Major Modifications Proposal

Faculty: Health (anchor but also Lassonde, Science, LAPS, AMPD)

Department: Graduate Program in Psychology (lead)

Graduate Programs in Biology, Electrical Engineering and Computer Science, Digital Media, Kinesiology, Philosophy, Physics and Astronomy

Centre for Vision Research

Program: Collaborative Graduate Specialization in Vision Research

Degree Designation: Collaborative Graduate Specialization

Type of Modification: New interdisciplinary specialization

Location: Keele

Effective Date: Fall 2024

Overview

1. **Provide a brief summary of the proposed changes to the program.**

    This proposal is for a new collaborative Graduate Specialization in Vision Research. The specialization will draw from multiple graduate programs to offer Masters and Doctoral students the opportunity to specialize and earn credentials in vision research, a cross-disciplinary area of excellence at York as exemplified in the Centre for Vision Research (CVR).

    The graduate specialization in vision research will be offered by members of the CVR, a leading world-class research centre involving faculty members from multiple graduate programs at York University. The specialization will prepare students from multiple disciplines for interdisciplinary and translational research in human, animal, or computer vision. Students will learn the computational and biological basis of seeing and how it helps to act successfully in the world. Students will learn from vision researchers using a broad range of experimental and theoretical approaches which will prepare them for careers in academic, industrial, or public sector settings in vision research and related fields. They will also be introduced to translational approaches to moving vision research results from the lab to application in the clinic, community, or industry. These skills will

be developed and evaluated through experiential education, coursework and a thesis in the area of vision research.

In addition to the requirements of their home graduate program, students seeking the Collaborative Graduate Specialization in Vision Research must successfully complete the following requirements:

1. GS/VIS 6001 0.0 Seminar in Vision Research
2. A research thesis or dissertation in vision research (broadly defined including visual neuroscience, visual psychophysics, visually-guided motor action, visualization, visual cognition, computer vision, image processing, visual human factors, and clinical vision science).

3. Experiential Breadth Requirement: Students must demonstrate engagement in academic and scholarly activities in vision research at York. Given the broad interdisciplinary background of our students this requirement will be met by at least one major activity such as a leadership role at the CVR summer school, presentation at the CVR conference, industry practicum or internship, or project in another vision-related laboratory.

2. Provide the rationale for the proposed changes.

Vision research is a broad interdisciplinary field that relies on techniques from physics to philosophy, from genetics to artificial intelligence. Vision research at York is internationally recognized as world-class and has a particular focus on systems aspects. Students study the fundamental nature of visual problems, investigate the computational and physiological means that allow machines and animals to see the world, and apply this knowledge to diverse applications. There is currently no formal program that introduces students to the field and mentors rely on ad-hoc and individual approaches. The proposed program will allow for a more systematic and principled approach to the training of vision researchers at York.

Vision and visual media are key components of many aspects of life. Graduates will contribute to art and entertainment, health care, robotics and automation, transportation, data science, and numerous other fields. Visual impairments and disorders can have a wide range of human health impacts. Clinical applications of our basic vision research address the impact of diseases and disorders affecting vision and visual cognition as well as technological adaptations to visual impairments. The CFREF funded Vision Sciences to Applications program (VISTA) has involved dozens of external industry, non-profit, government and other partners and this network will be leveraged to help further determine and document the external and labour market need for the program. Also MITACS internships and other industry interactions have led to valued

learning experiences for CVR trainees and demonstrated the capacity and interest of industry in our students.

Graduates of York in vision research have been very successful in obtaining excellent positions in academia, industry, government and non-profit organizations. The program will provide additional institutionally-recognized credentials that will help graduates better market their skills and training to potential employers.

The program is beneficial for the vision research community at York as it provides an externally visible and marketable program that will aid in student recruitment. It further highlights and emphasizes the inter-disciplinary strength of York in this and other areas. The program will further increase the visibility of vision research at York extending these interdisciplinary aspects by drawing interest from other academic groups/people at York not currently aligned with CVR.

The collaborative specialization is the most appropriate format for this credential, as it respects, and does not detract from, the robust requirements of the associated degree programs. In addition, it also supports those students who also choose to pursue a concurrent graduate diploma. The specialization enables this flexibility by providing a very concentrated path of study that will serve students well post-graduation given the various credential options available to them. This well-defined and externally visible credential can also benefit recruitment to both the specialization area and the associated graduate programs.

3. **Comment on the alignment of the program changes with Faculty and/or University academic plans.[1]**

The groundwork for this specialization is already well-established by CVR infrastructure and programming. Vision research at York is highly interdisciplinary involving many graduate programs (Psychology, Kinesiology, Electrical Engineering and Computer Science, Digital Media, Philosophy, Physics, Biology, and Neuroscience), multiple Faculties and researchers at all 3 campuses. Combined with the participation of numerous community partners these activities epitomize the UAP priority of Working in Partnership with ourselves and our community and Global Engagement with global industry and academia. Vision science is a key driver of the UAP priority of Knowledge for the Future and, in particular, the SRP goals in Health, Digital Cultures and Artificial Intelligence. The SRP also highlights York's Vision Research as a prime example throughout the document particularly in support of Comprehensive Research Excellence with International Reach, Building Healthy Lives and Exploring and Interrogating the Frontiers of Science and Technology. There are no similar programs at York or at other

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[1] This can include the 2020-2025 University Academic Plan, the 2018-2023 Strategic Research Plan, the UN Sustainable Development Goals (SDGs), A Framework and Action Plan on Black Inclusion, the Indigenous Framework for York University, and others, along with Faculty plans and frameworks.

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Ontario Institutions. Several medical schools have ophthalmology programs with Vision Science components (for example at the University of Toronto) but these tend to be clinically oriented and focused on eye health. The University of Waterloo School of Optometry has a Vision Science program, but it is focused on physiological optics and the eye and not the systems vision science that York is known for. Other institutions have research groups or individuals working in the field but do not have a graduate program.

