GRAND NCE
FINAL REPORT

Canada's Digital Media
Network of Centres of Excellence

June 2015

Visitors explore Canada's Arctic exhibit at the Vancouver Aquarium. Photo courtesy Uta Hinrichs.

Graphisme, animation et nouveaux médias

grand
Graphics, Animation and New Media

The GRAND NCE (Graphics, Animation and New Media / Graphisme, animation et nouveaux médias NCE Inc.) Network of Centres of Excellence was a Canadian national research network launched in 2009 through five-year federal funding of $23.25M. GRAND was in operation from January 2010 to June 2015. The following is a selection of key achievements.

(BIG) DATA
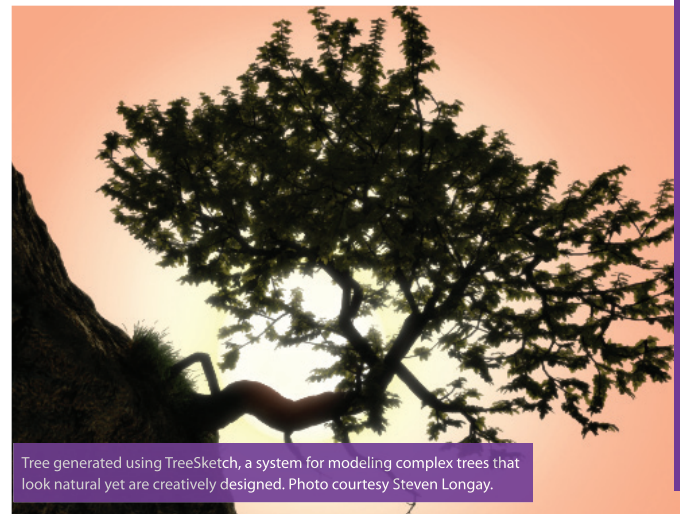
TRANSFORMING INFORMATION INTO EXPLORATION – By studying the complex ways we interact with touch technology, University of Calgary researchers are learning how our engagement with data can become a deeper, more rewarding experience. Their award-winning field study at the Vancouver Aquarium analyzed thousands of visitor interactions with tabletop displays to better understand how to promote open-ended explorations of data, and social collaborative play through rich visualizations. The research will help inform designs for a new generation of interactive public displays, such as in museums and art galleries.

ENTERTAINMENT

CREATING BELIEVABLE WORLDS – Digital graphics and botany converge in the naturalistic modeling of plant growth pioneered by researchers at the University of Calgary. Not only an illuminating research tool for biologists, algorithmic botany is key to creating many of the true-to-life natural landscapes we see in Hollywood's computer-generated imagery. Creating believable video game characters and storylines is the aim of sophisticated artificial intelligence software developed at the University of Alberta. Game designers at Edmonton-based Bioware used the software to script virtual characters for a role-playing game with complex, lifelike behaviours that adapt to rapidly changing environments.

CITIZENSHIP

UNDERSTANDING OUR NETWORKED SOCIETY – In his 2012 book *Networked: The New Social Operating System*, University of Toronto sociologist Barry Wellman (with co-author Lee Rainie, Director of the Pew Internet and American Life Project) presents a landmark study of the transformation of social networks in the digital age. Through the impact of a technological "Triple Revolution" – the synergistic rise of the Internet, mobile technology and social networks – Wellman outlines how people's relationships to information and with each other have transformed. Far from making society more isolated, *Networked* makes the case that our lives offline and online are now integrated.

Tree generated using TreeSketch, a system for modeling complex trees that look natural yet are creatively designed. Photo courtesy Steven Longay.

TRUE2FORM

Inspiration

Input curves

3D Reconstruction
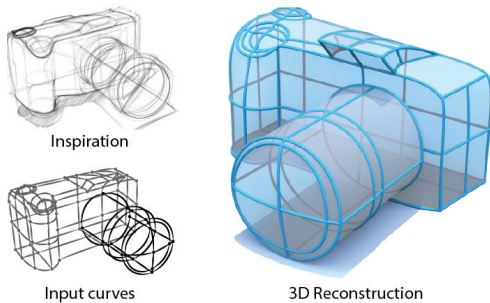
True2Form, a new graphics system created by University of British Columbia computer scientists, could greatly simplify how artists and designers turn simple drawings into virtual 3D models. Inspired by the work of professional designers, the technology uses complex algorithms to infer accurate 3D shapes and curves from 2D sketches – a difficult process using conventional tools. The research was showcased at SIGGRAPH 2014.

Image courtesy Baoxuan Xu.

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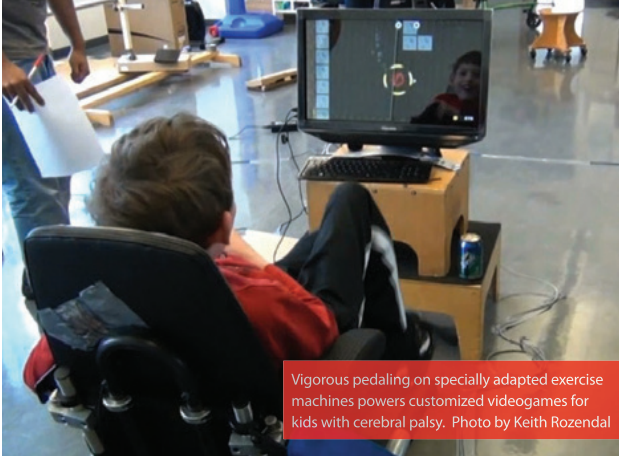
Vigorous pedaling on specially adapted exercise machines powers customized videogames for kids with cerebral palsy. Photo by Keith Rozendal

THE FUTURE OF SUSTAINABLE HOMES – The Simon Fraser University West House, located in Vancouver, British Columbia, is a state-of-the-art home and living laboratory for computerized technologies that promote sustainability. The product of an extraordinary collaboration by academia, industry and government, West House was first showcased during the Vancouver 2010 Olympic Games. The home continues to serve as a key research space now situated on a City of Vancouver owned site. Fitted with a host of green innovations, the home's built-in interactive tools – energy consumption visualizations, and touchscreen interfaces to control lighting, heating and appliances – are all digital tools designed to encourage a sustainable lifestyle.

TOOLS FOR MANAGING CHRONIC DISEASES – Simon Fraser University researchers are leaders in developing new immersive virtual reality, visualization, and biofeedback technologies to treat chronic pain, a disease afflicting one in five Canadians. These computerized therapies teach patients techniques of mindfulness meditation to reduce stress levels and self-manage pain. A partnership between GRAND and the NeuroDevNet NCE developed novel therapies for treating neurodevelopmental disorders, including Cerebral Palsy (CP), Fetal Alcohol Spectrum Disorder (FASD), and Autism Spectrum Disorder (ASD). A successfully piloted cycle-based exercise game for teens with Cerebral Palsy combines a vigorous workout with customized videogames played with others linked via a social network.

SFU West House in Vancouver, BC.
Photo Credit: Keith Henderson Photography

NEW MODELS FOR ENGAGING YOUTH – The AMD Kids Game Development Camp at York University has allowed researchers to delve into the nature of digital gaming as an educational tool and to understand how to best engage youth with technology. The peer-mentoring program teaches local disadvantaged kids the skills needed to construct their own computer games from start to finish. Particular emphasis is given to sparking interest in STEM fields among female campers. The insights gained through the study will help educators create learning environments where girls can explore their interests and perform better.

TRAINING FOR A CHANGING WORLD – GRAND and international game developer Funcom piloted a unique mentorship initiative to give ten students an intensive, industry-focused intro to game development. Tasked with developing a videogame from concept to prototype in ten weeks, the team had full creative control plus the resources of Funcom's Montréal game studio. An embedded sociologist from Concordia University tracked the team's progress in developing core game design competencies and industry readiness, providing an inside look into what makes game design teams 'tick.' Many participants went on to launch professional careers or entrepreneurial ventures in games.

