

Empowering Productivity

The modern workplace demands more of its employees than ever before as technology assumes a larger role. Yet, little is known about the productivity of the employees and the interplay of the various facets of productivity. The vision of this multidisciplinary research cluster is to empower the productivity of individuals and teams by (1) developing holistic measures of productivity, and (2) designing interventions to foster productive workplace behaviour and mental health.

This research cluster brings together internationally renowned researchers from various disciplines (e.g., Psychology, Management, Psychiatry, Computer Science, etc.) with a rich variety of backgrounds and expertise in methods and their application for measuring and monitoring various facets of productivity. The expertise and methods range from individual levels to organizational levels (e.g., van Jaarsveld, Walker), and from coarse-grained, such as counting the days a professional is present at work with full capacity versus less capacity (e.g., Zhang, Bansback), to medium grained, such as tracking computer-based activity (e.g., McGrenere, Fritz, Holmes), all the way to fine-grained measures of an individual's attention, focus, and cognitive load based on biometrics (e.g., Kingstone, Conati, Fritz) or the neural bases and executive functions (e.g., Diamond).

By bringing together this diverse expertise, our research cluster will be able to focus on a more holistic understanding of productivity and the interplay between the various facets that influence productivity. This will not only allow us to significantly advance our overall understanding of, and ability to improve, productivity, it will also inform and strengthen the individual research of each collaborator. For instance, by relating the various measures of productivity, we will be able to define more accurate coarse-grained measures that not only take into account the days and capacity level, but also the various work activities performed and the worker's focus; or correlate interventions to train executive functions (EFs) and attention to an overall measure of return on investment at the organizational level.

As most individuals and organizations want to productively contribute to society, this research cluster has broad social relevance. By focusing on improving productivity and examining its relationship to mental health, the cluster will have broad impact, benefit society and workers' well being, and will attract future research talent.

We seek funding to foster the proposed cluster of research excellence and enable the group to establish meaningful deep research relationships that will in turn result in significant and impactful research advances in the field of productivity, strengthen our ability to seek larger institutional grants, and establish UBC's reputation as a multi-disciplinary leader in research on productivity.

Research Objective 1 -- Monitoring Productivity

Labour expenditures represent a primary expense in the modern workplace. Yet, little is known about whether organizations derive a positive return on their investment on labour input, because it is difficult to ascertain whether employees are focusing the majority of their time on their primary work tasks or spending their time as efficiently as expected. Traditional forms of performance evaluation occur once or a few times a year and research draws on archival measures, such as supervisor assessments or employee self-reports. These measures lack detail and are subject to potential biases.

Accurately measuring productivity is fundamentally complex due to the variety of tasks people perform, the diversity of their workplaces, and the individual differences in competence and motivation. Overall, the concept of measuring productivity is multifaceted and depends on many different factors, including the goal of measuring

productivity (e.g. assessing an intervention or identifying productivity impediments), the unit of analysis (e.g. individual, team, or organization), and the time horizon being examined (e.g. a short task, a day, or a year).

Our primary objective for this research cluster is to identify *generalizable and accurate real-time measures of productivity for individuals, teams and organizations*. By integrating various methods of measuring productivity, we will be able to provide a more holistic understanding of productivity, and for instance, will be able to examine when professionals are focused on their primary work task or when obstacles arise. Our goal is to identify generalizable measures of productivity using behavioural and biometric data and to provide automatic and real-time monitoring approaches for individual and team productivity at work. These measures will provide sufficient accuracy, fidelity, and sensitivity to enable evaluating the effects of a wide variety of productivity-enhancing interventions, such as personal/team training, productivity-aware tooling, and or other wellbeing approaches (including pharmaceutical interventions). As part of this objective, we also investigate the relation between productivity and mental health or well-being at work.

Research Objective 2 -- Empowering Productivity

Getting “in the flow” and staying focused at work is challenging given various external and self-initiated interruptions and distractions in the modern collaborative workplace that often feature open concept office configurations. While reducing interruptions and increasing focus and attention at work can improve overall productivity, little is known about the most effective ways and approaches to do so.

Identifying effective interventions is complicated by the plethora of factors undermining focus and attentiveness at work. While some of these factors are work-related, such as teammate interruptions or scheduled meetings and tasks, there is also a large number of more personal factors that affect cognition and work focus, such as sleep quality, personal conflicts, decrease in motivation overtime. In medical contexts, randomized controlled trials are used to control for these confounding factors, suggesting that larger-scale experiments may be required to gain sufficient data to understand the impact of these interventions.

Our second key research objective that we will address in this cluster is to *determine effective interventions that increase focus and attention and improve overall productivity and wellbeing of individuals and teams*. In particular, our objective is to develop focus- and attention-enhancing interventions and to evaluate their impact on productivity and the wellbeing of the individual and teams.

