Natural Sciences and Engineering Research Council of Canada | Conseil de recherches en sciences naturelles et en génie du Canada

FORM 100
Personal Data Form
PART I

Date: 2013/06/15

Family name	Given name	Initial(s) of all given names	Personal identification no. (PIN)
Graham	Nicholas	TCN	**Valid** 102324

☐ I hold a faculty position at an eligible Canadian college (complete Appendices B1 and C)

☐ I do not or will not hold an academic appointment at a Canadian postsecondary institution

Place of employment other than a Canadian postsecondary Institution (give address in Appendix A)

APPOINTMENT AT A POSTSECONDARY INSTITUTION

Title of position: Professor

Department: Computing, School of

Campus:

Canadian postsecondary institution: Queen's

Tenured or tenure-track academic appointment — Yes [X] No [ ]

Part-time appointment [ ] Full-time appointment [X]

- For all non-tenured or non tenure-track academic appointment and Emeritus Professors, complete Appendices B & C
- For life-time Emeritus Professor and part-time positions, complete Appendix C

ACADEMIC BACKGROUND

Degree	Name of discipline	Institution	Country	Date yyyy/mm
Bachelor's	Computer Science	Toronto	CANADA	1985 / 05
Master's	Computing and Information Science	Queen's	CANADA	1988 / 06
Doctorate	Software Engineering	Technische Universitat Berlin	GERMANY	1995 / 01

TRAINING OF HIGHLY QUALIFIED PERSONNEL

Indicate the number of students, fellows and other research personnel that you:

	Currently		Over the past six years (excluding the current year)		
	Supervised	**Co-supervised**	**Supervised**	**Co-supervised**	**Total**
Undergraduate	1		6		7
Master's	2		6	2	10
Doctoral	2	1	4		7
Postdoctoral	1				1
Others	1		4		5
Total	7	1	20	2	30

Personal information collected on this form and appendices will be stored in the Personal Information Bank for the appropriate program.

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Version française disponible

Completed

ACADEMIC, RESEARCH AND INDUSTRIAL EXPERIENCE (use one additional page if necessary)

Position held (begin with current)	Organization	Department	Period (yyyy/mm to yyyy/mm)
Professor	Queen's	Computing, School of	2010/07
Professor	Queen's University	School of Computing	2010/07 to 2012/10
VP Research & Development	Namzak Labs	Development Lab	2000/12 to 2006/12
Associate Professor	Queen's University	School of Computing	1999/07 to 2010/06
Assistant Professor	Queen's University	Computing and Information Science	1997/07 to 1999/06
Assistant Professor	York University	Computer Science	1993/01 to 1997/06
Researcher	German National Research Center (GMD)	Computer Science	1989/10 to 1992/09
Research Associate	Queen's University	Computing and Information Science	1988/03 to 1989/08
Computer Systems Software Programmer	University of Toronto	Computer Systems Research Institute	1985/05 to 1986/08

Personal identification no. (PIN)	Family name
Valid 102324	Graham

RESEARCH SUPPORT

List all sources of support **(including NSERC grants and university start-up funds)** held as an applicant or a co-applicant: a) support held in the past four (4) years but now completed; b) support currently held, and c) support applied for. For group grants, indicate the percentage of the funding directly applicable to your research. Use additional pages as required.

Family name and initial(s) of applicant	Title of proposal, funding source and program, and time commitment (hours/month)	Amount per year	Years of tenure (yyyy)
a) Support held in the past 4 years			
TCN Graham	Software Engineering of Collaborative Systems NSERC Discovery Grant 40 hours/month	30,000 30,000 30,000	2009 2010 2011
TCN Graham and two others	Technology for Rich Group Interaction in Networked Games NSERC Strategic Project 10 hours/month	159,100 (33%) 163,075 (33%) 160,050 (33%)	2009 2010 2011
b) Support currently held			
Kellogg Booth and 51 others	Graphics, Animation and New Media (GRAND) NSERC NCE 15 hours/month	5,000,000 (1%) 5,000,000 (1%) 5,000,000 (1%) 5,000,000 (1%) 5,000,000 (1%)	2010 2011 2012 2013 2014
Frank Maurer and 11 others	Digital Surface Software Application Network NSERC Strategic Network 32 hours/month	1,000,000 (6%) 1,000,000 (6%) 1,000,000 (10%) 1,000,000 (6%) 1,000,000 (6%)	2010 2011 2012 2013 2014