HitchBOT, the world's first hitchhiking robot, finished a coast-to-coast tour across Canada in 2014, gaining international interest in its mission to explore the possibilities of robot-human interaction – and trust. The collaborative project involved GRAND researchers at McMaster, Ryerson, and U of T who equipped the sociable but simply constructed hitchhiker with advanced speech recognition software and 3G-network connectivity allowing it to converse with fellow travellers and track its own journey on social media. HitchBOT continued its grand tour in Europe in 2015.
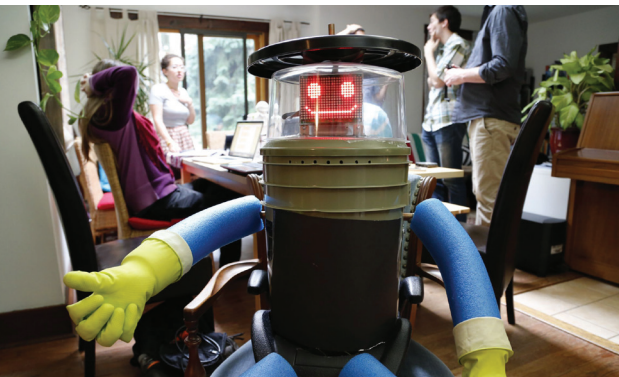
Photo courtesy Ryerson University.

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PAPERTAB

Researchers at Queen's University were ahead of the curve with the launch of PaperTab, a revolutionary paper-thin, flexible tablet, at the 2013 Consumer Electronics Show (CES). With the look and feel of a regular sheet of paper, PaperTab offers a robust alternative to conventional glass panel touchscreens, with such UI innovations as navigating information by bending sides of the screen, similar to turning the pages of a magazine.

AN INTERDISCIPLINARY APPROACH – As Canada's largest digital media research network, GRAND linked digital media researchers, industry partners, and other organizations from across Canada and across the disciplinary boundaries of the natural sciences, engineering, the social sciences, humanities, art, and design. The network spanned 31 universities across Canada with industry, government, and nonprofit partners, as well as collaborative relationships with other NCE networks including CDMN, Neurodevnet and Wavefront.
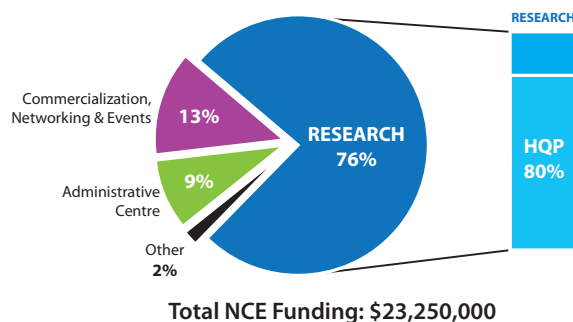
ARTS-SCIENCES CONNECTION – GRAND worked to foster a culture of exchange and collaboration between artists, designers and other researchers in the network. Together with member arts and design schools NSCAD University, OCAD University, and Emily Carr University of Art + Design, GRAND created AD-Node (Art and Design Node), an initiative to seed and develop budding projects, train HQP, and expand network connections. AD-Node ensured artistic and design projects had an equal footing with projects based at research-intensive universities. The GRAND Media Artist and Scientist Collaboration program, co-sponsored by the Canada Council for the Arts (CCA), funded cross-disciplinary projects that explore and develop leading-edge technologies and applications through artistic works. Piloted in 2013, the program supported four projects led by Canadian artists and their collaborating researchers at McGill University, Ryerson University, and Simon Fraser University.

PARTNERSHIPS WITH INDUSTRY – The gap between academic research and industry development is an ongoing challenge in Canada's digital economy. By closely engaging its 184 industry partners through networking, tech transfer and commercialization initiatives, GRAND fully utilized its connections to unlock opportunities and maximize the benefits and impact of Canada's research.

TECH TRANSFER & COMMERCIALIZATION – In 2011, GRAND partnered with Western Economic Diversification (WD) in a two-year initiative to support technology transfer, start-up creation, and prototype development in BC, Alberta, Saskatchewan and Manitoba. Networking events showcased new research technologies to over 160 businesses and organizations. Business development expertise provided through GRAND helped commercialize seven new technologies and develop 13 new prototypes with over $300,000 in new business funding. The initiative has ensured university entrepreneurs understand both the needs of their receptor communities and the business realities of stepping into the market.

BUILDING A DIGITAL NATION – GRAND researchers inform public and governmental debate around important social issues. Speaking at the prestigious 2010 "Big Thinking Lecture Series" in Ottawa, Ryerson University professor Catherine Middleton challenged politicians, policymakers, and the public to envision Canada's future as a broadband-enabled digital society. One of Canada's leading experts on the emerging digital economy, Middleton testified to the House of Commons Standing Committee on Industry, Science and Technology study of Broadband and Internet Access Across Canada in 2013.

CANADA'S NEXT INNOVATORS – Attracting, developing, and retaining young researchers – or Highly Qualified Personnel (HQP) – is a key part of GRAND's mandate and vital to ensuring Canada maintains a competitive advantage worldwide. GRAND helped train over 1,500 graduate students and postdoctoral fellows through its comprehensive HQP program that provided a distinctively interdisciplinary, cross-university, and applied research experience not found in other training programs. GRAND provided multiple platforms for HQP to share their research and learn through peer mentorship. A total of 139 RNote (Research Note) papers and 443 Poster and Demos were presented at GRAND's annual conferences, providing valuable experience in the peer review process comparable to top-tier conferences. Overall, GRAND invested over 64% of its total NCE Funding, or over $14.8M, in HQP support.

Commercialization, Networking & Events **13%**

Administrative Centre **9%**

Other **2%**

RESEARCH 76%

RESEARCH

HQP **80%**

Total NCE Funding: $23,250,000

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GRAND NCE FINAL REPORT

INTRODUCTION

The GRAND NCE (Graphics, Animation and New Media Network of Centres of Excellence) was created in 2009 through the Networks of Centres of Excellence (NCE) program to employ an interdisciplinary and interconnected approach to address Canada's technological, creative, socio-economic, legal and cultural challenges in digital media. Over the course of its five-year life, the network made significant progress in realizing this vision. Through its innovation and creative achievements, GRAND research has developed lasting social, health, and economic benefits that will improve the quality of life of all Canadians and enhance Canada's global competitiveness.

At the end of its five-year funding period, GRAND had grown to become Canada's largest digital media research network, linking **250+ researchers at 31 Canadian universities** in nine provinces, as well as **184 industry partners and other receptors** – the stakeholders and receptors of the research outcomes. GRAND's distinctive cross-disciplinary research program included a very broad range of the disciplines funded through Canada's research Tri-Council – NSERC, SSHRC, and CIHR – as well as artistic and cultural initiatives funded by the Canada Council for the Arts. Network activity supported the training of over **1,500 Highly Qualified Personnel (HQP)** – Canada's up-and-coming digital media researchers, practitioners, and entrepreneurs. Nine of GRAND's outstanding HQP are profiled in this report.

GRAND's large and strongly interdisciplinary community has fostered new research agendas and opened new avenues for collaboration. This community built an identity and a voice for Canadian digital media researchers that overcame barriers between disciplines and between institutions, which led to enriched knowledge and more informed engagement for Canadians.

GRAND's five-year mission to expand the social, economic and cultural impact of university research in digital media achieved significant results. GRAND research advanced the state of the art for digital media technologies and methodologies, and informed public policy. The network's many partnerships with government, industry, and other organizations stimulated new collaborative R&D, commercialization of pioneering technologies, and new entrepreneurial ventures. These results will contribute to revolutionizing how Canadian businesses compete in the global marketplace and how Canadian cultural discourse is conducted.

This report highlights GRAND's key achievements that align with the objectives of the Networks of Centres of Excellence program.

RESEARCH EXCELLENCE

PHASE 1: GRAND'S FIVE CORE COMPETENCIES

GRAND's research program was initially structured around five themes that provided the framework that established the core research capabilities of the network. Each theme represented a key element of GRAND's expertise in the field of digital media. During the first four years of the network, the resulting 38 projects built up critical digital media research capacity that was unique not only within Canada, but also internationally.

NEW MEDIA CHALLENGES AND OPPORTUNITIES

nMedia

The tools, skills, and techniques needed to advance the next generation of new media applications and distribution channels.

GAMES AND INTERACTIVE SIMULATION

GamSim

The construction, use, and understanding of games and simulation in three areas: game development technologies, education, and applications.

ANIMATION, GRAPHICS AND IMAGING

AnImage

New knowledge and technology addressing the challenge of content generation and scalability required for deployment of digital technologies in a large range of social contexts.

SOCIAL, LEGAL, ECONOMIC AND CULTURAL PERSPECTIVES

SocLeg

Research results made available to policymakers about how best to adopt legal and regulatory processes to the challenges of digital media so that technological innovations are relevant and beneficial to Canadians in all walks of life.

