and creative constraints of the large industry clusters. In essence, the suggestion is that the independent game scene may be a model of social economic organisation within geographic regions facilitated by clustering.

While projected revenues and employment are not on the same order of magnitude as the larger studios it should be noted that independent game developers offer a number of key tactical elements in the overall digital economy strategy for Canada.

Implications

Requires different government incentives. The nurturing of an independent gaming community requires different incentives than those used to promote clustering, which are typically achieved through tax incentives. Instead, an incubation model that assisted small and medium sized enterprises (SMEs) to develop new IP would be more useful.

Less immediate results. Building an environment that allows Canadian SMEs to thrive is more challenging and time-consuming than luring a single large company into an area through direct tax incentives. The latter is significantly more attractive politically given the large splash such actions receive in the media.

4. In Detail: Montreal's Game Development Ecosystem

Montreal remains one of the top-ranked geographic regions for video game development in the world. Certainly within Canada, Vancouver and Montreal remain the most economically productive centres for the games industry with Toronto quickly advancing. While long ago the Quebec government made Montreal attractive to industry developers through a generous tax incentive program and clustering initiatives, it is clear that the industry also benefits from the concentration of digital entertainment related middleware companies (Autodesk, SoftImage, AudioKinetic, Quazal), a high density of universities and colleges with programs in new media arts and programming, strong municipal and provincial support for new media arts (especially film, music, and circus performance), strong ties to French and Franco-European industry and talent, and the relatively lower price of real estate and costs of living compared to Vancouver and Toronto.

According to one recent labour report (TechnoCompetences, "L'emploi dans l'industrie du jeu electronique au Quebec en 2010," October 2010) there are currently over 7000 employees working in the game industry in Quebec with a projected increase of over 18% by 2012. Nearly 75% of these employees across approximately eighty companies in Quebec are in the Montreal area. The vast majority of businesses are game developers or game studios engaged in the creation of games and game content, including companies contracted for playtesting, quality assurance, localisation, special effects, voice-acting, audio, and specialised middleware services (such as those needed for online and network games).

In our review of approximately sixty five video game and game related companies in Montreal, it is readily apparent that in terms of video game development (rather than middleware or support services), the largest employers and the majority of production is carried out by a group of large studios owned by multinational foreign-owned game publishers. These studios employ approximately 90% of the game-related labour force in Quebec and current conditions point to their continued expansion. While Ubisoft (France) and Electronic Arts (U.S.) already have a strong presence in Montreal, the relatively recent establishment of 100+ employee studios by Funcom (Norway), Square-Enix/Eidos (Japan), THQ (U.S.) and Warner Brothers (U.S.) have further focused international attention on Montreal as a world hub in game development. Over the past year, there has been a significant amount of horizontal migration as employees shift to the new studios and new employees arrive from other studios outside Montreal (for instance, fifty+ employees from Funcom's Oslo studio have moved to Montreal in the past year).

While the employment projections for Montreal and Quebec are promising (some projections call for a nearly 20% increase over the next five years) it is also clear that projections based on industry reporting alone are misleading. The October 2010 TechnoCompetences report, for instance, does not indicate what the rate of employee

turnover is in Quebec studios, nor do we have accurate figures on how much of the game-related labour workforces is contract based, cyclical, and temporary.

For this reason and others, we are not confident that the current form of public-sector support in its current form for the continued expansion of the largest foreign-owned studios in Montreal should be the provincial and federal government's primary strategic concern in looking to the long-term growth and development of the game industry in Canada's digital economy.

Changing Trends in Montreal's Gaming Industry

In our research, we have noticed that in addition to the activities of these global multi-national publisher/developers, Montreal is host to an increasing number of very small or micro-studios focused on game development for mobile platforms, serious games (games for education and training), and other niche platforms for online distribution (such as Xbox live Indie Games, Valve's Steam network, and online Flash games).

In spite of the tendency towards vertical integration and globalisation in the industry as a whole, the number of small independent game developers is increasing. This trend is buoyed by innovation in models and methods of game development, publishing and distribution, the rapid expansion of the mobile market segment in Canada (which has significantly lagged behind Europe and Asia), and a very prominent independent games movement composed of experienced developers, college and university students, and active players/consumers advocating for more creative control and content innovation by game designers on the one hand and the fostering of a culture of small scale innovation, auteurship, and entrepreneurialism on the other.

In Montreal, we have seen a number of smaller studios being formed (Trapdoor, Crankshaft, Massive Finger) from former employees of the larger studios. This is unusual since the predominant trend has been for employees to move horizontally between the larger studios in Montreal. We have identified several reasons for this new trend.

- Some developers feel there is a lack of autonomy and creative control in larger organisations
- Some resent the overwhelming focus on publishers' market-driven demands rather than trusting designers' concerns with quality and innovation
- Some have a sense of the cultural and artistic, rather than purely entertainment, potential of video games as a medium
- Some feel the risk to go it alone is manageable given lower barriers to entry

We are struck by the relation of these sentiments to more wide-spread criticism of the prevalent development model of the game industry as a whole. In the past few years, the top game designers in the world have become increasingly vocal about the dangers of publisher-centric vertical integration in ensuring long term creativity, innovation,

and ultimately productivity. The methods, practices, and organisation of game design have changed rapidly in the last ten years but the industry is largely configured to take advantage of only a small proportion of the innovation occurring at the level of interactive technologies, new creative content and experiences, increasing social and cultural relevance (beyond relatively narrow market segments), and education and training. In short, the games industry at large is currently organised to be an entertainment industry rather than a cultural industry (like book publishing, film production, or theater).

The economically viable independent games sector as a relatively new model for game-related industry and innovation shows signs of being able to expanding and deepening the cultural salience of video games. The independent game development sector does this by taking risks with respect to the exploration of new topics and content for games, paying closer attention to developing principles of game design, being more willing to experiment with new technologies, and paying greater attention to diversity in needs and desires of players and audiences. There are three main reasons why the independent games sector is of strategic importance for the Canadian digital economy.

1. The relatively small size of independent game studios usually means a smaller employee pool and lower revenues overall. If a studio can achieve a modicum of profitability then it is certainly possible to survive as a business but the value of such business has less to do with providing employment for Canadians (relative to the large studios) than it does with facilitating faster and more flexible innovation in game creation, the establishment of new markets for specific audiences, and the expansion and development of video games as a medium for multicultural expression, communication, and reflection.

2. For many developers, the independent game sector may be a valuable way-point between formal education and mainstream studio employment. Working for an independent game studio or indeed working to manage such a studio provides valuable low cost experience for students and even professionals wanting to move laterally into the industry. By the same token, designers from larger studios may desire to work in independent game development to enhance their own skills and expertise.

3. The independent games sector is the single most important route to developing Canadian-owned IP in the games industry. Canada lacks a multinational publisher/developer of its own. The largest Canadian owned developer is Behaviour Interactive (formally Artificial Mind and Motion) with 375 employees and studios in Montreal, Quebec City, and Santiago, Chile. At the same time unlike film and television, more distribution mechanisms for video games also provide opportunities for sustained creation and consumption of Canadian owned and operated micro studio-based games that will ensure the relevance of this valuable medium for Canadians.

B. The Universities

1. Assessing the Necessary Skills

The interdisciplinary nature of game design demands a team of employees with a diverse set of skills, including the following:

- *Programmers.* These are typically recruited from Computing Science departments though some companies are going off-shore to get hard-to-find skills in the mathematics needed for programming rendering engines (the component of the game that draws images to the screen).
- *Artists.* Artists typically come out of technical colleges and they are responsible for the concept art, the art for characters, and levels.
- *Animators.* Animators also come typically from technical colleges and they are responsible for the animations for cut-scenes and characters.
- *Game Designers.* The role of game designer is the most open-ended. A game designer is responsible for bringing together the different components from the code to the art,that make a game. Interviewees seemed to feel that good game designers came from all disciplines from industrial design to English. As one interviewee put it, "Good game designers come from many places – could be communications, creative writing, art, literature, programming, engineering – anything really."
- *Character and Level Designers.* Game designers are rarely hired as "juniors" (new to the business.) They are typically promoted from positions where they are designing parts of a game like a level or a character. Character and Level Designers in turn are often trained as graphic designers or animators (and occasionally play testers) who are then given responsibility for an entire level or character.
- *Writers.* Studios that develop larger games with complicated backstories also hire technical and creative writers to develop and maintain the stories. These writers come from all walks of life, though few interviewees seemed to feel that creative writing programs prepare technical writers appropriately. They felt that the type of interactive writing they need is very different from the narrative writing taught in traditional programs.

Other specialised roles like sound designers, user-interface designers, game testers, and project managers were also mentioned. With the exception of project managers, many of the specialised tasks associated with these roles are subcontracted. Interestingly a number of interviewees speculated that the game industry will move to a free-lance model similar to the film industry where most roles in the development of a game are held by free-lancers or service companies that are hired when needed. The theory is that as the game development process is better understood and formalized, then game studios will be able to subcontract more and more to individuals or service providers that specialise in specific roles. Examples of areas where there are already

established service providers include internationalisation (also called localisation – where games are adapted to local languages and cultures) and testing.

In addition, most of the industry people we interviewed looked for employees with a diverse set of skills and experience, including knowledge of standard game design tools, the fundamentals of programming and design, a passion for games and the medium of games, teamwork, the game development process, and (somewhat unexpectedly) architectural knowledge.