Alignment with the anchor Faculty of Health is evidenced by involvement of sixteen core CVR members from the Department of Psychology and School of Kinesiology and Health Science. There is also a long tradition of fundamental and applied research in the vision sciences in these departments. CVR formed the core of York's successful CFREF program Vision: Science to Applications (CFREF, 2016) and was one of the core ORUs underlying the transformative Connected Minds (CFREF 2023) program. Vision science is at the intersection of several areas of Faculty and institutional research excellence identified in the SRP supports York's vision to "better understand the human condition and the world around us", support "building healthy lives and communities". The CVR is aligned with other Institutional research initiatives such as the Centre for Integrated and Applied Neuroscience (CIAN) Organized Research Unit and ongoing Neuroscience extension project in which the Faculty of Health is involved.

4. **Provide a detailed outline of the changes to the program. Include as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.**

   There are no changes to programming as this is a new specialization for multiple programs. Requirements for the specialization include a thesis or dissertation in the area of vision research, completion of VIS 6001, and an experiential breadth requirement.

Learning Outcomes and Program Requirements

5. **If applicable, provide the current and/or updated Learning Outcomes.[2] Identify and map how these Learning Outcomes meet Ontario's Degree Level Expectations. Include an additional curriculum map showing how courses map onto to the Program Learning Outcomes.**

   There are no changes to learning outcomes of the various graduate programs. Specific learning outcomes for the Collaborative Specialization include that students should be able to:

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[2] Ideally, a program would have 8-12 Program Learning Outcomes (PLOs) that clearly reflect how the program meets Ontario's Degree Level Expectations. Support for visioning, defining, and mapping your PLOs can be found in the Office of the Vice Provost Academic.

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LO-A) Synthesize links across disciplines to understand current theoretical and experimental approaches to problems in vision research from multiple perspectives. [GDLE Depth and breadth of knowledge, Research and scholarship, and Awareness of limits of knowledge]

LO-B)   Conduct vision research using appropriate methodologies to address transdisciplinary problems [GDLE Research and scholarship, Level of application of knowledge]

LO-C) Communicate findings, theory and analysis effectively in a multidisciplinary context [GDLE Research and scholarship, Professional capacity / autonomy, Level of communication skills]

6.   **If applicable, describe how the proposed modifications will support the achievement of Program Learning Outcomes.**

LO-A) The broad range of experimental, theoretical, computational, and applied techniques students will be exposed to in the *Seminar in Vision Research* will build knowledge of the foundational concepts of vision research. The course will encourage focusing on intersections and extensions of these ideas across the seminars to build a richer and more nuanced view of the key ideas in vision research. These skills will be applied to a particular interdisciplinary vision problem in the literature review and discussion of their work in the *Thesis/Dissertation in Vision Research* which will demonstrate they can place their work in the broader context.

LO-B) The ability to conduct vision research at a graduate level will be supported by the *Experiential Breadth Requirement* that provides opportunity for in-depth experience with one or more aspects of research culture and will be demonstrated in the *Thesis/Dissertation in Vision Research*.

LO-C) Communication in a multidisciplinary context will be supported by the networking and presentation aspects of the *Seminar in Vision Research* and demonstrated by the student's *Thesis/Dissertation in Vision Research*. In most cases, the *Experiential Breadth Requirement* will also provide opportunity for improving and demonstrating communication skills.

7.   **If applicable, describe how the achievement of the Program Learning Outcomes will be assessed and how that assessment of the Program Learning Outcomes will be documented.**

The course director of the *Seminar in Vision Research* will ensure that students have demonstrated adequate grasp of multiple aspects of vision research and their intersection through their presentations and class discussions (LO-A). They will also ensure students have had opportunity for interacting with speakers and for leading

discussions (LO-C). Adequate achievement of these objectives will be required to pass the course. Please see the associated course proposal for more details.

The specialization advisor will certify (on a standard form to be developed) that the thesis or dissertation meets the topic requirements for the specialization (LO-B) and that it considers inter- and trans-disciplinary aspects of vision research as appropriate in the literature review, analysis and discussion of the research (LO-A and LO-C).

The specialization coordinator will ensure that the chosen activity for the *Experiential Breadth Requirement* provides adequate opportunity to gain experience with one or more aspects of vision research (LO-B) and that there is opportunity to develop communication skills (LO-C). This requirement will be assessed based on a brief proposal form for the *Experiential Breadth Requirement* submitted by the student and approved by the coordinator. We expect that the VIS 6001 course director will also undertake the role of specialization coordinator at least in the initial years of the specialization.

8. **If applicable, describe changes to any admission requirements and the appropriateness of the revised requirements for the achievement of the Program Learning Outcomes.**

   Not applicable, no change to admissions requirements in home programs. Admission/enrollment in the specialization will be accomplished via a form to indicate intent to proceed in the specialization.

Teaching and Learning

9. **If the proposed changes include a revision to mode(s) of delivery, comment on the appropriateness of the revised mode(s) of delivery for the achievement of the Program Learning Outcomes.**

   No changes to modes of delivery of the various graduate programs.

   The modes of delivery for the specialization includes seminars, experiential education, research practice and thesis research. These align directly with the learning outcomes of the specialization as indicated in section 6.

10. **If applicable, describe changes to assessment and the appropriateness of the revised forms of assessment to the achievement of the Program Learning Outcomes.**

    No changes to assessment of the degree requirements of the various home graduate programs.

Assessment of the dissertation/thesis will follow FGS/program norms with the exception of an additional determination of whether the research and its presentation meet the requirements of being in vision research (broadly defined). Assessment of the seminar course will be pass/fail and is more fully described in the course proposal.

