



UNIVERSITY OF
CALGARY

Human Dynamics in a Changing World: Smart and Secure Cities, Societies, and Cultures

A Research Strategy
December 2015

Changing the world for the better

Over 50 per cent of the world's 7.2 billion people live in cities, and in a few short decades the world's population is expected to exceed 10 billion. This rapid and geographically unequal population growth, combined with increasing resource scarcity, makes it urgent to rethink our understanding of social interactions and organizations, and to offer innovative ways to make our social, political, cultural and natural systems more sustainable. In practical terms, our current global challenges require the development of creative ideas as to how to best address our increasing needs — including housing, education, healthcare, security, and employment.

The world in which we live is more interconnected than ever before, creating novel opportunities for cross-cultural understanding that can help address our needs through unprecedented global collaboration. People, goods, ideas and images circulate around the planet with increasing ease and speed, bringing into contact conflicting cultural beliefs and attitudes that can change and challenge previous definitions of social norms, community, and wellbeing. Migration patterns today reflect world economic trends and political and humanitarian crises, and are bringing people together in ways unimaginable 30 years ago, giving new meaning to the word 'community'.

Although technological revolutions have made the world seem smaller, these newfound intimacies have brought to the fore privacy and security issues that in turn are influencing politics and policies — from the level of personal information in the Internet age and security in the urban environment, to national security on the international stage. If we want to create a more safe, secure, peaceful and prosperous future for generations to come, we must forge solutions to our problems together.

The rapid pace of change in our world presents challenges to our ability to adapt. Increasing population size and density have an impact on housing, food supply, transportation, education, and health. Increasing diversity in turn has an impact on cultural norms, notions of community, and ideas of citizenship.

The strategic research theme *Human Dynamics in a Changing World* encompasses how humans adapt to rapid change. Cities that are smart, safe and secure, and possess a vibrant culture, will prosper and grow because they attract diverse populations looking for desirable places to live and work.

Navigating the rapid rate of change requires scientific, technical and cultural competence. Incorporating but extending beyond cross-cultural exchange, cultural competence combines intellectual abilities (inquiry, interrogation, and critical analysis) with emotional processes (perception, imagination, empathy) to enable responsible engagement with the world. In this sense, cultural competence lays the foundation for both personal and public creativity, for identifying and assessing social challenges, and for making innovative and enriching contributions to

individual wellness and social progress. University of Calgary researchers apply their expertise in contexts such as environmental issues, governance, urban design, cyber-security, population and mental health, social dynamics, questions of philosophy and faith, emerging technologies and new media, and fine and performing arts.

The research expertise of our scholars across all disciplines advances our understanding of the changes by exploring and commenting on past and present challenges that have affected society. Our scholars recognize and contribute to the vitality of national and urban cultures, turn smart cities into livable spaces, and analyze the multiple dimensions of poverty, urban growth, and sustainable resource use.



Managing change

Throughout human prehistory and history, we have adapted to change. Long-term adaptations have been accomplished through biological and physiological means, but the key to our success as a species lies in our capacity to use social and cultural innovations to manage change in our physical and cultural environment and to shape the society in which we want to live.

Today, adaptation is made more challenging due to the rapid pace of change, driven in part by the tremendous increase in the size of the human population. We must learn how to manage new and serious challenges to our societies and cultural institutions as well as to our health. From the challenge of ensuring food security across the world to concerns about Internet security, we need to better understand the nature of these challenges and the processes required to meet them. For example, increasing urbanization and mechanization have led to a dramatic decrease in physical activity amongst humans, with resulting obesity and other health issues.

The University of Calgary's research strategy *Human Dynamics in a Changing World* will draw on our extensive research capacity to explore these challenges and deliver solutions. Specifically, the research strategy is organized around three sub-themes that will bring researchers from various disciplines together to address the identified challenges:

- **Smart Cities** focuses on human interactions in urban environments with special focus on Calgary. This includes the planning and design of buildings, urban spaces, communities, transportation and service infrastructures for health and resilience. Critical issues in the production of smart cities include design for sustainability, urban governance, social cohesion, and expanded opportunities for creative inquiry, exchange and collaboration.
- **Secure Societies** examines how individual and collective needs can be met in a sustainable, equitable fashion, and analyses how the associated challenges and struggles have

manifested themselves across human history and human societies. This includes national security, cyber security, and how we respond to threats to institutions and infrastructure, while at the same time protecting the human right to security from unwarranted government and corporate intrusions.

- **Cultural Understanding** focuses on the interactions of people from diverse backgrounds, traces the roots of different cultures, languages, religions and cultural interactions in the past, and addresses current challenges of integrating diverse individuals and groups into a well-functioning society that respects cultural diversity while encouraging a shared national identity.

As researchers across the country consider the challenges that emerge from these sub-themes, we are poised to answer them through the development of this research strategy and our **confederation of scholars**, a network of interdisciplinary researchers that is employing collaboration and innovative thinking to address the broad-reaching questions facing society.

Urban Space and the City of Calgary

Calgary's rapid growth and increasing diversity lends itself as a test to study *Human Dynamics in a Changing World*. With long-term and continued increase in population, the city presents a microcosm of the effects of rapid growth in a globalized and interconnected world. People from across Canada and all over the world move to Calgary because of its strong economy and positive employment prospects. This migration, as well as global flows of information, creates a very diverse and cosmopolitan population with a wide range of cultural expression and artistic activity. Rapid growth and global interconnectedness of cities necessitates the development of **smart cities**.