While interviewees discussed skills, a couple emphasised that skills can be a limiting way to look at prospective employees. One interviewee said, "We are looking for individuals, not skill sets." A number of interviewees also emphasised the importance of a portfolio over training. Some recruiters go by what applicants have done more than by what they have been trained to do. In this context a couple of interviewees complained that students often do not know how to prepare a portfolio. They put everything in rather than concentrate on their best work.

Regional Variation in Job Demand

The types of skills game production companies are looking for varies widely across the country and different needs arose during our interviews. In each city we asked which positions were the most difficult to fill and which skills were the most sought. Experienced employees of all kinds and specialised technical skills were a common thread throughout the interviews, but there are also localised needs that must be recognised.

In Montreal, companies are looking for a mix of technical and Humanities skills. Rendering specialists and programmers with advanced training in specialised skills like artificial intelligence are needed along with artists who understand the technology used to build the games. Employers seem eager to hire architecture graduates to work on level design as well as people with interactive writing and cinematic design experience. Overall, when hiring new employees companies of all sizes are looking for people with intermediate or high level skills. New graduates who have past work experience or have completed a co-op stand out in this job market.

In Toronto, by far the most difficult positions to fill are quality programmers of all kinds. Additionally companies are looking for people with project management and general managerial skills who also know the game industry well. Artists and designers who can multitask and can do art, graphic design, and web design are needed, which is a facet of the blended skill sets for which many companies indicated they are looking. People with a mix of business, technical, and artistic skills are valued as they contribute unique perspectives.

Vancouver differed more in the types of skills requested, which could be due to the longer history of the game industry in this city and the well developed network of large

companies and educational institutions. Specialised programmers who work in newer technologies like cloud computing and multi-player platforms are needed in addition to senior engineers and networking specialists. In general, companies did not find it difficult to hire general programmers, but finding people with specialised skills and experience working in newer technologies is more difficult. Quality game designers are difficult to find in Vancouver, while people with experience in social gaming are currently in demand. There is a need for people with business skills who are market and user-oriented rather than focusing primarily on the types of games the designer and the team would like to build for themselves. Demand for producers with strong project management skills is high and a general trend toward hiring to fill business management and project management roles is evident.

2. Courses and Curriculum

Post-secondary programs that aim to train students to enter the game design and development industry in Canada vary widely in their structure and the type of skills and qualifications they provide. In general there are three types of pedagogical approaches to teaching game design:

- Expansive game curricula that explore multiple aspects of game design and game study, usually wrapped in an interdisciplinary approach and coupled with some form of game company collaboration.
- Individual courses on games that focus on game design or games as objects of study without a broader integration, usually unrelated to other courses taught at the institution.
- Technical institutions (often private) that provide intense training in the nuts and bolts of game design, usually focusing on one particular technology or platform.

A list of post-secondary institutions contributing to the study of games can be found in Appendix 1. The following section will briefly outline what the current distribution of programs is like across the country.

Table 1: Number of Post-Secondary Institutions Offering Courses and Curricula in Game Design and Game Studies.

Province or Region	Degree with Specialisation	Departmental Courses	Diploma Program	Certificate Program
British Columbia	3	4	0	1
Alberta	2	7	3	0
Manitoba	0	1	0	1
Saskatchewan	0	3	1	0
Ontario	7	9	6	4
Quebec	4	1	1	0
Atlantic Provinces	2	0	0	0

Interdisciplinary Programs:

Interdisciplinary programs consisting of curriculum that is designed specifically for the gaming industry are by far the rarest type of program in Canada currently. They offer a mix of courses that deal with both technical and theoretical approaches to game design and aim to give students a range of experiences and skills that would prepare them to enter the industry in a range of roles. The majority of these programs are offered in Western Canada with the exception of the University of Western Ontario's game development minor within their Computing Science department and the College of the North Atlantic's two-year game design program. This program is an interesting example of the interdisciplinary curriculum model offering courses in game theory, cinematics, art, animation, 2D and 3D modelling, basic game programming, game theory, production methods, creative writing, and non-linear storytelling, game documentation, the creative process, and project management.

Perhaps the most well known program for video game production in Western Canada is the Great Northern Way in Vancouver, a collaborative campus project between Emily Carr University of Art and Design, University of British Columbia, Simon Frasier University and British Columbia Institute of Technology. The Masters of Digital Media (MDM) Program is a full-time, team-based professional Master's degree in entertainment technology and digital media. This program focuses on project based learning with a strong emphasis on current industry standards and needs. The program is developed with input from both industry and academia and the curriculum strives to remain relevant to the rapidly changing digital media market. Each intake of students

spends twenty months in addition to a final required internship with the goal of preparing students to be effective creators, practitioners, and senior managers in the digital media and gaming industry.

The Northern Alberta Institute of Technology (NAIT) offers a two-year, part-time evening certificate in game development. The introductory courses focus on game genres, the industry, and game play experience before introducing the technical content which is focused on group projects that model industry work environments. Students are required to complete all ten courses within a two-year time frame to ensure their technical skills remain current. Guru Digital Arts College, a private college also located in Alberta, offers a six-month interdisciplinary program that combines technical, artistic, theoretical, and business skills in an intensive class schedule.

Outside of the traditional university degree or college certificate programs, the University of Winnipeg offers a diploma program in serious gaming with either an educator or game developer stream. The educator stream consists of a set of theory and pedagogical courses designed to prepare educators to use games in the classroom to teach students and enhance learning. The game developer stream is a set of practical courses designed to train skilled and experienced developers for employment in the serious games industry. This is a unique program in Canada and while not as interdisciplinary as the other programs mentioned in this section, it is the only one that is offered at a Canadian university as well as the only program to focus exclusively on gaming for educational purposes. Graduates of this program are less likely to be prepared for an entry-level job in the mainstream gaming industry, but they do acquire serious gaming experience and skills not currently offered in other learning environments.

Individual Courses:

In nearly every province in Canada there are courses at the college and university level that provide technical skills needed to work in the industry. Animation and digital media classes can be found in most University visual arts programs and are a common subject at the college level. Many Computing Science programs at the university level offer individual courses for game programming, design, or 3D modelling. It appears that it is becoming more common for university Computing Science programs to offer either a curriculum stream or electives that deal specifically with gaming. In Alberta alone there are twelve post-secondary institutions ranging from private colleges to accredited universities that do not grant credentials specifically in gaming but do offer individual technical and theoretical courses.

The type of individual courses ranges widely across the post secondary landscape but generally they can be described as either purely technical courses in programming for gaming and computer graphics or interdisciplinary and Humanities focused courses that look at aspects of game design such as storytelling, game play, the history of games, and the use of games in educational contexts. The University of Western Ontario offers

an undergraduate course within their Media, Information, and Technoculture bachelors program on video game culture and technology. The University of Alberta offers an interdisciplinary, team-based course that mixes both Arts and Computing Science students into teams that use their heterogeneous skills to design a game. Although it does not offer video game courses within the Computing Science department, the University of Saskatchewan has recently piloted two new undergraduate courses in 2009 which targeted Humanities and Social Sciences students by taking an interdisciplinary approach to game design curriculum and teaching basic coding as well as game design principles.

Technical Diplomas and Certificates:

Technical degree and certificate programs specifically for game design are less numerous than individual courses embedded within an existing program but they are becoming more common. Currently, these types of specialised programs are offered in British Columbia, Alberta, Ontario, and Quebec, mainly at the college level. At this time there are no accredited universities in Canada that offer a degree in technical game design although there are Computing Science departments at universities like Toronto, Guelph, Calgary, Algoma, Acadia, Windsor, Prince Edward Island and Alberta where students can choose to take a number of electives to specialise in game design or programming. The University of Western Ontario offers a BA in Information Technology with a specialisation in game development and entrepreneurship. If a student is looking for an accredited program that is designed specifically for the game industry, private colleges are leading the way. Schools like Pixel Blue (a private college in Edmonton, AB) focus exclusively on training students to work on the technical aspects of game production in an atmosphere that mimics the industry environment.

3. In Detail: Ontario

Universities in Ontario exemplify the *ad hoc* nature of computer game curriculum in Canada. A few universities offer majors in game-like programs:

- Interactive Arts & Sciences program at Brock University
- Computing and the Creative Arts program at Queens University
- Game Development & Entrepreneurship specialisation at the University of Ontario Institute of Technology
- Media, Information, and Technoculture program at the University of Western Ontario
- Three interdisciplinary programs around technology and the Humanities at University of Toronto (Mississauga campus)

However, students entering an Ontario university will be hard pressed to find a program that will make them into a games developer/programmer, designer, engineer, or artist. Outside of the excellent college offerings (Sheraton stands out here), the

offerings at most universities are slim. Even Waterloo, with their intensive Computing Science degree and lauded internship program, seems to offer little directly related to game development, particularly at the curriculum level.

A student willing to grapple with the bureaucracy to create their own interdisciplinary program might find enough general programming, digital arts, and design courses to cobble together a pseudo game design degree. For example, Carleton's Computing Science department has a computer game development stream and an interactive technology stream. The psychology department is a founding member of the Human Computer Interaction lab. If a student merged the BA major in computer game development with a minor (or double major) in Psychology, it appears they would have an excellent grounding, lacking only an internship or co-op component to replicate game design programs found elsewhere in the country. A student in University of Windsor's Multimedia specialisation in Computing Science could possibly tweak such a degree to be more relevant to games.

