G89.3233 – Seminar in Perception

Topic: 2nd-Order Processes in Vision

Fall 2003

Taught by: Michael Landy, 998-7857, 6 Washington Place #961, landy@nyu.edu, Mailbox outside of room 862.

Class time/place: Wednesdays, 12-2PM, Room 851, 6 Washington Place

Web Page: http://www.cns.nyu.edu/~msl/courses/3233

Tentative Schedule

Week of:	Topic
Sept 8	Organizational Meeting
Sept 17	Spatial Beats
Sept 24	Spatial Vision: Evidence of Nonlinearities
Oct 1	Spatial Vision: Contrast Contrast and 2nd-Order Illusions
Oct 8	Contrast Modulation Detection
Oct 15	Texture - Basics
Oct 22	Texture Segmentation
Oct 29	Texture Segmentation Models
Nov 5	Texture Modulation Detection
Nov 12	Texture: Other Topics: Appearance, Combination of ''Cues''
Nov 19	2nd-Order Motion
Nov 26	2nd-Order Motion
Dec 3	2nd-Order Motion
Dec 10	2nd-Order Stereopsis

Assigned readings are generally available on the Web page and are indicated with a '*'.

Special issues, reviews, etc.:

Bergen, J. R. (1991). Theories of visual texture perception. In Regan, D. (Ed.), *Vision and Visual Dysfunction, Vol. 10B* (pp. 114-134). New York: Macmillan.

Bock, G. R. & Goode, J. A. (Eds.) (1994). *Higher-Order Processing in the Visual System*, *CIBA Foundation Symposium, Vol. 184* (pp. 170-192). New York: Wiley.

Chubb, C., Olzak, L. & Derrington, A. (Eds.) (2001). Second-order processes in vision. *Journal of the Optical Society of America A*, *18*, 2175-2370.

Landy, M. S. & Graham, N. (in press). Visual perception of texture. In Chalupa, L. M. & Werner, J. S. (Eds.), *The Visual Neurosciences*. Cambridge, Massachusetts: MIT Press.

Wilson, H. R. (1999). Non-Fourier cortical processes in texture, form, and motion perception. *Cerebral Cortex*, *13*, 445-477.

Spatial Beats

*Badcock, D. R. & Derrington, A. M. (1989). Detecting the displacements of spatial beats: No role for distortion products. *Vision Research*, *29*, 731-739.

*Derrington, A. M. & Badcock, D. R. (1985). Separate detectors for simple and complex grating patterns? *Vision Research*, *25*, 1869-1878.

*Derrington, A. M. & Badcock, D. R. (1986). Detection of spatial beats: Non-linearity or contrast increment detection? *Vision Research*, *26*, 343-348.

Spatial Vision: Evidence of Nonlinearities

*Lin, L. M. & Wilson, H. R. (1996). Fourier and non-Fourier pattern discrimination compared. *Vision Research*, *36*, 1907-1918.

Moulden, B. (1994). Collator units: Second-stage orientational filters. In Bock, G. R. & Goode, J. A. (Eds.), *Higher-order processing in the visual system*, *CIBA Foundation Symposium, Vol. 184* (pp. 170-192). New York: Wiley.

Olzak, L. A. & Thomas, J. P. (1991). When orthogonal orientations are not processed independently, *Vision Research*, *31*, 51-57.

Olzak, L. A. & Thomas, J. P. (1996). Uncertainty experiments support the roles of second-order mechanisms in spatial frequency and orientation discriminations. *Journal of the Optical Society of America A*, *13*, 689-696.

*Olzak, L. A. & Thomas, J. P. (1999). Neural recoding in human pattern vision: model and mechanisms. *Vision Research*, *39*, 231-256.

Olzak, L. A. & Wickens, T. D. (1997). Discrimination of complex patterns: orientation information is integrated across spatial scale; spatial-frequency and contrast information are not. *Perception*, *26*, 1101-1120.

Thomas, J. P. & Olzak, L. A. (1990). Cue summation in spatial discriminations, *Vision Research*, *30*, 1865-1875.