Calgary boasts one of the best-educated populations anywhere in North America. It is also a highly connected city. Most Calgarians have access to broadband Internet connectivity; across the city, a total of 91.8 per cent of households have access to the Internet at home, which is significantly higher than the overall Canadian statistic of 82.5 per cent. Therefore, Internet security and privacy — key components of **secure societies** — are of great interest to the larger community.





The city's population includes people of 240 different ethnic origins and is ranked third across the country in terms of the proportion of people who belong to visible minority groups. More than a quarter of the city's current population (26.2 per cent) consists of people born outside of Canada. With early settlement over 13,000 years ago by First Nations peoples, followed much later by immigration from Great Britain and other European countries (1800s), and more recently from the Philippines, India, China, Pakistan, the U.S. and other countries, the region's cultural diversity delivers a rich tapestry in which to examine ***cultural understanding***.

On a larger scale, challenges associated with climate change are a concern in Calgary. Changes in precipitation and temperature influence severe weather events locally. We have economic and social connections to northern and remote communities that are particularly impacted by climate change. Our researchers are well positioned to study the effects of diminishing sea ice and permafrost, and the resulting social, political and legal implications on traditional modes of subsistence, transportation of goods, and increasing access (and potentially pollution) resulting from the opening of the Northwest Passage.

From studying the flow of traffic to quantum-based secure communication systems, researchers at the University of Calgary are exploring how to improve our lives. With nearly 200 scholars engaged in this research theme and dozens of partnerships in the community, we are actively involved in developing solutions to a number of challenges stemming from our rapidly changing world.

Multidisciplinary research at the Institute for Security, Privacy and Information Assurance (ISPIA) is advancing work in software security, malicious code, and network and operating systems security, while interdisciplinary work underway at the O'Brien Institute of Public Health is improving health care systems.

Our many strong connections in the community include the Urban Alliance, a unique partnership with The City of Calgary that includes a state-of-the-art wastewater treatment research facility (Advancing Canadian Wastewater Assets (ACWA)), as well as research in transportation planning, urban design and planning — including walkability, resilient design, healthy cities and spatial equity through the Urban Lab and the Design Research Innovation Lab. We also work in cooperation with the Calgary Board of Education on best practices for educating children from diverse backgrounds. A joint initiative involving the Calgary Police, our Faculty of Social Work and several other stakeholder groups addresses the challenge of creating positive experiences for youth from immigrant populations to counteract participation in gangs.

With its rich diversity, our increasingly urbanized environment fuels cultural production such as art, cinema, dance, music and theatre. University of Calgary researchers engage in collaborations with Wordfest, the Calgary International Film Festival and local galleries, and performance venues. The Calgary Distinguished Writers Program strives to advance the careers of Canadian writers, and the School of Creative and Performing Arts is breaking new ground in terms of performance as research and practice-based research methodologies.

We have the capacity, the interdisciplinary knowledge and the research strategy to explore and advance how we live and adapt in our world as it rapidly changes around us.





Smart cities

In 2008, for the first time in human history, the number of people living in cities or towns surpassed 50 per cent of the world's population. By 2030, it is expected that nearly 5 billion people will live in urban environments around the world¹.

We urgently need to create more sustainable, smart and resilient cities. Sustainability refers to the notion, established by the United Nations' Brundtland Commission (1987)², that development must meet the needs of the present without compromising the ability of future generations to meet their own needs. The notion of sustainability commonly addresses environmental, economic, and social sustainability, as well as the governance institutions and processes they require. The notion of smart cities commonly refers to the use of digital and other technologies to enhance health and wellbeing, reduce environmental impacts, increase participation, and improve productivity. Smart cities are designed to optimize human health and create the most efficient systems. Transportation networks provide important connections for work, family, education and health, but they may also create barriers, pollution, lost productivity and stress. The notion of resilient cities commonly refers to the ability of cities to withstand or recover from external shocks, whether environmental or economic. These three concepts, while distinct, are clearly intertwined.

As we strive toward sustainable, smart, resilient and culturally dynamic cities, we must be aware of the possibility of creating unintended consequences for some segments of society, such as the displacement of some of society's most vulnerable groups through sustainable development and the exclusion of some segments of society from smart initiatives. The creation of new environmental problems may be an unintended consequence of efforts to solve other environmental problems.

Urbanization brings people of different cultural backgrounds together, allowing for fertile exchanges of ideas and learning through work, politics, and creative and performing arts, but can also result in conflicts with respect to education, gender roles, religion, laws and politics. Urban institutions have to highlight and foster the positive aspects and potential of a multicultural society while mitigating potential problems.

Our strengths

Researchers at the University of Calgary have demonstrated expertise in architecture, design, planning, sustainability, transportation and health in the urban environment. Cross-disciplinary evidence-based research conducted in the Faculty of Environmental Design (EVDS) and the O'Brien Institute for Public Health examines human activities in urban spaces and seeks to maximize activity within well-planned communities. Behavioural research on how people find their way through cities and behavioural models for the design of transportation networks incorporate psychology and engineering to improve the urban experience.

Key initiatives, research groups and centres

- **Urban Alliance**

This partnership between The City of Calgary and the University of Calgary matches issues identified by the city with researchers who have the expertise to address these issues.