In the Arts, many digital arts programs could be relevant to the gaming industry, although the paucity of course offerings that specifically reference the kind of art or music needed for gaming, for example, was surprising. The Ontario College of Art & Design has a few offerings, including a minor in digital media that could be made relevant by an enterprising student, but the course offerings themselves rarely mention gaming as an option. Similarly, York University, which has an excellent reputation as a home for interdisciplinary studies, lacks specific offerings that relate to game development, game studies, and digital design.

It is difficult to make summarising statements about the current state of such gaming programs in Canada, but in general it appears that training for technical aspects has been the main focus up to this point at both the college and university level. Universities and colleges are beginning to take concerted steps toward teaching on the Humanities and Social Sciences side of game design by incorporating aspects of narrative, interactive writing, history, art, architecture, sociology, and psychology as well as business strategies such as project management skills and team dynamics.

3. Mentorship

Here, mentorship refers to what happens outside a formal classroom setting, either through co-op programs, internships, collaborative research projects, conferences, etc., which bring students, universities, and game companies together.

Co-ops and Internships

Almost universally, industry interviewees extolled the value of student co-ops and internships. The reasons for this are two fold. First, no matter what the degree or diploma, most employers placed the highest value on real-world experience in pushing

a game through a completed development cycle. Whether this was done during an internship or in a students' off-time did not matter. What mattered was experience (preferably working in teams) in designing and completing games. As stated by a creative director at a large game development company, "Anyone who has worked on a team stands out in the juniors we hire." Second, co-ops and internships give employees a chance to view numerous students with little risk. Many of the people we interviewed noted that their company ended up hiring people they first worked with as interns or co-op students. Although larger companies were more likely to have formal internship programs, many small companies had taken a co-op student or two. A business manager at a medium sized game company in Vancouver noted, "There was some concern we would have to baby-sit the students but that hasn't been our experience, we would do it again." Developers and game insiders repeatedly praised the co-op program at Waterloo and Sheraton.

One interviewee, a senior technology specialist in an executive position with PhD in Computing Science, suggested inverting the co-op model to have industry people come spend time in university labs and degree programs. He noted,

> We'd love to work with masters or PhD students and implement their theses on our tool set. Flip side – give the opportunity with current employees who should go to grad school. Let people get recognition for the great work that they're doing [in industry]. Then the university would be better connected to what the industry is doing. We could get students to start implementing their work in an industry context. It's useful to have both. Our people work with university researchers so that the university learns what's being done in industry, then students work in our environment who implemented his or hers thesis here. No problem with IP or him or her publishing what he or she did or how he or she did it.

Implementing such a collaborative model seems easiest when it involves game industry people familiar with the structure and bureaucracy of a university.

There were some concerns with co-ops. For gaming companies one of the major stumbling blocks to participating in a co-op is the discrepancy in time frame between the four-month university semester and development cycles in industry. Video game production can take anywhere from one year for a small project to upwards of five years for a very large console title (or twelve if you are making Duke Nukem Forever). Many of the industry professionals who were interviewed expressed concern that co-op students who came for a three to four month period did not receive an accurate experience of what it is like to work on a significant part of a gaming project and they would not be able to contribute in a meaningful way in such a short period of time. An independent game designer who has worked for large game developers in the past stated,

> the raw amount of work to get done is hard, but to be creative you really need the mental space to think about it. You need time for the big 'ah ha' moments.

> You just do not have the time to do the lateral thinking during a short, intensive co-op program.

This was a major concern that came up repeatedly and one of the issues that led to reluctance to take on co-op students. The representatives we interviewed wanted to make sure that the students learned something valuable during their time with the company and do not simply spend their days sitting at a computer. Co-ops could be used to teach a talented student a specific set of skills that could make them a desirable candidate to be hired upon their graduation directly into the company. A game designer at a mid-sized company thought that "longer co-ops could be helpful, they would give an opportunity to take a strong programmer who hasn't worked on the iPhone and in two months they would be more knowledgeable on the device. But, if you have them for six months, you can work on a full project up to the testing point. At sixteen weeks or less companies who might be interested may not go for it (co-op programs) because it is just too short."

The other major stumbling block companies face when thinking about initiating a co-op program is the concern that it will be a drain on both financial and human resources. A representative from a new studio who was very interested in initiating a co-op program said they had been unable because "we really need to have a critical mass of people to be fair. You want the student to get something out of the experience too, we need to have the staff to support the student." Most of the representatives from smaller organisations we spoke to felt that having an employee mainly devoted to supervising and teaching a co-op student to ensure that both sides benefited from the partnership would be too costly.

From a university perspective, co-ops for large programs are very costly programs to setup and administer. The process of establishing sufficient industry contacts may in itself take years to build to a sustainable level.

Scandinavian Co-op Model

One possible co-op model that could help mitigate the drain of resources some companies experience when trying to supervise and teach co-op students is based on a model found at the Centre for Information Technology Studies as a Human Science at the University College of Borås in Sweden (etjanst.hb.se/bhs/ith//ith-eng.htm). This model would see students in their final year of university form a small team of four to five who are assigned a stand-alone project by their company co-op partner. This project would be a discrete piece of a larger initiative that could potentially be used as part of a game or game engine but would not be absolutely necessary. This allows the students to experiment and take some risks without endangering the success of the larger project or potentially causing loss to the company if the student project ultimately fails. It also gives the team members experience managing their own project apart from the larger game design process. The co-ops in this example have been six months long, which the interviewee felt was necessary for the students to be able to

produce something of value from scratch and to do it well. Key to success in this program required clear roles for students as wells as treating the student team as part of the overall project while keeping the actual code separate until completion.

Identifying and Promoting Talented Students

Many individuals interviewed for this project stated that they had no formal relationship with universities to identify and promote talented students. This need not be the case, as professors with good game company contacts may facilitate student transition from university to industry. For example, one interviewee, who is currently in a senior position at a large game company, had previously taught a fourth-year game design course in Computing Science at a Canadian university. The instructor made it clear at the beginning of the year that he would choose the top five students from the class and personally send their names with his recommendation to his contacts in the gaming industry. This gave the graduating students a tremendous advantage upon entering the industry, and subsequently, led to a highly competitive and productive class culture. The recommended students were all hired each year the course was offered and the professors' contacts in industry would often ask him for more recommendations. In addition to promoting his students to the industry, this professor also brought in lecturers both during class and for extra-curricular presentations. This consistent and sustained contact between the professor and industry representatives fostered relevant knowledge transfer about the current state of the industry to the students as well as giving companies a chance to get to know the students.

C. University-Industry Partnerships

There are dozens of university-industry partnership in Canada, ranging from informal exchanges involving a few people to complex instructional programs involving multiple industry and university partners. Here is just a sample, beginning with the informal:

- Many of the game industry people we interviewed have lectured at various universities and colleges, usually at their *alma mater*.
- The Humanities Computing program at the University of Alberta has established an informal partnership with a local independent game company for specific projects. The industry partners act as advisors and students gain valuable work experience and mentorship.
- University of Winnipeg has a formal collaborative relationship with Project Whitecard, a game development studio located in Winnipeg. A four-week summer immersion camp was developed to help students gain relevant skills and knowledge that will help them find employment in the video game industry.
- The Computing Science department at the University of Alberta offers a "Computers and Games" course, which groups students from different disciplines with the end goal of building a game. Industry contacts from Bioware assess the projects and provide feedback.
- The University of Lethbridge's Department of New Media has an internship program that places students in a working environment to help facilitate students' understanding of digital media technologies.
- Brock University has an informal partnership with Silicon Knights (the CEO is an *alumni*). Silicon Knights contributed to the development of Brock University's "Interactive Arts and Sciences" program, which brings core Humanities subjects together with courses on interactive media. Silicon Knights is also one of the founders of the Interacting with Immersive Worlds conference, which is a biennial conference that takes place at Brock University.
- TAG (Technoculture, Art and Games) is an interdisciplinary collaboration, based at Concordia University, for research in game studies, design, digital culture, and interactive art. This interdisciplinary group consists of faculty members, artists, designers, and graduate students from different faculties and disciplines from several universities, as well as employees at video game companies and members of community-based groups.
- Ubisoft Campus is a collaboration between Ubisoft, Cégep de Matane, Université de Sherbrooke, Dawson College, Cégep du Vieux Montréal, and Université de Montréal. This collaboration offers a series of college and university level training programs for video game development. It has recently completed its mandate.
- The Masters of Digital Media program at the Great Northern Way has an Industry Affiliate Program that is a core component of the degree. The program promotes industry and academic collaboration by connecting businesses with students and researchers. Student teams are created based on cross-disciplinary skills and a team-based approach to project delivery. The program also requires

students to complete four-month internships during their program. Industry affiliates provide guest lectures, mentorship. Continuing education and professional development courses for industry employees are currently under development.

1. Barriers to Collaboration

Despite the above mentioned efforts (or perhaps as a result of some of them) there remain significant barriers to increased collaboration between industry and universities. A number of our questions focused on eliciting opportunities for partnerships and teasing out the barriers that prevent partnerships.

