Psychology 751-301 S/T Cognitive
Topics in the Psychology of Human Attention
Spring Semester, 2000

Instructor: Saul Sternberg
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Syllabus

Readings: We will read most of the chapters in Pashler (Ed.) (the "Principal Book" below). Readings marked "**S**" will be read by all participants. Those marked "**A**" will each be assigned to one or two participants for critical review. Others are also encouraged to read them, of course! Except for the chapters in Pashler (Ed.), copies of all readings marked "**S**" and "**A**" will be distributed to all participants. The photocopying work may be shared among participants. Readings listed under "**Week n**" should be prepared for the meeting during that week; the date of that meeting is indicated.

Meetings: After the initial organizing meeting, the seminar will meet once per week for two hours; there will be 14 meetings in all. After the first, these will occur on Thursdays, at 10:00 am, in Room A-1 of the Solomon Laboratories.

Email alias: attention@psych.upenn.edu (within Penn: attention@psych)
Email to this address will go to all participants (see page 4).

Principal Book:

Pashler, H. (Ed.) (1998) *Attention*, Psychology Press. Chapter n will be denoted HP:n.

Other books from which more than one chapter will be drawn:

Wright, R. D. (1998) *Visual attention*. Oxford University Press. Chapter n will be denoted RW:n.

Humphreys, G. W., Duncan, J., & Treisman, A. (1999) *Attention, space and action: Studies in cognitive neuroscience.* Oxford University Press. Chapter n will be denoted HDT:n.

Coltheart, V. (1999) *Fleeting memories: Cognition of brief visual stimuli.* MIT Press. Chapter n will be denoted VC:n.

Comments/Questions on Readings: Due by 2 pm on Wednesday (not 5 pm)

Week 1. (Meet 1/18.) **Organizational Meeting**

Week 2. (Meet 1/27.) **Introduction to Attention; and, for those who need it, Introduction to Signal-Detection Theory**

S: Palmer, S. E. (1999). *Vision Science: Photons to Phenomenology,* MIT Press. Section 11.2: Visual Attention. Pp. 531-570.

(S): Snodgrass, J. G., Levy-Berger, G., & Haydon, M. (1985) *Human experimental psychology*. New York: Oxford University Press, Pp. 66-75. [Notes on signal detection theory]

Week 3. (Meet 2/03.) **Visual Search; Multiple Information Sources; Set-Size Effects: Part 1.**

S: Wolfe, J. M. (1998) Visual Search (HP:1)

A:[NJ] Shaw, M. L. (1984) Division of attention among spatial locations: A fundamental difference between detection of letters and detection of luminance increments. In H. Bouma & D. G. Bouwhuis (Eds.) *Attention and performance X*. Erlbaum. Pp. 109-121.

A:[EG] Bonnel, A.-M. & Hafter, E. R. (1998). Divided attention between simultaneous auditory and visual signals. *Perception & Psychophysics*, *60*, 179-190.

A:[EE] Bravo, M. J. & Nakayama, K.(1992) The role of attention in different search tasks. *Perception & Psychophysics*, *51*, 465-472.

Sternberg, S. & Scarborough, D. L. (1971) Parallel testing of stimuli in visual search. In *Visual information processing and control of motor activity.* Sofia: Bulgarian Academy of Sciences, 1971. Pp. 179-188.

Week 4. (Meet 2/10.) **Visual Search; Multiple Information Sources; Set-Size Effects: Part 2.**

S: Palmer, J. (1995) Attention in visual search: Distinguishing four causes of set-size effects. *Current Directions in Psychological Science, 4,* 118-123.

S: Mordkoff, J. T. & Yantis, S. (1991). An interactive race model of divided attention. *Journal of Experimental Psychology: Human Perception & Performance, 17,* 520-538.

S: Supplement to above: Notes on the two-racers inequality (S. Sternberg)

A:[EE] Mordkoff, J. T. & Egeth, H. (1993). Response time and accuracy revisited: Converging support for the interactive race model. *Journal of Experimental Psychology: Human Perception & Performance. 19,* 981-991.