The researchers involved in this cluster, contribute a breadth of expertise in designing and evaluating interventions to increase focus, attention and overall productivity. In combination with the expertise and the findings for our first objective, we will be able to devise and evaluate interventions that more holistically address the many factors affecting productivity, and effectively empower individuals and teams to be more productive. In particular, we will focus on three groups of interventions:

- (a) interventions that train the mind to increase self-control and attention (e.g. improving aerobic capacity or mindfulness training in order to improve EFs),
- (b) interventions that streamline the workflow and reduce distractions (e.g. automating rote work, altering aspects of the work environment to improve EFs),
- (c) interventions that use (automatic) measures of cognitive load and attention to reduce interruptions and increase focus (e.g. personalization of computer applications or work schedules, self-monitoring applications, physical indicators to reduce external interruptions).

The activities that we propose to develop and advance include the promotion of collaborative research, e.g. performing large-scale field studies that integrate various measures (such as EF measures, biometric measures, or measures on work activities) on industrial-scale tasks, and workshops that we will use as a vehicle to invite faculty from other universities to share their knowledge about research on productivity and increase industrial involvement in the research program. We will involve our graduate students in these activities to help foster their research interests in these topics.

Budget

A large proportion of the funding for this grant aims to foster (1) stronger collaboration amongst the researchers in the cluster, in particular for starting concrete research projects as a unit, (2) the application for larger group grants, and, (3) external visibility and networking. We plan to have a program coordinator that helps with the organization of events, assists in identifying and supporting larger grant applications to a variety of funding agencies, helps determining networking opportunities, and helps establish new collaborations with industry for grants and studies.

To foster internal collaboration, we plan a three day retreat that provides students and faculty an opportunity to learn from each other and make tangible progress on planning and launching real projects. We further plan a one week summer school for which we will have a combination of researchers from the cluster and external experts that provide students, faculty and interested professionals the opportunity to learn about the state-of-the-art in the multi-disciplinary research. We will organize 2 one-day events for the main researchers of this cluster to coordinate, design and kick-off research studies and projects together. Finally, to promote collaboration between students, we will organize multiple social lab afternoons in which various labs of the cluster will meet and exchange ideas.

For external visibility and networking, we will have an alumni & industry evening. We will use this to engage with industry and solicit interest and feedback in our research and studies. We will further visit other institutions and invite four distinguished speakers to give talks throughout the year.

Program Coordinator (part-time)

Event organization, grant application support, networking opportunities, industry collaborations **\$30,000**

Fostering Collaboration

Three-day research retreat (faculty and students, approx. 30, Whistler) **\$10,000**
 One-week Productivity Summer School (@UBC) **\$10,000**
 2 one-day, off site experimental design sessions, 10 people each **\$4,000**
 Lab afternoons (@UBC) **\$4,000**

External Visibility and Networking

Alumni & Industry Event **\$10,000**
 Visits by Productivity team to other institutions (10 trips, 1 per faculty in the cluster) **\$20,000**
 4 Distinguished invited speakers (\$3,000 each) **\$12,000**

Proposed Research Cluster Activities

The activities this research cluster will engage in to develop future research grants, advance our research ideas and promote external visibility will include a research retreat, a summer school, research presentations, brown bag lunches, lab afternoons, experimental design sessions, an alumni & industry event as well as visits to other institutions. We will use several events as a vehicle to invite faculty from other universities to share their knowledge about research on productivity, in particular for the summer school and the invited speakers. We will

involve our PhD students in these activities to help foster their research interests in these topics and promote stronger collaborations between the labs.

Catalytic funding would enable the following (expected) outcomes:

- a. Development of a Letter of Intent for a SSHRC Partnership Grant.
- b. Identify specific research equipment that will overlap the cluster (e.g., sensors) that would make strong candidates for cluster-wide NSERC RTI submissions (or other equipment-oriented grants).
- c. Sponsorship of a workshop addressing productivity involving researchers from North America.
- d. Cross-unit collaboration within the cluster; this would involve both whole-cluster activities (e.g., cluster meetings and symposia) and part-cluster activities (e.g., designing and performing specific cross-unit experiments).
- e. Improved collaboration with local industry in the productivity space. This would be to both identify jobsites where our research could be evaluated and have tangible industrial impact, and to find new ways to encourage local industry to engage with active research teams within the university.

Secured Collaborators

Given the specific and targeted nature of this cluster, we do not have a notion of ‘affiliate’ members. All collaborators listed here have expressed interest in this research endeavour and have direct and meaningful overlap in the activities proposed above.

Thomas Fritz, Computer Science (Science)

Thomas is an Assistant Professor of Computer Science at the University of British Columbia. Before joining UBC, he was an assistant professor at the University of Zurich, Switzerland. His research focuses on empirically studying software developers and on using personal and biometric data to improve software developers' productivity. For his research, he works with over 20 international companies, including ABB, Microsoft, and IBM. Furthermore, his research has been prominently featured in the media, including The New Yorker, The Wall Street Journal, and The Times.