Intellectual Property

Universities and game studios have very different approaches to intellectual property that discourages university-industry research collaborations that require sharing IP. University researchers want to publish about innovations while studios want to use the innovation to create profitable games; this usually means keeping the IP secret. We heard of cases where there was useful IP in a university lab, but a studio could not commercialise it given university restrictions. As one interviewee put it,

> We don't have a lot of extra resources to coordinate/facilitate that relationship (the relationship around intellectual property). We tend to do our own research ... Universities are covetous of what they consider as academic knowledge, but keep all the rights to the academic knowledge. We can build our own from scratch if universities are going to keep all their knowledge.

Controlling IP is central to game studios and there is a legitimate suspicion that universities do not respect IP and do not have the appropriate culture of secrecy (eleven interviewees saw IP differences as a barrier and ten felt that university researchers had an inappropriate sense of ownership of IP.) For that matter, studios sometimes cannot share IP at all, for example in cases where they have licensed the IP from someone else or where they have been commissioned to develop a game. As for IP developed within a studio, studios are rightly protective of that IP and unwilling to share it with universities. As one interviewee put it, "In this industry we fight to retain IP on everything."

Research and Teaching Mismatch.

Interviewees felt there was a difference in research cultures and research outcomes. Studios will do "just-in-time" research to solve a problem, while universities tend to have a long-term view of research that is less tied to concrete problems, and tends to result in published papers rather than specific software solutions. Many of the interviewees from larger studios also commented on the importance of understanding

the larger process they are part of and their part in it. As one producer put it, "We would like everybody to understand that they are here to make games" and not, as was implied, make their personal art or vanity projects.

Three interviewees felt that university research simply did not match industry needs. A further dimension of this problem is that studios and university researchers both find it hard to identify potential research partners. Neither community knows the other as they do not have common communication channels. A complaint we heard from eight of our interviewees is that instructors (professors) are out of date and this affects not only their research, but also their teaching. One interviewee described how he would only take evening courses so as to get professors who actually worked in industry rather than full-time instructors.

Different Timelines and Pace

Universities have a definite pace and annual cycle of semesters that does not fit well with the pace of game development. This is especially apparent when studios try to integrate interns. Seven interviewees felt that the semester was too short a period for an intern to witness the full development cycle. It is also too short given the investment a studio has to put into training the student before they can actually contribute. Internships are one of the most promising forms of collaboration, but timing is an issue.

While both large and small game company executives expressed a desire to give back to the community, they also stated, quite clearly that formal collaboration with post-secondary institutions should benefit game companies in clear and precise ways. One such need is the creation of a talented labour force with skills needed for game production. However, industry has been hesitant to establish formal training relationships as there is no guarantee that students will work for the company that expended resources on said training. As a senior project manager at a large game company said, in reference to Ubisoft University,

> We want universities to be training the students but we also want them to stay on the same track as industry to make sure that the students are being trained in a way that is relevant to the industry now. With the economy the way it is, I cannot see a time in the near future when a private company will be investing in building a school to teach students who will benefit their competitors.

2. Opportunities for Collaboration

Despite these barriers, it is clear there are interesting opportunities for collaborations between universities and industry. As stated by a senior game designer with respect to difficult research problems, "We want to solve that problem ourselves, but that doesn't mean that there can't be interesting collaborations."

University-Industry Classes and Master Classes.

Universities may serve an important middle ground for teaching and upgrading skills outside of a formal degree program. Ubisoft started the Ubisoft Campus in Montreal in 2005, but it is rare that a company will invest in education that could also benefit their competitors. Instead, smaller-scale partnerships could be imagined where single courses could be organised in partnership between a university and studio. These might be open to only students and participants from the studio organizing the class. Most individuals we interviewed noted the lack of such resources, creating an opportunity for universities to establish meaningful contacts with industry. An experienced game designer noted, "There is really nowhere to go to improve skills – no part time programs that are suited to people who have jobs but want to go back part time to buff up skills, add on new programs or get a certification." A senior executive at a large publisher noted that a week long series of workshops packed with information on various themes (marketing, platform development, successful and unsuccessful case studies, Asia versus North America, etc.) would be very useful. He suggested that if done right, a fee of $1000 to $1500 would be reasonable and that many larger companies would be willing to send staff who wished to upgrade their skills.

Another model that six interviewees liked was that master classes be organised more as a seminar where senior designers could gather to exchange ideas. Such master classes could be organized, as a retreat, at a location like the Banff Centre <www.banffcentre.ca>. They could be coincide with conferences or they could be locally organised at times when industry professionals could attend. These could be set up to have seats for university and industry participants so that all can learn. Such master classes might, if faculty were involved, serve as a venue for university-industry communication and as a way for faculty to update their knowledge of industry practices and needs.

For such efforts to succeed, instruction must come from both university researchers and industry experts. Rightly or wrongly, university and college instructors are too often seen as people who could not make it in industry. As stated by a game designer who is also a part-time teacher at a private school,

> The biggest road-block the university has is that no one in the upper echelons of the game industry have degrees because they did a one year program to get into industry as fast as possible. They have the skills but not the credentials to teach at a university level. Those who do have PhDs don't have the industry experience and skills to teach the information - there is a huge gap.

Put more succinctly by a different game designer, "Teaching in gaming was the give up option."

The Vanier College BDC Case Challenge, an inter-collegial marketing case competition for business administration students from across Canada at the community college and CEGEP level, may also offer an effective model. It is a two day formal competition where

student teams are presented with a real-world business problem. They must devise a marketing solution and presentation in three hours and then present to a panel of judges from industry and academia. This model could be particularly useful for smaller companies who do their own marketing alongside game design and implementation. The competition results in marketing strategies that could potentially be used by industry participants in their own business plan. This model has low time and resource requirements for all participants. Taking place over two days, it does not take away from regular course time and does not require major reorganisation or investment by industry partners.

Content Research

One area where universities have deep resources that are not being taken advantage of by industry is content expertise. Many games either take place in an historical setting, simulate social processes, take place in real locations, have historical figures as characters, use design ideas from specific places and periods, or simulate real devices (from planes to weapons.) As gaming audiences mature they are demanding more verisimilitude, better history, more interesting spaces, better simulations, and more accurate devices. The arts, Social Sciences, and Humanities are custodians of knowledge about historical processes, locations, devices, and characters. There is an opportunity to connect university researchers who are passionate about a period with designers who need research for a game. As one participant put it, "There is a gap there that we should fill and I think the role of universities could be very helpful in that way. We have people that are very good at making games but are not specialists in the content production."

While we believe there is an opportunity, this is an area where the differences in pace and culture are difficult to overcome. Most faculty would be reluctant to drop everything (including courses) to assist a game development team on a tight deadline. Researchers, however, might be interested in consulting and testing games for period accuracy. We also believe that senior undergraduates and graduate students could hold content internships that bridged faculty and industry.

Canadian Game Archive

Ten of the interviewees were intrigued and supportive of the idea of collaborating to archive game design documents. Because of IP issues it is unlikely that studios would allow code or valuable IP to be archived in a public fashion, but many could see the historical, educational, and research value of archiving design documents. Institutions like the British Library and Stanford have already started developing game archives in Britain and the America. There is an opportunity for a national partnership here in Canada designed to preserve valuable creative materials around interactive arts and computer games.

Brainstorming the Future

One subject that interests both industry professionals and academics is trends in gaming. An opportunity that eleven interviewees agreed would be interesting are industry/university events that brainstorm the future of gaming. These could take the form of panels at conferences or meetups between academics and professionals. These could be the subject for master classes and, like master classes, they could be organised as national retreats or local events. Either way, there is a hunger to talk about the future.

Communication Channels

Given the absence of regular communication between industry and universities noted above, there is a clear opportunity to set up communication channels that efficiently introduce researchers and instructors to game developers. As one interviewee put it,

> Here at [a large game studio] we have one guy responsible for relationships with universities, mainly internships and hiring from universities. I could see a flipside of that where universities had someone responsible for relationships with industry. They come for a meeting once every month or so and meet with industry and see where matches could be made for projects. I would not have time to go to universities to seek this stuff out but if someone from a university came and asked to meet with me I would definitely be open to talking to them. As long as the university trusts that that person could represent them, I could trust that person.

Twelve of the interviewees felt that a barrier to collaboration is the lack of venues for regular communication between industry and university. As one person put it, "Even if I am talking to the wrong person at the right university I may not know about it [relevant research]. We need some kind of central repository or something to facilitate knowing the right person at the right time with the right idea." Four interviewees even felt that the process we followed by setting up interviews and coming to them was itself a start in communication.

Formal communication venues could take a number of forms, but the goals of such an outreach program might include the following:

- To help people on both sides learn about the needs and research of the other.
- To help connect studios to researchers and instructors as they need them.
- To build trust and understanding of the two cultures so that both sides can anticipate and better partner with the other.
- To help instructors stay current on industry trends and to introduce students to the industry.

It is also clear to us that communication cannot take one form. Many of the opportunities mentioned above, from internships to master classes, also serve to bridge the communities. What is missing is a more coordinated and national strategy to facilitate communication through many channels and to evaluate their effectiveness. We can imagine a strategy coordinated by the Canadian Game Studies Association and an industry association like the IGDA.

Other Opportunities

Interviewees suggested a number of additional efforts that could promote collaboration:

- Faculty / researcher internships so that faculty or postdoctoral candidates could be embedded in a game design team to learn about and study the industry. Three of the interviewees said they would consider having an ethnographer join a development team to see if they could learn about methods to support their processes and culture.