Refereed Contributions	1631
Non-refereed Contributions	595
Specialized Publications	172
Total Publications	**2398**

GRAND PUBLICATIONS

ENABLING TECHNOLOGIES AND METHODOLOGIES

Tech Meth

The building blocks that can be used to invent, design, produce and evaluate the next generation of games, animation and new media technologies for use by consumers, research and industry.

At the end of Phase 1, GRAND had established a strong core research capability. An extensive renewal process in 2014 introduced a fully revamped research program to better align projects with the priorities set out in the NCE Program. Phase 2 projects placed greater emphasis on end-to-end networking and partnerships between academic, public, and private sector stakeholders, and greater focus on research impact through commercialization, innovation, and informed public policy decisions.

PHASE 2: GRAND'S SEVEN CHALLENGES

GRAND's Phase 2 research program addressed seven problem areas, each a "Challenge" of strategic importance to Canada. Within each theme, a single Challenge was addressed through multiple projects that focused on specific issues within the overall problem area. Led by academic experts, each project had industry partners and other stakeholder representatives who helped define, execute, and evaluate the research activities.

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These seven Challenges – (Big) Data, Citizenship, Entertainment, Health, Learning, Sustainability, and Work – affect Canadians in a host of ways, from concrete problems such as workplace productivity and civic engagement to more abstract concerns such as perceptions of privacy and security in a world of ever increasing data. The successes described below reveal the broad and substantial impact made by GRAND research in each of the seven key areas.

(BIG) DATA
LIVING WITH BIG DATA

As quantities of data grow, so does our need to understand that data. From making government data more open and accessible, to assessing the impact of social media use on learning, nearly every human endeavour can benefit from making sense of "Big Data." The challenge lies in transforming data into knowledge, which demands innovative tools and new approaches for capturing, visualizing, and analyzing some of the biggest datasets "out there."

FATFONTS – A breakthrough in visualization, the unique numerical typeface "FatFonts" represents quantitative value by the font weight or ink amount used for each number. An invention of University of Calgary computer science professor Sheelagh Carpendale and fellow collaborators, FatFonts improves visualizations of numerical data by combining the symbolic and visual aspects of numbers. The project was featured in the science news weekly, *New Scientist* and on the website of the popular tech magazine, *Wired*.

SOCIAL MEDIA LAB – The Social Media Lab at Dalhousie University hosted Canada's first international symposium on social media, Social Media & Society in 2012, co-funded by GRAND, Mitacs and Dalhousie. Focused on best practices for research into the impact and implications of social media on society, the successful annual conference drew over 200 attendees from more than 20 countries. Social Media Lab, launched in 2013, is Canada's first facility dedicated to social

media research. GRAND worked closely with Director Anatoliy Gruzd to commercialize the lab's research, including cofounding Leadsift, a social media lead-generation company, which secured a $500,000 capital investment under PropelICT's Launch36 accelerator program for Maritimes-based start-ups. Social Media Lab relocated to Ryerson University in 2014 where it continued its affiliation with GRAND.

MOA EXHIBIT – GRAND researchers Alissa Antle, Kate Hennessy and Reese Muntean from SFU's School of Interactive Arts and Technology (SIAT) developed a compelling series of interactive exhibits for the Vancouver's Museum of Anthropology (MOA) to showcase past and contemporary Musqueam culture and community. The team designed the display's interactive concept, programming, graphics and photography. The project was a result of an exceptional collaboration between the MOA, the Musqueam Indian Band and SFU's School of Interactive Arts and Technology (SIAT) with assistance from GRAND, SSHRC, and NSERC.

GRAND 2010

Ottawa, ON
June 2-4

Over 180 researchers and students attended the inaugural GRAND Annual Conference held at the University of Ottawa. A research poster session that kicked off at the opening reception gave graduate students and postdoctoral fellows the opportunity to showcase their research through GRAND's Peer Reviewed Poster Program. Each student reviewed at least three posters from widely different disciplines across the GRAND network. GRAND 2010 followed the close of the 2010 AI/GI/CRV conference, also at the University of Ottawa. AI/GI/CRV delegates were invited to attend the opening reception and participate in the poster session.

ANNUAL CONFERENCE HIGHLIGHTS

[What] I'd like to get out of GRAND [are] the contacts, the networks, ... improving my research and getting feedback from people across Canada. – Neesha Desai, PhD Student, U of A, GRAND HQP

LENNART NACKE

Assistant Professor, University of Ontario Institute of Technology (UOIT)

Lennart Nacke is a remarkably active and talented researcher exploring the social, cognitive, affective, and physiological facets of digital entertainment and gameplay. He launched his Canadian academic career as a GRAND-sponsored postdoctoral research associate at the University of Saskatchewan. A leader within the HCI and game research communities, Lennart co-chaired the first-annual Gamification 2013 conference, co-sponsored by GRAND, Canada's first comprehensive event focused on the growing area of gamification. He was also chair of the inaugural CHI PLAY 2014 in Toronto, a conference on "player-computer interaction" organized in collaboration with other GRAND researchers. He began his faculty career as a GRAND Young Network Investigator.

CITIZENSHIP
DIGITAL CITIZENSHIP AND CIVIC ENGAGEMENT

New media has become embedded in civic and political life, raising questions about what it means to be a "digital citizen." Can social networks galvanize political movements? How equal is the access to information technology? Will online journalism build an informed and engaged public? Are governments and public institutions ensuring personal data is handled responsibly? How is the use of digital technologies reflecting the social values of the citizens those technologies are designed to serve?

NETWORKED – Prominent University of Toronto sociologist and GRAND Principal Investigator

Barry Wellman incorporated findings from his sociological investigations on the impact of the digital revolution into his 2012 book *Networked: The New Social Operating System* (co-authored with Lee Rainie, Director of the Pew Internet and American Life Project and published by MIT Press). Networked has been widely praised by scholars for putting forth a new theoretical framework, backed by substantial evidence, for analyzing networked society. In it, Wellman identifies a "new social operating system" called networked individualism triggered by a "triple revolution" – the rise of social networking, the capacity of the Internet to empower people and the connectivity of mobile tools. Through this transformation our personal relationships are moving beyond households, workplaces and neighborhoods to more disperse, remote social circles. This supplies us with new ways to solve problems and meet social needs.

DATA JOURNALISM – Veteran BBC journalist and UBC professor Alfred Hermida, with colleague Mary Lynn Young, have led GRAND research to better understand the challenges and opportunities of using data for journalists and those who train them. One of their key studies, published in the scholarly journal *Digital Journalism*, focuses on the creation of the Los Angeles Times Data Desk, an informal team of reporters and computer programmers who together pioneered new approaches to data-driven reporting. Hermida and Young are replicating their research in Canada to promote data-driven practices in news organizations. Hermida is author of the award-winning *Tell Everyone*, an insightful analysis of the origins and societal impact of information sharing on social media.

ENTERTAINMENT
ENTERTAINMENT IN AN ALWAYS-CONNECTED WORLD

The media and entertainment industries are heavily invested in a digital future. Just-in-time content creation and always-connected personal lives

Without GRAND, I would have never had the chance to start my research career in Canada the way I did … including helping me meet amazing researchers and having immediate access to experts in my core research areas. – Lennart Nacke

GRAND 2011

Vancouver, BC
May 12-14

GRAND's second annual conference, held at the Vancouver Convention Centre, featured an impressive line up of speakers, posters and demonstrations, presentations and 'Work In Progress' (WIP) papers from HQP. Plenary speakers included William (Bill) Buxton, Principal Researcher, Microsoft Research and GRAND's 2011 Canadian Digital Media Pioneer. The conference introduced the HQP-organized Works in Progress (WIP) track, which included presentations from GRAND HQP. Students from across the network's research projects participated in the student peer review process of WIP submissions.

offer new possibilities for interactive games and entertainment that challenge traditional production and distribution practices. This new paradigm demands powerful new tools for creating digital content, generating realistic models, and crafting believable virtual characters and interactive stories that capture our imagination.

SKETCH-BASED INTERFACE – Sketching and sculpting interfaces, often considered "natural" approaches to interactive design, are limited by the motor control of the human hand, drawing skill, as well as human perception and inference, which make the leap from 2D input to 3D shape challenging for the designer and artist. New sketch-based systems developed by GRAND researchers Yannick Thiel, Karan Singh and Ravin Balakrishnan at the University of Toronto are inspired by natural variations in the artist's stroke speed. When drawing quickly or with precision, the new interfaces use stroke dynamics to distinguish intentional fine detail from unintended "noise" to produce curves that balance smoothness with

detail. The research, presented at ACM UIST 2011, has important applications in computer animation, illustration and computer-aided design software.

