

Lab Manual

Perception Lab, UNSW Sydney

March 1, 2017

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1 Purpose of this document

Welcome to the Perception Lab at UNSW Sydney! The purpose of this document is to provide a reference to the details, policies, and procedures that relate to the day-to-day operation of the lab. It is expected that all members will have given it a close read and be able to refer to it when necessary.

The document will be evolving, and members are encouraged to verify that they are reading the latest version. Any problems, uncertainties, or questions should be directed to Damien (d.mannion@unsw.edu.au).

In this document, internal (within-document) links are specified in [green](#) and external links in [blue](#).

2 Introduction for new/prospective members

We are glad that you have joined, or are considering to join, the Perception Lab. Our aim is to create an environment in which we do world-class research in perception science while also maintaining a friendly and welcoming atmosphere. We ask that you give the remainder of this document a close read and contact Damien or other lab members with any questions.

The following are a set of principles, values, and skills that we aspire to instil in our lab members:

‘Vision person’ We seek to develop researchers that are motivated to always be thinking about how our research informs our understanding of vision and perception. It can be easy to lapse into becoming a ‘psychophysics person’, an ‘fMRI person’, a ‘computational modelling person’, etc.—these are all fine, but the goal of our lab is to understand vision and that is the focus.

Proficient with computing In the lab, we interact with computers in ways which are somewhat unusual but that we feel are integral to principled scientific practice. We aim for our lab members to be proficient with computing principles, particularly in the use of programming to develop custom solutions.

Scientifically rigorous We aim to do ‘good science’, and for our members to be vigilant in ensuring the reliability, validity, and reproducibility of our findings. To do so, we embrace new endeavours that seek to improve the quality of science performed in the field.

Collegial We aim to support each other in our research endeavours.

2.1 Tips on getting started

It may be a bit daunting to understand how to start to be involved. Here are a few tips:

Understand what being involved entails Reading this manual is a great start. You may also want to ask other lab members to have a chat with you about your experiences—most, if not all, will be glad to. It is also highly recommended that you give [this article](#) a thorough read. Although targeted at US ‘graduate school’, it is highly relevant to anyone that is beginning to be involved with the lab.

Pick an general area of interest Either select one from the [list of current research areas](#) or decide based on your own interests. Then start to read around the topic, and contact Damien and start to discuss it further and think about potential experiments that may advance our understanding. You might also find [How to choose a good scientific problem](#) and [Picking a research problem](#) to be useful reads in relation to picking your area of interest.

Start to learn the necessary skills There are many [skills](#) that are involved in being a successful member of the lab (note that not all skills are relevant to all roles), and many of them will be very new. You could start by learning the basics of Linux, or of Python programming, or how to plot figures using [Veusz](#), or how to write

a document in LaTeX, or how to do Bayesian data analyses, etc. If you're stuck on how to go about learning such skills, you can contact Damien and he can point you in the right direction on some relevant resources.

Attend vision-meeting The vision/perception researchers in the department meet semi-regularly to hear presentations or to discuss recent articles of interest. You could join these sessions and get more of an idea about how research is communicated and discussed.

Propose a discussion for a lab meeting Find something interesting, such as a recent article or a proposed experiment or area, and suggest that we hold a lab meeting on the topic.

Volunteer to be a pilot participant on experiments Often people in the lab will be developing their experimental paradigms and would appreciate a naive observer. This is a good opportunity to both learn about the ongoing research of the lab and to experience what is like to be a participant in psychophysics experiments. Of course, there is no obligation to participate in any studies.

Subscribe to a key journal As [described](#), there are several key journals for perception research. You might like to subscribe to their mailing list for the notification of new issue contents, and go through and read any articles that seem interesting.

2.2 A note for undergraduates

For those undergraduates that are interested in being involved in research in an 'independent study' capacity (see [Roles](#)), here are a few additional tips. Being involved with the lab in this capacity is unlike your other university studies—there are no classes, no assessments, and no timetables. Instead, your involvement is primarily self-directed in that you determine its extent and its trajectory, and we as a lab will attempt to support you in this.

3 Location & access

The lab is situated on Level 10 of the Mathews building on the Kensington campus of UNSW. The central components of the lab are the testing booths in MAT1018 (the left side of the corridor; rooms 11, 12, and 13), the larger testing booth in MAT1017 (room 8), and the common area in MAT1019.

Access to the corridors of MAT1017 and MAT1018 is restricted (swipe-card access only) outside the hours of 9am to 5pm. If after-hours access is required, let Damien know and he can have your ID card enabled. Access to the individual booths in MAT1017 and MAT1018 is by key, with a single key able to unlock the doors to each booth in a given corridor. Keys can be requested by visiting the TSU on Level 1 of the Mathews building, after discussing with Damien. It is important that booths be locked when not in use.