- Courses on writing for games appealed to four interviewees. Interviewees noted that writing for games is different than the narrative/linear writing typical of creative writing courses which is why game writers are not often recruited from such programs.

- Conferences for academics, students, and professionals appealed to two interviewees. What is more likely to work is to build on an already successful annual conference by adding elements that open the conference to the other. An example would be MIGS (Montreal International Games Summit <sijm.ca>), which is well attended by game designers, students, and researchers in Montreal already.

- Industry-Student-Faculty Hack Fests that tackle a theme or problem over the course of a weekend would bring students directly into contact with industry experts, providing an educational and mentoring opportunity.

3. The Decision to Collaborate with Industry

The decision to wrap curriculum within a game envelope should not be taken lightly. The challenges of providing sufficient depth of knowledge that remains sensitive to rapidly changing technologies and labour needs are remarkable. Many of the people we interviewed suggested that formal programs at colleges and universities would not, and in fact, could not, prepare most for a career in the gaming industry. At least one interviewee insisted that such efforts would compromise the depth of knowledge that universities offer, a significant advantage they have over technical colleges. As one business director at a well-respected company said, "You really should just take a year off school and build a great portfolio which shows your value and skill set as well as the ability to self teach. Schools are good to keep you on track, but for a school to teach gaming is a tough task."

Some were even more critical. A senior game designer stated, "Colleges are selling game design degrees that are basically useless – I would normally hire someone with a strong portfolio they made themselves on their own time over someone from a formalised game design program." Universities often fared little better. From four different experienced games designer, all in senior positions:

> "I have often struggled with the value of the university. I know there is significant value in a university education; strong time and project management skills, dealing with stress, dealing with people, strong computer skills, working with people to learn to succeed…However, all of the producers I know don't have a traditional education, it isn't really a teachable skill. They are hard workers, smart, focused and experienced."
>
> "University is not the way to break into working in the industry in a productive way. It takes too long and teaches the wrong skill sets."
>
> "Having a university degree can create a concern that you will have to help them unlearn a bunch of bad habits, it's possible you might want to take someone who is a blank slate over someone you will have to retrain in the corporate culture."
>
> "A lot of problems I see, and why students choose Vancouver Film Institute rather than university, is that they don't want to waste their time. A lot of universities use Second Life but it's a huge farce. It is not relevant to the game industry, it's just a hype machine. Most of the students trying to get into the industry are really well informed and won't be sold on things that are really antiquated. They want to be on the cutting edge of the industry."

Nor should faculty assume that industry will view their research skills and insights as useful or even welcome. As a senior game executive with a Computing Science PhD said, "They [game companies] do not want to hear that a researcher can 'make your game better.' They don't want a design framework from some academic of things they

already do, and do well." Or, from a senior game designer at a large game company, "Working with people in academia is similar to working with people in government and their bureaucracy – they are lost in their own world."

However, all is not lost. Despite these criticisms many of the people we interviewed were genuinely eager to collaborate with universities. To be successful, universities and university researchers must prove their usefulness to industry and eliminate any sense of entitlement (by entitlement, we mean an attitude amongst some university researchers and students who have an inflated sense of the value of their research and/or degree, rather than actual game design experience.)

E. The Case for Serious Games

Serious games are attracting attention as a new application for games and gaming technologies. As with any emerging field, definitions are evolving and contested. Complicating matters further, definitions upon which serious games are based – specifically definitions of "games" – are also contested. We propose the following: a serious game is not for entertainment, but rather to explore a problem related to learning, training or research. A serious game may sacrifice fun in order to better explore the problem. Opinions vary on the place of entertainment in serious games; some commentators argue that the pedagogy of serious games marks them as different from entertainment games, but that the pedagogy must be secondary to story and entertainment (Zyda, 2005). Others take the opposite approach - according to them, serious games are games that do not have entertainment as their primary focus (Michael & Chen, 2001). There is agreement, however, that serious games, while giving less attention to entertainment, must nevertheless engage players.

Entertainment games generally try to provide players with a rich experience in which to have fun. To this end, they often employ simplified simulation models (for example, simplified physics in a car race game). Serious games, in contrast, focus on learning or problem solving, and therefore include realistic simulation models (for example, real physics in a car race serious game.)

Serious games and digital game-based learning (DGBL) are sometimes considered to be the same (Corti, 2006). The concept of "game-based learning" is built on the assumption that today's students have been raised in an environment steeped in digital technologies including games, and therefore games are an ideal way to teach them (Prensky, 2001). In our opinion, serious games intersect with game-based learning tools, but are not the same. While serious games can be used for learning, they can also be used for other purposes such as research. And, while a game used for learning may be a serious game, one could also teach with a game originally designed for entertainment.

Serious games are also different from e-learning and edutainment. E-learning is education using or enhanced by computers especially distance learning (Hodson et al., 2001). Edutainment refers to educational entertainment games (typically focusing on reading, math and science (Michael & Chen, 2001), generally aimed at young children, which were especially popular in the 1990s. Serious games developed partly as a reaction to negative attention garnered by edutainment games. According to some commentators, edutainment games had come to embody the lowest forms of education, with their focus on drills, and lack of compelling gameplay (Charsky 2010).

The term "serious games" came into common use in 2002 when the "Serious Games Initiative" was founded at the Woodrow Wilson Center for International Scholars in

Washington, D.C. This ongoing initiative is "focused on uses for games in exploring management and leadership challenges facing the public sector. Part of its overall charter is to help forge productive links between the electronic game industry and projects involving the use of games in education, training, health, and public policy." (http://www.seriousgames.org/about2.html) 2002 also saw the release of *America's Army*, an online first-person shooter game developed by the US army as a recruiting tool, which focused on the use of tactics more realistic than those in other entertainment-oriented shooters. *America's Army* is considered by many to be the most successful serious game yet developed.

1. Serous Games across Sectors

Health

The Health sector has been one of the largest adopters of serious games. Conferences like "Games for Health", and organisations such as "Health Games Research" encourage the use of games and game technology for health and healthcare. "Games for Health" was started in 2004 and has been supported by the Robert Wood Johnson Foundation (which in 2007 invested $8.25M to start the "Health Games Research" initiative (Sawyer, 2007)).

Health games are one of few types of serious games to have already seen success in the marketplace. Nintendo's *Wii Fit*, a game featuring a balance board controller, is being used in households around the world for various fitness games. As of June 2009, *Wii Fit* had sold over 20 million copies in North America alone (Mazel, 2009). Its success has led to the development of games such as *Walk with Me* for the Nintendo DS, a game that includes a pedometer and encourages the user to view walking as fun (O'Neill, 2009). Indeed, even Nintendo's own *Pokemo*n franchise has embraced health, and includes a pedometer with its newest *Pokemon Heart Gold* and *Pokemon Soul Silver* (allowing users to train their *Pokemon* by walking (Ashcraft, 2009).

Business

Serious games have been adopted by businesses in two ways: first, businesses are using game-like simulations to emulate situations that would be too high risk, either for financial or safety reasons, for "real-world" training; second, businesses are using games, especially massively multiplayer online role-playing games (MMORPGs), to support the development of leadership qualities in their employees. Simulations teach and train in a manner that would be difficult, dangerous, costly, or otherwise unfeasible in the real world. These range from flight simulators some of which, like *X-Plane*, are available on home computers, to business simulations allowing new employees to test their mettle without putting actual capital at risk (Corti, 2006).

MMORPGs are of special interest because of the way they encourage leadership skills viewed to be directly applicable to business leadership. According to those who promote the use of MMORPGs for business, these environments support the development of: i. project-oriented organisation skills; ii. management of multiple real-time sources of information upon which to make decisions; iii. transparent skills and competencies among co-players; iv. transparent incentive systems; v. multiple and purpose-specific communications mediums (Virtual Worlds, Real Leaders, 2007).

IBM performed a survey of its employees who played games and found that about half believed that MMORPGs had improved their real-world leadership skills; 40% stated that they had applied these skills in the workplace (Virtual Worlds, Real Leaders, 2007). Whether or not this is the case, the perception now exists that games can cultivate business leadership: in 2006, *Wired Magazine* ran a story about an employee at Yahoo! who had been hired, in part, because of his success as a team leader in the MMORPG *World of Warcraft* (Brown & Thomas, 2006).

Social Change

The potential of games for social change has been well illustrated by *Darfur is Dying*, a game designed to increase awareness of the crisis in Darfur by giving players a window into the experience of refugees; it has been played by nearly 2.5 million people since its launch in 2006. "Games for Change" is the main organisation supporting the development and use of games for humanitarian causes. This network of non-profit organisations functions as a hub for developers; additionally, it offers conferences and workshops, and provides guidance concerning the use of games for social change. The organisation strives to create an accessible community for developers, assist with media coverage and funding, and document and research best practices.

Military

Military games have a long history: they have been played recreationally, and used to aid the development of military tactics, for centuries (Shephard, 1963). More recently the United States military has developed and released three games in the *America's Army* series. These are online first-person shooters that serve as recruitment tools, and have been used internally for military training. *America's Army* differs from many serious games in that it was developed and is supported with a large budget. As a result it uses current-generation technology, and resembles the sophistication of many large-budget entertainment games. Indeed, the three versions of the game have cost $33 million to develop over ten years (Remo, 2009). While *America's Army* is not the most popular FPS game on the market, it maintains a significant player base (battletracker.com/index.php).