Resources

11. **Describe any resource implications the proposed change may have and how they will be addressed. Attention should be paid to whether the proposed changes will be supported by a reallocation of existing resources or if new/additional resources will be required. If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.**

    A key requirement is the seminar course that will be foundational to the specialization and does not form part of the course offerings of any of the partner programs. Students will also be required to undertake a research thesis or dissertation in vision research (broadly defined).

    The seminar course (GS/VIS 6001, see separate course proposal) is built around and leverages the highly-successful and long-standing CVR research seminar series. The world-class lectures and speakers in this seminar form a core resource for students in the specialization to engage deeply with state-of-the-art cross-disciplinary vision research. To augment the lectures themselves we will have associated components coordinated and evaluated by faculty course instructors from one of the associated Faculties. Support for teaching the seminar course on load is required from the lead Faculty and ideally in cooperation with participating Faculties so that we could rotate the teaching responsibility and help foster a broad interdisciplinary approach. Given the diversity of the graduate program and degree requirements in the programs being targeted we have proposed the course as non-credit but mandatory program requirement. This would prevent complications with assessing degree requirements in programs that require completion of a set number of credits and ensure that the course remains additional to degree requirements as required for a specialization. Successful completion will be based on a series of assessments and the course would still require teaching and evaluation resources. Given the nature of the course a pass/fail evaluation is most appropriate. A team-taught or co-taught model with pro-rated teaching credit, of 0.5 (e.g. equivalent to a 3-cr course) is adequate (and reasonable based on the number of class meetings and discussions with the Faculty of Health) with the resource splitting accommodated administratively via ARMS. Teaching and evaluation resources will be allocated to coordinating the scheduling of students, assessment of preparation activities, participation in seminar discussion when not lead and assessment of the project/presentation. Please see the associated course proposal for more details.

Additional administrative resources for the course will be provided by the CVR coordinator as will administrative and travel support for seminar speakers. Currently the weekly seminar series is subsidized by the VISTA program and we anticipate that many of these resources will continue to be available under the recently awarded Connected Minds program. Regardless we expect a minimum of 6 invited speakers per semester (every two weeks) throughout the academic year. Some modest support of student involvement in the seminars associated with the course may be necessary.

We do not expect that the vision thesis requirement and other requirements will entail significant additional financial resources as all envisioned graduate programs have thesis requirements and existing resources and CVR members on the committee will certify the suitability of the thesis. We will invest administrative resources to promote cross-disciplinary supervisory committees for students in the program and to evaluate the *Experiential Breadth Requirement*. This coordination and other program administration would fall under the role of the GS/VIS 6001 course director/coordinator to simplify teaching and administrative credit for the program.

Governance: The Faculty of Health is the anchor Faculty for the CVR as an inter-Faculty institutional ORU and is appropriate for hosting the graduate specialization. The graduate program in Psychology will serve as administrative home responsible for submitting this proposal and subsequent changes through the approval process and subsequent quality assurance processes. Psychology has experience with offering interdisciplinary program such as the Graduate diploma in Quantitative methods and will coordinate with other graduate programs for any subordinated by the sequent modifications. Administration and operation of the program will be coordinated by the CVR steering committee (or a subcommittee thereof) which will include the specialization coordinator. This body has members from multiple disciplines and is highly aware of vision research activities at York. As such it has the expertise to guide the program, manage operational issues, monitor quality and propose improvements and changes to the program through the host graduate program in Psychology.

Program Capacity: We anticipate that a significant fraction of graduate students supervised by CVR faculty members (currently all members have FGS supervisory privileges in one or more graduate programs) will be interested in the specialization. The capacity of the program is potentially limited by supervisory capacity and VIS6001 enrolment. All students will have already been admitted to a graduate program so the Specialization will have minimal impact on supervisory capacity. VIS6001C has limits in terms of room capacity and course instructor workload. We have estimated based on an expectation of roughly 15 students per year which can be accommodated in the current seminar structure and with the requested resources. Larger demand could be accommodated in a larger room and with increased instructor resources.

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Consultation

12. **Summarize the consultation undertaken with relevant academic units. Include in this summary a commentary on how the proposed changes could impact other programs. Provide individual statements from the relevant program(s) confirming consultation and support.**

At the NOI stage we spoke about this initiative with 5 Faculties (Science, Health, Lassonde, AMPD, and LAPS) and the various graduate programs associated with the CVR (Psychology, Kinesiology, Physics, EECS, Biology, Digital Media, Neuroscience, Philosophy) and with the ITEC and Science Technology Studies graduate program for advice on interdisciplinary programming. We have compared and benchmarked against similar (either in topic or structure) programs at York including the Health Psychology Graduate Diploma, the undergraduate certificate in Aging, and the Graduate Gender, Feminist and Women's Studies Program. We consulted with CVR and VISTA project members including CVR adjuncts at other institutions. We consulted with leaders of related NSERC CREATE programs that have been hosted at York (Hugh Wilson, Doug Crawford, Denise Henriques and James Elder) on academic priorities and with the Vice Provost of Markham Campus.

More detailed feedback was sought from these groups based on drafts of this proposal and are included in the appendix.

Externally we have consulted with Waterloo Vision Science as the most relevant similar program. As there are no Collaborative Graduate Specializations yet at York we have looked at similar programs at Guelph and Toronto and consulted with the director of the Collaboration Specialization in Robotics at University of Toronto which has a similar structure and crosses two of our disciplines (Engineering and Computer Science).

13. **Summarize the consultation regarding the changes that has been undertaken with current students and recent graduates. Include in this summary how students currently enrolled in the program will be accommodated.**

We have discussed the proposal at two CVR AGM meetings as well as in the VISTA leadership committee and the CVR steering committee specifically seeking input of student reps on the committee during the development of the proposal. A draft of this proposal was circulated to the CVR student community for comment and suggestions.

There are no students currently in the program as it does not yet exist. Current students could enrol when the specialization becomes available if they have at least a year remaining in their program to complete the *Seminar in Vision Research* and are working on a thesis/dissertation in vision research under a CVR member.