¹ www.unfpa.org/pds/urbanization

² www.un-documents.net/our-common-future.pdf

University, City and industry partners collaborate on aging-in-place initiative

By 2030, it is estimated that four out of every five new households will be formed by people over 65. Most houses are designed for people in good health and can be difficult, isolating, even dangerous places for older people to live. If this situation remains unchanged, the majority of Canadian seniors (9.6 million by 2036) may be forced out of their homes and into communal settings such as long-term care facilities. This will adversely affect their quality of life and further stress an already overburdened health care system.

Aging-in-place is concept that seeks to design spaces and environments that allow older people to live in their homes and communities for as long as possible. This research project — part of the *makeCalgary* initiative — developed cutting-edge design strategies for a small laneway house that could be constructed in the backyard of a standard Calgary residential lot. It is a unique community-based research collaboration between architecture and medical researchers at the University of Calgary and industry partners (Homes by Avi and the Alberta Real Estate Foundation).

An Urban Alliance initiative, *makeCalgary* is a community-based research platform managed by the University of Calgary's Faculty of Environmental Design. It brings together researchers, students, industry professionals, and community partners to help design a bright future for Canada's most enterprising city, with research organized into four design criteria that define a great city — resilience, health, vibrancy, and equitability.



- **Advancing Canadian Wastewater Assets (ACWA)**

A partnership with The City of Calgary that is developing wastewater treatment technologies to remove existing and emerging contaminants as part of improving ecosystem and human health. ACWA brings researchers, practitioners and industry together to solve important problems facing cities everywhere.

- **makeCalgary**

A community-based research platform in EVDS in which researchers, graduate students, industry and community partners help design Calgary's future. The research is organized into four criteria that define a great city: resiliency, health, vibrance, and equity.



- **Urban Lab**

This group in EVDS works with other research groups on campus and with community associations, small municipalities and with The City of Calgary through the Urban Alliance. It focuses on complex issues regarding urban planning, design and development that involve a strong applied research component.

- **Design Research Innovation Lab (DRI)**

A 163 m² black-box test-bed environment used by architecture researchers to assemble full-scale mock-ups of architectural spaces and building components. It is equipped with human factors observational equipment that assesses the acceptability and functionality of the mock-ups.

- **Laboratory for Integrative Design (LID)**

This interdisciplinary research group explores design, its allied disciplines engineering and production, as well as computer science, material science, mathematics and biology. LID uses algorithmic thinking, biomimicry, computation, digital fabrication, material exploration, and/or performance analyses to discover and create processes, techniques, and products that optimize building performance.

- **Cities, Policy & Planning Lab**

Engages graduate students, faculty, professional planners, social workers and community organizations in collaborative projects exploring sustainable communities. These communities build on their assets, value healthy ecosystems, use resources efficiently, and actively seek to retain and enhance a locally based economy.

- **Cenovus Spo'pi Solar House**

The only Canadian entry in the U.S. Department of Energy's 2011 Solar Decathlon competition in Washington, D.C, was designed and built by students. The house is net-zero, producing as much electricity as it consumes, and is a hub for solar energy and sustainability research on campus.

- **The City of Calgary Expert Management Panel on River Flood Mitigation**

This initiative included 12 researchers from the faculties of Arts, Science, EVDS, Schulich School of Engineering and the Haskayne School of Business. The panel presented a list of recommendations on flood/climate-related disaster mitigation and is collaborating to address 10 of the recommendations and help form a national flood risk management-networking group.



- **O'Brien Institute for Public Health**
A research group where interdisciplinary work focuses on improving health-care systems and preventing chronic disease. Researchers work on projects such as injury prevention in sport, national food and vaccine policies, government decisions affecting drug prices, and developing tools to care for patients from hospitals to community health providers working with people in their homes. Institute members include researchers from a number of faculties, Alberta Health Services and The City of Calgary.
- **Population Health and Inequities Research Centre (PHIRC)**
Builds capacity to improve population health outcomes and reduce inequity in people's daily lives. It includes researchers from the social sciences, the humanities and the health sciences along with researchers and decision-makers with Alberta Health Services, other governmental organizations, and non-governmental organizations.
- **Traffic Laboratory**
Researchers in this facility, based in the Schulich School of Engineering, collect and analyze live traffic video and information from sensors along Deerfoot Trail to find ways to increase road safety, ease congestion and develop new solutions for traffic issues in Alberta.



- **Sport Technology Research Laboratory**
Investigates and enhances the impact of technology on performance and learning. The lab liaises with organizations and individuals on and off campus to promote human performance and learning technology and works with industry to develop and disseminate technology-based research and resources.
- **Human Performance Laboratory (HPL)**
A group of full-time and adjunct faculty members with varying research backgrounds and scientific interests. The HPL objective is to be a leader in both basic and applied research relating to human neuro-musculo-skeletal health and well-being, from birth to advanced age. The research is interdisciplinary and members are focused on the common goal of wellness across the life span.
- **Urban Studies Research Group (USRG)**
A broad interdisciplinary group of urban scholars associated with the Urban Studies Program, housed in the Department of Geography. The group fosters a variety of research collaborations, from the local to the global, and organizes speaker series and other forms of intellectual exchange.
- **International Institute for Infrastructure Resilience and Reconstruction (IIIRR)**
A multi-university international consortium that provides overall leadership in research, education, planning, design and implementation for mitigation of the impact of natural disasters and infrastructure renewal and reconstruction projects in tsunami-affected or underdeveloped regions.
- **Canadian Institute of Resources Law (CIRL)**
Explores environmental and climate-change strategies to incentivize clean transport and healthy cities.

