Mr. Bill Milner
Director, Consular Corporate Management and Innovation
Department of Foreign Affairs, Trade and Development Canada
125 Sussex Drive
Ottawa, Ontario  K1A 0G2

October 13, 2015

## Re: Assessment and Analysis of DFATD Consular Data (Phase 1)

Mr. Milner,

Based on discussions held between you and your team, as representatives of the Department of Foreign Affairs, Trade and Development Canada (DFATD), and Drs. Jennifer Schellinck of Sysabee and Patrick Boily of Carleton University's Centre for Quantitative Analysis and Decision Support (CQADS), we are pleased to submit this proposal for the analysis of a subset of DFATD consular data. A detailed description of Phase 1 of the project, including a timeline and cost estimate, is provided here, along with a more general description of a suggested Phase 2.

# Contents

# Background

DFATD (Consular Corporate Management and Innovation) has a mandate to manage resource allocation within Canadian consulates. In order to do this, DFATD needs the tools to justify reallocating resources as the work requires. This involves considering what types of activities are done, how long it takes to complete these activities, and the factors that affect consulates' ability to perform this work.

　　Relevant to this, DFATD has a software application (COSMOS, produced by WorldReach) that tracks consular case management statistics and notes and is used to enable consulates to

provide assistance to their consular clients while at the same time helping to identify where the workload stresses are and to provide basic statistics for requests from journalists and others.

There is a wealth of information in COSMOS databases that may potentially be utilized to the advantage of DFATD. More specifically, datasets within COMSOS (e.g. COMIP, CAMANT) may potentially be used to address questions relating to resource allocation of consulates. Such decisions on where to put resources abroad need to be based on a solid understanding of the workload in each location, and how that is affected by local conditions. This will allow for DFATD to maintain effective and efficient consulates.

To this end, DFATD wishes to use the available COSMOS datasets to identify:

- what the available data can and can't reveal about the current consulate operations program and how to manage it;

- possible gaps in the information that could be addressed through modifications to the software, and

- possible sources of data that could enhance and improve on what is currently available.

## Project Purpose, Objectives and Questions to be Answered

### Project Purpose

There are a number of questions that DFATD would like to answer in relation to the operation and management of their consulates. These include questions about how DFATD can provide an appropriate level of required services to Canadians given an available operating budget, which regions are most effective, which consulates should continue to exist, and how many people are required to properly conduct consular activities in each region.

In this context, the overarching goal of this project is to determine how current and potential data can be used to provide support to answer these questions in an evidence-based fashion. Even more generally speaking, the broad purpose of this project is to enable DFATD to use appropriate data about previous and current consulate operations to make informed, defensible, effective and evidence-based decisions regarding the future operation of their consulates.

### Project Objectives

*Phase 1 (Data Assessment and Visualization)*

By extracting the information contained within the data that is currently being collected by the COMIP database, it is possible to create a preliminary understanding of both the operations of specific consulates and, more broadly the operations of the consulate network as a whole. The first objective of Phase 1 will be to assess the validity of the currently available data on consulate operations and, where possible, clean it to improve its analysis capacity. A basic analysis of the data will then determine uses to which the data as it stands may be put, and what additional work is required to make the data usable for the project purpose. Finally, by

providing a visual description and narrative of the existing data on consulates within the consular network, some preliminary evidence for the possible effects of future changes to the network will be provided. Meeting these objectives will allow DFATD to increase their understanding of the effect that changing consulate operations will have on the consular network, as well as their understanding of what data is required for informed, evidence-based decision-making in that context.

*Phase 2 (Data Analysis)*

A key element in predicting the effects of possible changes to the consular network is the understanding of factors influencing the network's functioning. To that end, the main objective of the second phase of the project will be to use data analysis techniques to increase the understanding of the factors that influence resource use across the consular network. Meeting this objective will allow DFATD to increase their understanding of the effect of consulate operations changes on the consular network.

**The Questions to Answer**

In connection to broader questions DFATD itself is asking about its consular network, the specific questions that this project will answer are:

*Phase 1*

- How reliable is the existing data? To what extent is it possible to verify its accuracy?

- Can the existing data address the broad questions (above) that DFATD would like to answer?

- Which of the above questions can the existing data address?

- In the case of the questions that existing data can address, what are the answers to these questions as suggested by the data?

- What additional data would need to be gathered to address, or further address, the questions that the current data cannot address?

*Phase 2*

- What properties of consulates are connected to other properties (clustering)?

- What are some combined metrics that can be developed to measure consulate properties?

- What factors are correlated with these metrics?

## Methodology

In general we will take the approach of dividing the tasks as follows:

1. those tasks that provide a basic data assessment and analytics, and

2. those tasks that provide more sophisticated data analysis to provide more focused, direct and comprehensive answers to the questions being asked.

As discussed in the task breakdown, data assessment will include standard methods for reviewing data soundness and data quality (including but not limited to: validity, completeness, accuracy and precision, consistency, uniformity, detection and correction).

Following this, techniques will be applied to deal with missing and anomalous observations. Prior to and during this process, the data will be contextualized by gathering background material, obtained both through individual interviews and a panel discussion of experts to verify data analysis assumptions.

At this point, basic analytics will be applied to the data to explore and create a more detailed picture of the data. This activity will include some preliminary data analysis and visualization techniques, including but not limited to:

- traditional visualization techniques (box plots, line graphs, histograms, etc.)

- specialized techniques specifically relevant to this project (e.g. scatter plot matrices, heat maps, spaghetti plots).

These methods will be applied to provide a useful description and data narrative, but also to provide a clear understanding of the uses to which the data as it currently stands can be put.

Once the pre-analysis has been completed, the second phase of the project will involve more complex analytics (e.g. clustering, correlation analyses, etc.), which will be used to derive an understanding of the factors that influence resource use within the consular network. We shall also develop combined metrics that provide higher level conceptual measures of consulate operations.

## Project Overview

### Tasks and Suggested Workplan

The project tasks and suggested timelines for both Phases 1 and 2 can be found in Table 1. These are suggested activities which may be further discussed and re-arranged according to DFATD requirements. In particular, DFATD could elect to only carry out one of the phases, or portions of either.

### Deliverables

The primary deliverables for both Phase 1 and Phase 2 will be reports containing a description of results of the data assessment (for Phase 1) and the analyses carried out on the data (for Phases 1 and 2). Any relevant diagrams (e.g. data visualization results) will be included in the reports as well. The revised dataset will also be provided.

**Project Scope**

The project will analyze existing data using the described methodological techniques. A substantive representative sample of existing COMIP data between the years of 1995 and 2015 will be analyzed. It is possible that a subset of data from the CAMANT database will be analyzed in Phase 2 of the project.