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Appendix A: Proposed Program Requirements and Graduate Calendar Copy

Offered in conjunction with the Centre for Vision Research, the Collaborative Graduate Specialization in Vision Research prepares students from multiple graduate programs (Biology, Electrical Engineering and Computer Science, Digital Media, Kinesiology, Philosophy, Physics and Astronomy, and Psychology) for interdisciplinary and translational research in human, animal, or computer vision. Students will learn the computational and biological basis of seeing and how it helps to act successfully in the world. Students will learn from vision researchers using a broad range of experimental and theoretical approaches which will prepare them for careers in academic, industrial, or public sector settings in vision research and related fields. They will also be introduced to translational approaches to moving vision research results from the lab to application in the clinic, community, or industry.

Admission Requirements

Students pursuing thesis and dissertation based graduate degrees in the Graduate Programs in Biology, Electrical Engineering and Computer Science, Digital Media, Interdisciplinary Studies, Kinesiology, Philosophy, Physics and Astronomy, and Psychology may apply for the Collaborative Graduate Specialization in Vision Research. Students must undertake thesis research supervised by a member of the Centre for Vision Research (CVR). With permission of the *specialization coordinator*, students under the supervision of another member of the graduate faculty may enroll in the specialization if a member of the CVR serves on their supervisory committee. In either case the CVR member (referred to as the *specialization advisor*) must confirm that the thesis topic meets the requirements of the specialization (see program requirements).

Collaborative Specialization Requirements

In addition to the requirements of their home graduate program, students seeking the Collaborative Graduate Specialization in Vision Research must successfully complete the following requirements:

1. GS/VIS 6001 0.0 Seminar in Vision Research
2. A research thesis or dissertation in vision research (broadly defined including visual neuroscience, visual psychophysics, visually-guided motor action, visualization, visual cognition, computer vision, image processing, visual human factors, and clinical vision science).
3. Experiential Breadth Requirement: Students must demonstrate engagement in academic and scholarly activities in vision research at York. Given the broad interdisciplinary background of our students this requirement will be met by at least one major activity such as a leadership role at the CVR summer school, presentation

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at the CVR conference, industry practicum or internship, or project in another vision-related laboratory.

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Appendix B: Curriculum Map

As a Collaborative Specialization the GDLE and program learning outcomes are met by the requirements of the home program and supplemented and extended by the specialization as below.

	Graduate Degree Level Expectations					
	1. Depth and breadth of knowledge	2. Research and scholarship	3. Level of application of knowledge	4. Professional capacity / autonomy	5. Level of communication skills	6. Awareness of limits of knowledge
LO-A	Thesis in Vision Research	Thesis in Vision Research				Thesis in Vision Research
LO-A	Seminar in Vision Research	Seminar in Vision Research				
LO-B		Thesis in Vision Research	Thesis in Vision Research			
LO-B		Experiential Breadth Requirement	Experiential Breadth Requirement			
LO-C		Thesis in Vision Research			Thesis in Vision Research	
LO-C		Seminar in Vision Research		Seminar in Vision Research	Seminar in Vision Research	
LO-C				Experiential Breadth Requirement	Experiential Breadth Requirement	

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Appendix C: Consultation and Support Letters

Consultations and comments sought:

1. Graduate Program in Biology (included)
2. Graduate Program in Electrical Engineering & Computer Science (included)
3. Graduate Program in Digital Media (comments on NOI, update requested)
4. Graduate Program in Kinesiology & Health Science (promised)
5. Graduate Program in Philosophy (included)
6. Graduate Program in Physics and Astronomy (included)
7. Neuroscience Graduate Diploma (promised)
8. Graduate Program in Science & Technology Studies (included)
9. Graduate Program in Information Systems & Technology (included)
10. Graduate Program in Interdisciplinary Studies (promised)
11. Collaboration Specialization in Robotics at University of Toronto (promised)
12. Vision Science Graduate Program at the University of Waterloo (included)

We also consulted and incorporated feedback from:

13. Associate Deans Research
14. CVR Faculty members
15. Current CVR trainees
16. FGS program development staff

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MA Graduate Degree-level Learning Objectives			
Degree-Level Expectation This degree is awarded to students who have demonstrated the following:	**Program Learning Objectives** By the end of this program, students will be able to:	**Appropriate Degree Requirement & Assessment** Listed below are the degree requirements that fulfill the program learning objectives:	**Comments**
1. Depth and breadth of knowledge			
A systematic understanding of knowledge, including, where appropriate, relevant knowledge outside the field and/or discipline, and a critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of their academic discipline, field of study, or area of professional practice.	Demonstrate a basic understanding of the key concepts in their specific area of study, within the 7 Areas. This shall include but not be limited to: 1) the ability to list, define and/or describe the state of knowledge in the general area of research focus, as well as the current gaps in the knowledge base of that particular field. 2) demonstrate a detailed understanding of the quantitative and/or qualitative research techniques used in their particular research field (e.g. Anova, Regression analysis). 3) describe how their own research contribution fits within the larger field of study. Students in the Clinical and Clinical-Developmental areas, in addition to the academic skills listed above, will demonstrate a basic understanding of clinical assessment, intervention, diversity issues, and ethics relevant to clinical practice.	• Coursework (6 credits in data analysis, at least 3 credits in the History and Theory of Psychology, other elective courses offered in the psychology program and/or specified as required by Area) • One research practicum, with mentorship and evaluation from Supervisor, to provide experience with research practices in their area of psychology • For clinical students, initial clinical training in-house to provide experiences that will instantiate professional and clinical knowledge and expertise. • Thesis proposal • Master's thesis and presentation including oral examination of written work • Clinical Rounds (Clinical and Clinical-developmental students)	Compared to a BA or BSc, knowledge is more specialized and based on original research. More emphasis is placed on the student to synthesize, critique and communicate information from the field rather than merely memorize information. This kind of knowledge may be a stepping stone to a PhD in a related field, but covers less breadth and depth by comparison