NON-PHOTOREALISTIC RENDERING – Traditional computer graphics produce photorealistic images believed to have less emotional appeal than more expressive, stylized images created using non-photorealistic rendering (NPR). NPR-based images are often used in computer games, films, advertisements, and web sites. Carleton University researchers David Mould and Hua Li, working with Regan Mandryk at the University of Saskatchewan, studied emotional responses to NPR-based images using subjective data from 42 participants, as well as eye gaze data to track their visual attention. They found that the NPR algorithms indeed dampened participants' emotional responses in terms of arousal (activation) and valence (pleasure). The researchers believe confusion or distracting visual artifacts in the NPR images might lessen interest and cause the reduced response. The research was published in the journal *Computers & Graphics* in 2012.

ALGORITHMIC BOTANY – A long-term collaboration between researchers in botany and biology and distinguished University of Calgary professor and GRAND researcher Przemyslaw Prusinkiewicz has led to groundbreaking mathematical models for the growth and shapes of plants. These models are used both as theoretical frameworks for understanding biological processes, and to assist in generating highly realistic renderings of plants, trees, and foliage used in animated and cinematic works. Procedural systems based on Prusinkiewicz's research have become foundational in systems that allow artists to generate tree and plant growth. Presinkiewicz's app TreeSketch, developed in GRAND, allows artists to create complex trees that look natural yet can be creatively designed. The system integrates procedural tree generation with a multi-touch interface that provide detailed control of tree form.

GRAND is an organization that gives us really good insight into where the world is going in a digital economy...it gives us a view into what might exist as we go forward. – David Martin, Co-founder, Smart Technologies Inc., GRAND Board Member

NCE RCE

SIMULATION GRAPHICS – From smoke billowing from a smokestack to the subtle flicker of a flame, the visual simulation of natural phenomena has been revolutionized over the last decade, thanks in part to computer graphics research led by GRAND researcher Eugene Fiume at the University of Toronto. Grasping potential applications in film, animation, architecture, medicine and other fields, Fiume's Dynamic Graphics Lab began a 20-year partnership with design software leader Autodesk (Toronto) to orchestrate a very successful technology transfer effort that allowed these phenomena to be implemented in the software product in a matter of a few months. Fiume and GRAND's former Research Management Committee Chair Gord Kurtenbach, Director of Research at Autodesk, were awarded the 2011 NSERC Synergy Award for Innovation in recognition of the collaboration.

LESLEY NORTHAM

PhD Student, Computer Graphics Lab, University of Waterloo

Lesley Northam is an exceptional student researcher. Her investigations into how interactive computer graphics can support filmmakers in designing, preparing, and shooting movies has made important advances to digital film and TV postproduction. Through a partnership between GRAND and Sheridan College's SIRT Centre in Toronto, she developed a Real-Time Special Effects (RTFX) framework to improve film pre-visualization. She interned with Side Effects Software in Toronto, creators of the Houdini software, building tools to bring cinematic special effects to computer games and expand their entertainment production capability. Her research on stereoscopic 3D media has likewise influenced 3D conversion techniques adopted by Gener8, a Vancouver-based visual effects company.

HEALTH
PATIENT-CENTRED HEALTHCARE AND WELLNESS

Advances in new media are rapidly moving the healthcare sector towards a digital revolution. Games and interactive media are helping to promote health and fitness, rehabilitate patients, and reduce social isolation. Virtual reality and visualization are training doctors and informing patients. Online networks are providing cost-effective prevention and care at a distance. Research is making a difference in the wellbeing of Canadians and helping to transform established practices in healthcare.

ARTHRITIS RESEARCH – University of British Columbia associate professor and Canada Research Chair, Dr. Linda Li, is working to help patients and their caregivers better manage their health, and potentially reduce the cost of chronic diseases in Canada. The ANSWER (Animated, Self-serve, Web-based Research) tool, a project led by Dr. Li and supported through the partnership of UBC, Arthritis Research Centre of Canada, University of Ottawa and the Centre for Digital Media, was designed to help Rheumatoid Arthritis patients assess the pros and cons of using Methotrexate – a common drug treatment. ANSWER assists patients who find Methotrexate ineffective and require the stronger treatment of "biologics" (genetically engineered proteins) when recommended by their doctors. In 2014, Li launched the Improving Cognitive & jOint health Network (ICON) to develop other new digital technologies for promoting cognitive and joint health in Canada's growing elderly population. The network is funded by the Canadian Institutes of Health Research (CIHR).

CONFRONTING PAIN – Using biofeedback, immersive virtual reality, visualization, robotics and innovative social media, GRAND's CPRM (Confronting Pain: Redefining Mobility) project has pioneered drug-free therapies for treating long-term chronic pain. The research has the potential to improve the lives of seven million Canadians

I'd really like to stay in academia, but I'd like to maintain a strong relationship with … both the film industry and the visual effects industry. Why GRAND is so important is that I can start my collaborations now and hope that they carry on past my PhD degree. – Lesley Northam

suffering from or disabled by the disease as well as reduce costs associated with chronic pain, which surpass costs for cancer, heart disease and HIV infection combined. GRAND helped SFU professor Diane Gromala lead a Canadian-U.S. partnership with Seattle-based Firsthand Technology, funded by the American National Institutes of Health. Their prototype "Virtual Meditative Walk" includes a $5,000 head-mounted virtual reality display customized for chronic pain patients that is comparable to an existing $40,000 unit. A documentary about the research entitled *In Your Head* was featured on Google's exclusive Solve for X website, a forum for breakthrough technologies.

TAGLAB – Led by pioneering computer scientist Ronald Baecker, the University of Toronto's Technologies for Aging Gracefully Lab (TAGlab) has introduced wide-ranging cognitive and communication aids for seniors and those suffering from Alzheimer's disease, aphasia, and Multiple Sclerosis, as well as social isolation. TAGlab researchers work directly with hospitals, hospices, and therapy and disability support organizations. Field trials were conducted at seniors' services provider Revera Inc. for TAGlab's Families in Touch (FIT), an interactive tablet-based device that allows seniors to connect with families and friends. MyVoice, another communication aid developed at TAGlab, hit the market in the summer of 2012 as "Talk Rocket Go." The context-aware application suggests vocabulary - words, phrases, and sentences - based on a user's location; over 10,000 people worldwide have embraced it as their alternative communication tool.

NEUROGAME – In 2010, GRAND NCE computer science researchers teamed up with neuroscientists in the NeuroDevNet NCE (NDN) to form NEUROGAME, a $500k initiative co-funded by the two NCEs to apply emerging computer and gaming technologies as novel therapeutics for neurodevelopmental disorders. The joint research explored the impact of videogame play on cognition and attention and working

Over the last few years, the GRAND annual meetings have become a primary networking venue for Canadian research groups in graphics and new media. – Dr. Michiel van de Panne, Computing Science Professor, UBC

GRAND 2012

Montréal, QC
May 2-4

GRAND's third annual conference, held in Montréal, featured prominent speakers and guest panelists including renowned youth online privacy expert Dr. Valerie Steeves (University of Ottawa), and Academy Award winning computer scientist Dr. Ken Perlin (New York University). Over 300 scholars from across Canada attended the conference along with guests from industry, government and the non-profit sector. Celebrated film producer Robert Forget was also honoured with a GRAND Digital Pioneer Award for his original work in computer animation at the National Film Board.

memory in children with Fetal Alcohol Spectrum Disorder (FASD), and Autism Spectrum Disorder (ASD), as well as the physical fitness and social connectedness of children with Cerebral Palsy (CP). Nicholas Graham, a computer scientist at Queen's University, and NeuroDevNet Senior Scientist Dr. Darcy Fehlings, a physician at the University of Toronto and the Bloorview Research Institute, successfully piloted a cycle-powered videogame for children with cerebral palsy that combines a vigorous physical workout with exciting games. Multiple players can connect via a dedicated social network for a lively social experience. Unveiled at the ACM CHI 2013 conference in Paris, the team's paper submission went on to win Best Paper in Child-Computer Interaction. In 2014, researchers marked World CP Day with a live cross-Canada demonstration of the system involving players in Vancouver and Toronto.

