

1. Workload: The assistantship position is for a half-time (10 hour per week) position for the Fall and Winter semesters 2021/2022.

2. Special project description

Title position: Software and computational model developer

Title of the project:

“Quantum effects in perception & decision making”.

Project description:

The goal of this project is to explore whether the quantum physics effects, can be observed in human perception and decision making. I propose to conduct a version of the famous “double slit” experiment, from physics, by developing a comparable replication study in psychology. Thus, the project could potentially allow for comparison between the laws of the physics and the laws of human psychological brain functions.

In modern physics, the double-slit experiment is a demonstration that light and matter can display characteristics of both classically defined waves and particles. Moreover, it displays the fundamentally probabilistic nature of quantum mechanical phenomena. In this classical experiment, a light is sent through two narrow slits and projected on a screen. When the light meets a second wall placed behind the first, you will see a stripe pattern, called an *interference pattern*. The most interesting results is when the light photons are projected one by one, and only through one slit, while the other slit is “open”, the interference patterns remain, as if the focused light escaped the expected trajectory of being projected through the slit, diverted around and passed through the other opened slit. The quantum theory explanation is that, despite being controlled, the light photons travel in probabilistic paths. Such a result is challenging for the classic physics.

Similar phenomena could be observed when a neural impulse is propagated through a brain. As a photon of light, a neural impulse doesn’t take the projected path, and ends up in various parts of the brain, showing an overall brain engagement, rather than a localized brain area response. Thus, showing alike phenomena the quantum particles in physics. Interestingly, as the observer of light in the double slit-experiment, a perceptual observer of the brain response, usually reports a clear perceptual effect.

The research will accomplish three objectives: (1) to replicate the classical double slit experiment from Physics, with the human perception and decision making in Psychology. (2) developing an experimental research method procedure using applicable software environment, and (3) to rigorously compare among the top decision-making theories based on the new empirical findings.

To support the research project the first two (1 and 2) objectives are expected to be achieved by a student receiving a research stipend.

Terms:

- (1) The assistantship position is for a half-time (10 hour per week) position.
- (2) The beginning/end date is 9/1/2021 – 5/1/2022.
- (3) The position will be offered to a full-time student

Responsibilities: Graduate Research Assistant duties will include the following lines of work:

[The percentage of effort that is expected 50%]• Developing of laboratory experiments: Help with developing Python based language code for experimental studies (a student will help refining an already existing python code and later on will work on developing new codes).

[The percentage of effort that is expected 50%]• Programming of data analyses and computer simulation programs: a student will be developing simulations of relevant human cognitive models, and data analysis using the script language R, and Fortran. It is not expected that the student has knowledge on how to use R and Fortran, upon starting the position. The lab coordinator Dr. Mario Fifić will be providing necessary guidance and tutorials.

Enhancing and/or expanding the student's academic experience, and/or building on advanced skills of a graduate student:

The graduate student will attend weekly Dr. Fifić's lab meetings and will separately meet individually with Dr. Fifić for collaboration on the proposed research and progress updates. The student will have the opportunity to attend a national or international conference each to present their research and for professional development. The conference presentation will not be required.

1. The student will have opportunity to work on the scientific problem identification, literature searches, and background reading, leading to focused work on one or more research problems.
2. The student may help in writing preliminary research reports, thus contributing to completion of to be published manuscripts, and receive a recognition through publication.
3. A significant focus will be on developing and enhancing the student's communication skills by sharing his/her work in various oral and written forms. For example, the student will work on writing the peer-reviewed publication while collaborating closely with Dr. Fifić. Thus, the student will help Dr. Fifić in making research publications. In return, it is expected that students will be able to improve their confidence and independence.

3. Selection Process

The position will be advertised on the GVSU website.

All interested applicants should submit a cover letter that addresses the main responsibilities, a resume, and 2 letters of recommendation to Dr. Mario Fifić fificm@gvsu.edu.

Qualified applicant pool will be interviewed by Dr. Mario Fifić in August 2021. Graduate assistant applicants will be asked to provide some evidence toward their programming skills that will include their own previous work.

Contact information:

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QUALIFICATIONS:

Required: coding skills, preferably in Python.

Desirable but not required: programming skills in Java, R, Fortran, Mathematica. Knowledge in statistical data analyses, that could include Bayesian hypothesis testing and Bayesian Hierarchical modelling.

Eligible programs for consideration: open to students from a number of GVSU programs.

Workstation: A graduate student will be able to use computer/software resources of the Psychology Department. Computer and Major equipment: A personalized PC laptop will be assigned to the graduate student to use as his/her workstation at home. 23 PC desk top computers are available for conducting experiments. Dr. Fifić also has a Dell Precision T7500 Server, based on Dual Six Core Intel® Xeon® Processor X5650, for computer analyses and simulations.

OFFICE SPACE: No separate office space will be assigned to the graduate assistant. Given the nature of work such a workplace is not required, and the student will be able to work from his home and/or will be able to share the space with Dr. Fifić's in his office/and or online through virtual meetings.

ORIENTATION: Dr. Fifić will orient a graduate assistant during the first week of work.

SUPERVISION AND EVALUATION: Dr. Fifić will supervise and evaluate working progress of a graduate assistant. Dr. Fifić will evaluate the quality of the work done in the development of software and also will evaluate the learning progress.