2. Research & scholarship			
A conceptual understanding and methodological competence that: a) enables a working comprehension of how established techniques of research and inquiry are used to create and interpret knowledge in the discipline; b) enables a critical evaluation of current research and advanced research and scholarship in the discipline or area of professional competence; and c) enables a treatment of complex issues and judgments based on established principles and techniques; and, on the basis of that competence, has shown at least one of the following: (i)The development and support of a sustained argument in written form; or (ii) originality in the application of knowledge.	1) understand and competently execute the process of information gathering from the major literature sources available for their given Area of study 2) synthesize, interpret, and critically evaluate the current state of knowledge in their particular research field 3) integrate and describe the main literature themes and or seminal papers published in their specific research field 4) design, propose, execute, present, and defend a thesis embodying a unique contribution to knowledge 5) articulate how their thesis work fills a gap within the research field and be able to present the strengths and limitations of this contribution.	• Research practicum, with mentorship and evaluation from Supervisor, to provide experience with research practices in their area of psychology • Thesis proposal (information gathering and synthesis) • Graded coursework	The expectation is that a student's thesis has the potential to be published based on their data collection, analysis, and interpretation. If not published, then portions of the work should be considered as an important component of publishable work. Compared to a BA or BSc, the scholarship is more specialized; and based mainly on first hand experiences within a research setting. This work includes an independent review of the relevant literature surrounding their thesis project. Research is the key component of the MA Degree; and will include a "mastering" of a research skill (or achieving a set of skills) necessary for contribution to the field of research. This is similar to the PhD, but more limited in breadth and depth (including the expertise in the number of techniques and analyses used and the scope of the study).

3. Level of application of knowledge			
Competence in the research process by applying an existing body of knowledge in the critical analysis of a new question or of a specific problem or issue in a new setting.	1) make critical use of scholarly reviews and primary sources to review, present and critically evaluate, either qualitatively or quantitatively, information from within their field of study 2) demonstrate the capacity to develop new lines of argument and hypothesis testing, make sound judgment on the theories, concepts and methodologies used within their discipline. 3) demonstrate the ability to use a range of learned techniques (theory integration and critique, qualitative or quantitative analysis, etc.) to initiate new creative areas of knowledge acquisition, research and/or problem solving.	• Thesis written work, oral presentation of written work, oral examination/defence • Coursework electives • Research or applied practicum	Compared to a BA or BSc, the Masters student is actively involved in probing and extending the current state of knowledge for their field of study, but not with the same depth and breadth as PhD students. A Masters student is capable of implementing a project from the supervisor's research program, whereas a doctoral student is responsible for the more independent development of a research question and appropriate research methodologies.
4. Professional capacity/autonomy			
a) The qualities and transferable skills necessary for employment requiring: (i) The exercise of initiative and of personal responsibility and accountability; and (ii) Decision-making in complex situations; b) The intellectual independence required for continuing professional development; c) The ethical behaviour consistent with academic integrity and the use of appropriate guidelines and procedures for responsible conduct of research; and d) The ability to appreciate the broader implications of applying knowledge to particular contexts.	1) use qualities and transferable skills necessary for further study within academia (e.g. to become a PhD candidate or to attend "professional" school) or employment in a health-related field. 2) demonstrate critical thinking skills and communication skills in a new environment (i.e., workplace, new area of study, another institute or elsewhere). 3) work independently, as well as cooperatively, within a professional context (e.g. hospital or research or clinical setting) 4) manage their own learning challenges both within and outside of the discipline of study and select an appropriate program of further study, if desired. 5) demonstrate behaviour that is consistent with a high level of academic integrity and social responsibility, and professional/clinical ethics.	• Thesis proposal (information gathering and synthesis) • Thesis written work, oral presentation of written work, oral examination/defence • Coursework electives • Practicum experiences	Compared to a BA or BSc, MA level students will be capable of gathering and synthesizing information with little guidance, and use information to contribute (through independent scholarship and experimentation) to their field of study. Clinical and Clinical-developmental students will be capable of a limited range of clinical assessment and/or intervention activities under the supervision of a registered psychologist.

5. Level of communication skills			
The ability to communicate ideas, issues and conclusions clearly.	1) communicate information, arguments, and analyses accurately and reliably to a variety of audiences including discipline experts and the general population. 2) communicate effectively through a number of ways including orally, visually and in writing to a varied audience. 3) answer challenging questions about their research contribution effectively and appropriately and have the capacity for discussing the implications of their work to related fields.	• Thesis proposal (information gathering and synthesis) • Thesis written work, oral presentation of written work, oral examination/defence • Seminar presentations in courses • Coursework electives • Discipline-specific external communication (conferences, poster presentations, abstracts, articles, knowledge mobilization events, etc.)	Students in the MA level will achieve a level of written and oral communication that contributes to, and is valued by, other disciplines outside the classroom.
6. Awareness of limits of knowledge			
Cognizance of the complexity of knowledge and of the potential contributions of other interpretations, methods, and disciplines.	1) demonstrate an understanding of the limits to their own knowledge, theories, and techniques used within their thesis work (experimental and methodological). 2) appreciate and be able to articulate the uncertainty and limits to their own knowledge and research contribution and how this might influence the analysis and interpretation of the research of others.	• Thesis defence • Conference presentations • Graduate seminars • Reviews of work submitted for publication	Students at the MA level will be able to appreciate the complexity and multifaceted nature of their field of research. Students will be aware that there are limitations to all research designs and clinical approaches. Clinical students will begin to develop understanding of the role of clinical psychology among other health care providers.

