

# CENTRE FOR RESEARCH ON BIOLOGICAL COMMUNICATION SYSTEMS (CRBCS): AN INTEGRATED SYSTEMS APPROACH TO COMMUNICATION

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Thanks to generous grants from the Canada Foundation for Innovation, the Ontario Innovation Trust Fund, and the City of Mississauga, I am pleased to announce the establishment of a Centre for Research on Biological Communication Systems (CRBCS), with research facilities located at the Mississauga campus of the University of Toronto (UTM), Queen's University, and Sheridan College. This Centre will provide researchers with state-of-the-art facilities to probe the nature of human and animal communication systems across the lifespan at levels ranging from gene expression to the development and organization of social behaviour.

The Centre's philosophy is to take an integrated systems approach to the study of human and animal communication. Biological communication systems are interactive and multimodal. Whereas most researchers tend to focus their efforts on one aspect of human or animal communication, and usually restrict themselves to a single information channel, researchers at CRBCS will be encouraged to study biological communication as an integrated system that is developing and changing across the lifespan. Hence, we are building research facilities and expanding our research complement so that we can 1) pursue a lifespan approach to human communication that takes into account its multimodal nature, 2) determine the effects of new technologies on human communication systems, and 3) trace the effects of genetic contributions to communication systems through to behaviour in animals and humans. Five research facilities will work together to obtain these goals.

## 1.0 HUMAN COMMUNICATION RESEARCH FACILITY (UTM)

Currently under construction (completion date, January, 2004) is a new 2000 m<sup>2</sup> research facility that will occupy the top floor of the new Communication, Culture, and Information Technology Building at UTM (partially funded by Ontario's SuperBuild Fund). This research facility will include: signal-processing equipment to measure, record, store, analyze, and process sounds recorded in a natural environment, equipment to provide virtual simulations of these environments; sound-attenuating chambers and associated equipment to be used for testing human-to-human and human-machine communication; a multimodal virtual-reality test station (identical to one at the Queen's Multimodal Research Facility); test stations to monitor attentional behaviour (e.g., eye movements) in studies of

reading, reading development, and developmental dyslexia; test stations to assess age-related changes in visual processing of information; and video capturing and image processing equipment to be used in the development of instructional modules for use in second-language acquisition.

## 2.0 ANIMAL COMMUNICATION RESEARCH FACILITY (UTM)

The animal communication research facility will occupy newly renovated facilities (completion date, summer, 2004) which will consist of dedicated facilities for surgical, histological, molecular, genetic, and behavioral work, along with excellent outdoor "fields," and confocal and biotechnology facilities. As well, UTM has a first-class, well-serviced, small-mammal animal vivarium which is being expanded to accommodate small mammals for genetic research. These facilities will permit researchers to investigate communicative behaviour at a level that is often not possible in the study of human communicative interactions. By linking animal and human geneticists with sensory physiologists and behavioural scientists, we hope to identify the genes that contribute to the development and expression of communicative behaviours in both animals and humans, trace their influence on neural development, neurochemistry, and sensory functioning, and determine how their differential expression affects communication and social interaction.

## 3.0 QUEEN'S MULTIMODAL COMMUNICATION RESEARCH FACILITY

A new research laboratory (completion, summer, 2003) will give this facility a unique capacity for simultaneously monitoring several communicative behaviours, and for testing audiovisual integration during communication. Specifically, researchers in this lab will be able to measure 3D movements of the vocal tract in adult humans, measure and analyze facial movements, and monitor body, head, and eye position in both humans and animals. Moreover, Silicon Graphics computers and associated hardware and software will allow us to produce the high definition audio and visual stimuli required in studies of animal and human communication. Combined audio-visual tests stations and associated soundproof rooms will permit us to examine how the auditory and visual channels are integrated in face-to-

face communications. Working in cooperation with the geneticists and neuroscientists at Queen's and UTM, this equipment will also be used to study communication in clinical populations where there are genetic bases to communication disorders.