LEARNING
LEARNING IN THE DIGITAL AGE

Digital media and technologies are transforming what, how, and where learning

LOLA WONG

PhD Student, Faculty of Information and Media Studies, Western University

Lola Wong had been a long-time contributor to GRAND and central to making the student-led Graduate Student and Postdoc Committee (GSPC) an active and engaged voice for HQP. As GSPC co-chair in 2012, and chair in 2013 and 2014, Lola Wong kept students and postdoctoral fellows informed about the important role the network can play in their research and industry work. She represented the GRAND network at the American Association for the Advancement of Science (AAAS) 2013 Annual Meeting in Boston, USA and the 2013 World Social Science Forum (WSSF) in Montréal. Lola's GRAND-supported research focused first on new user-generated content (UGC) models and needed UGC policy infrastructure, and later on viral media.

occurs – as well as what counts as knowledge. While learning has never been confined to the classroom, the opportunities for the acquisition of knowledge and skills in informal contexts such as tutorials, online communities, MOOCs, and digital games, among others, have grown enormously. Anticipating, documenting and detailing these shifts are the central challenges to learning in the digital age.

DIGIKIDZ – For many children living in Nepal – a country troubled by poverty, civil war and social unrest – life is scarred by traumatic events, leaving them little chance for success in school. Simon Fraser University professor Alissa Antle, an expert in child-computer interaction and co-leader of GRAND's DIGIKIDZ project, led research into how edutainment-based interactive technologies can improve the lives of traumatized children, their families and their communities. Antle's research team worked with children at the Nepal House Kaski School in Nepal to test simple neurofeedback tablet games designed to teach young students to better self-regulate their emotions so they can focus, and pay attention.

EPIDEMIC – Timed around anxieties caused by misinformation about recent SARS, Avian Flu, and H1N1 outbreaks, GRAND researcher Jennifer Jenson at York University led the creation of the online educational game Epidemic that invites users aged 14-20 to develop game-based knowledge and practices around prevention and self-care in the face of contagious diseases. The game was designed for accessible and straightforward creation of educational content, where players generate and publish their own virus-like avatars, stop-motion animations, and disease-related PSAs. An innovation in the field of educational game design, Epidemic bypassed the clichéd "what did you learn today" to instead show how laughter, engagement and attention contribute to learning.

SUSTAINABILITY
BUILDING SUSTAINABLE COMMUNITIES

Digital media has the potential to radically change how we – as individuals and as a society – make decisions and take action around sustainability. With 80% of Canadians living in urban communities, embedding sustainable thinking in the computer-based design and decision-making processes and practices of our built environment has become an urgent, national priority. New technologies can promote environmental awareness, encourage conservation, and enable control of energy and water use.

WEST HOUSE – West House is an eco-friendly state-of-the-art laneway home that serves as a "living laboratory" for sustainable research technology. First envisioned by Simon Fraser University SIAT researchers Lyn Bartram and Rob

My opportunities with GRAND have demonstrated the value of making connections beyond the classroom and beyond the lab. It isn't just about presenting your research; it's about sharing your research with colleagues you might not have known you had.– Lola Wong

Woodbury, and David Ramslie, the Sustainable Development Program Manager of the City of Vancouver, the project was the result of an extraordinary partnership by academic researchers, planners, designers, architects, builders, engineers, computer scientists, and policy makers. West House was showcased during the Vancouver 2010 Olympic Games to over 66,000 people and is now a legacy installation on a City of Vancouver owned site, where it serves as an evolving research space. Demonstrating that the sustainable home of the future is not so far away, the house is equipped with interactive digital technologies designed to promote sustainable living: an built-in computer system called ALIS tracks the home's energy consumption in real time. Networking tools support residents' sustainable milestones. Decorative designs include an illuminated kitchen backsplash digital display that subtly changes with water, electricity and gas use.

GREENEST CITY CONVERSATIONS – The innovative, interdisciplinary and wide-scale Greenest City Conversations (GCC) project aimed at developing multiple channels for public engagement on sustainability policies. Led by researchers at Simon Fraser University and the University of British Columbia, GCC undertook a comprehensive look at the effectiveness of social media, multiplayer games, visualization, mobile computing and other media in engaging thousands of Vancouver residents in conversations around the City's green policies. Though focused on the views of Vancouverites, the results provide a critical best practices case study relevant to other urban jurisdictions across Canada. GRAND, the Pacific Institute for Climate Solutions (PICS), BC Hydro, Envision, Mitacs, and the City of Vancouver sponsored the project.

WORK
WORK IN A GLOBAL ECONOMY

For many in a knowledge-based digital economy, work is no longer the production of

GRAND is a great place to network, to start new research relationships, and to exchange ideas in a (mostly) informal venue about current research projects and direction.– Audrey Girouard

physical goods and services; it is understanding and utilizing information in creative and innovative ways. This has transformed the nature of work and changed the historic relationship between labour, capital, and natural resources as the drivers of economic growth. As well as improved work tools that support interaction and collaboration across time, distance, and scale, new policies are needed that reflect the new realities of working in the digital age.

COMPUTER GAMES AND CANADA'S DIGITAL ECONOMY – In 2002, Canada ranked sixth globally in videogame production. By 2010, Canada had risen to the world's third top game producer with projected revenues of more than $2 billion. In a comprehensive 2010 report entitled "Computer Games and Canada's Digital Economy, The Role of Universities in Promoting Innovation" submitted to the Canadian Government, GRAND researchers confirmed Canada's leadership in the global games

AUDREY GIROUARD

Assistant Professor, School of Information Technology, Carleton University

HQP THUMBNAIL PROFILE

As a postdoctoral fellow at Queen's University's Human Media Lab (HML), Audrey Girouard was part of the research team behind PaperTab – a revolutionary paper-thin, flexible tablet. Unveiled at the 2013 Consumer Electronics Show (CES), the device was acclaimed as a breakthrough in flexible electronics. Audrey contributed to other ingenious HML inventions and furthered studies into bend gestures for organic user interfaces. In 2011, she was awarded one of the first Young Network Investigator (YNI) Awards – a GRAND initiative introduced to help former HQP transition into faculty positions while remaining involved in GRAND projects – and thereafter became a GRAND Collaborating Network Investigator (CNI).

industry, demonstrating how making video games and interactive entertainment is a critical engine of the country's present and future digital economy. The report, commissioned by SSHRC, examines the potential played by universities in training for game design and game study, identifying areas for greater collaboration between academia and game companies. The report is based on a study of 307 companies and 25 industry interviews from across the country.

GRAND-FUNCOM INITIATIVE – GRAND and top massively multiplayer online game developer Funcom piloted an intense hands-on summer mentorship program at Funcom's Montréal studio in 2012. The non-commercial initiative engaged ten students who worked closely with professional game developers to develop a game concept into

a playable prototype in a mere ten weeks. The immersive experience provided valuable industry skills for participants, and a rare inside look into the game development process for researchers. GRAND HQP Jennifer Whitson, then a doctoral student at Carleton University, tracked the team's progress from start to finish as part of a unique ethnographic study of game development culture spearheaded by Concordia University professor Bart Simon. The study opened the door to further sociological research in games. For participants, the initiative delivered more than expected, with many going on to take up professional work in the games industry.

Beyond leading world-class research in digital media, GRAND also had significant achievements in other areas.

ART & DESIGN CONNECTION

GRAND worked to integrate art and design knowledge and practice into Canadian scientific research through unique initiatives that bridged the artistic and scientific communities.

AD-NODE – In 2012, GRAND began a two-year initiative to better integrate artists and designers at the network's three art and design universities (OCAD University, NSCAD University and Emily Carr University of Art + Design) with researchers within the larger GRAND network. Internal competitions within each of the three universities provided funds to seed and develop budding projects, train HQP, increase network connections, as well as ensure an equal footing with projects based at research-intensive universities.

An AD-Node collaboration led by Jonathan Aitken, Director of Emily Carr University's Health Design Lab and Dr. Darren Warburton, an associate professor and physician at UBC, developed a new clinical app that makes exercises prescribed by doctors easier for patients to follow. Designed for mobile devices, the tool lets physicians customize

HQP THUMBNAIL PROFILE

JENNIFER WHITSON

Assistant Professor, Department of Sociology and Legal Studies, University of Waterloo

Sociologist Jennifer Whitson is taking a close look at Canada's transforming game industry – from the inside. Both a PhD student and then a postdoc in GRAND, she was part of a 2012 initiative led by GRAND and international game developer Funcom. Jennifer studied a team of student developers at Funcom's Montréal game studio as they developed a complete multiplayer game. Appointed assistant professor at Waterloo in 2014 as a GRAND Young Network Investigator, Jennifer co-directed Critical Hit '14, an annual summer incubator for experimental games sponsored by GRAND. Whitson's highly original cultural research into game development and technology is of great interest to industry and is a direct result of her GRAND involvement.