The common area in MAT1019 is shared with the labs of Colin Clifford and Skye McDonald. If you're running a research project, you are free to work in that area, including using the computers along the walls, however please be mindful that you may be asked to leave to accommodate meetings at short notice. You are also likely to be interrupted by people coming in to use the kitchen. Access to MAT1019 is by swipe-card access (when it is working)—let Damien know if you need access to be enabled on your card.

Access to the Mathews building is restricted before 7:30am and after a certain time (9pm?) on weekdays, and always during weekends. If needing to enter the building with such hours, discuss with Damien and swipe-card access can be enabled. Note that this is not typically granted for non-honours undergraduate students.

4 People & roles

The following is a guide to the roles of different people that are associated with the lab. At any particular time, there may not be any active members for a given role.

4.1 Director

The lab director is Damien Mannion (d.mannion@unsw.edu.au), who is a lecturer in the School of Psychology at UNSW. His office is located at Mathews 1014.

4.2 Postdoctoral fellows

Postdoctoral fellows ('postdocs') are researchers that have completed their PhD and are undertaking additional research training. Postdocs are often highly autonomous and implement and conduct their own projects. They are often shared between Damien and others in the department, and are usually situated in MAT1015.

4.3 PhD/Masters students

Postgraduate students (PhD and Masters) are completing a higher degree that have a substantial research component. They would typically be supervised, or co-supervised, by Damien.

4.4 Honours students

Honours students are those that are completing their fourth-year research project with Damien. Such projects are typically intensive studies that run between around March until October.

4.5 Undergraduate students

Undergraduate students associated with the lab are typically from one of the following sources:

Internship Students that are enrolled in the third-year Research Internship course and have been assigned Damien as a supervisor or co-supervisor.

Summer research scholarship Students that have been awarded a [Summer Vacation Research Scholarship](#).

Research assistant Students that have expressed interest in being involved in lab research and have either volunteered or been employed to collect data on a study.

Independent study Students that are developing and conducting their own studies with Damien as part of independent study.

4.6 Collaborators

A collaborator is another researcher, in the department or external, who is involved in the lab research. The most visible collaborator is Colin Clifford, with whom we share testing booths, lab, and equipment. Other specific 'friends of the lab' in the department are Branka Spehar, Tom Whitford, and Chris Donkin.

5 Communications

The majority of communication amongst lab members is done via email. We have a dedicated mailing list to send messages to everyone. All members should be sure and [subscribe](#) to this email list (the same link can also be used to unsubscribe). Messages can be distributed by emailing mannion-lab@lists.unsw.edu.au.

5.1 Lab bookings

Dedicated lab member, Lindsay, has so graciously offered to administer the lab booking system for testing booths 11, 12, and 13 in Mathews 1018. Bookings are organised one week in advance. To book any of the booths for the upcoming week, contact Lindsay by the Wednesday prior at the latest with the number of hours required, preferred days/times, and preferred booths.

Lindsay will then create a booking schedule and distribute it at the lab meeting on Thursday (see below). If additional bookings are required during the week, contact Lindsay and she will work tirelessly to accommodate your needs.

You're welcome.

(Above was written by Lindsay)

5.2 Lab meetings

Most of the lab meetings will be held in-person in Mathews 1019. Currently (Semester 1, 2017), these are held weekly on Thursdays between 10am and 11am.

6 Expectations and conduct

Most of the guidelines regarding conduct are covered by the [UNSW student code policy](#) and the [UNSW research code of conduct](#). Here, we expand upon several key aspects of the expectations and conduct for those in the lab.

6.1 Reliability

We have a strong expectation for punctuality with appointments. This is particularly important when testing; a large part of getting high-quality data is having a good rapport with individual participants and with the participant pool overall. Showing up late, cancelling testing sessions at short notice, or not showing up goes a long way towards threatening this rapport and should be avoided as far as possible.

6.2 Confidentiality

During your involvement with the lab, you may be required to interact with confidential data. It is vitally important that you do not disclose any of this information outside of those you know to have direct access to it, and also that you seek to anonymise any data collected as much as possible.

6.3 Scientific integrity

The integrity of the research we conduct is paramount to our operation. It is never acceptable to commit scientific dishonesty by fabricating data, manipulating data, or surreptitiously departing from agreed-upon methods and analyses. Furthermore, there is a continuum of scientific misconduct that fall within the realm of '[questionable research practices](#)'. We will do our best to be aware of such grey areas and perform our research such that it meets the highest standards of scientific integrity, regardless of the criterion used to determine which side of dishonest a particular questionable practice falls under.