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RESEARCH SUPPORT

Family name and initial(s) of applicant	Title of proposal, funding source and program, and time commitment (hours/month)	Amount per year	Years of tenure (yyyy)
List all sources of support **(including NSERC grants and university start-up funds)** held as an applicant or a co-applicant: a) support held in the past four (4) years but now completed; b) support currently held, and c) support applied for. For group grants, indicate the percentage of the funding directly applicable to your research. Use additional pages as required.			
b) Support currently held			
Stacey Scott and 5 others	LEIF: A Multicultural Exploration into Research and Education for Surface Computing HRSDC EU-Canada Transatlantic Exchange Partnerships	200,000 (10%) 200,000 (10%) 200,000 (10%)	2011 2012 2013
JR Cordy and 9 others	Graduate Specialization in Ultra-large-scale Software Systems NSERC CREATE 5 hours/month	150,000 (5%) 300,000 (5%) 300,000 (5%) 300,000 (5%) 300,000 (5%)	2011 2012 2013 2014 2015
TCN Graham	Exergaming System for Children with Cerebral Palsy NSERC Research Tools and Instruments 5 hours/month	34,422	2011
TCN Graham and 1 other	CP Cycle to Fun NSERC Collaborative Health Research Project (CHRP)	177,577 (75%) 176,210 (75%) 157,190 (75%)	2012 2013 2014

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RESEARCH SUPPORT

Family name and initial(s) of applicant	Title of proposal, funding source and program, and time commitment (hours/month)	Amount per year	Years of tenure (yyyy)
List all sources of support **(including NSERC grants and university start-up funds)** held as an applicant or a co-applicant: a) support held in the past four (4) years but now completed; b) support currently held, and c) support applied for. For group grants, indicate the percentage of the funding directly applicable to your research. Use additional pages as required.			
b) Support currently held			
TCN Graham	Software Engineering of Networked Digital Games NSERC Discovery Grants - Individual 10 hours/month	22,000 22,000 22,000 22,000 22,000	2012 2013 2014 2015 2016
T.C. Nicholas Graham	Digital Tabletop Interaction for Simulation-Based Training NSERC Engage Grant	25,000	2013
Ryan E. Rhodes, T.C. Nicholas Graham, and 3 others	Exercise games and physical activity: Does multi-player online play improve adherence? Canadian Cancer Society Canadian Cancer Society Innovation Grant	100,000 99,648	2013 2014 2015

Highly Qualified Personnel (HQP)

Provide personal data about the HQP that you currently, or over the past six years, have supervised or co-supervised.

Personal identification no. (PIN)	Family name
Valid 102324	Graham

Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Bortolaso, Christophe	Postdoctoral (In Progress)	Supervised 2012 -	Simulation-Based Training	School of Computing, Queen's University
Graham, Maxwell	Master's (In Progress)	Supervised 2011 -	Consistency Maintenance in Games	School of Computing, Queen's University
Hernandez, Hamilton	Doctoral (In Progress)	Supervised 2011 -	Exergames for Children with CP	School of Computing, Queen's University
Ye, Zi	Lab Programmer (In Progress)	Supervised 2011 -	Game Programmer and Artist	Senior Programmer at Queen's University
Savery, Cheryl	Doctoral (In Progress)	Supervised 2010 -	Consistency Maintenance in Networked Games	School of Computing, Queen's University
Roy, Banani	Doctoral (In Progress)	Supervised 2006 -	Disconnection in Synchronous Groupware	School of Computing, Queen's University
Patel, Mrunal	Master's (Completed)	Supervised 2012 - 2012	Game Orchestration with Tabula Rasa	Institute for Software and Multimedia Technology, TU
Schumann, Irina	Intern (Completed)	Co-supervised 2011 - 2012	Game orchestration	MSc Student, University of Magdeburg
Hamza, Ameer	Master's (Completed)	Supervised 2010 - 2012	Architectures for Game Prototyping	Software Developer, Cisco, Ottawa
Kurczak, John	Master's (Completed)	Supervised 2009 - 2012	Mobile Interfaces for Mobile Games	Software Developer, Namzak Labs
Pape, Joseph	Master's (Completed)	Supervised 2009 - 2012	Surface-Based Board Gaming	Game Developer, Longtail Studio, Halifax
Bellay, Quentin	Intern (Completed)	Co-supervised 2011 - 2011	Game Orchestration	Game Development Studio, Algonquin College
Stach, Tadeusz	Doctoral (Completed)	Supervised 2007 - 2011	Collaborative Computer-Aided Exercise	Associate Producer, Electronic Arts Vancouver
Wolfe, Christopher	Doctoral (Completed)	Supervised 2001 - 2011	Failure Recovery in Distributed Groupware Systems	Software Engineer, Google Waterloo
Berkok, Erik	USRA Student (Completed)	Supervised 2010 - 2010	Multiplayer Computer-Aided Exercise	B.Comp. Student, Queen's
Heard, Andrew	USRA Student (Completed)	Supervised 2010 - 2010	Tabletop Simulation Environment	B.Comp. Student, Queen's
Joly, Claire	Intern (Completed)	Supervised 2010 - 2010	Growl Patrol Ambient Audio Game	Software Engineer, Thales
Noval, Louis	Intern (Completed)	Supervised 2010 - 2010	Exergaming Framework	Software Engineer, Airbus
Qiu, Eric	Master's (Completed)	Supervised 2007 - 2010	Platform Modeling for Ubiquitous Computing	QA Specialist, Electronic Arts
Brehmer, Matt	USRA Student (Completed)	Supervised 2009 - 2009	General Active Input Model	PhD Student, UBC