Secure societies

Security is a broad concept, ranging from the safety and privacy of the individual to the security of communities, societies and regions around the world. The explosion of available information through the Internet presents challenges to individual privacy, national security, business, banking, and information storage and exchange. Cyber-security and privacy practice must keep pace with advances in technology.

The security of societies also depends on the resilience of national political systems and on the maintenance of economic prosperity to ensure acceptable levels of welfare and state power. These in turn offer the potential that societies will sustain shared values and cultural identity, thereby preserving the local and global biosphere on which all human endeavours depend. The erosion of any of the six supporting pillars of society — military, political, economic, legal, social and environmental — may undermine the stability and security of a society.

Our strengths

Our researchers have expertise in political, legal and historical aspects of international relations, security and domestic policies. These researchers work in cooperation with others who have expertise in cybersecurity, quantum computing and biometric methods for identification.

Key initiatives, research groups and centres

- **Institute for Security, Privacy and Information Assurance (ISPIA)**

Addresses a broad spectrum of areas ranging from cryptography and quantum information processing to software security, malicious code, network and operating systems security, and technical and legal issues surrounding privacy and digital rights.

- **Centre for Military, Security and Strategic Studies (CMSS)**

Draws from a variety of disciplines, including anthropology, political science, history, religious studies, economics, and computer science and has ties to the Canadian Forces and the Department of National Defence. One of the leading centres of excellence in military and strategic studies in North America, CMSS explores defence and security issues in Canada and internationally.

- **Biometric Technologies Laboratory**

Focuses on modeling and simulation of biometrics, human physiological characteristics (facial image, iris or retina pattern, thermal image of the body, fingerprint, hand- and foot-print, ear) and behavioural characteristics (voice pattern, handwritten signature, keystroke pattern, gait, mouse-usage dynamics).

- **Institute for Quantum Science and Technology (IQST)**

This group is the only one of its kind in Western Canada and the third of this scope in Canada. Focused on quantum optics, quantum information, molecular modelling and nanotechnology, these researchers investigate, control, and exploit natural phenomena at small scales and high energies where standard classical science does not apply.

- **Consortium for Peace Studies (CPS)**

This group is concerned with war and peace, human security to meet basic human needs, violence and nonviolence, conflict and conflict resolution as well as post-conflict reconstruction and reconciliation. Research takes place from the macro-level examining international peace issues, to the micro-level examining internal conflict and peace in the individual. The CPS unites peace researchers in many fields of study. Through international research, publication, public presentations and celebration of peace activists, the CPS strives to promote peace studies and educate the community about peace work.

- **iCORE Information Security Laboratory (iCIS)**

Focuses on research and development in all aspects of information and communication security and privacy. The iCIS Lab includes academic staff, researchers and students with interests in theoretical and practical aspects of information security. iCIS promotes collaborative and industry-driven research.

- **Interactions Lab**

The Institute for Security, Privacy and Information Assurance (ISPIA) at the University of Calgary and the Calgary Police Service (CPS) have joined forces to try to fight cyber-criminals.



- **iRadio Lab**

Develops knowledge and innovative enabling technologies relevant to intelligent and green radio systems targeting the future generations of wireless and satellite communication, covering the radiofrequency to millimetre-wave bands.

- **Alberta Civil Liberties Research Centre (ACLRC)**

Undertakes research on contemporary civil liberties and human rights issues that are of concern to Albertans. The projects are diverse – from proposals for reform of human rights legislation, to a report on citizen complaints about police conduct, to a manual for lawyers who represent mentally disabled clients.

University collaborates with Calgary Police Service to fight cybercrime

The Institute for Security, Privacy and Information Assurance (ISPIA) at the University of Calgary and the Calgary Police Service (CPS) have joined forces to try to fight cyber-criminals. ISPIA's security expertise is helping the CPS Cybercrime Unit in areas such as cryptography and system security, including the analysis of devices and data.

The partnership is based on a common interest in protecting privacy and ensuring a secure online environment for Canadians. As criminals become increasingly sophisticated in their efforts to exploit loopholes in computer systems, security experts are also getting smarter, identifying potential weaknesses and methods of protection.



ISPIA is considering developing short courses about trends in information security that could help CPS members update their skills and stay connected to the latest research. In turn, the police can give guest lectures to computer science students to share hands-on experience in everything from extracting information from mobile devices to searching a hard drive when judicial authorization exists.



Cultural understanding

Cultural institutions are an important part of individual and collective identity. When people of different cultural backgrounds come together to live, work and learn, their various institutions, languages and customs are an important consideration. How have people adapted to cultural change, mitigated the impact of migration, and integrated into new societies? Pluralist societies define themselves by their inclusiveness towards minorities, yet the definition of the space to which minority citizens are entitled in a democracy requires continuous debate and discussion.

Immigration is a central tenet in this research sub-theme. Immigration brings together people who have very different backgrounds, including language, religion, ways of interacting in business, raising a family and educating their children. New waves of immigrants bring a diversity of social, economic and political experiences as well as histories and gender attitudes from their countries of origin.

Rapid changes in technology may also create new inequalities. Both economic as well as generational factors affect the ways in which information technologies are consumed, produced and shared.

Our strengths

Researchers in cultural understanding explore human cultural institutions, including law, governance, religion, language, education and the historical perspectives on institutions. Others work on psychology and the limits of our ability to adapt, including depression and feelings of alienation.