It is important to note that honest mistakes can and will occur. Because we are all operating at the boundaries of our capacities (if not, we should be), mistakes and errors are to be expected. The important thing is that mistakes must be acknowledged and shared, however difficult it may be. We seek to cultivate this atmosphere by being accepting and forgiving of mistakes that are brought to our attention.

6.4 Undergraduates and teaching

For undergraduate students, it is important to keep in mind that your interactions with Damien in the lab context are separate from those relating to teaching. To ensure equity across the student cohort, it is best to refrain from discussing aspects of undergraduate courses with Damien while in a research context (Damien will need to be mindful of this also). Of course, you are welcome to contact Damien regarding anything to do with teaching—but please try and keep such discussions separate from those relating to research.

7 Research focus

In our research, we seek to understand visual perception at multiple levels. Ideally, we will investigate (or at least think about) the levels consecutively, according to the following system:

1. **Characterisation of the problem.** What is the problem that perception needs to solve? This stage typically involves a consideration of the structure of the incoming image and of the task that is being performed.
2. **Capacity to resolve the problem.** How well do we perform, behaviorally, when confronted with the problem? This stage typically involves detailed psychophysics/behavioural measures.
3. **How do we resolve the problem.** This stage typically involves a computational analysis of the steps involved in producing a solution to the problem.
4. **How is the resolution implemented in the brain.** This stage typically involves the use of fMRI to develop and test theories of how the resolution relates to the visual processing architecture of the brain.

7.1 Areas of interest

The following are some examples of the current areas of interest and their experiments. This list is not exhaustive, and proposals for novel contributions/areas of enquiry are welcome. You can also see a more detailed list of projects that Damien circulates on occasion.

7.1.1 Surface representations in human perception and visual cortex

- Does human V1 represent lightness or luminance? (fMRI, with psychophysics components)
- Does shape from structure-from-motion affect lightness? (psychophysics)
- Do surface properties, such as shininess, that are specified by local cues spread across an object? (fMRI, with psychophysics components)
- How does the visual system compute surface properties from motion flows? (fMRI, with psychophysics components)

7.1.2 Perceiving size and distance

- What information is contained within the increased spread of activation in V1 during illusory size perception? (fMRI, with psychophysics components)
- What metrics are used to judge ‘similarity’ when using relative size as a cue to depth? (psychophysics)
- How are estimates of an object’s centre affected by perceived size and distance? (psychophysics)

7.1.3 Perception in schizotypy

- Are the strength of visual context effects dependent on the degree of schizotypy? (psychophysics)
- What is being adapted in sensorimotor calibration and how might it relate to processing delays in schizotypy? (psychophysics)
- What are the behavioural consequences of impaired self-suppression in schizotypy? (psychophysics)

7.1.4 Grouping and ambiguity resolution

- What is the neural circuitry that underlies motion assimilation (fMRI, with psychophysics components)
- Can static form that implies motion (Glass patterns) cause motion assimilation? (psychophysics)
- What is the strength of grouping as a cue to disambiguating the depth ordering of surfaces in ambiguous structure-from-motion? (psychophysics)

7.2 Grant cycle

Much of our research (particularly fMRI) is funded by external agencies—typically the Australian Research Council (ARC) or the National Health & Medical Research Council (NHMRC). This process works by submitting a grant application that is then assessed and funding awarded (given considerable luck; success rates are typically between 10%-15% of applications).

This imposes something of a predictable temporal cycle to the research focus of the lab (or Damien, at least). Submission dates are typically March, so between December and February is typically when Damien will develop ideas, collect pilot data, etc. for each application. Announcement dates are typically sometime in October and November, which is when Damien will typically be evaluating the lab's research focus.

Note that this also means that Damien will probably be more stressed during the submission window, absent-minded during the development window, and grumpy/happy during the announcement window.

8 Dissemination

Having conducted a piece of research, it is important to think how it will be disseminated to the broader community.

8.1 Journals

A first important point, that is perhaps non-obvious for a newcomer, is that there tends to be a hierarchy of journals. That is, some journals are perceived as publishing higher quality research than others. This is debatable, but is somewhat true (in Damien's experience).

The highest prestige journals are often "general interest", in that they publish research on multiple topics (including, on the odd occasion, vision). Typically, the articles are very short and dense. The key journals here are Nature, Science, PNAS, Neuron, and Current Biology (Damien's favorite).

For so-called 'specialty' journals, those relevant to fMRI studies of perception include Journal of Neuroscience, NeuroImage, Journal of Neurophysiology, and European Journal of Neuroscience. For those with a particular focus on vision (typically psychophysics), good outlets include Journal of Vision, Perception, AP&P, and Vision Research. There is also often good research published in the 'mass' journals; PLoS One, PeerJ, and Frontiers.