| Phase 1 – Data Preparation | | | |
|---|---|---|---|
| **Tasks** | **Estimated Time (hrs)** | **Suggested Timeline** | **Deliverable** |
| **1.1** Importing and Hosting Data | 2 | Nov 9 - 13, 16 - 20 | |
| **1.2** Data Inspection (i.e. data structure, metadata info) | 12 | | |
| **1.3** Soundness and Data Quality | 51 | Nov 23 - 27, Nov 30 - Dec 4, Dec 7 - 11 | |
| **1.4** Dealing with Missing Observations | 37 | Dec 14 - 18 | |
| **1.5** Dealing with Anomolous Observations | 37 | Jan 4 - 8, 11 - 15 | Deliverable 1: Cleaned Data Set (Nov 9 - Jan 15) |
| **1.6** Data Contextualization | 40 | Jan 18 - 22, 25 - 29 | |
| **1.7** Data Visualization and Data Description | 60 | Feb 1 - 5, 8 - 12, 15 - 19 | |
| **1.8** Meetings and Reporting | | | |
| **1.8.1** Creating Report Describing Findings | 20 | Feb 22 - 26, Feb 29 - Mar 4 | |
| **1.8.2** Meeting To Review Report | 1 | Mar 7 - 11 | Deliverable 2: Data Visualizations (Jan 18 - Mar 18) |
| **1.8.3** Revising Report Based on Client Feedback | 10 | Mar 14 - 18 | Deliverable 3: Data Assessment Report (Jan 18 - Mar 18) |
| **Phase 1 – Total Estimated Time  (hrs)** | **270** | | |
| **Phase 1 – Total Cost @80.00/hour** | **$21,600.00** | | |

| Phase 2 – Data Analysis (preliminary suggestions) | | | |
|---|---|---|---|
| **Suggested Tasks** | **Estimated Time (hrs)** | **Suggested Endtime (weeks from start of Phase 2)** | **Deliverable** |
| **2.1** Auxiliary Data Gathering | 28 | 2 | |
| **2.2** Answering the Questions (see p. 3) | 28 | 4 | |
| **2.3** Factor and Cluster Analyses | 28 | 6 | |
| **2.4** Exploration of CAMANT Data | 28 | 8 | |
| **2.5** Composite Metrics | 28 | 10 | |
| **2.6** Reporting | 30 | 13 | Deliverable 4: Final Report (13 weeks from start) |
| **Phase 2 – Total Estimated Time  (hrs)** | **170** | | |
| **Phase 2 – Total Cost @100.00/hour** | **$17,000.00** | | |

**Figure 1:** Suggested project tasks and workplan. Phase 2 is optional – a high-level description is provided here solely for future reference.

## Schedule, Assumptions, Liability and Force Majeure

Sysabee understands that Mr. Bill Milner will act as the Department of Foreign Affairs, Trade and Development Canada Project Authority (PA) and Sysabee will rely on him for assistance throughout this assignment, in particular to receive, review and approve (or obtain approval of) the deliverables. The suggested timeline is provided in a previous section: assuming that there are no significant delays in gathering the data, we expect Phase 1 to be completed approximately 5 months after its start. Prior to the start of each phase, DFATD will approve the work of the preceding phase.

In estimating our time and resource requirements, we have assumed that the PA will identify appropriate contacts, stakeholders and subject matter experts, and that these contacts will provide Sysabee with the necessary information pertaining to their management systems, database and data, in a timely manner.

The overall project cost and timing is based on the estimated level of effort identified to date for this assignment. Unexpected circumstances may require adjustments to the schedule and/or predicted costs: no additional funds will be required for delays for which Sysabee is responsible; should there be a DFATD-mandated change in scope or level of effort required, costs and/or timelines would be modified accordingly through a contractual amendment adjusting time and charges, subject to DFATD approval. Should Sysabee find itself unable to complete a task by the deadline, we will inform DFATD as soon as possible in order to re-organize the project's priorities.

Sysabee further reserves the right to review the use of the analysis results in any external publication to ensure that conclusions are not misrepresented or selectively omitted. Unless otherwise specified, all information and documents made available to Sysabee during the course of this project are deemed proprietary, and shall be returned to DFATD upon completion of the project.

Sysabee warrants to DFATD that its services will be provided using reasonable care and skill. Notwithstanding any provision to the contrary, any dates, periods or times specified by Sysabee in the proposal are estimates only and time shall not be of the essence for the performance by Sysabee of its obligations under an eventual contract.

Except in respect of death or personal injury caused by Sysabee negligence, or as expressly provided in any subsequent conditions agreed upon by Sysabee and DFATD, Sysabee shall not be liable to DFATD by reason of any representation (unless fraudulent), or any implied warranty, condition or other term, or any duty at common law, or under the express terms of an eventual agreement, for any loss of anticipated savings, business revenues, or profits (direct or indirect) or any indirect, special or consequential loss (including losses arising from business interruption, wasted management time, loss of goodwill, data and all other such loss whether or not arising in the normal course of business, damages, costs, expenses or other claims) whether caused by the negligence of Sysabee, its agents or otherwise, arising out of or in connection with the provision of the services or their use by DFATD.

The entire liability of Carleton University, Sysabee, and the project team members to DFATD under or in connection with an eventual contract shall not in any event exceed the amount of the charges paid by DFATD for the provision of the services.

DFATD will agree to indemnify and keep Carleton University, Sysabee, and the project team members fully indemnified from and against any loss, claim or liability whatsoever incurred or suffered by Sysabee or Carleton University as a result of negligence or any default by DFATD or its employees, agents or representatives of its obligations however arising in connection with the Services, together with expense, claim, loss or damage which Sysabee or Carleton University or any of its employees, agents, sub-contractors and other DFATD s may suffer due to the negligence or breach of DFATD or its employees, agents or subcontractors. DFATD further agrees and acknowledges that the allocation of risk in the preceding clauses is fair and reasonable in the circumstances, having been taken into account in setting the level of the charges.

Finally, Carleton University, Sysabee, and the project team members shall not be liable to DFATD or be deemed to be in breach of an enventual agreement by reason of any delay in performing or any failure to perform any of Sysabee's obligations under an eventual contract if the delay or failure was due to any circumstances or cause beyond Sysabee's reasonable control.

Without prejudice to the generality of the foregoing, circumstances beyond Sysabee's reasonable control shall include: acts of God, server crashes, virus attacks on equipment, fire or accident, war or threat of war, sabotage, insurrection, civil disturbance or requisition, acts, restrictions, regulations, bylaws, prohibitions or measures of any kind on the part of any governmental, parliamentary or local authority, damage, bad weather, software, power or equipment failure, strikes, lockouts or other industrial actions or trade disputes whether involving Sysabee's employees or of a third party.

## Resources and Costs

Dr. Jennifer Schellinck, Sysabee principal, will be the Lead Investigator assigned to this project, together with Dr. Patrick Boily, a CQADS consultant who specializes in Data Analysis and Operations Research. Other resources may also be assigned to the project as needed; DFATD will be informed of any new resource joining the project. The team members' CVs are provided in Appendix B.

Due to the ongoing nature of the project, we estimate that Phase 1 will be completed within a five-month period (assuming no DFATD-imposed excessive delays) and that it will take no more than 270 hours to complete (with the possible exception of overtime due to a DFATD-mandated change in scope and/or objectives). As an initial discount, the hourly rate for Phase 1 will be set at $C\$80.00/hour$. Under these assumptions, DFATD would not be billed in excess of $C\$21,600.00$ (excluding the 13% Harmonized Sales Tax).

More details concerning Phase 2 will become available upon completion of Phase 1. Should DFATD chose to further avail itself of our services at that time, the regular hourly rate will apply: $C\$100.00/hour$. Please consult the Workplan on p. 5 for possible tasks and timelines.

## Travel and Invoicing

Travel is undertaken only with your specific pre-authorization and charges are based on rates previously agreed to and billed separately, at cost. We do not anticipate the necessity of travelling for this project.

Our invoices will be sent to you upon completion of all tasks associated with a particular deliverable of the project. The first invoice will be sent once Deliverable 1: Cleaned Data Set has been delivered (around Jan 15, for an approximated 140 hours of work; cf. Table 1 for details). The final invoice will cover the rest of Phase 1 and will be sent once Deliverables 2 and 3 have been delivered. All questions regarding our invoices should be directed to the contact whose name and phone number appear on each invoice.

