PS3037 Perception

Module Booklet 2016-17

Prof. Julie M. Harris (jh81@st-andrews.ac.uk)
Tue 25th Oct – Tue 22nd Nov, 2016

9am-11am Lectures in Maths Lecture Theatre D
2pm-5pm Afternoon sessions, Seminar Room and then Psychology 1.02-1.06 (you will be asked to attend 4 afternoon sessions in the 5 weeks, either 2pm-3.30pm, or 3.30pm-5pm, depending on group and week). Groups for afternoon sessions will be posted on Moodle before the course starts.

Your are expected to attend all 5 morning and 4 afternoon sessions. If you are a Joint Honours student and have a timetable clash with the afternoon timings, please talk to the lecturer as soon as possible.

In this course I will cover several core areas of visual perception in detail. The main focus will be on understanding the ways in which behavioural methods can make powerful predictions that allow us to devise and develop theories of how visual information is processed by the human visual system.

Lecture and Afternoon session timetable

1 **25/10/16**	**Concepts and Methods for Visual Perception** The problem of perception Theoretical principles Methods used in perception research Visual Psychophysics	**Afternoon 1** Method of constant stimuli lab Group 1: 2pm Group 2: 3.30pm
2 **1/11/16**	**Spatial vision** Spatial representation Simple visual stimuli: the power of the sinusoidal grating Linking behaviour to neuroscience A model of early spatial vision: spatial frequency channels.	**Afternoon 2** Method of constant stimuli lab Group 3: 3.30pm Contrast sensitivity lab Group 1: 2pm
3 **8/11/16**	**Vision and experience** Individual differences in perception Development of vision Restoring Vision Adult visual plasticity	**Afternoon 3** Contrast sensitivity lab Group 3: 2pm Group 2: 3.30pm
4 **15/11/16**	**Colour and lightness** What is colour? Theories of colour vision. Colour in the brain. Colour constancy.	**Afternoon 4** Critique a vision paper Group 1: 2pm Group 2: 3.30pm
5 **22/11/16**	**Depth and Motion** Cues for 3D depth and distance Binocular vision Motion perception in the brain Complex motions	**Afternoon 5** Critique a vision paper Group 3: 2pm Revision session (**all groups**) 3.30pm

Afternoon session details

Lab 1	Using Method of Constant Stimuli to explore a size-distance illusion. A computer-based lab using the Matlab programming language.	Group 1: 25/10/16, 2pm Group 2: 25/10/16, 3.30pm Group 3: 1/11/16, 3.30pm
Lab 2	Using a Staircase Method to measure constrast sensitivity. This lab uses the FrACT software to measure constrast sensitivity using sinusoidal gratings. You will also explore simulated central visual field loss.	Group 1: 1/11/16, 2pm Group 2: 8/11/16, 3.30pm Group 3: 8/11/16, 2pm
Critique a vision paper	Erskine, Mattingley & Arnold (2012) Synaesthesia and colour constancy. Cortex, 49, 1082-1088, on how colour constancy affects synaesthesia. You will learn how to read and evaluate a research paper.	Group 1: 15/11/16, 2pm Group 2: 15/11/16, 3.30pm Group 3: 22/11/16, 2pm Read paper before session.
Revision session	Revision of lectures and afternoon sessions	**All groups**: 22/11/16, 3.30pm (seminar room)

Note: Group 3 meets at different times each session. Group 2 will always meet at 3.30pm, group 1 always at 2pm.

Skills

The module aims to allow you to gain knowledge and understanding in the area of perception. Afternoon sessions in particular will allow you to use knowledge gained from the lectures to enhance real understanding of the material.

This module will also allow you to develop a range of transferable graduate skills that will be of use whatever your future plans. By attending both morning and afternoon sessions, and engaging seriously with the course material, you will be able to develop the skills below.

Transferable Skills and Graduate Attributes

- Discipline specific abilities in numeracy. Vision uses advanced mathematical concepts. You will be introduced to these gently and encouraged to explore and develop more general skills in this area. Week 2.
- Evaluate relevant best practices for the task at hand. Labs 1, 2.
- Engage directly with current research, developments and skills in the discipline. All weeks.
- Engage with primary and secondary material and differentiate between them. All weeks, in particular, Afternoon 3.
- Work as part of a team. Afternoon sessions.
- Engage with the views and opinions of others. Afternoon sessions.
- Learn and use research skills Labs 1,2.
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Assessment

There will be a single examination, during the examination period, which will provide 100% of the assessment for this course.

