St. Andrews University

2014-2015

PS4091: *Modeling and Computer Aided research.*

Semester:	1
Class hours:	2 Hours per week. 9:00-11:00am
Lecture:	1 Hour per week. 9:00-10:00am
Practical:	1 Hour per week. 10:00-11:00am
Credits:	15
Timetabled hours:	20
Total commitment:	150 hrs
Assessment:	100% Continuous Assessment
Staff:	Dr. David Hunter, dwh5@st-andrews.ac.uk

Contents

Introduction

A significant amount of scientific research relies on computers. From EEG and MMR to behavioural interaction, much of the research performed today would be either impossible or significantly harder without computers. Researchers have developed a wide range of tools to both gather data and process it. At the cutting edge these tools rarely come with convenient user interfaces. Assuming no previous experience with scripting languages this course is designed to give you the skills to enable to interact with powerful scientific software. Moving beyond the basic point and click interfaces that you are used to, you will learn to write scripts in a language that these systems understand. Known as 'high level' languages, these languages do not require knowledge of how computers actually work and give you direct and relatively easy access to the actual functionality you require.

The particular focus of this course using powerful scientific scripting languages in the course of your own psychology experiments. Being able to write a program in a scripting language will allow you to craft software to your research design rather than the other way round. Using face shape analysis as an example, you will learn how to use these languages to both create an interactive experiment and perform powerful analyses that would be exceptionally difficult in standard statistical packages (e.g. SPSS).

Rather than teach you how to become a software engineer, this course will teach practical skills aimed at developing your abilities as a general researcher.

Assessment

The assessment is 100% continuous assessment.

Course Aims

By the end of this course you should

- Be able to write basic scripts to perform analysis in Matlab.
- Be able to create computer controlled experiments using Psychtoolbox.
- To read other peoples scripts and use their code in your own projects.
- Be able to effectively document your code.
- Be able to write a detailed and accurate specification from which others could code an application.
- Be able to perform critical reasoning about your software.
- Be able to deal effectively with problems that arise during development.
- Be able to produce examples of computer aided experimentation and analysis.

Teaching

The course is scheduled for two hours, one hour of lecture and one hour practical/help session. Lectures will be delivered (where possible) in a computerised classroom, allowing for more interactive lectures, where student can immediately attempt what they are being taught.

Demonstrators

There will be demonstrators on hand during the practical sessions (2nd hour of each lecture) to help with any problems you might have. They are there to offer help and advice but cannot provide you with answers (or hints) to assessed problems or to solve specific problems with your project.

Office Hours

Students who require assistance are welcome to contact the lecturer during normal office hours. Dr Hunter holds a regular walk-in surgery between 3:00pm and 5:00pm on Wednesday afternoons; office 1.67, School of Psychology and Neuroscience in St. Mary's quad. Alternatively you can make an appointment by e-mail or phone on ext. 3059.

Feedback

Feedback is considered a vital part of teaching and we will endeavour to provide feedback on each assignment before the next assignment is issued. The dates when feedback is due can be found in the assignment section.

Feedback will be provided in three forms. Once grading is completed, individual feedback will be posted as a text document to MSS. You will normally be alerted by email when the feedback is available. Secondly, general feedback will be provided on the feedback forum in Moodle *"Generic feedback for assignments Forum."* Thirdly general feedback will be delivered during lecture hours.

Note any grading information is provisional; all grades are discussed with another member of Lecturing staff and have to be agree upon by the external examiner before they are finalised.

Class Communication

All class news will be disseminated via e-mail, and where possible and appropriate during lecture hours. A *"news"* forum can be found on the course Moodle page, with an archive of news messages.

Assignments

The continuous assessment component consists of three parts, 1 assessed worksheet, a small group assignment and a personal project.
The assessed worksheet will contribute 15%, the group assignment 15% and the personal project 70% of the overall grade.

Assessed worksheet.

During the first three weeks a series of worksheets will be posted to Moodle, these are designed as learning aids and are **not** assessed. The final worksheet is designed as part of continuous assessment to test your knowledge of concepts taught in the early part of the course. This **is** assessed and accounts for 5% of the overall course grade. Which assessments are graded and which aren't will be clearly marked on the assessment. This final worksheet must be uploaded to MSS by **17:00hrs Monday 13th October (week 5).**

The continuous assessment should be completed by you independently, so please do ***not*** discuss the exercises with any other student. All students should read the University's policy on academic misconduct, paying particular attention to the sections on plagiarism and aiding and abetting.

All work must be submitted as a single file (e.g. word document or zip file as appropriate) to MMS by the due date. Submission details will be on each hand-out. All assignments and datasets can be found on the course's Moodle page. Lateness penalties will be applied according to school policy, see the honours handbook for details.