Thank you for contacting Sysabee and the Centre for Quantitative Analysis and Decision Support on this matter. We look forward to working with the Department of Foreign Affairs, Trade and Development Canada on this intriguing project.

Regards,

Jennifer Schellinck, Ph.D.
Principal
Sysabee

Phone: 613 266-9543
info@sysabee.com

# Appendix A — **List of Relevant Former Projects**

Sysabee was founded in 2012 by Dr. Jen Schellinck, with the goal of facilitating effective decision-making through the use of predictive simulations and data-driven analysis of the behavior of human systems.

Former and current clients of Sysabee include:

| | | | | |
|---|---|---|---|---|
| **Client:** | Nuclear Waste Management Organization | **Client:** | Children's Hospital of Eastern Ontario | |
| **Project:** | Nuclear Waste Repository System Probability Failure Model | **Project:** | Experience Based Co-Design Pilot Project (Data Analysis Coaching) | |
| **Dates:** | Phase 1: May 2015 — Apr 2016 Phase 2: May 2016 — Dec 2018 | **Dates:** | Mar 2014 — ongoing | |
| **Reference:** | (Redacted) Manager, Repository Engineering Design (Redacted) NWMO (in collaboration with CQADS) | **Reference:** | (Redacted) Project Manager Patient Engagement and Professional Programs (Redacted) (Redacted) | |
| **Client:** | Environment Canada | **Client:** | Forbes Lab, Carleton University | |
| **Project:** | Species at Risk Protection Process Analysis | **Project:** | A Simulation of Discrimination and Nondiscrimination in Parasites | |
| **Dates:** | Phase 1: Sep 2014 — Dec 2015 Phase 2: Sep 2015 — Nov 2015 | **Dates:** | Phase 1: May 2007 — Dec 2008 Phase 2: May 2015 — May 2014 | |
| **Reference:** | (Redacted) Recovery Biologist National Species at Risk Protection, EC (Redacted) (Redacted) | **Reference:** | (Redacted) Biology Department Carleton University (Redacted) (Redacted) | |

The Centre for Quantitative Analysis and Decision Support (CQADS) opened its doors in 2013. A joint initiative of the Faculty of Science and of the School of Mathematics and Statistics at Carleton University, CQADS offers a variety of analytical services on a cost-recovery basis (further details are available at `http://cqads.carleton.ca`).

A small sample of former and current clients of the Centre or its consultants is presented below:

| | | | | |
|---|---|---|---|---|
| **Client:** | United Way Centraide Canada | **Client:** | Ottawa Integrative Cancer Centre | |
| **Project:** | Analysis of United Way of Canada Historical Fundraising Data | **Project:** | Covariance Analysis of Irritable Bowel Syndrome Study Data | |
| **Dates:** | January 24, 2013 — October 31, 2014 | **Dates:** | March 21, 2013 — August 15, 2014 | |
| **Reference:** | (Redacted) VP, Research and Planning (Redacted) (Redacted) | **Reference:** | (Redacted) Associate Director, Research Canadian College of Naturopathic Medicine (Redacted) (Redacted) | |
| **Client:** | Transport Canada | **Client:** | Canadian Air Transport Security Authority | |
| **Project:** | Index for Container Transit Times in a Multi-Modal Supply Chain Network | **Project:** | Modeling of Wait Time at Pre-Board Screening Checkpoints at Canadian Airports | |
| **Dates:** | May 9, 2013 — July 1, 2013 | **Dates:** | June 14, 2013 — June 20, 2015 | |
| **Reference:** | (Redacted) Policy/Economic Officer (Redacted) (Redacted) | **Reference:** | (Redacted) Manager, Operations Reporting and Analytics (Redacted) (Redacted) | |

# Appendix B — Team Composition

**Dr. Jen Schellinck** graduated from Carleton's Institute of Cognitive Science with a PhD in 2009. She is currently the principal of Sysabee and a consultant with CQADS, as well as an adjunct professor at both the Institute of Cognitive Science at Carleton University and the Information Studies Department at the University of Ottawa.

Jen's expertise in the application of systems principals to the creation of quantitatively accurate conceptual models and working simulations of cognitive systems has led her to most recently focus on the analysis and creation of predictive simulations of the behavior of human organizations and other human systems. During her work as an information management consultant (2009-2012) she had the opportunity to study and model the behavior of multiple government departments, including an in-depth study of the Canadian Army. Current research projects and interests include the contribution of individual human parameters to social organization behaviour, the use of facets to understand best options for organizational structure, nearest neighbour vs all-neighbour algorithms for aggregation, the role of host selection in host-parasite system dynamics (with the Forbes Biology Lab at Carleton University) and the role of models in scientific research.

Given the interdisciplinary nature of her research, she is a strong believer in the value and potential of collaborative inquiry and the importance of developing overarching communication frameworks to facilitate cross-disciplinary efforts.

**Dr. Patrick Boily** is a graduate from the University of Ottawa. He obtained his Ph.D. in Mathematics in 2006. He taught over 50 courses as an Instructor at the University of Ottawa and the Université du Québec en Outaouais from 1999 to 2009, and worked on a number of projects as a federal public servant from 2008 to 2012, including the award-winning Canadian Vehicle Use Survey. He joined Carleton University in 2012 to start and manage the Centre for Quantitative Analysis and Decision Support (CQADS).

Patrick's academic interests reside in the application of mathematics and statistics to evidence-based decision support. He has provided consulting services to numerous entities over the years, including United Way, the Public Health Agency of Canada, the Canadian Air Transport Security Authority, the Royal Canadian Mounted Police, Transport Canada, Correctional Services Canada, Foodicus Inc. and Little Red River Cree Nation.

One of his role as Managing Consultant with CQADS is to provide students of the School of Mathematics and Statistics with opportunities to apply their knowledge to real-world and industrial problems.

# Jennifer Schellinck, Ph.D.

Dr. Jennifer Schellinck graduated from Carleton's Institute of Cognitive Science with a PhD in 2009. She is currently the principal of Sysabee and a consultant with CQADS, as well as an Adjunct Professor at both the Institute of Cognitive Science at Carleton University and the Information Studies Department at the University of Ottawa.

Jen's expertise in the application of systems principals to the creation of quantitatively accurate conceptual models and working simulations of cognitive systems has led her to most recently focus on the analysis and creation of predictive simulations of the behavior of human organizations and other human systems. During her work as an information management consultant, she modeled the behavior of multiple government departments, including an in-depth study of the Canadian Army. Current research projects and interests include the contribution of individual human parameters to social organization behaviour, the use of facets to understand best options for organizational structure, nearest neighbour vs all-neighbour algorithms for aggregation, the role of host selection in host-parasite system dynamics (with the Forbes Biology Lab at Carleton University) and the role of models in scientific research.

Given the interdisciplinary nature of her research, she is a strong believer in the value and potential of collaborative inquiry and the importance of developing overarching communication frameworks to facilitate cross-disciplinary efforts.