Highly Qualified Personnel (HQP)

Provide personal data about the HQP that you currently, or over the past six years, have supervised or co-supervised.

Personal identification no. (PIN)	Family name
Valid 102324	Graham

Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Grad, Kevin	Master's (Completed)	Co-supervised 2007 - 2009	Peripheral Displays to Aid Collaborative Group Awareness	Founder and Software Developer, Couchware Inc., Toronto
Smith, David	Doctoral (Completed)	Supervised 2005 - 2009	Prototyping of Interactive Entertainment Media	Assistant Professor, Clemson University
Fletcher, Robert	Master's (Completed)	Supervised 2006 - 2008	Usability of Consistency Maintenance Algorithms	UI Developer, Shopify, Ottawa
Yim, Jeffrey	Master's (Completed)	Supervised 2006 - 2008	Computer-Aided Exercise	Software Developer, Electronic Arts, Vancouver
Long, Barry	Master's (Completed)	Co-supervised 2004 - 2007	Automatic Failover Mechanism for Groupware Systems	Senior Quality Assurance Analyst, Titus Ottawa

1. MOST SIGNIFICANT CONTRIBUTIONS

My research addresses techniques for designing and implementing multi-player computer games. This work has led to the development of novel tools, software architectures, and implementation techniques for distributed collaborative applications, with particular focus on networked games.

Consistency Maintenance in Networked Games: Many multi-player digital games require high consistency between different players' views; for example, in first-person shooter or racing games, players must see accurate representations of other players' positions. However, network latency means that complete consistency cannot be achieved. Numerous algorithms have been developed for helping to mitigate inconsistencies resulting from network latency, including predictive, delayed input and time-offsetting algorithms [22]. These algorithms are complex, hard to program, and their tradeoffs are poorly understood. With PhD student Cheryl Savery, I have developed the Timelines model to ease the expression of consistency maintenance algorithms for games [5,16,20]. The key feature of timelines is that shared data is indexable by time, so that previous and future versions of states can be queried and modified. Timelines have been implemented in the *Janus* toolkit, which is available as a free open-source download.

Collaborative Exergaming: North Americans have adopted an increasingly sedentary style of life, contributing to widespread health problems such as diabetes and heart disease. We are investigating whether peoples' motivation to engage in exercise can be increased by providing them with collaborative video games in which physical activity is an integral part. Together with a team of researchers at Holland Bloorview Kids Rehabilitation Hospital, PhD student Hamilton Hernandez, programmer Zi Ye and I have developed *Liberi*, an exergame allowing children with Cerebral Palsy to exercise together at a distance [9,10,11]. With Hernandez and recently graduated PhD student Tad Stach, my research focuses on how collaborative games can increase motivation in exercise [12, 23,40,41], and on tools for simplifying the development of exergames [18,21]. We are currently investigating the design of networked games allowing children with Cerebral Palsy to perform exercise. We anticipate that this research will help in the design of games that involve a physical component, will eventually lead to new markets in game technology and will provide health benefits to society at large.