#### **4.0 VISUALIZATION DESIGN INSTITUTE (SHERIDAN)**

The Visualization Design Institute (VDI) is dedicated to the pursuit of excellence of design in the field of computer visualization and simulation. VDI has the equipment and expertise that will allow CRBCS researchers to incorporate new animation, auralization, and visualization techniques into virtual-reality systems to be used in studies of communicative interactions between humans, and between humans and machines. Working in cooperation with researchers associated with the Human Communication Research Facility, and the Sheridan Elder Research Centre (see below), the VDI will also be involved in studies evaluating the impact and potential usefulness of new communication technologies in addressing the communication needs of special populations such as the elderly. By working together we will be able to *customize* systems to accommodate the psychological and physiological differences among individuals. This will increase system performance, reduce user problems, and increase user satisfaction. Because of its close ties with industry, the VDI will also serve as a conduit for translating research results into commercial products and services.

#### **5.0 SHERIDAN ELDER RESEARCH CENTRE (SERC)**

The Sheridan Elder Research Centre (SERC) was designed for research on psychosocial aspects of aging. When it is completed in the summer of 2003, it will enable CRBCS researchers to study older adults in a more naturalistic setting than that of the artificial and sterile environments characteristic of research laboratories. Among other things it will permit the creation and manipulation of an environment that could serve as a model for adult day programs. This existence of such an environment will allow us to study communication in the elderly in a naturalistic setting, and to determine how communication deficits affect lifestyle choices, and test ways to improve communication in such an environment. In this way we hope to be able to translate our research findings into practical solutions, and test these solutions in a realistic environment. In addition, SERC's contact with 120 community-based field sites will provide not only input at the research development phase, but also a vehicle for translating research results into practical solutions to real world problems. Finally, our history of cooperation with the City of Mississauga and its Board of Trade will also help in identifying community-based health problems related to communication, as well as

provide a venue for translating research on these problems into practical solutions.

#### **6.0 OPPORTUNITIES FOR TRAINING**

CRBCS offers a number of opportunities for graduate and postgraduate training. Among these is a newly funded Canadian Institutes of Health Research (CIHR) training grant in Communication and Social Interaction in Healthy Aging. This is a multi-disciplinary and multi-institutional training program open to graduate students who are working toward an advanced degree in one of the following departments: Audiology and Speech-Language Pathology (Université de Montréal), Biomedical Engineering (University of Toronto), Psychology (Concordia University, McMaster University, University of Calgary, University of Toronto), and Optometry (Université de Montréal). The goal of the program is to provide an environment that will permit students to develop transdisciplinary approaches to the study of communication systems and their effects on social interaction in older adults. The specific objectives of this program are to provide trainees with (1) excellent training within one's own discipline, (2) an appreciation of the potential contributions and advantages of a transdisciplinary approach, (3) a working knowledge of the techniques used in the other disciplines, including their strengths and weaknesses, (4) experience as part of a transdisciplinary research team, and (5) training in effective research translation. Students in the program will receive generous support to attend workshops to receive training in audiology, speech-language pathology, optometry, cognitive assessment, and the development and use of assistive technologies. In addition they will spend one semester at a department or institution other than their own working on a transdisciplinary research project. All trainees will be fully supported and receive generous support to attend conferences, workshops, and seminars.

CRBCS also will have a number of openings for postdoctoral training. These positions and other opportunities for collaborative research will be posted on our website, which is currently under construction (when completed the address for this website, as well as the one for the CIHR training program may be found at the website of the CIHR Research Group on Sensory and Cognitive Aging, <http://www.erin.utoronto.ca/~w3cihrsc/Cihr/index.htm>). We are excited about the new research and training opportunities afforded to us because of the generous support we have received from the Canada Foundation for Innovation, the Ontario Innovation Trust Fund, the City of Mississauga, the Natural Sciences and Engineering Research Council, and CIHR. We look forward to good relations and a number of cooperative ventures with scientists, humanists, health care professionals, industrial partners, the general public, and all those who share an interest in biological communication systems.