Group Assignment

This is a new assessment introduced this year as a result of feedback from students on the previous course. The aim is to allow for group learning and problem solving. The class will be split into small groups (sign up for these will open on Moodle shortly before the assignment details are released). A single problem will be released on Moodle for the group to tackle.

Members of the group should meet to discuss the assigned problem and come up with a common solution which they then code together. The project is assessed primarily via an individually (and independently written) report.

All work must be submitted as a single file (e.g. word document or zip file as appropriate) to MMS by the due date. Submission details will be on each hand-out. All assignments and datasets can be found on the course's Moodle page. Lateness penalties will be applied according to school policy, see the honours handbook for details.

Due date: **17:00hrs 27th October (week 7).**

Main Project

70% overall grade
Due: 17:00hrs 28th November

You will be required to specify, build and run a computer based experiment using Matlab. The subject is human faces. You will be supplied with a set of face images, with associated landmark information (i.e. locations of eyes, mouth, chin etc.) You will design an experiment what will probe human subject's perception of the face images and link this perception to the landmarked data in an appropriate fashion.

As an example you could attempt to link perceived masculinity to the face shape. You would write a script that shows the user a sequence of face images and asks the user to rate the masculinity of each. Another script would extract the width and height of the face from the landmark data and compare it to the rated masculinity using an appropriate statistical measure. Your report would use the outcome of the analysis to draw a conclusion on whether width/height ratio is related to perceived masculinity. You do not need to use this example, you can ask you own question.

It is very important to note that you are being primarily examined on your ability to design and create the experiment in code, not your ability to perform any subsequent analysis. For the highest marks you will need to demonstrate, the ability to clearly describe the requirements of your program, a solid design that takes into account abnormal input, that the program has been rigorously tested and works and that it produces output consistent with expectations.

All work must be submitted as a single file (e.g. word document or zip file as appropriate) to MMS by the due date. Submission details will be on each hand-out. All assignments and datasets can be found on the course's Moodle page. Lateness penalties will be applied according to school policy, see the honours handbook for details.

This project should be completed by you independently. All students should read the University's policy on academic misconduct, paying particular attention to the sections on plagiarism and aiding and abetting.

The experiment project will account for 70% in total of your grade.

Lab Timetable

Lab sessions are scheduled for Fridays 12am in the Old Library.

Week(s)	Title	Due Date	Feedback date	% of overall grade.
1	Introduction to Matlab (Moodle)	-	-	0
2	Variables and Function calls (Moodle)	-	-	0
3,4	Worksheet	17:00 13th October (week 5)	20th October (week 6)	15
5,6	Group assignment	17:00 27th October (week 7)	3rd November (week 8)	15
7,8,9,10	Mini-project	17:00 28th November	8th December (week 13)	70

Software

Matlab – Software for performing scientific and mathematical scripting.
Psychtoolbox – Software that works within Matlab to provide methods to display images or animations and handle user input (e.g. key-presses).
Microsoft Office – To hand in reports.

Reading

There are few set texts for this course and no specific text book. The set texts are listed along with a link below. They should not be considered exhaustive. You may be asked to do some reading in advance of some of the later lectures. You will be given at least one weeks' notice and the list and links added to Moodle. All other materials are provided in lectures or on Moodle and MMS. However the following texts might aid you in your learning.

Recommended.

MATLAB for psychologists - Borgo, Mauro, Soranzo, Alessandro, Grassi, Massimo, SpringerLink (Online service), c2012.

Secondary reading.

How to think like a programmer: problem solving for the bewildered - Vickers, Paul, c2008 Book

Schedule

Week	Topics
1	Introduction Examples of computer use in Psychology research. How to make a cup of tea – the computers perspective Basic ideas in programming Commands States Loops Practical 1: Introduction to Matlab - Ungraded
2	Standard Operators and Arithmetic Basic arithmetic operators Operator precedence. Variables Loading and saving data. Practical 2: Variables and Function calls - Ungraded
3	Data Manipulation Vectors and lists Ranges Math with vectors Assignment: Syntax
4	Boolean Logic Conditions Filtering Plotting
5	Matrix operations Extending from vectors to matrices. Basic math with matrices. Common vector and matrix operations. Program flow control Loops Conditions Breaking out of loops Variable Scope Assignment: Group project
6	Putting it all together; first scripts. Working with script files Functions Documentation
7	Generating stimuli. Computer aided experimentation. Introduction to Psychtoolbox. Displaying an image. Displaying text. Handling user input. Structure of an experiment. Assignment: Main Project

8	Classical psychophysical methods. Method of limits Staircase procedures.
9	Documentation and Technical writing.
10	No Lecture, 2 hours of practical.
11	