## RELEVANT PROJECT EXPERIENCE

Nuclear Waste Repository System Probability Failure Model: Feasibility Assessment and Methodology Design (Sept. 2014 – Dec. 2014)

### Project Description
- This project encompassed a feasibility study and methodology development for the creation of a probability of failure model of a proposed nuclear waste barrier system (the Adaptive Phased Management Repository Design – Mark II). Project activities included:
  - a review of currently available statistical and simulation techniques for failure probability evaluation, along with failure analysis methodologies developed for structured failure analysis.
  - an assessment of the availability of evidence and data on factors identified to be relevant to the design of a failure model for a deep geological repository for nuclear waste
  - an assessment of the feasibility of creating a probability failure model for the system in question and a development of a methodological approach for the construction of this model
  - A development of a step-by-step methodology and analytic approach for the creation of the required failure model for the Adaptive Phased Management Repository Design – Mark II

### Related Publications and Presentations
- Requirements for the design and analysis of a statistical failure model for the Adaptive Phased Management Repository Design – Mark II

Modeling, analysis and creation of predictive simulations to support the development of Species at Risk (SAR) Protection Plan (Aug '14 - ongoing)

### Project Description
- The creation of conceptual models and simple simulations of organizational behaviours that influence document flow through relevant aspects of the SAR Program, along with an analysis of the conceptual models and simulations in order to identify potential system issues and make recommendations in relation to these identified issues.
- Simulations developed in the project will then be used on an ongoing basis by Environment Canada staff to support decision-making, resource allocation and realistic timeline forecasting by enabling the exploration of current and future scenarios via simple model parameter adjustments.
- Primary researcher/consultant on this project.

**Related Publications and Presentations**
- Schellinck, J. (2011) "Applications of Systems Theory to Cognitive Systems: Modeling Information Flow in Government Departments," presentation to Carleton University Institute of Cognitive Science, December 2011.

## Data Science Professional Development Workshops and Weblog (Nov. 2014 – Present)

**Project Description**
- Participated in the creation of two data science workshops designed to introduce key data science concepts and algorithms to a non-technical audience of people either working with data scientists (e.g. project managers and subject matter experts) or undertaking knowledge skills transfer from other areas of expertise.
- Ongoing development of data science articles for the CQADS Data Science website (to be launched in February 2015).

**Related Publications and Presentations**
- Workshop II: Mining for Information Gold: Data Science Concepts and Techniques
- Workshop III :Hands-on Data Discovery: Exploring Data with IBM SPSS Modeler and Other Platforms

## Discrimination and nondiscrimination in parasites: a simulation created for analysis of evolutionarily stable states and population dynamics (Phase 1: May '07 – Dec '08, Phase 2: May '13 – May '14)

**Project Description**
- The Netlogo simulation environment and graphical interface were used for the creation of an individual based simulation which was used to study parasite evolution and population dynamics behaviours over time, via manipulation of simulation parameters, in order to determine the likelihood of a number of relevant biological scenarios, including the evolution of non-discriminant parasites and the conditions under which parasites may seek out novel hosts over time.

**Related Publications and Presentations**
- Schellinck, J., Forbes, M (2014) "The evolution of nondiscrimination in parasites: an individual based model", presentation at Genomes to/aux Binomes (Canadian Society for Ecology and Evolution), Montreal, Canada.

## Information flow within organizations – Cogniva Information Science Research Institute
(Sep '11 – Apr '13)

**Project Description**
- Along with other founding members, developed the organizational goals, research programs, five-year research plan and administrative structure of the research institute.
- Directed the 'Information Flow within Organizations' research stream, acting as the primary researcher for this stream. Also recruited participant organizations, developed research protocols, organized research and collaboration opportunities for CISRI researchers, directed, coordinated and carried out research projects.
- Organized and chaired quarterly CISRI mini-conference for Information Science researchers associated with CISRI.

**Related Publications and Presentations**
- Schellinck, J., Eby, C. (2011) "Towards a Unified Information Services Architecture", invited keynote speech presented at ARMA NCR Fall IM Days, Gatineau QC, November 2011 (invited talk).

## Creation of organizational models for the development of intelligent automated metadata tagging systems (ISIS systems)
(Sep '08 - May '12)

**Project Description**
- Canadian Army ACIMS Information Mapping Project, Library and Archives ISIS Pilot Project, Western Diversification Records Management System project, Library and Archives EDRMS Requirements Project.
- Analysed the business processes, workflows, functional structure, relevant business objects, Electronic Document and Records Management System (EDRMS) requirements and metadata requirements of organizations in-depth analysis and content extraction of existing data and documentation relevant to organizational modeling and functional and business process interviews.
- Developed high-level functional mappings, functional decomposition and detailed activity-process models of organizations based on organizational analysis.
- Generated information mappings, faceted classification taxonomy schemes, document classification schemes, EDRMS specifications and information architectures for relevant branches of organizations.

- Created organization specific automated metadata tagging systems
- Primary researcher/consultant on these projects
- Supervised the Cogniva analyst project team

**Related Publications and Presentations**
- Alberts, I., Schellinck, J., Eby, C., & Marleau, Y. (2010). Bridging Functions & Processes for Records Management. Canadian Journal of Information and Library Science, 34(4), 365-390.

Modeling best practices in scientific research and industry applications (May '10 - ongoing)

**Project Description**
- Ongoing academic research project to investigate and publish findings relating to recommended modeling best practices within science and industry, including most appropriate application of different model types to support different activities within science and industry.
- Primary researcher on this project, in collaboration with Richard Webster.

**Related Publications and Presentations**
- Schellinck, J., Webster, R. (2013) "Cognitive models: Understanding their critical role as explanatory and predictive hypothesis generators in cognition research". Poster presented at ICCM 2013 – the 12th International Conference on Cognitive Modeling, Carleton University, Ottawa, Canada.
- Schellinck, J., Webster, R. (2010). "The Scientific Power of Good Models: Unifying Hypothesis Discovery and Hypothesis Testing". Presented at Models and Simulations 4, University of Toronto, Toronto Canada.

A general perception-based framework for modeling animal aggregation (Sep'05 – Sep '09)

**Project Description**
- The creation of a physically and behaviourally realistic modeling framework- the PCA framework- for creation of quantitatively accurate simulations allowing for the realistic analysis, exploration and characterization of species-specific aggregation behaviours (e.g. swarming, flocking, herding). The framework was created using the Breve simulation platform.
- Species-specific stochastic individual based models were generated using the PCA framework, based on data collected on the three dimensional movement patterns of an aggregating fish species (*Danio rerio*), gathered using 3D motion capture techniques, with data analysis carried out via motion analysis packages available in MatLab.
- Simulations were optimized in order to allow for feasible runtimes, given the number of model parameters being investigated.
- Results were displayed and communicated using physically realistic three-dimensional animations of the simulation behaviors, as supported by Breve graphical display libraries.
- Simulation behaviours and outputs were analyzed using SPSS Statistics.
- Primary researcher on this project.

**Related Publications and Presentations**
- Schellinck, J., White T. (2011) A Review of Attraction and Repulsion Models of Aggregation: Methods, Findings and a Discussion of Model Validation. Ecological Modeling, 222(11), 1897-1911.
- Schellinck, J. (2009). A General Perception Based Framework for Modeling Animal Aggregation. Carleton University, Ottawa, Canada.
- Schellinck, J. (2007). "Three-dimensional aggregation model of the interplay between species-specific characteristics." Presented to the International Ethological Conference 2007, Halifax, NS.
- Schellinck, J. (2007) "Animal Aggregates: Joining Theory and Practice" presentation to Carleton University Institute of Cognitive Science, November 2007.

Simulation of crowd behaviour and investigation into aggression related causes of riot triggers within crowds (Jan '07 – Mar '07)

**Project Description**
- Created a simulation that replicated the results of a previous research paper and then carried out additional simulation analysis to investigate underlying causes of emergent simulation behaviour.
- The simulation was recreated using the Repast simulation framework. Resulting model behaviours and output were analyzed using the Perl scripting language.
- Principal Researcher for this project.

