

PS1061: Sensation and Perception

<http://www.pc.rhul.ac.uk/staff/J.Zanker/PS1061/PS1061.htm>

Course co-ordinator: Johannes M. Zanker, j.zanker@rhul.ac.uk, (Room W 214)

Lecture 4: Travelling through Space and Time

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Lecture Topics

- the world is three-dimensional (3D), but the eyes provide flat (2D) images
- the brain is constructing depth information from 2D images, using a bag of tricks
- mechanisms of depth perception give rise to illusions and are the basis of various applications
- motion understood as change in space and time, which can be used as the basis of a computational model
- motion perception is used as a tool to study the principles of brain function
- a range of illusions is generated by the mechanisms of motion detection

After this lecture you should understand some of the main principles underlying the encoding of visual information:

- **depth** perception is the **reconstruction of the third dimension** from flat images
- depth perception exploits a number of **pictorial, binocular and dynamic cues**
- conflicting depth and size information can lead to ambiguities: **size constancy**
- depth perception cues are exploited by **various technologies** (e.g. 3D cinema)
- **motion** is the change of position across time: the crucial stimulus feature is **spatio-temporal correlation**
- a simple **motion detector (EMD)** accounts for the perception of real and apparent motion (e.g. movies)
- apparent motion was used extensively to **study perceptual organisation: Gestalt**
- **direction ambiguities** produce stunning **illusions** (e.g. barberspole), which help us to understand mechanisms of motion processing

Reading list (key readings in bold, papers available through virtual resources room):

- Adelson E H, Movshon J A, 1982 "Phenomenal coherence of moving visual patterns" Nature 300 523-525
- **Borst A, Egelhaaf M, 1989 "Principles of visual motion detection" Trends in Neuroscience 12 297-306**
- Bacceti, Tom, 1993 "Magic Eye", Andrews and McMeel, Kansas City, USA
- Castet E, Zanker J M, 1999 "Long-range interactions in the spatial integration of motion signals" Spat.Vision 12 287-307

- Gibson J J, 1979 The ecological approach to visual perception (Hillsdale, New Jersey: Lawrence Erlbaum Associates)
- **Gregory R L, 1968 "Visual illusions" Sci.Am. 219 66-76**
- Gregory R L, 1998 Eye and Brain (Oxford: Oxford University Press)
- Gregory R L, Harris J P, 1984 "Real and apparent movement nulled" Nature 307 729-730
- Julesz B, Foundations of Cyclopean Perception. University of Chicago Press, Chicago, IL, 1971
- Julesz, B. and Miller, J.E., 1962 'Automatic stereoscopic presentation of functions of two variables.' Bell System Technical Journal 41: 663–676
- Koffka K, 1935 Principles of Gestalt Psychology (London: Routledge)
- Marr D, Poggio T, 1979 "A computational theory of human stereo vision" Proc.R.Soc.Lond B 204 301-328
- **Ramachandran V S, 1988 "Perceiving shape from shading" Sci.Am. 256, 8 , 76-83**
- **Ramachandran V S, Anstis S M, 1986 "The perception of apparent motion" Sci.Am. 254, 6 80-87**
- Reichardt W, 1961 "Autocorrelation, a principle for the evaluation of sensory information by the central nervous system", in Sensory Communication Ed W A Rosenblith (Cambridge: Cambridge) pp 303-317
- **Rogers B, Graham M, 1982 "Similarities between motion parallax and stereopsis in human depth perception" Vision Research 22 261-270**
- Thimbleby, H. W. Inglis, S. and Witten, I. H., 1994 "Displaying 3D Images: Algorithms for Single Image Random Dot Stereograms", IEEE Computer 27(10):38-48
- Tyler, C. W. and Clarke, M. B., 1990 "The Autostereogram" SPIE Stereoscopic Displays and Application, 182-196
- Ullman S, 1979 "The interpretation of structure from motion" Proc.R.Soc.Lond B 203 405-426
- Wallach H, 1935 "Ueber visuell wahrgenommene Bewegungsrichtung" Psychologische Forschung 20 325-380
- Wertheimer M, 1912 "Experimentelle Studien über das Sehen von Bewegung" Z.Psychol. 61 161-278

Textbooks:

- **Zanker, J. M. (2010) Sensation, Perception, Action – an evolutionary perspective. Palgrave, chapters 5 and 6**
- chapters 8 and 9 of Goldstein, E.B. (2007) Sensation and Perception (7th ed.) Wadsworth-Thompson (152.1 GOL)

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