Key initiatives, research groups and centres

- **Identity-based Wrap-around Intervention Project (Faculty of Social Work)**
Engages immigrant youth and prevents gang involvement.
- **Arctic Institute of North America (AINA)**
Advances the study of the North American and circumpolar Arctic through the natural and social sciences, the arts and humanities. Its researchers acquire, preserve and disseminate information on physical, environmental and social conditions in the North.
- **Circum-Arctic Health Project: Northern and Remote Community Health and Resilience Considering Economic and Environmental Changes**
Seeks to understand and respond to health opportunities and challenges in the northern and remote regions of Canada and the circum-Arctic, and to explore community health and resilience given economic and environmental change.
- **Calgary Anti-Racism Education (CARED)**
Consists of six women from the anti-racism community in Calgary. Each member brings her own knowledge of racism and anti-racism and a commitment to anti-racism activism.

- **Language Research Centre (LRC)**
Provides leadership in research on language acquisition, learning and teaching, the effective use of technologies, and policy-making.
- **Shift: The Project to End Domestic Violence**
Focused on significantly reducing and preventing domestic violence in Alberta using a primary prevention approach to stop first-time victimization and perpetration of domestic violence. The name Shift represents the spirit of this innovative project, designed to create transformational change using a primary prevention approach to stop first-time victimization and perpetration of domestic violence.
- **Werklund Youth Leadership Centre (YLC)**
Designs, leads, advocates for and connects to initiatives that support youth leaders and foster youth leadership knowledge, skills, and abilities.
- **Calgary Institute for the Humanities (CIH)**
Supports multidisciplinary research in languages, literature and philosophy as well as in philosophical and historical aspects of the social sciences, sciences, arts and professional studies.



- **School of Creative and Performing Arts**
Provides a multi- and interdisciplinary platform for the focused and innovative exploration of social, cultural, ideological and aesthetic aspects of contemporary social life through its diverse programs.
- **Centre for Research in the Fine Arts (CRFA)**
Fosters innovative research in the visual and performing arts within the Faculty of Arts, awarding small grants in support of creative and scholarly research, whether individual or collaborative, disciplinary or interdisciplinary.
- **Informatics Research Centre**
Explores any use of information and communication technology between and within organizations, including business-to-business (B2B) electronic commerce (also known as e-business), business-to-consumer (B2C) electronic commerce, electronic markets, and inter-organizational information systems (IOS), information technology (IT)-enabled business process reengineering, IT-supported decision-making, information infrastructure, the diffusion of new information and communications technologies, design of contractual infrastructures for interoperability of IT, the impact of IT on organizations, markets, and public policy, and the implications for leadership and governance of IT infrastructure and services.
- **Institute for Gender Research (IGR)**
Dedicated to the study of gender and sexual diversity, with a mission to foster and provoke transformative gender research within the University of Calgary and its community stakeholders.
- **Latin American Research Centre (LARC)**
Engages students, faculty and the general public on issues related to Latin America through a variety of activities, including film screenings and festivals, a speaker series, publications on current events, conferences and workshops, and its support of the Latin American and Caribbean Studies book series at the University of Calgary Press.

- **Research Group in Ethical Theory**

Located within the Department of Philosophy, this group provides a forum in which faculty working in ethics can help each other with ongoing research and inquiry.

- **Creating Opportunities for Resilience and Engagement (CORE)**

This research project in Southern Alberta schools explores the best ways for schools to help students feel safe, valued and connected. By making schools more welcoming, CORE hopes to decrease rates of childhood anxiety and depression and improve learning.

- **History of Intellectual Culture**

An international peer-reviewed open-access academic electronic journal that provides a forum for publication and discussion of original research on the socio-historical contexts of ideas and ideologies and their relationships to community and state formation, physical environments, human and institutional agency, personal and collective identity, and lived experience.

- **Alberta Civil Liberties Research Centre and the Canadian Research Institute for Law and the Family**

Engages in research and public education on human rights, aboriginal law, international development law and family violence.

Developing cultural competence is a key endeavor of the humanities, social sciences and fine arts. The research questions and methodologies in these disciplines provide a diverse means of analyzing cultural production, interaction, and conflict, with the aim of creating opportunities for citizens' full engagement with and participation in society.

Understanding the culture of youth violence is the first step

Hieu Van Ngo, Faculty of Social Work, captured dozens of stories from immigrants and first-generation Canadians as he researched what drove them into gang life, discovering that an unravelling of their identities, absence of cultural heritage and lack of citizenship in Canada were factors. He then expanded the scope of his research with \$5.3-million in federal funding that he is using to prevent children of immigrant families from setting out on a life of crime.

Ngo is now working with police, schools, immigrant services and cultural organizations to reach 140 to 150 people aged 12 to 24, who are either connected to gangs or at risk of involvement. Counsellors, teachers and mentors will all work with the youngsters to offer life skills, employment training, academic help, social activities and volunteer opportunities. He is focusing on children of immigrants and visible minorities because they are most vulnerable.

Known for its tough-on-crime approach, the federal government awarded the grant through its proactive Public Safety Canada's National Crime Prevention Centre. Ngo's grant is one of the largest received by the faculty and could produce an intervention program not just for Calgary, but Canada. Today, most youth gang intervention programs are modelled after ones used in the U.S., but experts aren't sure they work or reflect Canada's multicultural identity. Calgary's Centre for Newcomers is working with Ngo to augment what it is already doing to help troubled youth.