Course reading

As well as the main textbook, each week there will be set readings linking the lecture material to recent research in the topic area. All the material, including papers presented in the afternoons, and practical classes, is examinable.

This reading list should not discourage you from further reading around the topics.

Course textbook: Mather, G. (2016) Foundations of Sensation and Perception. Psychology Press, 3rd Edition
[If all the copies in the library have been borrowed, the second edition (2009) is similar, I will comments on readings using this version of the textbook too]

Week 1

Mather, Chapter 1, 'General Principles' ([2nd edition lacks computational neuroscience section].

Some general alternative reading can be found on a web-based vision book, "The Joy of Visual Perception". Many of the sections will be relevant to this course, and it provides a good reference:
http://www.yorku.ca/eye/toc-sub.htm

This web site, by Michael Bach, allows you to explore a wide range of visual illusions, each with some background text, including hypotheses for why they might occur:
http://www.michaelbach.de/ot/

Week 2

Mather, Chapters 7, Visual Physiology, and 9, Spatial Vision [in 2nd edition, Spatial Vision is Chapter 8].

Lennie, P. (2003) Receptive fields. *Current Biology*, 13, R216-R219.

Pelli, D.G. & Bex, P. (2013) Measuring contrast sensitivity. Vision Research, 90, 10-14.

User manual for the Freiburg Vision Test (FrACT):
http://www.michaelbach.de/fract/media/FrACT3_Manual.pdf

Week 3

Mather, Chapter 15, Individual Differences [in 2nd edition, Chapter 14].

Caplovitz, G.P. & Kastner, S. (2009) Carrot sticks or joysticks: video games improve vision. *Nature Neuroscience*, 12, 527-528.

Li, R., Polat, U., Makous, W., and Bavelier D. (2009) Enhancing the contrast sensitivity function through action video game training. *Nature Neuroscience,* **12**, 549–551.

User manual for the Freiburg Vision Test (FrACT):
http://www.michaelbach.de/fract/media/FrACT3_Manual.pdf

Further reading:

Kalia, A., Lesmes, L.A., Dorr, M., Gandhi, T., Chatterjee, G., Ganesh, S. Bex, P.J. & Sinha, P. (2014) Development of pattern vision following early and extended blindness. Proc. Nat.

Acad. Sci, 111, 2035-2039.

Week 4

Mather, Chapter 8, Colour vision [in 2nd edition, Chapter 12].

Erskine, Mattingley & Arnold (2012) Synaesthesia and colour constancy. Cortex, 49, 1082-1088.

Further reading:

Gegenfurtner, K.R., Bloj, M. & Toscani, M. (2015) The many colours of 'the dress'. Current Biology *25*, R523–R548
Lafer-Sousa, R., Hermann, K.L. & Conway, B.R. (2015) Striking individual differences in color perception uncovered by 'the dress' photograph. Current Biology *25*, R523-R548.

Hurlbert, A. (2007) Colour constancy. *Current Biology*, 17, R906-T907. http://dx.doi.org/10.1016/j.cub.2007.08.022

A website that allows you to simulate colour vision deficits:
http://www.vischeck.com/examples/

Extra reading for those interested in colour synaesthesia:
Safran, A.B. & Sanda, N. (2015) Color synesthesia. Insight into perception, emotion, and consciousness. Current Opinion in Neurology, 28, 36-44.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4286234/pdf/coneu-28-36.pdf

Week 5

Mather, Chapter 12, Visual motion perception [in 2nd edition, Chapter 11].

Mather, Chapter 11, Depth perception. [in 2nd edition, Chapter 10].

Winawer, J., Huk, A. C. & Boroditsky, L. (2008) A motion aftereffect from still photographs depicting motion. *Psychological Science*, 19, 276-283. http://dx.doi.org/10.1111/j.1467-9280.2008.02080.x

Further reading:

Snowden, R.J. & Freeman, T.C. (2004) The visual perception of motion. *Current Biology*, 14, R828-R831.

Todd, J. T. (2004) The visual perception of 3D shape. Trends in Cog. Sci., 8, 115-121.

Harris, J.M. (2004) Binocular vision: moving closer to reality. Phil. Trans. R. Soc. A., 362, 2721-2739.