PhD Graduate Degree-level Learning Objectives

Degree-Level Expectation This degree extends the skills associated with the Master's degree and is awarded to students who have demonstrated the following:	Program Learning Objectives By the end of this program, students will be able to:	Appropriate Degree Requirement & Assessment Listed below are the degree requirements that fulfill the program learning objectives:	Comments
1. Depth and breadth of knowledge			
A thorough understanding of a substantial body of knowledge that is at the forefront of their academic discipline or area of professional practice including, where appropriate, relevant knowledge outside the field and/or discipline.	1) demonstrate a specialized (expert-level) understanding of the key concepts in their specific dissertation area of study, within one of the 7 Areas. 2) list, define and/or describe the state of knowledge in the general area of research focus and current gaps in the knowledge base of that particular field. 3) devise research protocols (experiments or other methodologies) to fill gaps in knowledge. 4) demonstrate knowledge of the quantitative and/or qualitative research techniques used in the particular field. 5) develop critical thinking and analytical techniques within their discipline and appreciate and derive interpretations, inferences and application of their work and the work of others. 6) demonstrate a general understanding of the application of appropriate statistical techniques in relation to their area of research, where appropriate. 7) modify existing methodologies and/or develop new methodologies to examine their research questions, in collaboration with their supervisor(s).	• Coursework (6 credits in Quantitative methods, additional credits in core area courses, and program electives) • Graduate seminar presentations • Minor area paper proposal, execution, and submission (breadth requirement) • Dissertation proposal • Research work and or research techniques used (Research practicum) • Completion of peer-reviewed publications and conference presentations • Dissertation presentation and written thesis (oral examination/defence) • For Clinical and Clinical Developmental students, experience and expertise in therapy/intervention and assessment techniques (Practica) • For Clinical Area students, successful completion of the Clinical Competency exam • For Clinical and Clinical Developmental Student, a one-year clinical internship focusing on select therapy/intervention and assessment skills	Compared to a Masters degree, the knowledge base in the PhD is broader and deeper within a specialized area with more original research productivity. Compared to the MA, typically, PhD degree involves a more independent, self-directed role in more than one publishable works that contributes meaningfully to the literature in a unique way. Clinical and Clinical Developmental students have developed more comprehensive assessment and therapy experience and skills.

	8) in addition to the above, students in the clinical Areas should evidence competence in the essential knowledge base of the theory and practice of psychological measurement and assessment, have demonstrated competence in the theory, application, practice, and evaluation of psychological assessment and intervention, along with knowledge of ethics and jurisprudence relevant to clinical practice.		
2. Research and scholarship			
a. The ability to conceptualize, design, and implement research for the generation of new knowledge, applications, or understanding at the forefront of the discipline, and to adjust the research design or methodology in the light of unforeseen problems b. The ability to make informed judgments on complex issues in specialist fields, sometimes requiring new methods; and c. The ability to produce original research, or other advanced scholarship, of a quality to satisfy peer review, and to merit publication.	1) interpret, synthesize and critique information from the literature presented and published in their specific research field, and use this information to formulate new research to expand this knowledge. 2) identify an appropriate research question and demonstrate that their dissertation work is novel and fills one or more gaps within the field. 3) present the strengths and limitations of these contributions, and make unique inferences and propose new interpretations to their work and others. 4) write effective research proposals (Minor Area Paper, Dissertation, other projects, scholarship applications, grant applications) 5) submit a dissertation that will be made up of (or form the basis of) publishable works (i.e., a series of experiments or studies or a significant body of research), based on the students' collection, analysis, and interpretation. 6) submit their manuscripts for peer review to gain experience in the process of manuscript/book/chapter submission.	• Coursework electives • Practicum experiences • Graduate seminar presentations • Minor area paper proposal, execution, and submission • Dissertation proposal (information gathering and synthesis) and presentation • Dissertation written work, oral presentation and examination/defence	Compared to the Masters degree, the scholarship and research is more independent in nature, more original, and more productive. Doctoral candidates are expected to develop a number of skills and analytical techniques to be used within their scope of study.

3. Level of application of knowledge			
The capacity to a) Undertake pure and/or applied research at an advanced level; and b) Contribute to the development of academic or professional skills, techniques, tools, practices, ideas, theories, approaches, and/or materials.	1) review, critically evaluate and communicate, either qualitatively or quantitatively, information from their field of study 2) demonstrate the capacity to develop new lines of argument and hypothesis testing, create new ideas and make sound, critical judgment on the theories, concepts and methodologies used within their discipline. 3) develop and demonstrate expertise in a range of learned techniques (e.g. multivariate data analyses, psychological assessment, psychological intervention, qualitative or quantitative analysis, etc.).	• Dissertation proposal (information gathering and synthesis) and Dissertation written work, oral presentation and examination/defence • Original and publishable contributions to their field of work • Conference and seminar presentations	Compared to the Masters student, the PhD candidate is more actively involved in probing and extending the current state of knowledge for their field of study. A doctoral student is responsible for the development of appropriate research questions and the skill set needed to perform the methodologies to be used in their quest for answers.

4. Professional capacity/autonomy

a) The qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and largely autonomous initiative in complex situations; b) The intellectual independence to be academically and professionally engaged and current; c) The ethical behaviour consistent with academic and or clinical integrity and the use of appropriate guidelines and procedures for responsible conduct of research and practice; d) The ability to evaluate the broader implications of applying knowledge to particular contexts.	1) use qualities and transferable skills necessary for advancing their own independent research program (in academia) or other setting or for professional employment in a clinical setting or health-related field. 2) demonstrate the capacity to work independently as well as cooperatively within a professional context, and develop their capacity to mentor others. 3) create new ideas and/or improvements on old ideas and techniques and analyses. 4) demonstrate a professional level of academic and/or clinical integrity and ethical practices, and social responsibility. 5) act in an appropriate ethical fashion for research conducted in human and/or animal models and follow proper ethics procedures and protocols in experimental or research design and implementation of their studies	• Dissertation proposal and Minor Area paper (information gathering and synthesis, writing) • Dissertation written work, oral presentation and examination/defence • Coursework electives • Practicum experiences • Graduate seminar presentations • Clinical Competency completion (Clinical Area students) • satisfactory evaluations from supervisors of in-house training (Clinical & CD Area) • satisfactory evaluations from supervisors of external Clinical Practica (Clinical & CD Area) • satisfactory evaluations from supervisors of Clinical Internship (Clinical & CD Area)	Compared to a Masters student, a PhD candidate will be capable of gathering and synthesizing information with little guidance, and use information to contribute (through independent scholarship and experimentation) to their field of study. Clinical and Clinical Developmental doctoral candidates, as compared to MA students, will evidence competence and experience with a wider range of assessment and intervention techniques and greater independence in routine clinical activities (while still under supervision).