Smart cities

Cities face unprecedented challenges resulting from population growth, migration, changing demographic structure, socio-economic polarization, uneven development and environmental stress. This is resulting in increased pressure on all social and physical infrastructure including housing, health, social services, education, governance, public and private buildings, urban and suburban neighborhoods, landscape/open space systems and urban ecologies, transportation, water, wastewater, communication, energy and other city services and functions.

The concept of smart cities attempts to tackle these challenges by making cities more connected, efficient, livable, sustainable, equitable, accessible, resilient and safe, and by facilitating cultural competence within their citizens. Transitions to smart cities must be viewed as processes that simultaneously concern social systems, governance systems, environmental systems, networks for cultural expression and physical design systems — including both the public and private spaces of everyday life and the extensive infrastructure systems that connect people to each other and the environmental systems on which they depend.

The social infrastructure of smart cities: creating livable and resilient cities that promote health, social equity, efficiency, connectivity, mobility, and public engagement

Smart cities are socio-technical systems. Technologies must be understood broadly, including not only information and communication technologies (ICTs), transportation technologies, energy systems, etc., but also all tools, devices, and material structures that affect human activities and capacities. Technologies shape social practices just as social practices shape the use and adoption of technologies. As such, we must examine a wide

range of social processes and effects implicated in smart cities transitions. Key questions include:

- How do we ensure the benefits of smart technologies are broadly and equitably shared?
- How do we ensure that the adoption of smart technologies is clearly beneficial, without unintended negative consequences?
- How do we ensure the smart design of the built environment — the ‘bones’ of our cities — fosters sociability, inclusion, livability, resiliency, connection, health, freedom of expression and belonging?
- How can we use social media and big data resources to improve the quality and effectiveness of the built environment?
- How do we design cities that function efficiently, minimizing our consumption of resources and production of waste?
- How do we design cities with coherent urban form that fosters safety, vitality, and greater physical activity for all citizens?
- How do we ensure that our cities have appropriate landscape and open space areas to ensure both citizen enjoyment and ecological diversity?

- How do we continue to develop and grow our cities in an environmentally responsible way to ensure low-impact development, and responsible urban ecological management with awareness of the impact of urbanization on surrounding rural areas?
- How do we ensure that all segments of society, including the elderly, immigrants, and the poor have access to high-quality affordable homes that are safe, resilient, efficient, and uplifting places to live with a minimal environmental impact?
- What are the impacts of smart city design and ICTs on elderly and less privileged populations and how can we ensure that they have equal access to enhanced connectivity and mobility?
- How do we create cities that foster the meaningful participation of all citizens in the institutions of democratic governance?
- How do we counteract trends toward greater inequality and polarization?
- How do we create inclusive cities that foster collaborative decision-making?
- How can smart cities foster greater social cohesion and social capital?
- How do we acknowledge and expand the role of artistic activity and cultural competence in the transition to smart cities?
- How do we create cities that provide high-quality education, training opportunities, cultural competence and exposure to the arts for all citizens?
- How do we create smart and compact cities that integrate transit-oriented development (TOD) and pedestrian-oriented development (POD), encouraging active and sustainable modes of transportation such as transit, biking and walking?
- Which effects may emerging modes of transportation have on urban growth and how can they be employed to create better functioning, more sustainable cities?



The physical infrastructure of smart cities: creating smart and resilient urban design, transportation systems, energy systems, water systems, and buildings

Improved analysis, performance monitoring, operation management, service delivery, communication, planning, design, and governance are critical to smart city development. Smart cities harness advanced sensing, positioning and information and communication technologies to address urban challenges by simultaneously improving the efficiency of infrastructure, reducing ecological footprints, and actively engaging its citizens. Key research questions pertaining to the following physical infrastructure of smart cities include:

- Transportation infrastructure:
 - How do we update transport analysis, planning, optimization and simulation to better integrate and understand the impact of ICTs on the transportation systems, including road and rail transportation, public transit and paratransit, active transport such as walking and biking, aviation, parking, and logistics?
 - How do emerging transportation modes and their infrastructure affect mobility, safety and the environment?
 - How do we integrate the emerging concept of the 'shared commodity', e.g., ride-sharing, car-sharing, bike-sharing, in transportation modelling?
 - How do emerging transport modes affect urban sprawl?
 - How can sprawl be contained?
 - Which urban infrastructure and transportation policies can encourage further modal shift towards active transport?

- Urban design and morphology:
 - How does urban design and morphology relate to the adoption of active modes of transportation?
 - How does urban design and morphology affect energy and resource consumption practices?
 - How does urban design and morphology relate to sense of place and belonging?
- Performative architecture:
 - How can real-time sensing, performance-monitoring and responsive material assemblies improve the functioning of buildings including reducing life-cycle costs, energy usage and release of emissions?
- Water infrastructure:
 - How can water, storm water and wastewater infrastructure be designed to optimize water supply, demand management and treatment?
- Smart energy systems:
 - How can smart power grids maximize the collection, storage and distribution of low-carbon energy?
 - How can smart power grids and building control systems be designed to provide more efficient heating, cooling, lighting and appliance use?



- Climate and environment:
 - Which flood forecasting and mitigation strategies can be applied to protect the environment, lives, and property?
 - How can weather and environmental prediction tools be integrated with city infrastructure to reduce the risk of environmental hazards and extreme weather and improve disaster mitigation and management?
 - Which environmental monitoring and emission control tools are needed to minimize emissions?
- Communication and IT:
 - What telecommunications infrastructure is needed for improved connectivity and systems integration?