**Related Publications and Presentations**
- Technical report available at http://http-server.carleton.ca/~jschelli/cbmodel_report.html

Research into stakeholder acceptance of building energy labels (Jun'06 – Aug '06)

**Project Description**
- Provision of recommendations for the effective creation of eco-labels in order to support decisions being made relating to the possible development of an eco-label indicating energy efficiency of building construction methods.
- Project report discussed the psychological factors that influence individuals' decisions about engaging in pro-environmental behaviours, with a focus on ways in which the presence of eco-labels could influence these behaviour decisions.
- Primary researcher/consultant on this project.

**Related Publications and Presentations**
- Research into Stakeholder Acceptance of A Building Energy Label. Project report not publically available.

Student academic performance as related to course selection (Mar '06 – May '06)

**Project Description**
- Undertook an analysis of existing data on the academic performance of students enrolled in Carleton University's Enriched Support Program in order to create scenario projections of the likely performance of students in future years of the Enriched Support Program.
- Analysis and results of projections were used to make recommendations about whether or not the current structure of the program was contributing to, or detracting from, performance of students, relative to optional and required courses.
- Results and recommendations were then used to support decisions relating to a restructuring of the Enriched Support Program.
- Primary researcher/consultant on this project.

**Related Publications and Presentations**
- Enriched Support Program (ESP) Math Student Success Report. Project report not publically available.

A simulation of ungulate foraging and predator response behaviours (Jul '04 – Jun '05)

**Project Description**
- A simulation of ungulate (hoofed mammal) herding behaviours was created to explore emergent herd level behaviours developing from individual strategies used by herd members who were engaging in foraging behaviours when then confronted with predator behaviours.
- Simulation was created with the Netlogo simulation environment. Results were displayed via the Netlogo graphical interface. Animations depicting the simulated herding and predator fleeing behavior were also created via the Netlogo graphical interface.
- Principal researcher for this project.

**Related Publications and Presentations**
- Schellinck, J., White, T. (2005) Use of Netlogo as a rapid prototyping tool for the creation of more rigorous spatially explicit individual-based biological models. In Hill, D., Barra, V., Traore, M. (eds.) Open International Conference on Modeling and Simulation-OICMS 2005. Blaise Pascal University, France.

A neural network model of the development of phoneme recognition (Jan '02 – Jun '02)

**Project Description**
- Created a neural network model of the development of phoneme recognition in infants by presenting a representation of phoneme blocks to the neural network, training the network on this data, and then presenting novel data to the neural network.
- Resulting behaviours of the network were analyzed to determine if phoneme identification mistakes made by the network were comparable to identification mistakes made by infants, and an analysis of the resulting structure of the neural network was also carried out.
- Principal researcher for this project, carried out in collaboration with John Logan

**Related Publications and Presentations**
- Schellinck, J. (2002) "A developmental model of lexical knowledge". Poster presented to the Canadian conference on Brain, Behaviour and Cognitive Science, UBC, 2002.

Online medical database development (Jun '00 – Sep '00)

**Project Description**
- Provided project leads with decision support relating to the feasibility of provision of online medical database services and the viability of using the existing medical database to provide relevant medical content to service subscribers on an on-going basis.
- Developed software to parse data and generate Oracle database records.
- Made recommendations on appropriate structure for an XML schema for displaying medical database content on webpages via a user-friendly interface and assisted in the development of this XML schema.

**RELEVANT ANALYSIS, MODELING AND SIMULATION SKILLS AND COMPETENCIES**
- Experience with the following simulation environments: Netlogo, Repast, Breve, Simio (beginner)
- Experience with the following data and statistical analysis and software: IBM SPSS Statistics, IBM SPSS Modeler, Matlab
- Experience with the following computer programming and scripting languages: C, C++, Perl, Lisp, R, Java

**CHRONOLOGICAL WORK EXPERIENCE**
- **Consultant** and **Data Science Team Member**, *Centre for Qualitative Analysis and Decision Support* (Jun '14 - ongoing)
- **External Expert Reviewer**, *Ontario Centres of Excellence* (Feb '14 - ongoing)
- **Principal**, *Sysabee: Social Simulation, Social Network Analytics and Organizational Analysis* (Oct '12 - ongoing)
- **Human Factors and Systems Research Consultant**, Focal Research (May '12 - Oct '12)
- **Scientific Director**, Information Flow within Organizations Research Stream, *Cogniva Information Science Research Institute*, (Sep '11 – Apr '13)
- **Director of Modeling and Methodology**, *Cogniva* (Sep '08 - May '12)
- **Environmental Consultant**, *Office of Energy Efficiency, Natural Resources Canada* (Jun '06 -Aug '06)
- **Coach** and **Assistant Head Coach**, Academic Coaching, Enriched Support Program, *Carleton Centre for Initiatives in Education* (Sep '05 - Mar '08)
- **Computer Programmer**, *TalkCast* (Jun '00 - Sep '00)

**RELEVANT ACADEMIC AND PROFESSIONAL ATTAINMENTS**
- Adjunct Professor (gratis), School of Information Studies, *University of Ottawa* (Sep '12 - ongoing)
- Adjunct Professor (gratis), Institute of Cognitive Science, *Carleton University* (Aug '09 - ongoing)

**LIST OF PRESENTATIONS, POSTERS, AND PUBLICATIONS**
**Presentations and Posters**
- Schellinck, J., Forbes, M (2014) "The evolution of nondiscrimination in parasites: an individual based model", presentation at Genomes to/aux Binomes (Canadian Society for Ecology and Evolution), Montreal, Canada.
- Schellinck, J., Webster, R. (2013) "Cognitive models: Understanding their critical role as explanatory and predictive hypothesis generators in cognition research". Poster presented at ICCM 2013 – 12th International Conference on Cognitive Modeling, Carleton University, Ottawa.
- Schellinck, J. (2011) "Applications of Systems Theory to Cognitive Systems: Modeling Information Flow in Government Departments" presentation to Carleton University Institute of Cognitive Science, December 2011.
- Schellinck, J. Eby, C. (2011) "Towards a Unified Information Services Architecture" invited keynote speech presented at ARMA NCR Fall IM Days, Gatineau QC, November 2011. (invited talk).
- Schellinck, J., Webster, R. (2010). "The Scientific Power of Good Models: Unifying Hypothesis Discovery and Hypothesis Testing". Presented at Models and Simulations 4, University of Toronto, Toronto Canada.
- Alberts, I., Schellinck, J., Eby, C., & Marleau, Y. (2010). "Bringing Together Functional Classification and Business Process Analysis: Growing Trends in Records Management". Presented at the 38th Annual Canadian Association for Information Science Conference. Concordia University, Montreal, Canada.
- Schellinck, J. (2007). "Three-dimensional aggregation model of the interplay between species-specific characteristics." Presented to the International Ethological Conference, Halifax, NS.
- Schellinck, J. (2007) "Animal Aggregates: Joining Theory and Practice" presentation to Carleton University Institute of Cognitive Science.
- Schellinck, J. (2005) "The Folk Psychology Debate: We can't avoid it so let's deal with it" presentation to Carleton University Institute of Cognitive Science, 2005.

- Schellinck, J. (2002) "A developmental model of lexical knowledge". Poster presented to the Canadian conference on Brain, Behaviour and Cognitive Science, University of British Columbia.