Tabletop Gaming and Simulation: Digital tabletop surfaces support a new style of collaborative interaction, where small groups of people can view, discuss and modify visual artifacts together. We have shown how this medium for interaction supports the development of games where social interaction is as important as the gameplay itself [13], how it can support a novel style of gameplay that we term *game orchestration* [8], and how it can support collaborative planning in simulation-based training exercises [14].

Tools and Architectures for Groupware Development: With the proliferation of commercial tools for instant messaging systems, electronic meeting systems and multi-player gaming, computers are increasingly used as tools for remote collaboration. Applications supporting collaboration at a distance are hard to build, however, due to their distributed operation and real-time performance constraints. The mobility afforded by devices such as wirelessly connected laptops, smart phones and portable gaming devices has led to the additional complexity of *runtime adaptation*, where the locations of participants in a collaborative session change, along with the tools they are using. With PhD students Greg Phillips and Chris Wolfe and MSc student Xiao Feng Qiu, I have developed *Fiia* [28,30,31,48,55], a high-level programming model for synchronous groupware. Our *Fiia.Net* toolkit supports runtime adaptation in groupware architectures triggered by changes in users' tasks, devices and locations and in response to partial failure of the underlying distributed system. *Fiia.Net* implements the novel *trace update* model transformation algorithm allowing runtime transformation between a *Fiia* conceptual model and a distributed system [28].

WebArrow Toolkit for Remote Collaboration: My background in software architecture for multiuser applications allowed me to co-found the company Namzak Labs in 2000. Together with a team of

professional software developers, I created the *WebArrow* remote collaboration toolkit featuring desktop sharing, voice over IP and file sharing. WebArrow allows third party developers to add real-time collaboration facilities to their applications. Our work with WebArrow has informed the design of processes and architectures for commercial groupware systems [40] and has served as a case study in the application of model checking to fault tolerance in commercial-scale groupware products [35].

2. OTHER RESEARCH CONTRIBUTIONS

This work has largely been performed in collaboration with my graduate students; these students' names appear in boldface in the following paper contributions. As is traditional in this field, much of my work has been published in archival, refereed conference proceedings. The top conferences in computer science have acceptance rates of 25% or lower.

Articles in Refereed Publications

Edited Books

[1] Pedro Campos, Nicholas Graham, Joaquim Jorge, Nuno Nunes, Philippe Palanque and Marco Winckler, editors, *Human-Computer Interaction: Proceedings of INTERACT 2011,* Springer LNCS Volume 6947, 2011.

[2] Junia Anacleto, Sidney Fels, Nicholas Graham, Bill Kapralos, Magy Seif El-Nasr and Kevin Stanley, editors, *Entertainment Computing: Proceedings of ICEC 2011,* Springer LNCS Volume 6972, 2011.

[3] T.C. Nicholas Graham and Philippe Palanque, editors, *Proceedings of Design, Specification and Verification of Interactive Systems,* Springer LNCS Volume 5136, 2008.

Referred Journal Papers

[4] Ryan E. Rhodes, T.C. Nicholas Graham and Christopher Yao. Exergames for Cancer Prevention in Youth: Challenges and Contemporary Research. *Journal of the Canadian Physiotherapy Association*, 2013, to appear.

[5] **Cheryl Savery** and T.C. Nicholas Graham, Timelines: simplifying the programming of lag compensation for the next generation of networked games, Multimedia Systems Journal, 2012.

[6] **Jason Kurczak**, T.C. Nicholas Graham, **Claire Joly** and Regan L. Mandryk, Hearing is Believing: Evaluating Ambient Audio for Location-Based Games, *Computers in Entertainment,* to appear.

Refereed Conference Publications

[7] **Zi Ye**, **Hamilton Hernandez**, T.C. Nicholas Graham, Lauren Switzer and Darcy Fehlings, Liberi: Bringing Action to Exergames for Children with Cerebral Palsy, *CHI 2013 Video Review* (to appear)

[8] T.C. Nicholas Graham, **Irina Schumann**, **Mrunal Patel**, **Quentin Bellay** and Raimund Dachselt, Villains, Architects and Micro-Managers: What Tabula Rasa Teaches Us About Game Orchestration, in *Proceedings of Human Factors in Computing Systems (CHI 2013),* to appear.