The critical tools and methods on which the analysis of smart city transitions will depend include:

1. Big data: large-scale data collection, processing, management, sharing, storage, analysis, data analytics for prediction, data fusion and integration and systems integration;
2. Intensive case studies and comparative case study analysis to analyze the complex interactions, mutual modifications, and synergies of processes as they interact in particular places, laying the foundation for better understanding transferability of policies and practices and the potential for crafting context-sensitive policies;
3. The interrogation of physical and digital models of buildings and urban spaces with evidence-based human factors testing that evaluates the effectiveness of both existing and proposed design strategies; and
4. Behavioural models, spatial economic models and other spatial models to estimate and forecast the consequences of, and demand for, various types of infrastructure, and to understand the responses of citizens to new urban strategies and policies.



Secure societies

Ensuring national, regional and civic security while protecting individual human rights

Modern society cannot exist without security. One of the key challenges faced by citizens in a liberal democracy is to find the balance between safety for the greatest number and the privacy of the individual. This search for the tipping point has been a constant from the very beginning of the evolution of free societies. In Great Britain, the evolution of parliamentary democracy over several centuries, beginning with the Magna Carta of 1215, centered on this question. The evolution of democracy in the United States, embodied in the adoption of its constitution in 1789, also attempted to address this challenge. Canada's Charter of Rights and Freedoms, adopted in 1982, sought to guide the citizens of this country in finding the correct balance between government efforts to secure society and the rights of individual Canadians.

Maintaining cybersecurity for national and individual security; intelligence and national security relating to terrorism, radicalization and instability

With the growth of the Internet over the past three decades and the development of social media, the challenge to find that balance has grown incrementally. Invasion of privacy and the use of private information of both citizens and corporations for unlawful purposes, or even to do physical damage to society, has grown into a major threat. Governments are increasingly turning to the question of the unlawful intrusion into individual privacy, but are themselves often accused of crossing the line between gathering information necessary for security and violating individual rights. How can governments at the national, provincial and local levels be allowed to perform their responsibilities to secure societies while, at the same time, safeguard the privacy of individual citizens?

Key research areas pertaining to these challenges include:

- Developing quantitative and sociological means of deploying police assets to better protect cities against street crime;
- Developing smarter means of identifying self-radicalizing individuals and effective means of de-radicalizing them;
- Increasing capabilities to use intelligence gathering to determine developing threats to people, institutions and infrastructure;
- Working with security agencies to develop more effective means to analyze intelligence regarding threats to peace and security;
- Using quantitative and sociological data to plan responses to threats of pandemics;
- Developing theories, algorithms and architectures for next-generation security systems, including quantum cryptography, quantum-safe protocols, number theoretic algorithms, formal methods, and access control models;
- Developing data analysis and intelligence gathering methods for big data, including geo-social data for applications such as forensics;
- Designing new approaches to identity management including the use of biometric technologies in complex virtualized cyber-physical systems;
- Developing intelligent robust security and privacy technologies for highly complex software systems (including cloud) as well as emerging networked environments (including implantable and wearable medical devices); and
- Studying the interrelationship between the technical, social, moral, legal, economic, and policy aspects of security and other important values, such as individual privacy and freedom, and developing a framework and technologies that further those values.



Cultural understanding

Canadian society is rooted both in the diversity of indigenous peoples and immigration from changing source countries, resulting in the many and different cultural, religious, social and economic practices that characterize modern Canada. In a globalized and connected world where far-off events are reported to Canadians in real time and are as close as the nearest screen, issues of immigration, integration, and participation lead to new questions about the changing nature of Canadian identity and citizenship. This change in political attitudes and cultural values has been driven by broad trends, not just the growing ethnic diversity of the country, but also the coming of age of post-baby boomer generations, and the societal and economic changes that occur within a generation's life cycle.

Building a vibrant civil society through respectful and fruitful human interactions in a multicultural society

- Enhancing communication across cultural boundaries:
 - How do languages and linguistics contribute to overcoming translation and communication barriers?
 - What is the logic of clear and precise communication? How does the study of logic help us to communicate across linguistic boundaries?
 - What is the role of colonialism and its aftermath in understanding cultural differences? What are the intergenerational impacts of colonialism for social, economic, and community participation?
 - How do we negotiate diverse and conflicting moral and political traditions in a multicultural landscape?
- How can notions of identity and otherness in culture and society help us understand how majority and minority identities are formed?
- What are the best pedagogical practices to enhance dual language learning? How do we support adults and children to function well in environments that require communication in one of Canada's official languages?
- In what ways do advances in technology support and/or detract from learning, social interaction, and positive mental health?
- What are the threats and opportunities of informatics? How do we understand human capacity for interfacing with computers and managing the increasing demands for processing large volumes of information?
- How can we learn from one another in a pluralistic society across cultural, social and linguistic barriers?