**Publications**
- Schellinck, J., White T. (2011) A Review of Attraction and Repulsion Models of Aggregation: Methods, Findings and a Discussion of Model Validation. Ecological Modeling, 222(11), 1897-1911.
- Alberts, I., Schellinck, J., Eby, C., & Marleau, Y. (2010). Bridging Functions & Processes for Records Management. Canadian Journal of Information and Library Science, 34(4), 365-390.
- Schellinck, J. (2009). A General Perception Based Framework for Modeling Animal Aggregation. Carleton University, Ottawa, Canada.
- Schellinck, J., White, T. (2005) Use of Netlogo as a rapid prototyping tool for the creation of more rigorous spatially explicit individual-based biological models. In Hill, D., Barra, V., Traore, M. (eds.) Open International Conference on Modeling and Simulation-OICMS 2005. Blaise Pascal University, France.
- Jerzykiewicz, L., Kelly, J., Schellinck, J., Scott, S., & Wong, A. (2001) *Proceedings of the PHICS Conference*. Carleton University, Canada

**EDUCATION AND AWARDS**
- Ph. D. (Cognitive Science), *Carleton University*, 2009
- B. Sc. (Computer Science), *Dalhousie University*, 1997
- B.A. Honours (Philosophy), *Dalhousie University*, 1996
- Graduate Scholarship, *Cognitive Science Department*, 1999-2004
- Ontario Graduate Scholarship 2002
- Ontario Graduate Scholarship 2001

# Patrick Boily, Ph.D.

Dr. Patrick Boily is a graduate from the University of Ottawa. He obtained his Ph.D. in Mathematics in 2006. He has taught over 50 courses as an Instructor at the University of Ottawa and the Université du Québec en Outaouais from 1999 to 2009, and worked on a number of projects as a federal public servant from 2008 to 2012, including the award-winning *Canadian Vehicle Use Study*. He joined Carleton University in 2012 to start and manage the Centre for Quantitative Analysis and Decision Support (CQADS).

Patrick's academic interests reside in the application of mathematics and statistics to evidence-based decision support. He has provided consulting services to numerous entities over the years, including United Way, the Public Health Agency of Canada, the Canadian Air Transport Security Authority, the Royal Canadian Mounted Police, Transport Canada, Nordicity Group Ltd., the Department of National Defence, Correctional Services Canada, Foodicus Inc. and Little Red River Cree Nation, managing and being involved in numerous projects from inception to completion.

One of his role as Managing Consultant with CQADS is to provide students and recent graduates from the School of Mathematics and Statistics with opportunities to apply their knowledge to real-world problems.

## RELEVANT PROJECT EXPERIENCE

(Dr. Boily is the main contributor or a co-lead on all these projects, except for the Nordicity projects.)

Nuclear Waste Repository System Probability Failure Model: Feasibility Assessment and Methodology Design (Sept. 2014 – Dec. 2014)

**Project Description**
- This project encompassed a feasibility study and methodology development for the creation of a probability of failure model of a proposed nuclear waste barrier system (the Adaptive Phased Management Repository Design – Mark II). Project activities included:
    o a review of currently available statistical and simulation techniques for failure probability evaluation, along with failure analysis methodologies developed for structured failure analysis.
    o an assessment of the availability of evidence and data on factors identified to be relevant to the design of a failure model for a deep geological repository for nuclear waste
    o an assessment of the feasibility of creating a probability failure model for the system in question and a development of a methodological approach for the construction of this model
    o A development of a step-by-step methodology and analytic approach for the creation of the required failure model for the Adaptive Phased Management Repository Design – Mark II

**Related Publications and Presentations**
- Requirements for the design and analysis of a statistical failure model for the Adaptive Phased Management Repository Design – Mark II

Longitudinal analysis of weight trajectories in a Canadian study of the effect of a low-calorie diet program (Apr '14 - ongoing)

**Project Description**
- Analyzing the weight trajectories for roughly 2000 patients undergoing the low-calorie diet program to determine the time to failure for different demographic groups (using growth mixture models).

Attainability of sick leave objectives and assessment of the recording of training hours for the Ottawa Professional Firefighters Associations (Jan '14 - ongoing)

**Project Description**
- Investigating and modeling the effect of the current 24-hour shift on the rate at which leaves of all kinds are being taken.

Covariance analysis of irritable bowel syndrome study data (Mar '13 - ongoing)

**Project Description**
- Covariance analysis conducted on the data collected by the Canadian College of Naturopathic Medicine (CCNM) to determine the effect (if any) of an agent on Irritable Bowel Syndrome.
- Made suggestions for experimental design of second phase.
- Currently analyzing the data from second phase.

**Related Reports and Presentations**
- Hagiwara, S., Boily, P. (2014) Covariance Analysis of Irritable Bowel Syndrome Study II, *Canadian College of Naturopathic Medicine*, Ottawa, Canada – REPORT.
- Hagiwara, S., Boily, P. (2013) Covariance Analysis for the 2010 CCNM Pilot Study on Irritably Bowel Syndrome, *Ottawa Integrative Cancer Center*, Ottawa, Canada – REPORT.

Modeling of Industry Canada's 700/2500MHz bands combinatorial clock auctions (Apr '13 - ongoing)

**Project Description**
- Prepared a tool to model Industry Canada's Combinatorial Clock Auction (CCA) for Nordicity Group Ltd, which allocates portions of the 700MHz radio spectrum to Canadian bidders, using discrete methods and optimization.
- A second phase modeling the 2500MHz auction (with a number of significant changes due to IC's new rules) is currently in progress.

**Related Reports and Presentations**
- Gao, Z., Haidar, A., Macfie, A., Boily, P. (2014) Modeling of Industry Canada's 2500MHz Band Combinatorial Clock Auction, *Nordicity Group Ltd*, Ottawa, Canada – USER MANUAL.
- Gao, Z., Haidar, A., Moazzez, B., Boily, P. (2013) Modeling of Industry Canada's 700MHz Band Combinatorial Clock Auction, *Nordicity Group Ltd*, Ottawa, Canada – USER MANUAL.

Statistical analysis of use-of-force data (Jun '14 - Nov '14)

**Project Description**
- Provided advice on data cleaning, identifying invalid or anomalous entries, and dimension reduction in the use-of-force data for the Commission for Public Complaints Against the RCMP.
- Provided descriptive statistical analysis for the same data.
- Provided a predictive analytics tool using clustering analysis on the same dataset.

**Related Reports and Presentations**
- Boily, P. (2014) Cluster Analysis of Use-of-Force Data, *Commission for Public Complaints Against the RCMP*, Ottawa, Canada – REPORT.

Analysis of housing choices and changing housing needs of seniors and pre-seniors by age group (Apr '14 - Nov '14)

**Project Description**
- Provided profile analysis to help Clarity Consulting establish a comprehensive portrait of Canadian seniors living in housing with supportive services as well as seniors who express a strong interest in supportive housing by helping to for the Canada Mortgage and Housing Corporation
- Provided explanatory and predictive analysis of the same data set.

**Related Reports and Presentations**
- Rubenfeld, S., Boily, P., Robitaille, A. (2014) Determinants of Supportive Housing for Canadian Seniors, *Canada Mortgage and Housing Corporation*, Ottawa, Canada – REPORT.

Statistical analysis of United Way Centraide Canada fundraising data (Feb '13 - Aug '14)

**Project Description**
- Conducted statistical and cluster analyses of trends in fundraising outputs for roughly 100 Canadian United Way chapters.
- The latest phase of the project dwells on fundraising data from 2011 to 2013.
- Previous phases looked at simpler data from 2003 to 2011, then 2007 to 2012 data.

**Related Reports and Presentations**
- Boily, P. (2014) Analysis of 2011-2013 United Way/Centraide Canada Fundraising Data, *United Way/Centraide Canada*, Ottawa, Canada – REPORT.
- Boily, P., Almaskut, A., "Analysis of United Way Centraide Canada fundraising data", *UW Toronto*, Toronto, Canada, June 6, 2014 – PRESENTATION.
- Boily, P. (2013), Analysis of United Way Fundraising Data, *United Way/Centraide Canada*, Ottawa, Canada – REPORT.