5. Level of communication skills			
The ability to communicate complex and/or ambiguous ideas, issues and conclusions clearly and effectively.	1) demonstrate the capacity to communicate information, arguments, and analyses accurately and reliably (orally, visually and in written format). 2) work alongside with, communicate with and train other students, if possible, in their work environment. 3) demonstrate the capacity to work and communicate effectively within a team setting (i.e. collaboration, network, team projects, etc.). 4) Clinical and Clinical Developmental students will demonstrate the capacity to communicate effectively with a wide range of clinical clients.	• Dissertation proposal and Minor Area paper (information gathering and synthesis, research execution) • Dissertation presentation and dissertation written work • Peer-reviewed publications and conference presentations • Coursework electives • Graduate seminar presentations • Teaching assistantships • Supervision of undergrad thesis/ independent projects, if appropriate and available. • Clinical students may co-supervise more junior students, if appropriate and available.	Students in the PhD program will achieve a level of communication that contributes to, and is valued by, other disciplines within and outside of their discipline and those in clinical settings.
6. Awareness of limits of knowledge			
An appreciation of the limitations of one's own work and discipline, of the complexity of knowledge, and of the potential contributions of other interpretations, methods, and disciplines.	1) understand and be able to describe the limits to their own knowledge and techniques used within their dissertation work (i.e. experimental or research approaches) and, if appropriate, their clinical work 2) acknowledge the uncertainty and limits to their own research/clinical contribution and the work presented by others. 3) evaluate and plan the "next steps" in their research hypotheses and critically evaluate any limitations in their experimental/research designs 4) for Clinical and Clinical Developmental students, evaluate and plan the next steps in their clinical interventions and critically evaluate any limitations in their clinical competence and take steps to address these	• Oral dissertation defence and dissertation written work • Conference presentations • Internship and Grand Rounds presentations (Clinical and Clinical Developmental students only)	Students at the PhD level will be able to fully appreciate and be able to articulate the complexity and multifaceted nature of their field of research. PhD candidates will be aware that there are limitations to all research designs and approaches and be able to identify the areas of future research focus. In addition to the above, Clinical and Clinical Developmental students will be able to fully appreciate the complexity and multifaceted nature of clinical assessment/diagnosis and intervention and be aware of the limitations inherent in these activities.

New Graduate Course Proposal Form
Faculty of Health

The following information is required for all new course proposals. Provide evidence of consultation, where appropriate. To facilitate the review/approval process, please use the headings below (and omit the italicized explanations below each heading).

All new course proposals must include a library statement.

1. Graduate Program: Psychology in cooperation with other graduate programs and Faculties contributing to the CVR

2. Responsible Unit: Health, Psychology

3. Subject Code (Rubric) and Course Number: GS/VIS 6001 0.0 Seminar in Vision Research PSYC 6001 3.0

4. Credit Value: 0

5. Long Course Title: Seminar in Vision Research

6. Short Course Title: Seminar in Vision Research

7. Effective Term/Calendar Year: Fall 2024

8. Language of Instruction: English

9. Mode of Delivery: Seminar

10. Calendar (Short) Course Description:

Many humans and increasingly our technologies rely on vision to sense, represent, understand, and interact with the world. This course considers how we do so from a multi-disciplinary perspective. It is built around the highly-successful and long-standing CVR research seminar series, which serves as a framework for students to engage deeply with state-of-the-art cross-disciplinary vision research. This is a core course for the Collaborative Graduate Specialization in Vision Research.

11. Expanded Course Description:

This course considers modern approaches to the ancient question of what it means to see—for us, for other animals, and for the artificial vision systems we create. Various approaches are covered including computational, experimental, philosophical, and

theoretical, with these approaches applied at multiple levels or stages of visual processing ranging from optics and image formation to sensory transduction and coding to visual perception, cognition, and action. The course leverages the Centre for Vision Research seminar for core content, a seminar series which is unique in bringing together researchers and speakers in cognitive and sensory behaviour, computer vision, genetics, kinesiology, neuroscience, physiology, psychology, physics, and visual art to tackle common questions in visual sensing, representation, and cognition. The applications are similarly diverse ranging from clinical assessment and treatment, to human-computer interaction, to vision in outer space and other unusual environments, to the design of effective and engaging media. Students in the course will gain the knowledge, skills, and confidence to navigate these crosscutting interdisciplinary topics. The course activities will include active seminar participation, critical reflections, professional communication, and networking with leaders in vision research. The course is pass-fail based on specifications grading approaches to assessing the activities in relation to the course learning outcomes.

12. Course Learning Outcomes:

By the end of the course, students will be able to:
1. Identify major research themes and emerging issues.
2. Identify key research methodologies and theoretical approaches used in vision research.
3. Critically analyse findings and synthesize links across disciplines and research methodologies to better understand visual problems.
4. Develop confidence to discuss findings and controversies in the field with leading researchers.
5. Communicate complex ideas in a multidisciplinary context.