Government / Policy

Government bodies use serious games in ways similar to the business sector: to teach leaders and policy-makers how to deal with crises before they happen. These have been used to, for example, prepare for, protect from, and counter terrorist attacks; plan city development; and create and balance budgets (Micheal and Chen, 2006).

Education

Researchers and teachers have expended considerable effort to better understand computer games, and how these can be best developed and used for teaching and learning. A host of organisations have formed for this purpose. "Games, Learning and Society", for example, is an interdisciplinary group of researchers, primarily based at the University of Wisconsin-Madison, who are looking into games and serious games for education. The group also holds a conference under the same banner. The use of serious games for education has been actively promoted by scientists and science educators especially. In 2005, for example, the Federation of American Scientists published a white paper that concluded that digital games should be more actively employed for science learning by students (2005).

The Canadian Context

Serious games are being used in the sectors noted above by a host of Canadian-based organisations. The "Canadian Game Studies Association" (CGSA) supports the study of games in general, including serious games in a variety of contexts. The "Montreal International Games Summit", an annual gaming trade show, has promoted serious games along with other themes. And the "Graphics, Animation and New Media" (GRAND) project is exploring serious games as one of its themes ("GameSim").

Several university-based research projects are focused on the use of serious games in specific contexts. "Simulating History", for example, is exploring "best practices", and best potential" for educational serious games to teach Canadian history. Funded in part by the Social Sciences and Humanities Research Council of Canada, and lead by Kevin Kee, "Simulating History" has published articles (with a book forthcoming) and serious games for learning, organised major conferences, seminars and colloquia, held Canadian history games summer enrichment camp programs for teenagers, and spawned several other projects, (including the "Playing with Technology in History" project).

2. Serious Games in the Academy

Games in Courses and Programs

As the example of Simulating History suggests, serious games are being used for teaching and learning in schools, colleges and universities across Canada and around the world. Indeed, in the last decade the use of serious games as tools for learning has become commonplace.

Regardless of the domain, instructors want their students to engage substantive content, and serious games provide multiple formalisms (including text, audio, and video) by which this can be acquired. Indeed, serious games may provide opportunities to engage content in ways that text, for instance, cannot. In cases where students create serious games as part of their courses, they literally build their knowledge and understanding. These projects may be ambitious (students using programming languages and graphics libraries to develop serious games "from scratch"), or modest (students developing "mods" based on a commercial game).

Instructors also want their students to learn the practices of their discipline – for example, history instructors want their students to think like, and acquire the practices of, historians. In most serious games, students take on a role, and are immersed in an environment where the correct use of these practices will result in success. As linguist and games theorist James Paul Gee has shown, a learner assumes the following: one, a virtual identity (for instance, she might play the role of an historian trying to solve a mystery), and views the game through the eyes of that virtual identity; and two, a real-world identity, perhaps as someone with little interest in the subject matter.

But because serious games are engaging, they draw a learner in, offering a student an opportunity to try out virtual identities. As a result, the student develops iii. a projective identity, viewing the development of her identity as a project she wants to continue. In the process, a student who might otherwise view history as dull may begin to see herself as a historian. And as a result of taking that historical perspective, and engaging the other skills of historical practice, she will be more likely to view history as historians do (Gee 2003).

Programs and Courses on Games

Serious games are also being treated, at the post-secondary level, as objects of study: many programs and courses address the analysis, use, and development of games in general; some address serious games in particular. Examples include the Banff Centre's Banff New Media Institute (its 2008 Creative Producers lab included serious gaming as one of its six themes), the University of Calgary, which has an introduction to game-based learning course in its Faculty of Education, the University of Winnipeg, which runs a serious games summer camp for teens aged fifteen and up, and offers a serious games certificate in two separate streams (one for educators and one for developers), and Brock University, which emphasises serious games in their courses in Interactive Arts and Science, Humanities, and Computing Science.

The number of programs and courses focused on game development has grown significantly in the last decade. The knowledge and skills acquired in these courses are not exclusive to serious games, but can be applied to their study and creation. Game creation programs tend to be heavily weighted to Computing Science programs, with game analysis courses falling in the Arts/Humanities. Notably, many of these courses and programs are cross-disciplinary.

3. Serious Game Development

Conferences and Workshops

Canada boasts several large-scale gaming conferences and workshops, almost all of which include serious games as a track or subject. These presently include the following:

- Canadian Games Conference (www.gdc-canada.com)
- Digital Interactive Gaming (www.diglondon.ca)
- Game Design Expo (www.gamedesignexpo.com)
- Montreal International Games Summit (www.sijm.ca)
- Canadian Game Studies Association (playces.edu.yorku.ca/events.php)

Serious Game Development and Tools

The development of serious games figures in several university-private sector partnerships and business generators, such as Communitech, in Waterloo (with the University of Waterloo), and the Niagara Interactive Media Generator – nGen – in St. Catharines (with Brock University). nGen acts as a hub for digital interactive media projects and business development by bringing together partners in industry, economic development and post-secondary education. In this way it supports business incubation to help jump-start and grow new enterprise. Serious games for various domains have been, and continue to be, developed as part of this initiative. In this way serious games are contributing to the building of clusters based on emerging digital interactive media industries across Canada.

Options for serious game development are varied. These include off-the-shelf tools, some of which allow the user to build a game using a commercial game engine (these are often available free for academic use), others of which involve modifying extant games. Building these "mods" is free, and highly encouraged by the developers of the games on which they are based, because playing them requires that the player own the original game. One such mod is *Revolution*, which was built on top of the game *Neverwinter Nights*. This mod teaches students about eighteenth-century colonial Williamsburg, allowing players to participate in various aspects of daily life to better understand the social context of the era. Appendix 2 provides a chart outlining options

for serious game development; the chart also notes examples games made with these tools, and licensing options.

Development environments are different from toolkits in that they are programming environments that are not game-specific; instead these provide user-friendly interfaces with pre-built models, textures and computer code, allowing the developer a high degree of freedom. Of particular note are *Adobe Flash* and *Microsoft XNA*. *Flash* is widely used both for serious and entertainment games, including Facebook games; *XNA* is Microsoft's development environment for Xbox and PC, used by Xbox Live arcade games.

RECOMMENDATIONS AND POINTS OF CONSIDERATION

A. Universities

To better promote collaboration between the game industry and universities, and to promote innovation and the development of Canadian intellectual property, our team offers the following recommendations and points for consideration.

1. Stick to Strengths

Despite the temptation to focus on technology and technical training, universities should continue to emphasise specialised disciplinary expertise coupled with a strong interdisciplinary education. The decision to wrap curriculum in a game envelope should not compromise those values.

a. **Continue to promote deep domain expertise.** An essential element of a university education is expertise in a particular discipline. This should not be compromised.

b. **Promote a robust, interdisciplinary curriculum.** Along with the disciplinary expertise, a university education should include a broad and rigorous (but not necessarily game specific) education across and alongside other disciplines. As one interviewee stated, "[anyone interested in designing games should] spend a lot of time studying literature, writing, history, etc. – I think a lot of these programs now miss out on the arts side and focus far too much on the technical side."

c. **Consider carefully the adoption of technologies into the curriculum**. The technologies a student uses in their first year will more than likely be obsolete by their fourth. It is more important to focus on the best practices and theories of technologies. As one interviewee stated, "Universities are focusing too much on the technology and not enough on general creativity. When the industry changes it is going to be the creatives who will have work and the technical skills will be outmoded quickly." Another interviewee was more metaphorical: "The problem is that colleges are teaching kids to be mechanics, not to design new cars. They are missing the fact that the whole format of the car is changing."

d. **Consider developing gaming streams in some disciplines.** For disciplines that already have specialisations, universities should consider adding a gaming stream. An MBA in Game Development was repeatedly mentioned as a needed specialisation. Experts in market research for games and game consumption, mobile technologies, and social network gaming were deemed the most valuable.

e. **Promote avenues for games research in non-traditional disciplines.** The diverse skill sets needed to create games includes expertise in areas not normally associated with gaming. While we are not recommending gaming specialisation in all areas, curriculum developers might consider adding courses in the following areas: architectural design, interactive writing, psychology, government policy, and cultural resource management (costume and fabric design, for example).

2. Intellectual Property

A focus on generating revenue from gaming technology transfer is misguided. Talented, creative, and flexible students are the most important technology transfer that universities create, especially with respect to video game design and game study.

a. **Reduce or eliminate expectations regarding royalties and licensing fees.** Research Services Offices (RSOs) should overcome their desire to view advances in gaming technology as a source of revenue. Government and university administrators have increasingly looked to technology transfer agreements to generate capital. RSOs may seek royalties or licensing fees tied to any university research technology deployed in a commercial game. However, this is counter-productive when applied to gaming technology. Unlike pharmaceutical research, for example, where advances may come in the form of a single technological breakthrough, games are a complex combination of hundreds of technologies. A contribution in one area may enhance the game, but only represent a very small component of the final product. The "status" of contributing to a best-selling commercial product is often reward enough for the researcher(s), and can be used to help enhance the profile of the institution. Promoting Open Access publication and Open Source technology may be one avenue to consider.