A:[EG] Palmer, J. (1998) Attentional effects in visual search: Relating search accuracy and search time. Pp. 348-388. (RW:14)

A:[NJ] Palmer, J., Ames, C. T., & Lindsey, D. T. (1993) Measuring the effect of attention on simple visual search. *Journal of Experimental Psychology: Human Perception and Performance, 16,* 135-149.

Backus, B. T. & Sternberg, S. (1988) Attentional tradeoff across space early in visual processing. Paper presented at the Psychonomic Society, Chicago, November 1988.

Week 5. (Meet 2/17.) **Cued Attention; Spatially Biased Attention**

S: Hawkins, H. L., Hillyard, S. A., Luck, S. J., Mouloua, M., Downing, C. J., & Woodward, D. P. (1990). Visual attention modulates signal detectability. *Journal of Experimental Psychology: Human Perception and Performance, 16,* 802-811.

S: Lu, Z.-L. & Dosher, B. A. (1998) External noise distinguishes attention mechanisms. *Vision Research, 38,* 1183-1198.

S: Sternberg, S. (1998) Error rates and the interpretation of reaction-time data. In D. Scarborough & S. Sternberg (Eds.) *An Invitation to Cognitive Science, Volume 4: Methods, Models, and Conceptual Issues.* Cambridge, MA : M.I.T. Press, Pp. 436-440.

A:[KA] Hoffman, J. E. & Nelson, B. (1981) Spatial selectivity in visual search. *Perception & Psychophysics, 30,* 283-290.

A:[EE] Kinchla, R.A., Chen, Z., & Evert, D. (1995) Precue effects in visual search: Data or resource limited? *Perception & Psychophysics, 57,* 441-450.

A:[EG] Stelmach, L. B.; Herdman, C. M. (1991). Directed attention and perception of temporal order.. *Journal of Experimental Psychology: Human Perception & Performance, 17,* 539-550

Stelmach, L. B.; Herdman, C. M.; McNeil, K. R. (1994) Attentional modulation of visual processes in motion perception. *Journal of Experimental Psychology: Human Perception & Performance. 20,* 108-121.

Sternberg, S., Knoll, R. L., & Gates, B. A. (1971) Prior entry reexamined: Effect of attentional bias on order perception. Paper presented at the Psychonomic Society, St. Louis, November.

Muller, H. J. & Humphreys, G. W. (1991). Luminance-increment detection: Capacity-limited or not? *Journal of Experimental Psychology: Human Perception and Performance, 17,* 107-124.

Week 6. (Meet 2/24.) **Control of Visual Attention**

S: Yantis, S.(1998) Control of visual attention. (HP:6) Pp. 223-256.

A:[ES] Johnson, D. N. & Yantis, S. (1995) Allocating visual attention: Tests of a two-process model. *Journal of Experimental Psychology: Human Perception & Performance, 21,* 1376-1390.

A:[JS] Shaw, M. & Shaw, P. L. (1977) Optimal allocation of cognitive resources to spatial locations. *Journal of Experimental Psychology: Human Perception & Performance, 3,* 201-211.

A:[NJ] Kwak, H.-W., Dagenbach, D., & Egeth, H. (1991) Further evidence for a time-independent shift of the focus of attention. *Perception & Psychophysics, 49,* 473-480.

A:[EG] Remington, R. W., Johnston, J. C., & Yantis, S. (1992) Involuntary attentional capture by abrupt onsets. *Perception & Psychophysics, 51,* 279-290.

A:[KA] Nakayama, K. & Mackeben, M. (1989) Sustained and transient components of focal visual attention. *Vision Research, 29,* 1631-1647.

Shaw, M. L. (1978) A capacity allocation model for reaction time. *Journal of Experimental Psychology: Human Perception & Performance, 4,* 586-598.