Thomas, J. P. & Olzak, L. A. (1996). Uncertainty experiments support the roles of second-order mechanisms in spatial frequency and orientation discriminations. *Journal of the Optical Society of America A*, *13*, 689-696.

Thomas, J. P. & Olzak, L. A. (2001). Spatial phase sensitivity of mechanisms mediating discrimination of small orientation differences. *Journal of the Optical Society of America A*, *18*, 2197-2203.

Thomas, J. P., Olzak, L. A. & Shimozaki, S. S. (1993). The role of Fourier components in discrimination between two types of plaid patterns. *Vision Research*, *33*, 1573-1579.

Spatial Vision: Contrast Contrast and 2nd-Order Illusions

Cannon, M. W. & Fullenkamp, S. C. (1993). Spatial interactions in apparent contrast: Individual differences in enhancement and suppression effects. *Vision Research*, *33*, 1685-1695.

Cannon, M. W. & Fullenkamp, S. C. (1996). A model for inhibitory lateral interaction effects in perceived contrast. *Vision Research*, *36*, 1115-1125.

*Chubb, C., Sperling, G. & Solomon, J. A. (1989). Texture interactions determine perceived contrast. *Proceedings of the National Academy of Sciences USA*, *86*, 9631-9635.

Durgin, F. H. (2001). Texture contrast aftereffects are monocular; texture density aftereffects are binocular. *Vision Research*, *41*, 2619-2630.

Lotto, R. B. & Purves, D. (2001). An empirical explanation of the Chubb illusion. *Journal of Cognitive Neuroscience*, *13*, 547-555.

Motoyoshi, I. (1999). Texture filling-in and texture segregation revealed by transient masking. *Vision Research*, *39*, 1285-1291.

*Olzak, L. A. & Laurinen, P. I. (1999). Multiple gain control processes in contrast-contrast phenomena. *Vision Research* , *39*, 3983-3987.

Singer, B. & D'Zmura, M. (1995). Contrast gain control: A bilinear model for chromatic selectivity. *Journal of the Optical Society of America A*, *12*, 667-685.

Solomon, J. A., Sperling, G. & Chubb, C. (1993). The lateral inhibition of perceived contrast is indifferent to On-center/Off-center segregation, but specific to orientation. *Vision Research*, *33*, 2671-2683.

Spehar, B., Arend, L. E. & Gilchrist, A. L. (1995). Contrast contrast: Interactions between spatial and luminance factors. *Review of Psychology*, *2*, 3-12.

Spehar, B. & Zaidi, Q. (1997). New configurational effects on perceived contrast and brightness: Second-order White's effects. *Perception*, *26*, 409-417.

Contrast Modulation Detection

Cropper, S. J. (1998). Detection of chromatic and luminance contrast modulation by the visual system. *Journal of the Optical Society of America A*, *15*, 1969-1986.

*Dakin, S. C. & Mareschal, I. (2000). Sensitivity to contrast modulation depends on carrier spatial frequency and orientation. *Vision Research*, *40*, 311-329.

Hess, R. F., Achtman, R. L. & Wang, Y.-Z. (2001). Detection of contrast-defined shape. *Journal of the Optical Society of America A*, *18*, 2220-2227.

Jamar, J. H. T. & Koenderink, J. J. (1985). Contrast detection and detection of contrast modulation for noise gratings. *Vision Research*, *25*, 511-521.

Schofield, A. J. (2000). What does second-order vision see in an image? *Perception*, *29*, 1071-1086.

Schofield, A. J. & Georgeson, M. A. (1999). Sensitivity to modulations of luminance and contrast in visual white noise: separate mechanisms with similar behavior. *Vision Research*, *39*, 2697-2716.

Schofield, A. J. & Georgeson, M. A. (2000). The temporal properties of first- and second-order vision. *Vision Research*, *40*, 2475-2487.

*Schofield, A. J. & Georgeson, M. A. (2003). Sensitivity to contrast modulation: the spatial frequency dependence of second-order vision. *Vision Research*, *43*, 243-259.

Sutter, A., Sperling, G. & Chubb, C. (1995). Measuring the spatial frequency selectivity of second-order texture mechanisms. *Vision Research*, *35*, 915-924.