Reid Holmes, Computer Science (Science)

Reid is an Associate Professor of Computer Science at the University of British Columbia. His primary research interests revolve around the human aspects of software engineering. His research seeks to improve our understanding of how software engineers reason about complex software systems and deriving novel interventions to improve their ability to efficiently evolve these systems in ways that preserve the correctness of the systems. He has received four ACM Distinguished Paper awards for research related to these projects.

Alan Kingstone, Psychology (Arts)

Alan is a Professor and Distinguished Scholar at the University of British Columbia; and Social Sciences and Humanities research advisor in the VP Research & Innovation office. His research focuses on the brain mechanisms of human cognition and behaviour. He has published over 250 scientific peer-reviewed articles on human behaviour, cognition, and neuroscience. He is a Fellow of the Peter Wall Institutes for Advanced Studies, a Killam Research Fellow, Fellow of the American Psychological Society, and Fellow of the Royal Society of Canada.

Adele Diamond, Psychiatry (Medicine)

Adele is a CRC Tier I and Professor of Developmental Cognitive Neuroscience at UBC. Her specialty is the rigorous study of executive functions. She studies how they can be modified by the environment or neurobiology and improved by effective programs and interventions. Her discoveries have impacted education worldwide and improved medical treatment for 2 disorders (PKU & ADHD). A Fellow of the Royal Society of Canada, her many awards include an honorary doctorate, Inaugural Distinguished Achievement Award for Service to the Community from UBC's Faculty of Medicine, and being named one of the “2000 Outstanding Women of the 20th Century” and one the “15 most influential neuroscientists alive today.”

Danielle van Jaarsveld, Organizational Behaviour Division (Sauder School of Business)

Danielle is an Associate Professor of Organizational Behavior and Human Resources in the Sauder School of Business at the University of British Columbia, and the E.D. MacPhee Chair in Management. She received her M.Sc. and PhD from Cornell University's School of Industrial and Labor Relations. Her primary research interests include high performance work systems, organizational and individual productivity, and service quality. She has published over 18 articles that examine productivity in the workplace from the organizational and individual perspectives in the service industry.

David Walker, Organizational Behavior (Management)

David is an Assistant Professor in the Faculty of Management at the University of British Columbia-Okanagan. He received his M.Sc. and PhD from UBC's Sauder School of Business. His primary research interests include understanding the effect of customers on service employee productivity, and human resource management in service organizations. He has published 6 articles examining factors contributing to service quality in low wage workplaces.

Nick Bansback, School of Public Health (Medicine)

Nick is an Associate Professor in the School of Population and Public Health, UBC, and Program Head of Decision Science at the Centre for Health Evaluation and Outcome Sciences. His research seeks to promote decisions that maximize value, for individuals and for policy makers. He has published over 50 articles on the cost-effectiveness of different drugs and technologies in health care, and is currently a CIHR New Investigator.

Wei Zhang, School of Public Health (Medicine)

Wei is an Assistant Professor of Health Economics in the School of Population and Public Health at the University of British Columbia and Program Head of Health Economics at the Centre for Health Evaluation and Outcome Sciences. Her primary research interests include measurement and valuation of work productivity loss due to illness, economic evaluation of health care interventions, and pharmaceutical policy. She has published over 20 articles that focus on measuring and valuing productivity losses due to health problems. These studies include setting up a framework for measuring work productivity. Her research has been applied in research for a variety of different diseases, such as rheumatoid arthritis, asthma, cardiovascular disease, colorectal cancer, obesity, and ulcerative colitis.

Cristina Conati, Computer Science (Science)

Cristina is a Professor of Computer Science at the University of British Columbia. She received a M.Sc. in Computer Science at the University of Milan, as well as a M.Sc. and Ph.D. in Intelligent Systems at the University of Pittsburgh. Conati's goal is to integrate research in Artificial Intelligence (AI), Human Computer Interaction (HCI) and Cognitive Science to create intelligent interactive systems that can capture relevant user's properties (states, skills, needs) and understand how to personalize the interaction accordingly, in an effective, non-intrusive manner. Her areas of interest include User-Adaptive Interaction, User Modeling, Affective Computing, Intelligent Virtual Agents, and Intelligent Tutoring Systems.

Joanna McGrenere, Computer Science (Science)

Joanna is a Professor in the Department of Computer Science at the University of British Columbia. Her research area is Human Computer Interaction, with a specialization in interface personalization, universal usability, assistive technology, and computer supported cooperative work. Joanna's work is consistently being published in top-tier international venues and has been recognized with awards at ACM CHI 2016, Graphics Interface 2012, ACM CHI 2009, ACM IUI 2007, and ACM ASSETS 2007. Joanna recently served as an Associate Head in CS at UBC (2013-15) and lead the HCI@UBC initiative: an interdisciplinary meeting for scholars working in the area of Human-Computer Interaction at UBC (2013-15), which is now being re-branded as the Designing for People (DFP) initiative.