Yantis, S. & Johnson, D. N. (1990) Mechanisms of attentional priority. *Journal of Experimental Psychology: Human Perception & Performance, 16,* 812-825.

Week 7. (Meet 3/02.) **Overlapping Tasks**

S: Pashler, H. & Johnston, J. C. (1998) Attentional limitations in dual-task performance. (HP:4) Pp. 155-189.

S: Sternberg, S. (1998) Doing two things at once: Why are we slower? In D. Scarborough & S. Sternberg (Eds.) *An Invitation to Cognitive Science, Volume 4: Methods, Models, and Conceptual Issues.* Cambridge, MA : M.I.T. Press, 1998. Section 14.5.9, Pp. 788-802. [More quantitatively specific about deferred-processing model and its predictions than HP:4.]

A:[JS] Schumacher, E. H., Lauber, E. J., Glass, J. M., Zurbriggen, E. L., Gmeindl, L., Kieras, D. E., & Meyer, D. E. (1999) Concurrent response-selection processes in dual-task performance: Evidence for adaptive executive control of task scheduling. *Journal of Experimental Psychology: Human Perception & Performance, 25,* 791-814.

A:[ES] Luck, S. J. (1998) Sources of dual-task interference: Evidence from human electrophysiology. *Psychological Science, 9,* 223-227.

Week 8. (Meet 3/09.) **Attention and Inhibition**

S: Milliken, B. & Tipper, S. P. (1998) Attention and inhibition. (HP:5) Pp. 191-221.

A:[KA] Moran, J. & Desimone, R. (1985) Selective attention gates visual processing in the extra-striate cortex. *Science, 229,* 782-784.

A:[EG] Raymond, J. E. , Shapiro, K. L., & Arnell, K. M. (1992) Temporary suppression of visual processing in an RSVP task: An attentional blink? *Journal of Experimental Psychology: Human Perception & Performance, 18,* 849-860.

A:[ES] DeSchepper, B. & Treisman, A. (1996) Visual memory for novel shapes: Implicit coding without attention. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 27-47.

Week 9. (Meet 3/23.) **Visual Attention and Eye Movements**

S: Hoffman, J. E. (1998) Visual attention and eye movements. (HP:3) Pp. 119-153.

A:[EE] Stelmach, L. B. Campsall, J. M. & Herdman, C. M. (1997) Attentional and ocular movements. *Journal of Experimental Psychology: Human Perception & Performance, 23,* 823-844.

A:[JN] Reuter-Lorenz, P. A. & Fendrich, R. (1992) Oculomotor readiness and covert orienting: Differences between central and peripheral precues. *Perception & Psychophysics, 52, 336-344.*

Week 10. (Meet 3/30.) **Neurophysiology of Selective Attention**

S: Luck, S. J. (1998) Neurophysiology of selective attention. (HP:7) Pp. 257-295.

A:[KA] Desimone, R. (1999) Visual attention mediated by biased competition in extrastriate visual cortex. (HDT:2) Pp. 13-30.

A:[JN] Martinez, A., Anllo-Vento, L., Sereno, M. I., Frank, L. R., Buxton, R. B., Dubowitz, D. J., Wong, E. C., Heinze, H. J., & Hillyard, S. A. (1999) Involvement of striate and extrastriate visual cortical areas in spatial attention. *Nature Neuroscience, 2,* 364-369.

A:[ES] Muller, M. M., Teder-Salejarvi, W. & Hillyard, S. A. (1998) the time course of cortical facilitation during cued shifts of spatial attention. *Nature Neuroscience, 1,* 631-634.

Week 11. (Meet 4/06.) **Task Switching**

S: Allport, A. & Wylie, G. (1999) Task-switching: positive and negative priming of task set. (HDT:16) Pp. 273-296.

A:[EE] Rogers, R. & Monsell, S. (1995) Costs of a predictable switch between simple cognitive tasks. *Journal of Experimental Psychology: General, 124,* 207-231.