[9] **Hamilton A. Hernandez**, **Zi Ye**, T.C. Nicholas Graham, Darcy Fehlings and Lauren Switzer, Designing Action-based Exergames for Children with Cerebral Palsy, in *Proceedings of Human Factors in Computing Systems (CHI 2013),* to appear. (Winner: Best Paper Honorable Mention Award)

[10] **Zi Ye**, **Hamilton A. Hernandez**, T.C. Nicholas Graham, Darcy Fehlings, Lauren Switzer, **Md Ameer Hamza**, and **Irina Schumann**, Liberi and the Racer Bike: Exergaming Technology for Children with Cerebral Palsy, in *Proceedings of the SIGACCESS Conference on Computers and Accessibility (ASSETS 2012),* pp. 225-226, 2012.

[11] Hamilton Hernandez, T.C. Nicholas Graham, Darcy Fehlings, Lauren Switzer, Zi Ye, Ameer Hamza, Cheryl Savery and Tadeusz Stach, Design of an Exergaming Station for Children with Cerebral Palsy, in *Proceedings of the 30th International Conference on Human Factors in Computing Systems (CHI 2012),* pp. 2619-2628, 2012.

[12] **Banani Roy**, T.C. Nicholas Graham and Carl Gutwin, DiscoTech: A Plug-In Toolkit to Improve Handling of Disconnection and Reconnection in Real-Time Groupware, in *Proceedings of Computer Supported Cooperative Work* (CSCW 2012), pp. 1287-1296, 2012. (Winner: Best Paper Honorable Mention Award)

[13] James R. Wallace, **Joseph Pape**, Yu-Ling Chan, T.C. Nicholas Graham, Stacey D. Scott and Mark Hancock, Exploring Automation in Digital Tabletop Board Games, in *Proceedings of Computer Supported Cooperative Work Companion* (CSCW 2012), pp. 231-234, 2012.

[14] T.C. Nicholas Graham, **Quentin Bellay** and **Amir Sepasi**, Toward Game Orchestration: Tangible Manipulation of In-Game Experiences, in *Proceedings of Tangible and Embodied Interaction* (TEI 2012), 187-188, 2012.

[15] **Jason Kurczak**, T.C. Nicholas Graham, **Claire Joly** and Regan Mandryk, Hearing is believing: Evaluating ambient audio for location-based games, in *Proceedings of Computer Entertainment Technology* (ACE 2011), 10 pages, 2011. (Winner: Best Paper Silver Award)

[16] **Cheryl Savery** and T.C. Nicholas Graham, What + When = How: The Timelines Approach to Consistency in Networked Games, in *Proceedings of the International Workshop on Network and Systems Support for Games* (NetGames 2011), 2 pages, 2011.

[17] T.C. Nicholas Graham, Emmanuel Dubois, Christophe Bortolaso and **Christopher Wolfe**, Scenarchitectures: The Use of Domain-Specific Architectures to Bridge Design and Implementation, in *Proceedings of INTERACT*, Springer LNCS vol. 6947, pp. 341-358, 2011.

[18] **Tadeusz Stach** and T.C. Nicholas Graham, Exploring Haptic Feedback in Exergames, in *Proceedings of INTERACT*, Springer LNCS vol. 6947, pp. 18–35, 2011.

[19] **Jason Kurczak** and T.C. Nicholas Graham, TREC: Platform-Neutral Input for Mobile Augmented Reality Applications, in *Proceedings of Engineering Interactive Computing Systems* (EICS '11), ACM Press, pp. 283-288, 2011.

[20] **Cheryl Savery** and T.C. Nicholas Graham, It's About Time: Confronting Latency in the Development of Groupware Systems, in *Proceedings of CSCW*, pp. 177-186, 2011. (Winner, Best Paper Award.)

[21] Carl Gutwin, Michael Lippold and T.C. Nicholas Graham, Real-Time Groupware in the Browser: Testing the Performance of Web-Based Networking, in *Proceedings of CSCW,* pp. 167-176, 2011.

[22] **Cheryl Savery**, T.C. Nicholas Graham and Carl Gutwin, The Human Factors of Consistency Maintenance in Multiplayer Computer Games, in *Proceedings of GROUP,* pp. 187-196, 2010.

[23] **Christopher Wolfe**, T.C. Nicholas Graham and **Joseph Pape**, Seeing through the Fog: An Algorithm For Fast And Accurate Touch Detection In Optical Tabletop Surfaces, in *Proceedings of Interactive Tabletops and Surfaces,* 10 pages, ACM Press, 73-82, 2010.