- Discovering the social determinants of learning and well-being across the lifespan
 - How do social processes influence the development and intersectionality of individual and social identities?
 - What are the ways in which early childhood interventions influence resiliency and healthy development?
 - What are the best practices in assessment and educational interventions with diverse learners across the lifespan?
 - How can we support youth to develop leadership skills?
 - What are the most effective strategies for addressing economic disparities and individuals/families who experience homelessness?
 - What are the best intervention practices for youth who are at risk for joining gangs?
 - What are the cognitive, emotional, and social influences on aging and how do these manifest in similar and different ways across populations?
 - How do we equip the next generation of children, youth, and adults with the cultural competencies required to foster their full participation in all aspects of society?
- Improving indigenous relations
 - How do indigenous traditions understand and enact different forms of authority and how might these interact with the dominant traditions' legal and authority systems?
 - What are the policies, programs and practices that increase access and retention of indigenous youth in educational and employment systems?
 - How can all Canadians better understand First Nations worldviews particularly as they relate to education, leadership and community relations?
- How do indigenous worldviews impact Canadian use of land resources in the context of climate change?
- What are the innovative ways that traditional languages can be preserved and transmitted across generations?
- Appreciating and understanding diversity, immigration and pluralism
 - What roles do religion and ethnicity play in multicultural Canada?
 - What are the best ways to support the integration and adaptation of immigrant students and workers? How can we engage Canadians to understand their roles in welcoming newcomers?
 - How do we understand and respond to the academic, social, and career challenges faced by international students?
 - How do forms of oppression within society, such as racism, sexism, and homophobia, interrelate, creating a system of oppression that reflects the intersection of multiple forms of discrimination?
 - What are the pedagogical practices that prepare professionals for their roles in contemporary society? How do professionals incorporate concepts of diversity and social justice into their practices with service users and with the public?
 - How do we define the space to which minority citizens are entitled in pluralist societies?
 - How can research inform our perceptions of what is appropriate, relevant and ethical in the contrasting experiences of both cultural difference and identity?

Collaboration, creativity and translation

Initiatives will be implemented to enhance the challenges identified in the *Human Dynamics in a Changing World* research strategy and to build on the established and emerging strengths of University of Calgary researchers. These initiatives will support our researchers as they find ways to adapt to the rapid change that humanity is facing as we advance into the 21st century.

Building on and expanding our confederation of scholars

A key element of the University of Calgary research strategies is the ongoing development of collaborative research and training across our faculties. Through various networking initiatives, the *Human Dynamics in a Changing World* research strategy will build on our strengths and continue to enhance communication, collaboration and exchange of information between scholars from across the academy. University of Calgary researchers will continue to work together with the aim of developing major collaborative and interdisciplinary initiatives.

Building on our research platforms

The strategic research plan identifies several research platforms that are established to support initiatives across the various research areas. A number of them are particularly important for the implementation of the *Human Dynamics in a Changing World* research strategy:

- **Analytics and visualization:** Our society is overwhelmed by data and information. Advances in many disciplines, using both qualitative and quantitative data, are limited by our abilities to make sense of this data: analysis and visualization allow us to synthesize knowledge from data and simulations. Data needs to be captured, analyzed, abstracted

and visualized to create meaning that helps problem solving and decision-making. Under this research platform, digital humanities, the intersection of computing and disciplines of the humanities, is one growing area that can have an impact on the implementation of the *Human Dynamics in a Changing World* research strategy.

- **Knowledge translation and community engagement:** From our perspectives, knowledge translation involves a two-way process of knowledge mobilization from the University of Calgary and partnership with the broader community of volunteer service organizations such as immigrant serving organizations. Our researchers work closely with community organizations to learn about the needs of the community, build research questions, present research findings, participate in strategic planning for community vision building, and offer suggestions about programs and services to the community. In addition, they also present research findings as well as policy and practical recommendations to governmental and non-governmental organizations, international organizations as well as private stakeholders. Moreover, University of Calgary researchers engage the general public through project websites and media (including social media and blogging), both in English and in newspapers, radio broadcasts, and various TV channels in different languages.

- **Entrepreneurship and innovation with a special focus on social innovation:** Social innovation seeks to find new ideas to solve social problems and create system-level change for the sector and the community with novel solutions that are more effective, efficient, and sustainable than current solutions. To address these problems and create large-scale change, our scholars will invest and participate in vibrant multi-sector networks that catalyze and sustain collaborative social innovation. They will provide leadership on questions of community prosperity, sustainability, citizenship and ethics. Social innovation can be applied all over the world, in every sector, resulting in social enterprise or leading social initiatives from within existing organizations. The research is essential to understanding what works and what does not. With the *Human Dynamics in a Changing World* research strategy, our scholars will contribute new thinking to achieve social impact.

- **Policy creation:** Championed by our School of Public Policy, this research platform draws together synthesis and analysis of information from many disciplines to advance public discussions of policy and to promote critical evaluation of policy alternatives. This integration is truly crosscutting, involving legal scholars, economists, political scientists, environmental scientists, engineers, health and resource economists, health practitioners, business and financial scholars, and social scientists. It considers an ever-evolving list of pressing demands from society for critical analysis and conclusions on the impacts of alternative policies.





The University of Calgary is a leading Canadian university located in the nation's most enterprising city.

The university has a clear strategic direction to become one of Canada's top five research universities by 2016, where research and innovative teaching go hand in hand, and where we fully engage the communities we both serve and lead.

This strategy is called *Eyes High*, inspired by the university's Gaelic motto, which translates as 'I will lift up my eyes.' As part of the roadmap to achieve these goals, the university's Strategic Research Plan identifies six research themes that will leverage our distinct capabilities while addressing the unmet needs and challenges of our society as a whole:

- Energy innovations for today and tomorrow
- Engineering solutions for health: biomedical engineering
- Brain and mental health
- Infections, inflammation and chronic diseases in the changing environment
- New Earth-space technologies
- Human dynamics in a changing world: smart and secure cities, societies, and cultures

Learn more about the University of Calgary's Strategic Research Plan and the Human Dynamics in a Changing World Research Strategy. Contact the Office of the Vice-President (Research) at vpr@ucalgary.ca

ucalgary.ca/research



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