Without GRAND, I would have never had the chance to start my research career in Canada the way I did ... including helping me meet amazing researchers and having immediate access to experts in my core research areas. – Jennifer Whitson

exercise routines and medical information for patients, as well as track the progress of their treatment.

CCA-GRAND COLLABORATION – The Canada Council for the Arts (CCA) – Canada's national arts funder – together with GRAND introduced a one-of-a-kind program that pairs independent artists with scientists in the creation of new artistic works. The GRAND NCE Media Artist and Scientist Collaboration supported cross-disciplinary projects that explore and develop leading-edge technologies and applications through artistic works. The joint program was created to build constructive exchanges and partnerships between the arts and the natural, social and health sciences, and to further artistic and scientific knowledge and practices for the benefit of Canadian society. The program funded four projects led by Canadian artists and their collaborating researchers at McGill University, Ryerson University, and Simon Fraser University. Media artist David Bobier and Ryerson University professor Dr. Deborah Fels used their grant to establish the VibraFusionLab media studio in London, Ontario.

GRAND has supported the creation and curation of many award-winning new media works shown at national and international exhibitions.

Dalhousie University professor Derek Reilly and his students have developed an interactive art installation/game called "Tweetris" that combines full body Tetris with Twitter. The collaborative art project involved researchers at the Digital Futures Initiative (OCAD University), computer scientists at the Dynamic Graphics Project Lab (University of Toronto), and independent artists. Launched at Nuit Blanche as part of Toronto's 2011 LEITMOTIF exhibition, Tweetris has entertained participants at Digifest, TEI 2012 as well as Halifax's 2012 Nocturne: Art at Night festival.

Concordia researchers developed a two-player sensor-based gestural game called "Propinquity"

The [conference] created a holistic meeting of the key digital media stakeholders in Canada [...] At no time during the conference was the living lab model more apparent than at the joint opening reception and poster session.– Kevin Tuer, Managing Director, CDMN

GRAND 2013

Toronto Ontario
May 14-16

GRAND's fourth annual conference was the network's largest gathering of researchers and innovators in digital media. Co-located with the CDMN's (Canadian Digital Media Network) Canada 3.0 event (May 14-15, 2013) in Toronto, the first ever CECR/NCE combined event drew more than 1,800 attendees from Canada and abroad, including over 350 GRAND researchers and scholars. The joint opening reception was a highlight for industry guests with 100+ GRAND research posters and demos on display. Sara Diamond (President of OCAD University) and Ron Baecker (U of T) were honoured at the 2013 Canadian Digital Media Pioneer Awards.

(meaning "proximity") that combines the rhythms and movements of dancing and fighting games. Focused on the actions of the body rather than the screen, Propinquity uses sound and game mechanics to produce an intensely social and physical experience. The game has been displayed in Montreal, San Francisco, Boston, Brussels, and Paris, and at IndieCade 2013 in Los Angeles.

INTERNATIONAL COLLABORATION

GRAND's international partnerships, student exchanges and collaborative research extended the network beyond Canada's borders and helped to enhance Canada's competitive advantage.

BRAVA/BRAZIL-CANADA 3.0 – The Brazilian Visual Analytics (BRAVA) Initiative was launched in 2012 to stimulate Brazilian-Canadian collaboration in Visual Analytics, the computational analysis and visualization of Big Data. VA technology is of critical interest for governments, companies and other organizations grappling with the modern deluge

of digital information. Sponsored by GRAND, The Boeing Company, Mitacs, and with support from Brazil's Federal University of São Carlos (UFScar), BRAVA held its second workshop in 2013, drawing over 50 researchers and industry representatives from around the world. BRAVA engaged over 18 research centres and universities in student exchanges and research collaborations, such as the development of mobile analytics tools for neurological and psychiatric care facilities in Brazil. GRAND and CDMN hosted a Brazilian delegation at the 2012 Canada 3.0 conference that led to the creation of the Brazil-Canada 3.0 conference, held in 2012 and again in 2013. This is Canada's main international summit devoted to boosting ICT cooperation with Brazil.

"REPLAYING JAPAN" – The field of Game Studies, as it has evolved in the West, has largely left out Japanese perspectives. With the first international "Replaying Japan" symposia series in 2012, GRAND researcher Geoffrey Rockwell at the University of Alberta has helped bridge the cultural gap between Canadian and Japanese researchers, advancing research connected to Japanese game culture, education and industry. Jointly organized by GRAND, the U of A and researchers at the Ritsumeikan University's College of Image Arts and Sciences in Kyoto, one of Japan's leading research centres in digital media, the conference fostered collaborative research between Ritsumeikan researchers and researchers in GRAND's PLAYPR project. The symposium is held annually in either a Japanese or Canadian city.

DEVELOPING HIGHLY-QUALIFIED PERSONNEL (HQP)

GRAND devoted over **$14.8M (approx. 64% of its overall budget)** over five years to provide opportunities and training to **more than 1,500 outstanding graduate students and postdoctoral fellows** at universities across Canada. GRAND HQP benefited from unparalleled cross-university connections and exposure to highly collaborative innovative research, competitive scholarships and bursaries, as well as internships and networking events that connected them with leading experts and industry partners. These opportunities gave Canada's future innovators and entrepreneurs pathways for great technological, socio-economic and cultural impact.
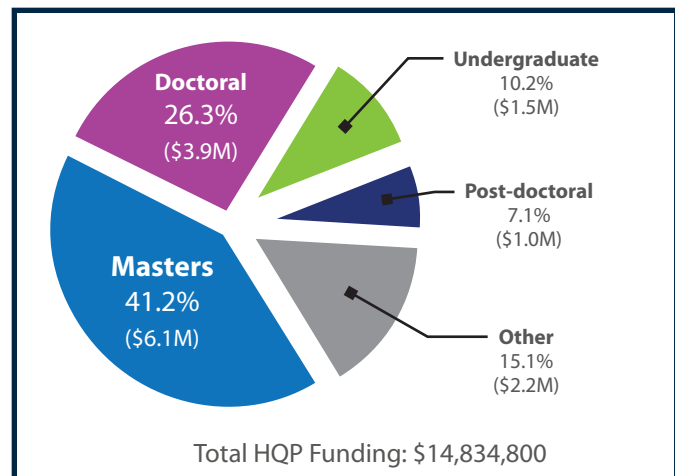
HQP THUMBNAIL PROFILE

CLAUDE FORTIN

PhD Student, School of Interactive Arts and Technology, Simon Fraser University

Claude Fortin sees a growing need for citizens to have a voice in the design and use of public technologies. A media artist herself, her research draws from artistic practice, the humanities, the social sciences, and human-computer interaction – a convergence that fits well with GRAND's interdisciplinary model of research. In Fall 2013, Claude led a groundbreaking ten-week ethnographic study of *Mégaphone*, an interactive "Speakers' Corner" in Montréal, examining how public spaces can support more participatory models of social, cultural and political interaction. A prolific contributor to top-tier conferences, through GRAND Claude took part in a series of top international workshops in the United States.

HQP FUNDING

Doctoral 26.3% ($3.9M)
Undergraduate 10.2% ($1.5M)
Post-doctoral 7.1% ($1.0M)
Masters 41.2% ($6.1M)
Other 15.1% ($2.2M)

Total HQP Funding: $14,834,800

NCE RCE

ANNUAL CONFERENCE – GRAND's annual conference offered new researchers a valuable venue for peer mentorship and scholarly exchange, plus access to Canada's academic research community. An initiative introduced at GRAND 2011 called "Work In Progress" papers, which later became RNote (Research Note) sessions, gave HQP the chance to present papers peer-reviewed
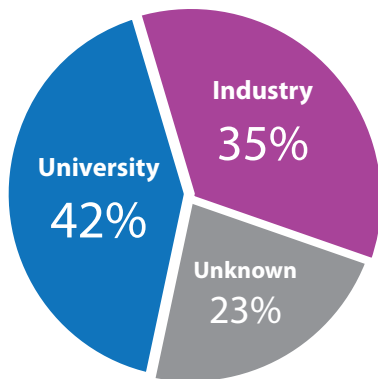
1,500+ HQP

$14.8M
(approx. 64% of GRAND's overall budget)

by fellow HQP. At the network's five conferences, GRAND students presented a total of **139 RNote** papers and **443 Posters and Demonstrations**. RNotes initiated students to a review process modeled on that used at top-tier conferences, such as ACM CHI and ACM SIGGRAPH, and provided authors informal feedback for future conference and journal paper submissions.