[24] **Matthew Brehmer**, T.C. Nicholas Graham and **Tadeusz Stach**, Activate Your GAIM: A Toolkit for Input in Active Games, in *Proceedings of FuturePlay,* ACM Press, pp. 151-158, 2010.

[25] **J. David Smith** and T.C. Nicholas Graham, Raptor: Sketching Games with a Tabletop Computer, in *Proceedings of FuturePlay,* ACM Press, pp. 191-198, 2010.

[26] Carl Gutwin, T.C. Nicholas Graham, **Christopher Wolfe** and Nelson Wong, Gone But Not Forgotten: Designing for Disconnection in Synchronous Groupware, in *Proceedings of Computer-Supported Cooperative Work,* ACM Press, pp. 179-188, 2010.

[27] **Tadeusz Stach**, T.C. Nicholas Graham, **Matthew Brehmer** and **Andreas Hollatz**, Classifying Input for Active Games, in *Proceedings of Advances in Computer Entertainment,* ACM Press, pp. 379-382, 2009.

[28] **Christopher Wolfe**, T.C. Nicholas Graham and **W. Greg Phillips**, An Incremental Algorithm for High-Performance Runtime Model Consistency, in *Proceedings of MODELS*, pp. 357-371, 2009.

[29] **Tadeusz Stach**, T.C. Nicholas Graham, **Jeffrey Yim** and Ryan Rhodes, Heart Rate Control of Exercise Video Games, in *Proceedings of Graphics Interface,* ACM Press, pp. 125-132, 2009.

[30] **Christopher Wolfe**, T.C. Nicholas Graham, **W. Greg Phillips** and **Banani Roy**, Fiia: User-Centered Development of Adaptive Groupware Systems, in *Proceedings of the ACM SIGCHI Symposium on Engineering Interactive Computing Systems,* ACM Press, pp. 275-284, 2009.

[31] **Xiao Feng Qiu** and T.C. Nicholas Graham, Flexible and Efficient Platform Modeling For Distributed Interactive Systems, in *Proceedings of the ACM SIGCHI Symposium on Engineering Interactive Computing Systems,* ACM, pp. 29-34, 2009.

[32] **Christopher Wolfe**, **J. David Smith** and T.C. Nicholas Graham, A Low-Cost Infrastructure for Tabletop Games, in *Proceedings of FuturePlay 2008,* ACM Press, pp. 145-151, 2008.

[33] **Jeffrey Yim**, **Eric Qiu** and T.C. Nicholas Graham, Experience in the Design and Development of a Game Based on Head-Tracking Input, in *Proceedings of FuturePlay 2008,* pp. 236-239, 2008.

[34] **Banani Roy** and T.C. Nicholas Graham, An Iterative Framework for Software Architecture Recovery: An Experience Report, in *Proceedings of the European Conference on Software Architecture,* pp. 210-224, LNCS, 2008.

[35] **Barry Long**, Juergen Dingel and T.C. Nicholas Graham, Experience Applying the SPIN Model Checker to an Industrial Telecommunications System, in *Proceedings of the International Conference on Software Engineering,* ACM Press, pp. 693-702, 2008.

[36] **Kevin Grad**, T.C. Nicholas Graham and James Stewart, Effective Use of the Periphery in Game Displays, in *Proceedings of FuturePlay 2007,* ACM Digital Library, pp.69-76, 2007.

[37] **Jeffrey Yim** and T.C. Nicholas Graham, Using Games to Increase Exercise Motivation, in *Proceedings of FuturePlay 2007,* ACM Digital Library, pp. 166-173, 2007.

[38] Jeff Dyck, Carl Gutwin, T.C. Nicholas Graham and David Pinelle, Beyond the LAN: Techniques from Networked Games for Improving Groupware Performance, in *Proceedings of Group 2007,* ACM Press, pp. 291-300, 2007.

[39] **J. David Smith**, T.C. Nicholas Graham, David Holman and Jan Borchers, Low-Cost Malleable Surfaces with Multi-Touch Pressure Sensitivity, in *Proceedings of the Second IEEE TABLETOP Workshop,* IEEE Xplore, pp. 205-208, 2007.