13. Rationale:

The course will be the cornerstone of the Collaborative Specialization in Vision Research. There are no similar courses at York. The course will contribute to successfully achieving the program learning outcome of *Synthesize links across disciplines to understand current theoretical and experimental approaches to problems in vision research from multiple perspectives*. The broad range of experimental, theoretical, computational, and applied techniques students will be exposed to in the course will build knowledge of the foundational concepts of vision research. The course will encourage focusing on intersections and extensions of these ideas across the seminars to build a richer and more nuanced view of the key ideas in vision research. The course will also contribute to successfully achieving the program learning outcome of *Communicate findings, theory and analysis effectively in a multidisciplinary context*. Communication in a multidisciplinary context will be supported by the networking and presentation aspects of the course.

14. Evaluation:

Satisfactory completion of the course will be assessed based on the following components.

Participation and attendance in the seminars. Students are expected to attend and actively participate in the seminars. Active participation will be demonstrated by engagement in the seminar (asking questions, follow up discussions with the speaker or others) or by relevance of critical reflections.

Critical Reflections: Asking and refining questions

1. To prepare students for each seminar, when scheduling speakers we will ask the speakers to provide a representative paper for background.
2. Based on this, their own background, and the presentations of previous speakers, students are required to submit a *pre-seminar reflection* identifying what they expect or hope to learn at the seminar. As part of this reflection, they will provide one question that they would like addressed by the speaker. All questions will be anonymized and made available to the class via e-class.
3. Students will ensure that their question is answered either as part of the presentation, by asking the speaker at the seminar, or when meeting them, or by follow-up email.
4. Following the seminar, they will submit a *post-seminar reflection* that discusses what they learned and how the seminar fits in the broader literature and with other seminars in the series. Students will be encouraged to take a broad view and look for links across disciplines or application areas. The reflection will also ask them to critique, in retrospect, the question they posed and one question posed by another student. Was it a valid, well-formed question. How could it have been improved. What would they have asked instead with the benefit of hindsight.

These exercises are designed to encourage critical interdisciplinary thinking, practice self-reflection, and hone skills in identifying key issues and refining questions. While personal and individual, these reflections must demonstrate critical self-assessment and build on the topics covered in the course. Feedback will be provided, and unsatisfactory response scan be refined and resubmitted until a sufficient mastery of these techniques is demonstrated.

Professional Communication and Networking
A key learning outcome of this course is developing knowledge, comfort, and skill in communicating with fellow researchers. To this end, students are expected to take advantage of opportunities to engage, communicate and network with the leading researchers providing the seminars. A variety of forms of interaction will be possible so that students can experience diverse ways of formal and informal communication and we can accommodate dietary, religious, and other constraints that might restrict participation in lunch meetings. These communication and networking activities include:
- Joining the speaker for lunch and discussion (5 or 6 external speakers in each of Fall and Winter)

- Hosting a group discussion with the speaker and students during the visit
- Presenting their thesis work or a research demonstration to the visiting speaker
- Leading a journal club discussion of a paper by or related to the speaker (we can leverage several existing reading groups in the CVR for this)

Expectation for successful completion

To pass students must meet the following minimum standard:
- Attending at least 10 seminars over the duration of the course *(Course Learning Outcome-1, CLO-2, CLO-3)*
- Completion of six satisfactory reflection exercises (consisting of matching pre-seminar reflection, posted question, and post-seminar reflection) *(CLO-2, CLO-3, CLO-4)*
- Completion of six networking and communication activities with at least 6 different speakers *(CLO-1, CLO-4, CLO-5)*

15. Integrated Courses:
Not integrated.

16. Cross-listed Courses:
Not cross-listed.

17. Enrolment Notes:

Open only to students enrolled in the Collaborative Graduate Specialization in Vision Research.

The course will run across the Fall-Winter sessions to align with the main activity in the CVR seminar series.

18. Faculty Resources:

The world-class lectures and speakers in the CVR seminar series form a core resource for students in the specialization to engage deeply with state-of-the-art cross-disciplinary vision research. To augment the speakers, we will have associated components coordinated and evaluated by faculty course instructors from one of the associated Faculties. Support for teaching the seminar course on load is required from the lead Faculty and ideally in cooperation with participating Faculties so that we could rotate the teaching responsibility and help foster a broad interdisciplinary approach. Given the diversity of the graduate program and degree requirements in the programs being targeted we have proposed the course as non-credit but mandatory program requirement. This would prevent complications with assessing degree requirements in programs that require completion of

a set number of credits and ensure that the course remains additional to degree requirements as required for a specialization. Successful completion will be based on a series of assessments and the course would still require teaching and evaluation resources. Given the nature of the course a pass/fail evaluation is most appropriate. A team-taught or co-taught model with pro-rated teaching credit, of 0.5 (e.g. equivalent to a 3-cr course) is adequate with the resource splitting accommodated administratively via ARMS. The course will run yearly.

19. Physical Resources:

There are no additional space or equipment requirements. The seminar room is already arranged for the speaker series.

20. Bibliography and Library Statement:

Note that many Vision Research papers are published in non-specialist and trans-disciplinary venues (such as Nature, Science, Cell, Cell Reports, , ...) , in high-profile general journals such as Journal of Neuroscience, Nature Neuroscience, and Neuron, and in application areas (Human-Computer Interaction, Graphics, Medicine, Virtual Reality, ...). Below is a selection of relevant specialized Journals in vision science.

ACM SIGGRAPH
Computer Vision and Image Understanding
IEEE Computer Society Conference on Computer Vision and Pattern Recognition
IEEE Transactions on Image Processing
IEEE Transactions on Medical Imaging
IEEE Transactions on Visualization and Computer Graphics
Image and Vision Computing
Journal of Experimental Psychology
Journal of the Optical Society of America. A, Optics, image science, and vision
Journal of Vision
Optometry and Vision Science
Proceedings of IEEE International Conference on Computer Vision
Vision (Basel, Switzerland)
Vision Research
Visual Cognition
Visual Computer
Visual Neuroscience

Please submit completed forms and required supporting documentation by email to Pina Guzzo-Foliaro, Administrative Secretary Research – pdimaria@yorku.ca