Texture: Basics

Beck, J. (1966). Effect of orientation and shape similarity on perceptual grouping. *Perception & Psychophysics*, *1*, 300-302.

Beck, J. (1972). Similarity grouping and peripheral discriminability under uncertainty. *American Journal of Psychology*, *85*, 1-19.

Beck, J. (1973). Similarity grouping of curves, *Perceptual and Motor Skills*, *36*, 1331-1341.

Beck, J. (1982). Textural segmentation. In Beck, J. (Ed.), *Organization and Representation in Perception* (pp. 285-317). Hillsdale, NJ: Erlbaum.

*Beck, J., Sutter, A. & Ivry, R. (1986). Spatial frequency channels and perceptual grouping in texture segregation. *Computer Vision, Graphics and Image Processing*, *37*, 299-325.

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Chubb, C. & Yellott, J. I. (2002). Every discrete, finite image is uniquely determined by its dipole histogram. *Vision Research*, *40*, 485-492.

Chubb, C. & Yellott, J. I. (2002). Dipole statistics of discrete finite images: two visually motivated representation theorems. *Journal of the Optical Society of America A*, *19*, 825-832.

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Julesz, B. (1981). Textons, the elements of texture perception, and their interactions. *Nature*, *290*, 91-97.

Julesz, B., Frisch, H. L., Gilbert, E. N. & Shepp, L. A. (1973). Inability of humans to discriminate between textures that agree in second-order statistics - revisited. *Perception*, *2*, 391-405.

*Julesz, B., Gilbert, E. N. & Victor, J. D. (1978). Visual discrimination of textures with identical third-order statistics. *Biological Cybernetics*, *31*, 137-140.

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Victor, J. D. (1994). Images, statistics, and textures: implications of triple correlation uniqueness for texture statistics and the Julesz conjecture: comment. *Journal of the Optical Society of America A*, *11*, 1680-1684.

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Texture Segmentation

Chubb, C. (1999). Texture-based methods for analyzing elementary visual substances. *Journal of Mathematical Psychology*, *43*, 539-567

Chubb, C., Econopouly, J. & Landy, M. S. (1994). Histogram contrast analysis and the visual segregation of IID textures. *Journal of the Optical Society of America A*, *11*, 2350-2374.

Chubb, C. & Landy, M. S. (1991). Orthogonal distribution analysis: A new approach to the study of texture perception. In Landy, M. S. & Movshon, J. A. (Eds.), *Computational Models of Visual Processing* (pp. 291-301). Cambridge, MA: MIT Press.

Chubb, C. & Nam, J-H. (2000). Variance of high contrast textures is sensed using negative half-wave rectification. *Vision Research*, *40*, 1677-1694

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Graham, N. (1992). Breaking the visual stimulus into parts. *Current Directions in Psychological Science*, *1*, 55-61.

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Graham, N. & Sutter, A. (2000). Normalization: contrast-gain control in simple (Fourier) and complex (non-Fourier) pathways of pattern vision. *Vision Research*, *40*, 2737-2761.

*Graham, N., Sutter, A. & Venkatesan, C. (1993). Spatial-frequency- and orientation-selectivity of simple and complex channels in region segmentation. *Vision Research*, *33*, 1893-1911.

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He, Z. J. & Nakayama, K. (1994). Perceiving textures: beyond filtering. *Vision Research*, *34*, 151-162.

Kingdom, F. A. A. & Keeble, D. R. T. (2000). Luminance spatial frequency differences facilitate the segmentation of superimposed textures. *Vision Research*, *40*, 1077-1087.

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Motoyoshi, I. & Nishida, S. (2001). Temporal resolution of orientation-based texture segregation. *Vision Research*, *41*, 2089-2105.

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Nothdurft, H.-C. (1985). Sensitivity for structure gradient in texture discrimination tasks. *Vision Research*, *25*, 1957-1968.

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discrimination tasks: implications for performance asymmetries. *Journal of the Optical Society of America A*, *7*, 1623-1643.

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Wolfson, S. S. & Landy, M. S. (1995). Discrimination of orientation-defined texture edges. *Vision Research*, *35*, 2863-2877.