Evaluation of Canadian aquariums and zoos accreditation scoring procedure (Feb '13 - Aug '14)

**Project Description**
- Investigated the current accreditation scoring procedure used by Canada's Accredited Zoos and Aquariums (CAZA).
- Suggested and implemented a new scoring model.

**Related Reports and Presentations**
- Hagiwara, S., Boily, P. (2014) Evaluation of CAZA's Accreditation Scoring Procedure, *Canada's Accredited Zoo and Aquariums*, Ottawa, Canada – REPORT.

Mathematical modeling using the Canadian Incidence Study of reported child abuse and neglect (Jun '13 - Mar '14)

**Project Description**
- The CIS introduced a new abuse category between its second (2003) and third (2008) cycles.
- Analyzed the datasets and built a Classifying Trees and Random Forests prediction model for PHAC to determine what the abuse type distribution would have been in 2003 had the 2008 abuse types definitions been in place.

**Related Reports and Presentations**
- Boily, P., Huang, Y. (2014) Analysis of Canadian Incidence Study of Reported Child Abuse and Neglect Data, *Public Health Agency of Canada*, Ottawa, Canada – REPORT.
- Boily, P., Huang, Y. "Analysis of Canadian Incidence Study of reported child abuse and neglect data", *Public Health Agency of Canada*, Ottawa, Canada, March 28, 2014 – PRESENTATION.

Queueing model of wait time at pre-board screening checkpoints (Jun '13 - Dec '13)

**Project Description**
- Built a model using queueing theory and general operations research to predict the number of servers required to process pre-board screening travellers to some wait time quality of service (QoS) level at Canadian airports checkpoints for CATSA
- The model also allows for the prediction of QoS levels given an arrival profile.

**Related Reports and Presentations**
- Boily, P., Ye, W., Zhao, Y. (2013) Wait Time Impact Model at Pre-Board Screening Checkpoints for Canadian Airports, *Canadian Air Transport Security Agency*, Ottawa, Canada – REPORT.

Time-series analysis of multi-modal supply chain networks (May '13 - Jul '13)

**Project Description**
- Developed a methodology for Transport Canada to produce a seasonally dependent index to track container transit times in multi-modal chain networks, depicting the reliability and the variability of transit times at each node.
- The index is defined in such a way as to facilitate the comparison of performance between differing time periods.

**Related Reports and Presentations**
- Boily, P., Huang, Y. (2013) Analysis of Fluidity Indicators and Seasonality Adjustments for Containers Transit Times in a Multi-Modal Supply Chain Networks, *Transport Canada*, Ottawa, Canada – REPORT.

Scheduling optimization for online food ordering (May '13 - Jul '13)

**Project Description**
- Designed a scheduling algorithm for Fast2eat that prioritizes meal preparation in a food court for which the orders were made online.

- Algorithm was implemented and testing against empirical data began at Carleton in May '14.

**Related Reports and Presentations**
- Ye, W., Boily, P. (2013) Scheduling Algorithm for Food Court Online Ordering, *Fast2eat*, Ottawa, Canada – REPORT.

Statistical surveying and analysis of Canadian vehicle use (Jun '10 - Sep '12)

**Project Description**
- Designed and participated in the implementation of the CVUS for Transport Canada, which has been providing provincial and national estimates of 60 vehicle related quantities since 2012, including fuel consumption, kilometers traveled and passenger-kilometers traveled.
- Prepared a series of CVUS "calculators" which can be used by end users to customize their estimate reports
- Winner of a 2012 GTEC Distinction Award

**Related Reports and Presentations**
- Boily, P. (2011) Methodology of the Canadian Vehicle Use Study, *Transport Canada*, Ottawa, Canada – REPORT.
- Boily, P. "Usage and interpretation of Canadian Vehicle Use Study results", *Transport Canada/Natural Resources Canada/Environment Canada*, Ottawa/Gatineau, Canada, June 2012 – PRESENTATION.

Simulation of the size of population of offenders in Canadian correctional facilities under various sentencing scenarios (Jan '11 - Jun '11)

**Project Description**
- Designed and implemented a complex stochastic simulation model predicting the effects of various policy scenarios on the size of offender populations for Correctional Service of Canada

**Related Reports and Presentations**
- Boily, P. (2011) CPSM Modeling System, *Correctional Services Canada,* Ottawa, Canada – USER MANUAL.

Imputation of blood alcohol contents level in driver and pedestrian fatalities (Dec '09 - Jun '10)

**Project Description**
- Designed and implemented a model imputing missing Blood Alcohol Content data in the National Collision Database for the Ministry of Tranportation (Ontario)
- Accepted for presentation at the Transportation Research Board meetings in Washington, D.C.

**Related Reports and Presentations**
- Boily, P. (2010) An Imputation Algorithm of Blood Alcohol Content Levels for Drivers and Pedestrians in Fatal Collisions, *Ministry of Transportation (Ontario)*, Toronto, Canada – REPORT.

Forecasting fatal traffic collisions using economic indicators (May '09 - Jun '09)

**Project Description**
- Developed a statistical model showing a link between Canadian road fatalities and the state of the Canadian economy
- Presented at the Canadian Multi-Disciplinary Road Safety Conference in Saskatoon.

**Related Reports and Presentations**
- Provost, M., Boily, P., Boase, P. (2009) Improving the Ability to Predict Fatal Traffic Accidents From Economic Indices, *Proceedings of the 19th Canadian Multidisciplinary Road Safety Conference*, Saskatoon, Canada – CONFERENCE PROCEEDINGS.

Ecosystem risk analysis of various repopulation/depopulation scenarios for bisons with bovine tuberculosis in Wood Buffalo National Park (Jun '04 - Nov '08)

**Project Description**
- Designed a complex ecological simulation model and GUI (using stochastic drivers, cellular automata and trophic cascades), at the behest of Parks Canada and Little Red River Cree Nation to assess the ecological damage associated with various bison depopulation scenarios in WBNP.

**Related Reports and Presentations**
- Boily, P. "An ecosystem simulation and risk analysis of Wood Buffalo National Park", *Parks Canada*, Fort Smith, NWT, Canada, November 7, 2008 – PRESENTATION.
- Boily, P. (2007) ERAS★ : Ecosystem Risk Analysis Software, *Parks Canada*, Ottawa, Canada – USER MANUAL.
- Boily, P., Findlay, S. (2005) Ecosystem Risk Analysis of Wood Buffalo National Park, *Proceedings of the Bison Diseases Technical Workshop (October 28-29)*, University of Alberta, Edmonton, Canada – CONFERENCE PROCEEDINGS.