This is true even for what are described as the "The Difficult Research Problems," such as solving the "uncanny valley" (Mori, 1970). Such research may not be immediately applicable to the game industry but there is potential for research from various fields to push forward very difficult research problems that may contribute to future game theory and design. Game companies are hesitant to tackle these research problems, providing university researchers an opportunity to contribute significantly to gaming technology. As stated by a game director at a large game company, "It would take someone with tremendous vision and very deep pockets to take the kind of risk and potentially fail spectacularly to drive these deep problems forward." However, even here, university administrators should not view advances in these technologies as potential revenue sources.

Additionally, games companies do not usually invest in research as universities understand it. Very few university research groups have been able to secure cash contributions from game companies. Universities should accept this reality and work towards securing in-kind donations. Access to code and industry expertise can be appropriate in-kind donations that may be acceptable for university-industry research funding programs. In fact, access to code and assets can be a multi-million dollar in-kind donation, and the optics of this may far exceed the benefits of achieving a small cash contribution. Further, if a researcher is able to negotiate a cash contribution from a game company, most universities immediately take a portion of the funds as overhead to cover the indirect costs of research. An overhead charge acts as a further disincentive to the company.

b. **Reduce administrative roadblocks.** Universities need to develop streamlined protocols for entering into IP agreements with game companies. Taking months to consider and sign an agreement is an eternity in the gaming industry, and will certainly put off small companies. Many of the game industry people we interviewed cited the long time taken to approve research agreements as a significant roadblock to university collaboration. Universities need a streamlined process for reviewing and signing research agreements with game companies. They must be ready to leap.

c. **Be flexible with IP agreements.** IP ownership can be a contentious issue, especially with game companies. Game companies expect to own all of their intellectual property and they guard it zealously. The notion of sharing ownership of IP is rare, particularly in new, untested relationships. They will work with university researchers, but their initial position will be that all IP is owned by the company.

   Furthermore, games companies will require Non-Disclosure Agreements (NDA) and/or confidentiality agreements to access many of their intellectual property assets (such as code, art work, scripts, etc.). Many universities have been uncomfortable with these agreements since the companies often try to impose overly restrictive constraints. Trust needs to be built here.

d. **Be flexible with location of research.** Stemming from the above, game companies are very protective of their IP. As a result, if they allow students to access any of their game assets (such as code or art work), they usually insist that the student be located on the company premises. Oftentimes this is inconvenient for the student and can be an impediment to building ties. Universities can provide a secure environment for using commercial assets. The university needs to be proactive at providing such an environment and addressing the security concerns of the company.

3. Build Sustained and Consistent Relationships

Perhaps the most valuable effort that could be made to foster collaboration between universities and industry is the formation of relationships that are maintained and re-examined on a regular basis. Co-op programs are already in place at several institutions and have generally been successful and beneficial for both the students and their industry partners. This model benefits both groups directly by giving students the valuable realworld work experience for which game development companies are looking, while at the same time it gives companies a chance to get to know the students before they graduate and to train the type of employees they need in their specific workflow.

People in the gaming industry generally feel open to collaborating with academia on initiatives of various scales, but it will require universities to take the initiative and approach companies with ideas. Our interview process itself was a beneficial exercise and could easily have served as an invitation to further collaboration with several of the participants. Unfortunately, both academia and industry tend to suffer the same problem of being pressed for time and having multiple complex projects taking place continuously. Large team sizes, staff turnover, and a lack of consistent communication compounds the problem of work isolation. The following recommendations may ameliorate some of these concerns.

a. **Collaboration is its own goal.** Games are very popular with students and game companies often have a special status. Working with a game company can be a marketing tool for the university and help attract students. Consequently, it is more important for the university to build a relationship with the company than it is to extract the most advantageous deal. Start from the premise that with a partnership, the university can gain more intangible benefits from the relationship than the game company.

b. **Build personal relationships before administrative relationships.** It became clear through our interviews that the most successful collaborations began at the individual level: a researcher building trust over time with a particular lab, a professor involving game designers in a particular course, etc. The professor who sent names of his best students to industry, as mentioned earlier, is an effective example of how this relationship can benefit all parties. Only after such trust is built between individuals will more comprehensive initiatives be possible.

c. **Be sensitive to the culture of the gaming industry.** The game industry is not homogeneous. There are significant differences in size, scope, focus, technology, and tradition. Further, many game companies tend to work in relative isolation from others. They are deadline focused and profit oriented. Many collaborations between companies and universities fail because of a clash of cultures.

d. **Be sensitive to local variation in such cultures.** The differences in studio culture and labour markets varies from city to city. Universities should be aware of such variations and adapt accordingly.

e. **Eliminate any sense of entitlement.** Almost universally, game developers noted the sense of entitlement amongst university administrators, faculty, and students as a significant roadblock to collaboration.

4. Outreach

Universities must make the case that they are useful to the video game industry. A significant number of game companies seem to view universities as places that make "not quite useful people" and "not quite appropriate technology." Clearly, universities have significant expertise and resources to promote innovation. However, when it comes to collaboration with game companies, it is up to the universities to make that contribution clear. Developing useful outreach mechanisms may help mitigate these concerns.

a. **Create a university research coordinator.** A popular idea was to organise regular visits at the game company's workplace with a university representative to showcase current research, discuss potential or ongoing projects, and to explore new areas of collaboration. A dedicated person (or team) who could keep track of both sides of the relationship and suggest good fits for collaboration would be ideal. Similar to the MITACS program (mitacs.ca) but specifically for games, this type of match making between industry and academia can happen on a local, provincial, or even national scale.

b. **Develop collaborative platforms for knowledge exchange and skills development through workshops, conferences, and hack-fests.** There is a desire to improve skills and gain experience on both sides of the university-industry relationship. Different training models could be used to benefit students, researchers, and company employees in various ways by sharing expertise. The traditional university term model is not conducive to collaboration between industry and academia, but alternate models and time frames could prove more productive. Involving industry experts, professors, researchers, and students in workshops, conferences, or master classes not only allows for the exchange of ideas and skill sharing, it also opens up opportunities for informal collaboration or formal partnerships.

   Many industry people we interviewed expressed an interest in taking courses at the university if it could fit more comfortably into their work schedule. A common opinion expressed during the interviews was that university credentials may be valuable and many of the people working in industry would like to teach game design, but they do not have the qualifications to teach at the university level. Several interviewees also expressed the desire to take

individual university courses or workshops because they felt the curriculum was more rigorous and at a higher level than other programs for upgrading skills. They like the official standing the university offers, and the depth the courses cover. The major drawback was that it is very difficult to complete a full degree while also working in the industry and credentials are not granted for completing individual courses.

Alternate learning models such as intensive master classes over weekends or a condensed series of evening classes would be a better model for this group. Retreats and conferences that mix industry and academia could also serve as a space to share ideas and talk about future goals to which both groups could contribute.

c. Broaden the discussion to include other cultural institutions. In addition to working directly with industry partners, universities could also involve other cultural institutions such as museums, art galleries, archives, and libraries in supporting the digital economy and gaming culture in Canada. Collaborative research toward an exhibition is something universities and museums have worked on in other cultural areas and could easily be extended to gaming. There is an interest in architecture and game environments expressed in several of the interviews that could inspire an interesting exhibition. There is a growing interest, particularly in many of the smaller companies, to make games that stand out due to their unique stylistic or game play elements. Game designers are looking for cultural inspiration in many places and existing cultural institutions are a rich resource.

A recent collaborative project in this vein was undertaken by McMaster University, Silicon Knights, Mohawk College, and the Art Gallery of Hamilton. *Eight: The Hamilton Institute for Interactive Digital Media* was initiated by McMaster University, a post-secondary institution that is working toward becoming well-known for its digital arts program. Their main goals in this project are research commercialisation, education and training, economic development, and job creation in the Hamilton region. This project is focused at the McMaster campus, but will have a wider impact in the region on multiple levels.

d. Build a digital repository of gaming IP. While there was some debate over the format a digital repository for video games could take and the value a project like this would have, a strong interest in the development of a digital repository or archive for video game culture in Canada was evident in the interview process in all three cities. A digital archive could take on many forms and the largest problem that would need to be addressed would be legal issues surrounding intellectual property. A repository might include the following:

i. Game design documents. A digital archive could preserve a record of game design documents and their iterations. The archive could potentially be

used by professors teaching game design and theory to build course content and as a classroom resource. The roadblocks to this model are that games are not always well documented and the documentation itself is not always complete or easily available. IP issues will also be a concern, particularly if development companies are willing to share their documents but publishing companies who own the rights to characters, story lines, or art disagree. The companies we spoke to were divided between those who would be open to sharing everything except code and proprietary technology, and those who felt it would be difficult to separate the acceptable documents from things they could not share. Contributing design documents to a university-run archive is an idea that found more traction in the smaller local companies we interviewed. Although some interest was shown by individuals we talked to at the larger companies, tempered by an understanding that legal departments would have to be involved in the decision making process. The head of a small game company thought that contributing to a digital archive would be beneficial for his company because, "some of the good games we made years ago are no longer on the market but people still talk about them. It would be a good opportunity to get our company talked about and it would be a good way to compare what was made three to four years ago and now. Things change so quickly."

ii. *Game play-throughs.* Taking a cue from fan-built online content on YouTube, many people we interviewed believed play-throughs with commentary from the designers (similar to the director's commentary often included in the special features of a feature film DVD) would be an invaluable asset to others. One company we interviewed already uses the YouTube videos, which usually feature a skilled gamer playing a section of a game, as part of their design planning and research.

iii. *Gaming traditions and mechanics.* A digital archive could also serve as a record of attribution in the industry; a way to easily to see what a person has worked on during their career. It would serve as a historical record of projects and the people who worked on them, as well as a hiring aid for industry to be able to see, with little effort, what someone has contributed to the genre. It would form a collaborative, universal portfolio for the industry that would be a rich resource for researchers interested in various aspects of the Canadian gaming industry.