Wolfson, S. S. & Landy, M. S. (1998). Examining edge- and region-based texture mechanisms. *Vision Research*, *38*, 439-446.

Texture Segmentation Models

*Barth, E., Zetzsche, C. & Rentschler, I. (1998). Intrinsic two-dimensional features as textons. *Journal of the Optical Society of America A*, *15*, 1723-1732.

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*Liu, X. & Wang, D. (2002). A spectral histogram model for texton modeling and texture discrimination. *Vision Research*, *42*, 2617-2634.

*Malik, J. & Perona, P. (1990). Preattentive texture discrimination with early vision mechanisms. *Journal of the Optical Society of America A*, *7*, 923-932.

Smith, S., Clifford, C. W. G. & Wenderoth, P. (2001). Interaction between first- and second-order orientation channels revealed by the tilt illusion: psychophysics and computational modeling. *Vision Research*, *41*, 1057-1071.

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Texture Modulation Detection

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Keeble, D. R. T., Kingdom, F. A. A. & Morgan, M. J. (1997). The orientational resolution of human texture perception. *Vision Research*, *37*, 2993-3007.

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Motoyoshi, I. & Nishida, S. (2002). Spatiotemporal interactions in detection of texture orientation modulations. *Vision Research*, *42*, 2829-2841.

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Texture: Other Topics: Appearance, Combination of ‘‘Cues’’

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Georgeson, M. A. & Schofield, A. J. (2002). Shading and texture: Separate information channels with a common adaptation mechanism? *Spatial Vision*, *16*, 59-76.

Gurnsey, R. & Fleet, D. J. (2001). Texture space. *Vision Research*, *41*, 745-757.

Harvey, L. O., Jr. & Gervais, M. J. (1978). Visual texture perception and Fourier analysis. *Perception & Psychophysics*, *24*, 534-542.

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2nd-Order Motion Processing (3 weeks)

Baloch, A., Grossberg, S., Mingolla, E. & Nogueira, C. A. M. (1999). Neural model of first-order and second-order motion perception and magnocellular dynamics. *Journal of the Optical Society of America A*, *16*, 953-978.

*(3)Benton, C. P. (2002). Gradient-based analysis of non-Fourier motion. *Vision Research*, *42*, 2869-2877.

Benton, C. P., Johnston, A. & McOwan, P. W. (2000). Computational modelling of interleaved first- and second-order motion sequences and translating 3f+4f pattern. *Vision Research*, *40*, 1135-1142.

Benton, C. P., Johnston, A., McOwan, P. W. & Victor, J. D. (2001). Computational modeling of non-Fourier motion: further evidence for a single luminance-based mechanism. *Journal of the Optical Society of America A*, *18*, 2204-2208.

*(1)Chubb, C. & Sperling, G. (1988). Drift-balanced random stimuli: a general basis for studying non-Fourier motion perception. *Journal of the Optical Society of America A*, *5*, 1986-2007.

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Cropper, S. J. & Hammett, S. T. (1997). Adaptation to motion of a second-order pattern: the motion aftereffect is not a general result. *Vision Research*, *37*, 2247-2259.

Cropper, S. J. & Johnston, A. (2001). Motion of contrast envelopes: peace and noise. *Journal of the Optical Society of America A*, *18*, 2237-2254.

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Edwards, M. & Badcock, D. R. (1995). Global motion perception: No interaction between the first- and second-order motion pathways. *Vision Research*, *35*, 2589-2602.

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Johnston, A. & Clifford, C. W. G. (1995a). Perceived motion of contrast modulated gratings: predictions of the multi-channel gradient model and the role of full-wave rectification. *Vision Research*, *35*, 1771-1783.

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Lu, Z.-L. & Sperling, G. (1995). The functional architecture of human visual motion perception. *Vision Research*, *35*, 2697-2722.

Lu, Z.-L. & Sperling, G. (1996). Contrast gain control in first- and second-order motion perception. *Journal of Optical Society of America A*, *13*, 2305-2318.

Lu, Z.-L. & Sperling, G. (1999). Second-order reversed phi. *Perception & Psychophysics*, *61*, 1075-1088.

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