## RELEVANT ANALYSIS, MODELING AND SIMULATION SKILLS AND COMPETENCIES
- Creative quantitative problem-solver
- Accomplished technical and scientific writer (fluent in English and French)
- Meticulous data gatherer, processor and analyzer
- Experience with the following data and statistical analysis and software: SAS, MATLAB, SQL, R, IBM SPSS Modeler, Maple, MS Excel
- Some experience with the following computer programming and scripting languages: C, C++,C#, Perl, Visual Basic

## CHRONOLOGICAL WORK EXPERIENCE
- **Managing Consultant**, *Centre for Qualitative Analysis and Decision Support* (Oct '12 - ongoing)
- **Lecturer**, Mathematics and Statistics, *Université du Québec en Outaouais / University of Ottawa / Carleton University* (Sep '99 - May '14)
- **Economic Advisor (EC-06)**, Economic Analysis, *Transport Canada* (Jun '11 - Sep '12)
- **Senior Consultant (EC-06)**, Government Consulting Services, *Public Works and Government Services Canada* (Jan '11 - Jun '11)
- **Research Analyst (EC-05/06)**, Road Safety, *Transport Canada* (Jan '09 - Dec '10)
- **Methodologist (MA-02)**, *Statistics Canada* (May '08 - Dec '08)
- **Project Officer**, *Canada Border Services Agency* (Jan '08 - May '08)
- **Professor**, Department of Mathematics and Statistics, *University of Ottawa* (Sep '06 -Aug '07)
- **Research Associate**, Institute of the Environment, *University of Ottawa* (Jun '04 - Aug '07)

## LIST OF PRESENTATIONS, PUBLICATIONS AND REPORTS
**Publications**
- Provost, M., Boily, P., Boase, P. (2009) Improving the Ability to Predict Fatal Traffic Accidents From Economic Indices, *Proceedings of the 19th Canadian Multidisciplinary Road Safety Conference*, Saskatoon, Canada.
- Boily, P, Leblanc, V.G., Matsui, E. (2007) Spiral Anchoring in Media with Multiple Inhomogeneities: a Dynamical System Approach, *Journal of Nonlinear Science*, 17:399-427.
- Boily, P., Findlay, S. (2005) Ecosystem Risk Analysis of Wood Buffalo National Park, *Proceedings of the Bison Diseases Technical Workshop (October 28-29)*, University of Alberta, Edmonton, Canada.

**Theses**
- Boily, P. (2006) Spiral Wave Dynamics Under Full Euclidean Symmetry-Breaking: A Dynamical System Approach (Ph.D. Thesis)*, University of Ottawa,* Ottawa, Canada.
- Boily, P. (2000) Analyse numérique des bifurcations dans les systèmes dynamiques paramétrés (M.Sc. Thesis)*, University of Ottawa,* Ottawa, Canada.

**Reports**
- Hagiwara, S., Boily, P. (2014) Covariance Analysis of Irritable Bowel Syndrome Study II, *Canadian College of Naturopathic Medicine*, Ottawa, Canada.
- Boily, P. (2014) Cluster Analysis of Use-of-Force Data, *Commission for Public Complaints Against the RCMP*, Ottawa, Canada.
- Rubenfeld, S., Boily, P., Robitaille, A. (2014) Determinants of Supportive Housing for Canadian Seniors, *Canada Mortgage and Housing Corporation*, Ottawa, Canada.
- Boily, P. (2014) Analysis of 2011-2013 United Way/Centraide Canada Fundraising Data, *United Way/Centraide Canada*, Ottawa, Canada.
- Hagiwara, S., Boily, P. (2014) Evaluation of CAZA's Accreditation Scoring Procedure, *Canada's Accredited Zoo and Aquariums*, Ottawa, Canada.
- Boily, P., Huang, Y. (2014) Mathematical Assessment of the Reliability of Childhood Physical Abuse Measure in the National Population Health Survey, *Public Health Agency of Canada*, Ottawa, Canada.
- Boily, P., Huang, Y. (2014) Analysis of Canadian Incidence Study of Reported Child Abuse and Neglect Data, *Public Health Agency of Canada*, Ottawa, Canada.

- Boily, P., Ye, W., Zhao, Y. (2013) Wait Time Impact Model at Pre-Board Screening Checkpoints for Canadian Airports, *Canadian Air Transport Security Agency*, Ottawa, Canada.
- Hagiwara, S., Boily, P. (2013) Covariance Analysis for the 2010 CCNM Pilot Study on Irritably Bowel Syndrome, *Ottawa Integrative Cancer Center*, Ottawa, Canada.
- Boily, P. (2013), Analysis of United Way Fundraising Data, *United Way/Centraide Canada*, Ottawa, Canada.
- Boily, P., Huang, Y. (2013) Analysis of Fluidity Indicators and Seasonality Adjustments for Containers Transit Times in a Multi-Modal Supply Chain Networks, *Transport Canada*, Ottawa, Canada.
- Ye, W., Boily, P. (2013) Scheduling Algorithm for Food Court Online Ordering, *Fast2eat*, Ottawa, Canada.
- Boily, P. (2011) Methodology of the Canadian Vehicle Use Study, *Transport Canada*, Ottawa.
- Boily, P. (2010) An Imputation Algorithm of Blood Alcohol Content Levels for Drivers and Pedestrians in Fatal Collisions, *Ministry of Transportation (Ontario)*, Toronto, Canada.

**Textbook**
- Boily, P., Hart, R. (2009) Le calcul dans la joie (format économique), Quadrangle, Ottawa.

**User Manuals**
- Gao, Z., Haidar, A., Macfie, A., Boily, P. (2014) Modeling of Industry Canada's 2500MHz Band Combinatorial Clock Auction, *Nordicity Group Ltd*, Ottawa, Canada.
- Gao, Z., Haidar, A., Moazzez, B., Boily, P. (2013) Modeling of Industry Canada's 700MHz Band Combinatorial Clock Auction, *Nordicity Group Ltd*, Ottawa, Canada.
- Boily, P. (2011) CPSM Modeling System, *Correctional Services Canada,* Ottawa, Canada.
- Boily, P. (2007) ERAS★ : Ecosystem Risk Analysis Software, *Parks Canada*, Ottawa, Canada.

**Presentations**
- Boily, P., Almaskut, A. "Analysis of United Way Centraide Canada fundraising data", *UW Toronto*, Toronto, Canada, June 6, 2014.
- Boily, P., Huang, Y. "Analysis of Canadian Incidence Study of reported child abuse and neglect data", *Public Health Agency of Canada*, Ottawa, Canada, March 28, 2014.
- Boily, P. "Usage and interpretation of Canadian Vehicle Use Study results", *Transport Canada/Natural Resources Canada/Environment Canada*, Ottawa/Gatineau, Canada, June 2012.
- Boily, P. "A model of the Canadian vehicle fleet", *Transport Canada*, Ottawa, September 2, 2010.
- Boily, P. "An ecosystem simulation and risk analysis of Wood Buffalo National Park", *Parks Canada*, Fort Smith, NWT, Canada, November 7, 2008.
- Boily, P. "Spiral anchoring under full Euclidean symmetry-breaking: a dynamical system approach", *International Conference on Recent Developments in Differential Equations and Applications*, Guangzhou, China, July 21, 2006.
- Boily, P. "Spiral anchoring under full Euclidean symmetry-breaking: a dynamical system approach", *University of Ottawa / University of Western Ontario / Queens University / University of Waterloo / Université de Montréal / University of Ontario Institute of Technology*, Ottawa / London / Kingston / Waterloo / Montréal / Oshawa, Canada, March – July, 2006.

**Workshops**
- Boily, P., "Analytics, Before and After: Gathering, Preparing and Visualizing Data", *CQADS Workshop Series*, Oct. 2014.
- Boily, P., Schellinck, J., "Mining for Information Gold: Data Science Concepts and Techniques", *CQADS Workshop Series*, Oct. 2014/
- Boily, P., Schellinck, J., "Hands-on Data Discovery: Exploring Data with IBM SPSS Modeler and Other Platforms", *CQADS Workshop Series*, Oct. 2014.
- Boily, P., "Challenges of Pre- and Post-Analytics", *CQADS Workshop Series*, Feb. 2014

## EDUCATION AND AWARDS
- Ph.D. (Mathematics), *University of Ottawa*, 2006
- M.Sc. (Mathematics), *University of Ottawa*, 2000
- B.Sc. (Mathematics), *University of Ottawa*, 1998
- Ontario Graduate Scholarship, 1998-2000