8.2 Conferences

Damien is not much of a conference goer, but it is important for PhD students and postdocs to attend conferences regularly. Anybody interested in attending a future conference should speak to Damien about the viability of funding.

8.2.1 Local

Australasian Experimental Psychology Damien typically attends each year, and it is good to have high lab representation at this conference. Often high-quality for vision research. Typically held around the start of April.

Australasian Cognitive Neuroscience Relatively new conference, typically held towards the end of each year. Some vision relevance, but not all that much.

Australian Neuroscience Society Typically held at the start of the year. Quite pricey, and not all that much of direct relevance.

8.2.2 International

Vision Sciences Society Large conference, held at a beach resort in Florida in May. Probably the best conference for vision.

Society for Neuroscience Absolutely massive conference held in the USA in Novemberish. Lots of great research, but so much research.

European Conference on Visual Perception Similar to VSS, but in Europe.

Asia-Pacific Conference on Vision The local conference for our region. A quality conference that is not too big and is well worth attending.

Fall Vision Meeting of the Optical Society of America A small conference that tends to be overlooked but is one of Damien's favorites. Typically in the USA, often Rochester or Seattle.

ACM Symposium on Applied Perception Features perception research from a number of disciplines (projects from Disney Research have been presented here). It has been held at locations across the USA and Europe.

9 Procedures

Many procedures are most extensively documented on the [wiki](#).

9.1 Ethics

The ethics process is usually fairly straightforward for psychophysics experiments. Damien has some previous applications that can be used as a template.

9.2 Participant payments

Typically, Damien will give the experimenter an amount in cash to cover the participant payments for a short duration. You should keep Damien informed when this pool of money is getting low, and remember to always ensure that the participants have signed a receipt for their payment. Also, you might want to visit the bank to convert the cash into a more suitable denomination.

9.3 Reimbursements

Should you need to purchase anything with your own money, keep the receipt and Damien will either claim it on your behalf or will give you the forms to fill out in order to be reimbursed.

10 Equipment

The lab has several important pieces of equipment. Probably most notably are the high-end display monitors, which allow much finer control than regular monitors. See the wiki for documentation and procedures on using such monitors. There is also several miscellaneous pieces of equipment that are integral to lab function, such as the photometer, spectrophotometer, mirrors, chinrests, oscilloscope, and timing probe. See Damien for training on the usage of any equipment that you may require.

11 Computing

11.1 Accounts

For account creation/access for the following:

Computer in testing booth Contact Damien

Shared drive Contact Damien, letting him know your School of Psychology username.

Wiki Visit http://roi.ad.life.unsw.edu.au/fmri_lab_wiki and create an account. You will not have access yet—after creating the account, let Damien know and he will enable it.

fMRI server Contact Damien

Bitbucket Visit <https://bitbucket.org> and create an account, using your UNSW email address so as to get a free account. Then contact Damien, letting him know your username, so he can add you to the Bitbucket ‘team’

11.2 The command line

Virtually all of the lab’s computing is done on Linux machines with very minimal graphical user interfaces. That means we do most of our interaction via the command line; that is, we type the commands we want the computer to execute and rarely use the mouse. There is some specific documentation on the wiki on how to use the command line, and Damien can show you the fundamentals or point you towards some good Internet resources.

11.3 Version control

Version control is key component to our approach in the lab. We use software called [Mercurial](#) as our version control platform. Typically, most everything we do will go into a version control repository. This makes it infinitely easier to ensure that you’re working on the latest version of a project, to move files between computers, and to merge contributions from multiple people.

11.4 Programming

Most of our programming is done using [Python](#). We currently use Python version 2, rather than the newer version 3, for compatibility with some of our libraries. However, Damien is currently porting some code to Python 3, so that may change in the future. For an introduction to Python, see Damien’s [Programming Fundamentals](#) website. To learn about using Python to create visual stimuli and control experiments, see Damien’s [Programming for Psychology—Vision science](#) website.

11.5 Producing figures

[Veusz](#) is the software that we use to create publication-quality figures. It is available for all platforms, and includes a Python interface so it can be scripted. It does have a bit of a learning curve, but is powerful and produces beautiful figures. To learn about veusz, see Damien's [Programming for Psychology—Data analysis and visualisation](#) website.

11.6 Writing manuscripts

Where possible, we use [LaTeX](#) to prepare documents. However, it is recognised that Microsoft Word is more familiar and is likely to be used under many circumstances (particularly at the undergraduate level; postgraduate and postdocs will be expected to primarily use LaTeX).

12 History

20/10/2015 Initial version created

29/12/2015 Updated info on virtual lab meetings and projects

26/04/2016 Updated lab meeting information; changed info on 1019 access; added links to learning material

28/02/2017 Updated info on lab booking system; added info on ACM SAP conference