GRAND CAFÉS – Cafés were regional HQP-driven events for students and postdocs to network and learn about each other's research in GRAND. Agendas were set by the student organizing

committee to reflect the needs of the local group. Brainstorming exercises, guest speakers, lab and facility tours and other interactive activities rounded out the events.

YOUNG NETWORK INVESTIGATORS (YNI) – GRAND created the Young Network Investigators Awards in 2011 to recognize the need for start-up funds when HQP transitioned from doctoral student or postdoctoral fellow to faculty members at Canadian universities. Up to $7,500 in seed funding over the first 12 months in their new positions allowed researchers to remain in GRAND until they become CNIs and qualified for funding requests. Nine researchers received YNI awards based on strong track records of research contributions and student successes.

GRAND SCHOLARS – Introduced in 2014, the GRAND Postgraduate Scholar (G*PGS) program awarded stable multi-year support for graduate

POST-NETWORK HQP EMPLOYMENT

- Industry 35%
- University 42%
- Unknown 23%

Based on a sample of 434 graduating HQP (2010-2015)
Approximately two-thirds remained in Canada

[Canada] has top-notch researchers interested in working on exciting, hard problems … GRAND makes it possible to work with all these folks, as well as to meet new people and discover new problems. – Tony Tang

students engaged in research critical to the success of a GRAND project and whose scholarship strongly advances the objectives of the network. GRAND Scholars were given special opportunities to network with each other and with other GRAND researchers engaged in related research. Ten G*PGS scholars were each awarded approximately $5K to support their research.

KNOWLEDGE AND TECHNOLOGY EXCHANGE AND EXPLOITATION (KTEE)

GRAND's national KTEE program has stimulated the commercialization of pioneering technologies, the launch of entrepreneurial ventures, and informed public policy decisions, ensuring the rapid flow of ideas and innovations from researchers to Canadian receptors.

WD INITIATIVE – In 2011, GRAND entered into a two-year funding agreement with Western Economic Diversification Canada (WD) to accelerate the network's commercialization and tech transfer in British Columbia, Alberta, Saskatchewan and Manitoba. The total project budget was $649,000, of which WD contributed up to $399,000 (more than 60%). The program supported existing small and medium enterprise outreach and promoted entrepreneurial start-ups from academic research. The initiative's networking events and workshops introduced over 160 businesses and organizations to over 65 different technologies being developed at Canadian labs, and helped commercialize seven new technologies, and develop 13 new prototypes. Canada-wide, GRAND's commercialization and outreach initiatives have led to over $1,000,000 in new business capitalization.

ENTREPRENEURSHIP – The area of entrepreneurship is one where GRAND has had some of its most notable successes. The network

helped launch 15 new companies exploiting research ranging from 3D simulations to haptics to medical training using VR techniques.

Through GRAND's support, researchers at Simon Fraser University started up FaceCo Labs to develop new facial 3D technology for mobile devices. The company debuted its mobile app "Face Fries" on Apple's iTunes in Spring 2014 that lets users create talking, animated 3D avatars from photographed faces and share them online. National media coverage of the app's release helped generate considerable online buzz.

GRAND helped Winnipeg-based startup MOBRO Software Ltd. develop a mobile games platform inspired by eye-tracking research at McGill University. The company's initial stride into the mobile market with Space Evaders was followed by special recognition during the Extreme Motion iPad Challenge in 2013 as the People's Choice Winner where it won second place in the overall challenge.

15 Start-Ups Launched
(at least 8 start-ups were still active in 2015)

Over $1M in new business capitalization

Three University of Calgary researchers turned their motion "sonification" technology into a winning design thanks to the support of GRAND. Using accelerometer data to produce real-time audio feedback during performance, the prototype allows athletes to follow rhythmic audio feedback to correct and improve techniques. The team's design placed second at the international Armour39 Challenge, winning $10,000 to take the prototype to the next level.

At the University of Waterloo, Ph.D. student

Krzysztof Pietroszek, working with GRAND researcher Dr. Edward Lank, started a Toronto-based company called Cineclick. Building on middleware that enables moviegoers to interact with the big screen using their mobile phones, Cineclick secured budget of $825,000 from the Canada Media Fund to create a system for interactive games to be played during theatre pre-shows.

NSCAD University Professor Sam Fisher along with GRAND researchers at Dalhousie University and McGill University applied advanced motion capture systems to automatically focus cinematic camera lenses in real time - a technique that provides greater accuracy and flexibility over manual "focus pullers." This work has the potential to increase artistic expression, especially in combination with 3D films and the higher frame rates that are possible with the newest digital projectors.
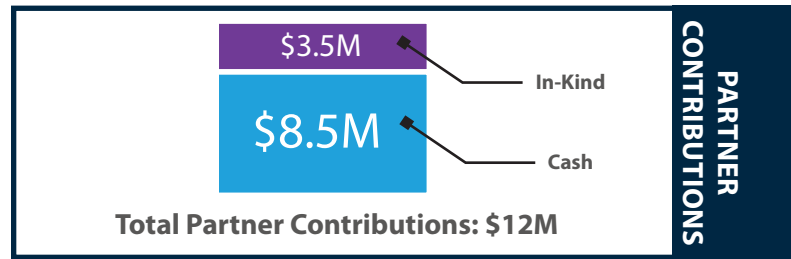
DAVID HOLMES

MA Graduate in Humanities Computing, University of Alberta

With the launch of his award-winning videogame "Life Goes On," David Holmes' career as an indie developer is off to a great start. David, along with three University of Alberta alumni, dreamt up the puzzle-based adventure game at the 2012 Global Game Jam. Challenging conventions, the game requires players to sacrifice their characters' lives to complete levels. Later developed in part through GRAND's support, "Life Goes On" became one of North America's top up-and-coming indie games, winning an Intel Level Up Award and one of the top games at Seattle's PAX Prime in 2013. David took part in the 2012 GRAND-Funcom Games Initiative, a hands-on, industry-focused mentorship program formed in partnership with international game developer Funcom.

With the launch of his company Cinema Control Laboratories in partnership with Sunsel Systems, Fisher expects his automated prototype the Andra Motion Focus system to hit the market in 2015.

Not all of GRAND's knowledge mobilization is through commercialization with existing companies or spin-offs. Dr. Deborah Fels at Ryerson University, an expert in inclusive media for people with disabilities, has proposed an ISO Standard for Guidance on Audio Descriptions for video, such as movies, TV shows and broadcast news and sports.

PUBLIC POLICY – New technology invariably requires new public policy, and conversely new public policy is often required to stimulate the development of new technology. Researchers in GRAND looked at both sides of this synergy.

In her presentation "From Canada 2.0 to a Digital Nation" at the prestigious 2010 "Big Thinking Lecture Series" in Ottawa, Ryerson University professor Catherine Middleton challenged politicians, policymakers, and the public to envision Canada's next-generation, broadband-enabled digital society. Warning that "digital era politicians ignore technology at their peril," she drew upon statistics and narrative to outline the importance of accessible, upgraded broadband connectivity for social and economic development. One of Canada's leading experts on the emerging digital economy, Middleton has revealed weaknesses in current Canadian approaches to telecommunications policy development. Middleton gave testimony to the House of Commons Standing Committee on Industry, Science and Technology Study of Broadband and Internet Access Across Canada in 2013.

NETWORKING & PARTNERSHIPS

Partnerships with industry are integral to GRAND's model of collaborative, receptor-driven research. The network partnered with 184 companies, universities, government agencies at the federal,

provincial, and local levels, as well as non-governmental organizations, comprising a wide-range of relevant receptor sectors where GRAND research has impact. (A complete list of our partners is presented below.)

NCE PARTNERSHIPS – GRAND was a key partner for two CECRs (Centres of Excellence for Commercialization and Research): Wavefront and the Canadian Digital Media Network (CDMN). GRAND and CDMN co-located their major annual gatherings, GRAND 2013 and Canada 3.0, in May 2013. GRAND and CDMN have directors on each other's Boards, as do GRAND and Wavefront, and meet frequently to collaborate on initiatives. GRAND's NEUROGAME project, in partnership with the NeuroDevNet NCE, explored therapeutic applications of game technology to treat neurodevelopmental disorders such as cerebral palsy. (Read more about this project in the section "Research Excellence".)