B. Government

Large "anchor" companies are important contributors to the vibrant gaming ecosystems of Vancouver, Montreal, and Toronto. Effective taxation policies that aid these companies are useful, if politically expedient, mechanisms for encouraging the

video game economy. Alongside these efforts, in order to promote the development of Canadian IP and encourage the development of local SMEs, we offer these suggestions to the Federal government:

1. **Consider commissioning a detailed study of the gaming industry.** We encourage a publicly funded study of the sector with collaboration from Statistics Canada, Revenue Canada, and an appropriate business analyst.

2. **Consider increasing development grants for small game developers.** Grants to specifically help small studios reach the production phase would be very useful in promoting the development of Canadian IP. Tax incentives are an effective mechanism for companies large enough to maintain an overlapping development structure. Small companies, however, need assistance upfront.

3. **With universities, consider the development of an incubation program for new Canadian IP.** To promote the development of SMEs, government should explore the creation of an incubation model to assist companies in bringing new games and technologies through conceptualisation, pre-production, and production. Collaboration with local universities may help broaden the success of this sort of initiative. Careful research and planning is needed to make such a program effective and successful.

4. **Consider supporting the development of a Canadian game publisher.** All large publishers active in Canada are foreign owned. Government could facilitate an industry-supported initiative to create a viable game publishing industry in Canada. One option is a publishing consortium composed of a number of smaller developers and media publishers, similar to how NESTA is structured in the United Kingdom (nesta.org.uk).

5. **Consider developing rural capacity for technological innovation.** Game development in Canada is highly concentrated in a few urban centres. The development of rural infrastructure will promote independent games development and training, and help diversify rural economies.

6. **Consider including more game experts on grant adjudication panels.** It is clear that video games cannot be considered in the same frame as either traditional media, such as television and film, or as merely software applications consistent with the IT sector. There should be more game industry and games research professionals involved in federal and provincial granting programs (such as Telefilm) and in establishing criteria for tax incentives and R&D credits. Government programs are slow in catching up to the reality of the specific economic and cultural needs and affordances of digital games as genuinely interactive media.

7. **Consider increasing the direct promotion of gaming in Canada.** Government should provide additional incentives for the development of independent games festivals and other such events.

C. Industry

Although much of this report focuses on how universities can foster improved relationships with game companies, game companies should be conscious of a number of issues important to universities.

1. **Understand the need for academics to publish.** From the academic point of view, intellectual property developed as part of a collaboration with a game company needs to be published. From the industry point of view, publication may cost them a competitive edge. Both game companies and professors should agree on a publication policy prior to commencing collaborative research. Oftentimes, a publication grace period (e.g., wait six months from completion before publishing) may be all that is needed to satisfy both groups.

2. **Encourage students to finish their degree.** As happens in many areas where skills are highly sought-after in industry, game companies have been known to recruit co-op students away from university before the students have completed their degree. Such efforts are often a shortsighted move, and can create a level of discomfort - even animosity - among university faculty towards the company's active presence on campus. It could also ultimately put students at a disadvantage if they forgo completing their degree in favour of immediate entry-level employment.

3. **Consider sharing or open-sourcing old or unused IP**. This was a controversial topic. Some felt this was a viable means for involving students in game research and should be pursued where appropriate. Others felt such efforts were inappropriate for the following reasons:
    a. As mentioned by a senior executive, unreleased IP that is twenty years old is still new IP. Furthermore, recent games and movies have shown that much old IP can be rebooted and find a new, profitable audience.
    b. Publishers usually own the IP so developers may not be in a position to allow it to be used.

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APPENDIX 1: HIGHER EDUCATION COURSES AND CURRICULA

Course only in Degree programs

These schools have no video game credential or specialized program but do offer at least one course relating to video games on either a technical, design, or theory level.

Alberta
Grand Prairie Regional College (Computing Science)
Grant MacEwan (Computing Science)
Keyano College (Computer Information Systems)
King's University College (Computing Science)
University of Alberta (Computing Science, Humanities Computing)
University of Calgary (Education, English, Fine Arts)
University of Lethbridge (Computer Information Technology, Mathematics)

Capilano University (Computing Science)
University of British Columbia (Library Sciences, Social Media Certificate)
Vancouver Island University (Digital Media)

Manitoba
University of Brandon (Computing Science/Mathematics)

Ontario
Nipissing University (Computing Science)
Trent University (Computing and Information Systems)
University of Guelph (Bachelor of Computing)
University of Toronto (Communication Culture and Information Technology)
University of Toronto (Computing Science)
University of Western Ontario (Computing Science)
University of Western Ontario (Media, Information, and Technoculture)
University of Windsor (Computing Science)
York University (Education)

Québec
Université du Québec en Outaouais (Computer Engineering)

Saskatchewan
University of Regina (Computing Science, Fine Arts)
University of Saskatchewan (Computing Science)
Yukon College (Continuing Ed Program: Computers and Multimedia)

Degree program with Specialisation in Video Games

Alberta
Nait (Game Development Certificate)
University of Calgary (Computing Science - specialisation in Computer Game Design or Computer Graphics)

British Columbia
British Columbia Institute of Technology (Bachelor of Technology in Computer Systems with Video Game Component)
Fairleigh Dickinson University (Bachelor of Film and Animation with Video Game Animation Major)
Great Northern Way (Masters in Digital Media)
Simon Fraser University (Degree in Interactive Arts and Technology)

Maritimes
Acadia University (Bachelor in Computing Science, Specialisation in Game Development)
Prince Edward Island University (Bachelor in Computing Science with Video game specialisation)

Ontario
Algoma University (Bachelor of Computing Science, Computer Games Technology specialisation)
Brock University (Bachelor in Interactive Arts and Science)
Carleton University (Bachelor of Interactive Technology)
Carleton University (Bachelor of Science with Computer Game Development Stream)
McMaster (Bachelor of Engineering in Multimedia)
University of Ontario (Faculty of Business and Information Technology – Game development and Entrepreneurship Specialisation)
University of Western Ontario (Minor in Game Development within the department of Computing Science)

Quebec
Centre NAD (3D animation and Digital Design)
Concordia (Computing Science and Engineering with video game specific courses)
McGill University (Centre for Intelligent Machines - Combination of Computing Science, Electrical Engineering, and Mechanical Engineering)
Université Laval (Bachelor in Software Engineering with Video Game Stream)

Video Game Diploma Programs

Alberta
Alberta College Art and Design (Media Arts and Digital Technology Program)
Pixel Blue (3D Game Modeling Program)

Guru Digital Arts (Interaction Design and Game Development)

Ontario
Academy of Design at RCC Institute of Technology
Centennial College (Advanced Diploma in Interactive Game Software Development – School of Engineering and Applied Science)
College of the North Atlantic (Diploma in Video Game Design)
George Brown College (Diploma in Game Programming)
Humber College (Diploma in School of Media Studies and IT: Game Programming)
Seneca College (Diploma in Animation)

Québec
Université de Montréal (Diploma of Higher Specialised Studies in Game Design)

Saskatchewan
New Media Campus (3D Animation and Game Design Online Diploma)

British Colombia
University of Frasier Valley (Certificate in Media Literacy - Rules of Play: Video Game Culture)

Manitoba
University of Winnipeg (Serious Gaming certificate program)

Ontario
Centre for Arts & Technology (3D Game Animation)
Humber College (Certificate in School of Media Studies and Information Technology: 3D Modeling and Visual Effects)
Max the Mutt™ Animation School (Concept Art for Animation Video Games)
Trios College (Video Game Design & Development)

APPENDIX 2: GAME DEVELOPMENT ENGINES AND TOOLSETS

Engine / Toolset	Games	License	Details
Unreal Development Kit (UDK)	Unreal Tournament, Gears of War, Mass Effect, Bioshock	Free for educational use and non-commercial use.	UDK is a full-fledged game development kit allowing complete development and release of a game for free. It is based on a current game engine and features a large development community. The engine was used for America's Army 3
Aurora Toolset	Neverwinter Nights 1 & 2, The Witcher	Mods are free to release	
Source SDK	Half-Life 2, Left 4 Dead, Portal, Team Fortress 2	Mods are free to release	Source is less user-friendly than UDK, but has an equally active community.
idtech	Doom & Quake series' Call of Duty 1 & 2	iDtech 1-3 are open source	iDTechs 1-3 are open-source and thereby completely free to use. They will run on almost any hardware.
Second Life	Second Life	In game real estate must be purchased or leased.	
Gamebryo	Civilization IV, Fallout 3, Oblivion	Mods are free to release	Gamebryo is a widely-used engine for games of different genres. Many mods have been produced for these games.
Unity	Tiger Woods Online, Battlestar Galactica Online	Commercial, with free version	Unity is unique among these toolkits in that it allows for creation of completely browser-based 3D games.
Torque	Penny Arcade Adventures,	Commercial, Education pricing available	Torque offers a 2D version, a 3D version, and a version for smart phones.
CryEngine	Far Cry, Crysis	Mods are free to release	