[40] T.C. Nicholas Graham, Rick Kazman and Chris Walmsley, Agility and Experimentation: Practical Techniques for Resolving Architectural Tradeoffs, in *Proceedings of the International Conference on Software Engineering,* ACM Press, pp. 519-528, 2007.

[41] **James Wu** and T.C. Nicholas Graham, Toward Quality-Centered Design of Groupware Architectures, in *Proceedings of Engineering Interactive Systems,* Springer Verlag, pp. 339-255, 2007. (CITO)

Other Refereed Contributions

[42] **Tadeusz Stach** and T.C. Nicholas Graham, Balancing Techniques for Multiplayer Exergames (extended abstract), in *Serious Games Summit,* Game Developers Conference, 2011.

[43] **Tadeusz Stach** and T.C. Nicholas Graham, Improving Exergames through Force Feedback (extended abstract), in *Games for Health,* 2011.

[44] **Christopher Wolfe**, **J. David Smith** and T.C. Nicholas Graham, A Model-Based Approach to Engineering Collaborative Augmented Reality, in *Emmanuel Dubois, Philip Gray and Laurence Nigay, editors, Engineering Mixed Reality,* Springer, pp. 293-312, 2010.

[45] **Joey A. Pape** and T.C. Nicholas Graham, Coordination Policies for Tabletop Gaming, in *Graphics Interface Poster Proceedings,* pp. 24-25, 2010.

[46] T.C. Nicholas Graham, Five Grand Challenges in the Engineering of Networked Digital Games, in *Proceedings of Distributed Engineering of Virtual Environments,* 4 pages, 2010.

Non-Refereed Contributions

[47] **Cheryl Savery** and T.C. Nicholas Graham**.** *Janus*. Open source software project; download available at: http://equis.cs.queensu.ca/?page_id=464.

[48] **Christopher Wolfe.** *EquisFTIR*. Open source software project; download available at: http://equis.cs.queensu.ca/?page_id=23.

3. OTHER EVIDENCE OF IMPACT AND CONTRIBUTIONS

Over the last six years, I have served as:

- Chair of IFIP Working Group 2.7/13.4 on Usability Engineering. (March 2007-Oct 2010)
- General Chair of: ACM Symposium on Engineering Interactive Computing Systems, 2009; Design, Specification and Verification of Interactive Systems, 2008. Program Co-Chair of INTERACT 2011, International Conference on Entertainment Computing 2011, Engineering for Human-Computer Interaction / Design, Specification and Verification of Interactive Systems 2004. Studios Co-Chair of Tangible and Embedded Interaction 2012. Associate Chair of ACM Conference on Computer-Supported Cooperative Work 2006. Video Program Co-Chair of INTERACT 2007.
- Member of the program committee of: ACM Symposium on Engineering Interactive Computing Systems, 2010-13; Evaluating Player Experience 2011; IEEE Software Special Issue on Engineering Fun, 2011; Model-based Methodologies for Pervasive and Embedded Software, 2008-09; Human-Centred Software Engineering, 2008; European Conference on Computer-Supported Cooperative Work 2007; Design, Specification and Verification of Interactive Systems (DSV-IS): 2001-08; FuturePlay 2006-10; GAME-ON NA 2006.
- Reviewer for: ACM TACCESS: 2013; ACM TOCHI: 2011; ACM CSCW: 2008, 2010-12; ACM CHI: 2006-12; Interacting with Computers: 2006; NSERC Discovery Program; NSERC Collaborative Research and Development Grant Program.

5. CONTRIBUTIONS TO THE TRAINING OF HIGHLY QUALIFIED PERSONNEL

My research group contributes to the training of six to eight graduate students and two to four undergraduate students on an ongoing basis. These students gain experience in modern techniques in software design and development, human-computer interaction and game development.

Three students that I have supervised have gone on to academic positions in computer science – David Smith at Clemson University, Said Elnaffar at University of the United Arab Emirates and Greg Phillips at the Royal Military College. The remaining graduate students are all employed in advanced software development positions in Canadian industry and abroad, including companies as diverse as Electronic Arts, Kobo Books and Deloitte and Touche. Of the undergraduate students whose fourth year projects I have supervised, at least five are currently enrolled in PhD programs at top universities in Canada and the United States.