Monsell, S. (1996) Control of mental processes. In V. Bruce (Ed.) *Unsolved mysteries of the mind: Tutorial essays in cognition.* Erlbaum (UK) Taylor & Francis. Pp. 93-148.

Week 12. (Meet 4/13.) **Auditory Attention**

S: Scharf, B. (1998) Auditory attention: The psychoacoustical approach. (HP:2)

A:[KA] Mondor, T. A. & Zatorre, R. J. (1995). Shifting and focusing auditory spatial attention. *Journal of Experimental Psychology: Human Perception and Performance, 21,* 387-409.

A:[VR] Kinchla, R. A. (1973) Selective processes in sensory memory: A probe-comparison procedure In S.Kornblum (Ed.) *Attention and performance IV,* Academic Press, 1973. Pp. 87-99.

Week 13. (Meet 4/20.) **Inattentional blindness versus inattentional amnesia**

S: Mack, A. & Rock, I. (1998) Inattentional blindness: Perception without attention. (RW:3) Pp. 55-76.

A:[NJ] Wolfe, J. M. (1999) Inattentional amnesia. (VC:4) Pp. 71-94.

A:[JN] Lachter, J. & Durgin, F. H. (1999) Metacontrast masking functions: A question of speed? *Journal of Experimental Psychology: Human Perception & Performance, 25,* 936-947.

A:[JS] Fagot, C. & Pashler, H. (1995) Repetition blindness: Perception or memory failure? *Journal of Experimental Psychology: Human Perception & Performance, 21,* 275-292.

Week 14. (Meet 4/27.) **Quantitative and Computational Models**

S: Bundesen, C. (1996) Formal models of visual attention: A tutorial review. In A. F. Kramer, M. G. H. Coles, & G. D. Logan, *Converging operations in the study of visual selective attention*. Washington, DC: APA, Pp. 1-43.

S: Mozer, M. & Sitton, M. (1998) Computational modeling of spatial attention. (HP:9) Pp. 341-393.

A:[NJ] Bundesen, C. (1999) A computational theory of visual attention. (HDT:4) Pp. 54-71.

Other Useful Reviews

Kinchla, R. A. (1992) Attention. *Annual Review of Psychology, 43,* 711-742.

Allport, A. (1993) Attention and control: Have we been asking the wrong questions? A critical review of twenty-five years. In D. E. Meyer & S. Kornblum (Eds.) *Attention and Performance XIV: Synergies in Experimental Psychology, Artificial Intelligence, and Cognitive Neuroscience.* Cambridge, MA : M.I.T. Press, 1993. Pp. 182-218.

Egeth, H. E. & Yantis, S. (1997) Visual attention: Control, representation, and time course. *Annual Review of Psychology, 48,* 269-297.

Chelazzi, L. (1999) Serial attention mechanisms in visual search: A critical look at the evidence. *Psychological Research, 62,* 195-219.

A few of the topics not explicitly included (Please suggest others so we know better what we're missing!)

Role of attention in feature binding.
Attention and action.
Attention: location-based, object-based, or scene-based.
Attention and automaticity.
Cross-modal links in attention.

Participants: (Initials **[??]** marking assigned readings indicate who will provide the critical review.)

Graduate Students:
[KA] R. Kirkland Ahern (Kirkland) [Annenberg]
Pavan K. Auluck [Neuroscience]
[EE] Eric M. Eisenstein [Marketing]
[EG] Elizabeth Gelfand (Liz) [Marketing]
[NJ] Narayan Janakiraman [Marketing]
[JS] Jesse Snedeker [Psychology]

Postdoctoral Fellows:
[ES] Eric Schumacher [Neurology]
Wei Yang [Institute for Research in Cognitive Science]

Faculty:
Frank Durgin [Psychology, Swarthmore]
Wes Hutchinson [Marketing]
[JN] Jacob Nachmias (Jack) [Psychology]
[VR] Virginia Richards (Ginny) [Psychology]
Saul Sternberg [Psychology]