GRAND 2014

**Ottawa Ontario
May 14-16**

GRAND's fifth and final annual conference hosted a wide-range of talks and panel discussions with academic and industry experts. GRAND Experiences, a new interactive portion of the annual Poster and Demo session, engaged attendees with hands-on presentations of emerging tech, design artifacts, or artworks. Two RNote (Research Notes) papers presented at GRAND 2014 went on to win first and second prizes at the ACM Student Research Competition hosted at SIGGRAPH 2014. The 2014 Canadian Digital Media Pioneer Awards went to Drs. Nestor Burtnyk, Ken Pulfer, and Marceli Wein (National Research Council); Nancy Knowlton and David Martin (SMART Technologies Inc.); and Dr. Barry Wellman (U of T).

$3.5M — In-Kind

$8.5M — Cash

Total Partner Contributions: $12M

SYNTHIUS – SPARK-GAP projects represent the natural evolution of GRAND's networking activities. These large-scale, high profile collaborations formalize relationships between researchers and partners who have identified a common, challenging, high-risk, and high-impact research objective that spans the competencies of the GRAND network and beyond.

The ambitious SPARK-GAP project SYNTHIUS is a multi-university collaboration with software giant Autodesk to develop a comprehensive and integrated digital human model. The project merged six cutting-edge research areas within GRAND, each exploring a core aspect of humans: physical form, motor control, biomechanics, cognition, emotion, and social behaviour. Intended as a much-needed catalyst for translating some of Canada's leading research in human modeling into new applications, SYNTHIUS has potential uses in advancing health sciences, education, ergonomics, animation, and design.

GRAND is providing great access to the research community in Canada. It would be a lot of work to find out who are the key people in all these different areas [without GRAND]. – Azam Khan, Autodesk Research

MANAGEMENT OF THE NETWORK

Managing a complex multidisciplinary, multi-institutional network such as GRAND presents a formidable challenge – but one ripe for innovation. Through the network's MEOW (Media Enabled Organizational Workflow) project led by Eleni Stroulia at the University of Alberta, researchers and programmers developed a web-based platform designed to streamline the administration of NCEs. Over the life of GRAND, the Forum evolved into an indispensable tool. It supported hundreds

of scholars and network staff in everything from progress reports and research budgets, to data collection on members and projects, to social networking, surveys, and high-level data analysis. Data gathered through the Forum was also studied in GRAND's self-reflective NAVEL (Network Assessment and Validation for Effective Leadership) project. AGE-WELL, a national research network focused on technology and aging, is using the Forum to manage its own administrative processes and promote collaboration among network researchers.

DAVID TURNER

Software Developer, Department of Computing Science, University of Alberta

Since GRAND's earliest days, David Turner played a main role in supporting research collaboration across the network. David joined GRAND as a U of A computing science undergrad to work on an ambitious web-based platform called the "Forum" – part of GRAND's MEOW (Media Enabled Organizational Workflow) project. He was involved with nearly every piece of the platform's coding, and users came to count on his expertise and problem-solving skills. Through his ingenuity, the Forum evolved into a system unlike any other used by NCEs: a one-stop portal supporting hundreds of scholars and network staff in everything from progress reports and budgets, to data collection on network activities, to social networking, surveys, and high-level data analysis.

GRAND PARTNERS

I have gained a lot by being a part of MEOW. Since my work on the Forum has involved the full development stack …
I have learned a lot about many new technologies and software engineering practices. – David Turner

UNIVERSITIES
Brock University
Carleton University
Concordia Univerity
Dalhousie University
École de technologie supérieure
Emily Carr University of Art & Design
McGill University
McMaster University
Memorial University of Newfoundland
NSCAD University
OCAD University
Queen's University
Ryerson University
Saarland University
Simon Fraser University
Trinity College Dublin
University of Alberta
University of British Columbia
University of Calgary
University of Canterbury
University of Lethbridge
University of Guelph
University of Manitoba
University of Maryland
University of Michigan
Université de Montréal
UOIT University
University of Ottawa
University of Prince Edward Island
University of Saskatchewan
University of Toronto
University of Victoria
University of Washington
University of Waterloo
University of Western Ontario
Wilfrid Laurier University
York University

INDUSTRIES
3D3 Solutions
Adobe Systems
AeroInfo Systems
AMD
Apple Canada
AT&T Labs Research
Autodesk Canada
Ayogo Inc.
BC Hydro Powersmart
Bentley Systems
Boeing
BravoFACT!
Byye Management
CA Technologies
CAE Professional Services
Canada Goose
Carré Technologies
CBC
Chiu Hippman Engineering Inc.
Christie Digital
Conversion Works
Coole Immersive
Decode Global
Digital Extremes
Disney Research
Durante Kreuk LA
Electronic Arts
Elsevier Science Ltd.
Embedded Automation Inc.
Execution Labs
Firsthand Technologies, Inc.
FortisBC
Funcom
Fundacion Telefonica
Gerri Sinclair Group
GestureTek
Globe and Mail
God Mode Games
Google Inc.
Hewlett Packard Inc.
IBM Centre for Advanced Studies
IBM T.J. Watson Research Centre
Ikamobile
Immersion Canada
InNOVAcorp
Intel Corporation
InteraXon
Janro Imaging Laboratories
Kitfox Games
Kiwi Wearables
KO-OP Mode
Komodo OpenLabs
Lab126
Lightning Platform
MapleSoft
Microsoft Corporation
Minority Media Inc.
Moscone Brothers
Motorola Solutions
Nognz Brain Fitness

NCE RCE

Nokia Canada

OpenText

Perimeter Partners

Precision Conference Solutions

Quillsoft Ltd

Ramius Corporation

RCI Solar

Relic Entertainment

Research in Motion

Revera

SAP

Schneider Electric

Science World at Telus World of Science

Seaspan Ferries

Side Effects Software

Sim Digital

Smallworks Studios and Laneway Housing Inc.

SMART Technologies Inc.

SoligSoft

ST Microelectronics

State Farm Insurance

TAD Inc.

Telus

Terasen Gas

TerraSol Energy

The Gerri Sinclair Group

The Globe and Mail

Thought Technology Ltd.

Upfront Analytics

Xerox PARC

Yahoo! Research

FEDERAL DEPARTMENTS AND AGENCIES

Canada Council for the Arts

Department of National Defence

FedDev Ontario

French Consulate

Heritage Canada

Office of the Privacy Commissioner of Canada

Parks Canada

United States Army

US National Institute of Standards & Technology

Western Economic Diversification

PROVINCIAL DEPARTMENTS AND AGENCIES

Alberta Health & Wellness

Alberta Innovates

BC Immigrant Investment Fund and BC Renaissance Capital

Ministère de l'Éducation, du Loisir et du Sport (Québec)

Nova Scotia Research and Innovation Trust

Ontario Research Fund

Ontario Science Centre

Province of Manitoba (Manitoba Centres of Excellence)

Vancouver General Hospital

OTHER ORGANIZATIONS

ADD Centre & Biofeedback Institute

Baycrest Centre for Geriatric Care

Canadian Digital Media Network

Canadian Film Centre Media Lab

Canadian Surgical Technologies and Advanced Robotics (Education)

Centennial College

City of Vancouver

CIV-DDD

Dawson CEGEP

Digital Humanities Summer Institute

Entertainment Software Association of Canada

Fasken Martineau Dumoulin LLP

Fraser Health Authority

Gaîté lyrique

Hexagram Institute

Hospital for Sick Children

IATSE 669

Le Centre Jacques Cartier

London Health Sciences Centre

Masters of Digital Media Program, Great Northern Way Campus (Education)

Michael Smith Foundation for Health Research

Mitacs

National Science Foundation

NeuroDevNet

New York University - Steinhardt

Pacific Institute for Climate Solutions

Pain Management Centre

Pain Society of BC

PricewaterhouseCoopers

Royal College of Physicians & Surgeons

Specialist Services Committee of the BC Medical Association

Spina Bifida and Hydrocephalus Association

SurfNet

Technoculture Art & Games Research Centre

The Arthritis Society

Ville de Montréal

Wavefront

Networks of Centres of Excellence of Canada | Réseaux de centres d'excellence du Canada

2009-2015

NSERC CRSNG

Social Sciences and Humanities Research Council of Canada

Conseil de recherches en sciences humaines du Canada

CIHR IRSC
Canadian Institutes of Health Research | Instituts de recherche en santé du Canada

UBC

The University of British Columbia was the host institution of the GRAND NCE.

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