Natural Sciences and Engineering Research Council of Canada | Conseil de recherches en sciences naturelles et en génie du Canada

SEND ONE ORIGINAL ONLY DO NOT PHOTOCOPY

APPENDIX A
Personal Data
(Form 100)

Complete this appendix (i) if you are an applicant or co-applicant applying for the first time; (ii) if you need to update information submitted with a previous application; or (iii) if you do not hold an appointment at a Canadian postsecondary institution. For updates, include only the revised information in addition to the date, your name and your PIN.

This information will be used by NSERC primarily to contact applicants and award holders. It may also be used to identify prospective reviewers and committee members, and to generate statistics. It will not be seen or used in the adjudication process.

Date: 2013/06/15

Family name	Given name	Initial(s) of all given names	Personal identification no. (PIN)
Graham	Nicholas	TCN	**Valid** 102324

Position and complete mailing address if your primary place of employment is not a Canadian postsecondary institution or if your current mailing address is temporary

School of Computing
Queen's University
Kingston ON K7L3N6

If address is temporary, indicate:

Starting date

Leaving date

Telephone number	Facsimile number	E-mail address
1 (613) 5336526	(613) 5336513	graham@cs.queensu.ca

Telephone number (alternate)

Give an alternate telephone number only if you can be reached at that number during business hours.

Gender (completion optional): [X] Male [ ] Female

LANGUAGE CAPABILITY

English	Read [X]	Write [X]	Speak [X]
French	Read [X]	Write [ ]	Speak [X]

I wish to receive my correspondence: in English [X] in French [ ]

AREA(S) OF EXPERTISE

Provide a maximum of 10 key words that describe your area(s) of expertise. Use commas to separate them. If you have expertise with particular instruments and techniques, specify which one(s).

Software Engineering, User Interface Architectures, Groupware Architectures, User Interface Development Methods, Software Architecture, Groupware Implementation Techniques, Video Game Technology

Research subject code(s)

Primary: 2706

Secondary: 2720

Appendix D (Form 100)
Consent to Provide Limited Personal Information About Highly Qualified Personnel (HQP) to NSERC

NSERC applicants are required to describe their contributions to the training or supervision of highly qualified personnel (HQP) by providing certain details about the individuals they have trained or supervised during the six years prior to their current application. HQP information must be entered on the Personal Data Form (Form 100). This information includes the trainee's name, type of HQP training (e.g., undergraduate, master's, technical etc.) and status (completed, in-progress, incomplete), years supervised or co-supervised, title of the project or thesis, and the individual's present position.

Based on the federal *Privacy Act* rules governing the collection of personal information, applicants are asked to obtain consent from the individuals they have supervised before providing personal data about them to NSERC. In seeking this consent, the NSERC applicant must inform these individuals what data will be supplied, and assure them that it will only be used by NSERC for the purpose of assessing the applicant's contribution to HQP training. To reduce seeking consent for multiple applications, applicants will only need to seek consent one time for a six-year period. If the trainee provides consent by e-mail, the response must include confirmation that they have read and agree to the text of the consent form.

When consent cannot be obtained, applicants are asked to not provide names, or other combinations of data, that would identify those supervised. However, they may still provide the type of HQP training and status, years supervised or co-supervised, a general description of the project or thesis, and a general indication of the individual's present position if known.

An example of entering HQP information on Form 100 (with and without consent):

Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Consent Received from Marie Roy				
Roy, Marie	Undergraduate (Completed)	Supervised 1994 - 1997	Isotope geochemistry in petroleum engineering	V-P (Research), Earth Analytics Inc., Calgary, Alberta
Consent Not Obtained from Marie Roy				
(name withheld)	Undergraduate (Completed)	Supervised 1994 - 1997	Isotope geochemistry	research executive in petroleum industry - western Canada

Consent Form

Name of Trainee

Applicant Information

Name Graham, Nicholas TCN

Department	Postsecondary Institution
Computing, School of	Queen's

I hereby allow the above-named applicant to include limited personal data about me in grant applications submitted for consideration to NSERC for the next six years. This limited data will only include my name, type of HQP training and status, years supervised or co-supervised, title of the project or thesis and, to the best of the applicant's knowledge, my position title and company or organization at the time the application is submitted. I understand that NSERC will protect this data in accordance with the *Privacy Act*, and that it will only be used in processes that assess the applicant's contributions to the training of highly qualified personnel (HQP), including confidential peer review.

Trainee's signature _____ Date _____

Note: This form must be retained by the applicant and made available to NSERC upon request.