

Studies on Attention:
*An Annotated Bibliography of
Theories and Research*

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By Patrick Reed

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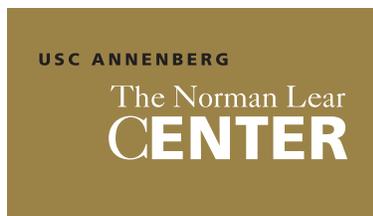
The Norman Lear
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Studies on Attention: An Annotated Bibliography

Does violence attract more attention than sex? Do video games destroy attention spans? Are pictures more eye-catching than words? What is “attention” and how does it work? The Norman Lear Center asked Patrick Reed to take a broad, cross-disciplinary look at how attention works and how it is defined. This annotated bibliography summarizes the work of psychologists, sociologists, neuroscientists, anthropologists, marketers and many others who have devised experiments and theories that attempt to explain a process that defines the human experience.

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Patrick Reed



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ATTENTION BIBLIOGRAPHY 6/23/06

Arkin, R., ed. (1990) "Special Issue: Centennial Celebration of 'Principles of Psychology.'" *Personality and Social Psychology Bulletin*. v.16.

Arnell, K. and P. Jolicoeur. (1999) "The Attentional Blink Across Stimulus Modalities: Evidence for Central Processing Limitation." *Journal of Experimental Psychology: Human Perception and Performance*. v.25, p.630-648.

The authors present results from experiments which examine the phenomenon known as "attentional blink" (millisecond delay in reporting a visual probe after locating a visual target) in terms of auditory information. The subjects in the experiments showed a similar attentional blink when reporting auditory probes. The authors' results suggest that limitations on attention are not modality-specific and point to a central limitation of attention in the brain. The article is useful in discussing the limitations on attention via the "attentional blink" deficit, which based on this evidence applies to both visual and auditory fields. It is also useful as a review of experiments that document attentional blink, which clearly indicates that human beings have a limited capacity for processing multiple stimuli presented rapidly. (See Raymond and also Fisher).

Bagozzi, R., Z. Gurhan-Camli, and J. R. Priester. "The Social Psychology of Consumer Behavior." *Open University Press*, 2002.

Bakalar, N. "Men Are Better than Women in Ferreting Out that Angry Face in a Crowd." *New York Times*, 13 June 2006.

Article discusses findings reported in June 2006 issue of *Current Biology* from a study conducted by MIT's Mark Williams and Jason Mattingley of the University of Melbourne. The findings indicate that an angry facial expression is overall most effective in capturing attention, and that men more quickly and easily pick out angry facial expressions from a crowd. The authors suggest that selecting angry facial expressions is rooted in humans' survival mechanism. These findings link attentional processes to biological impulses and demonstrate the role the limbic system (the amygdala in particular) plays in seeking out threat. See Ohman below.

Available online at:

<http://www.nytimes.com/2006/06/13/health/psychology/13face.html>

"Human beings have a limited capacity for processing multiple stimuli presented rapidly..."

"An angry facial expression is overall most effective in capturing attention..."

Bargh, J. A. and T. L. Chartrand. (1999) "The Unbearable Automaticity of Being." *American Psychologist*. v.54, p.462-479.



The authors argue against the precept that humans engage in conscious and systematic processing of information throughout their lives. They review various experiments that discard the notion of free will and indicate that people engage various automatic, subconscious mechanisms in forming and regulating their individual mental systems. They describe three main forms of self-regulation: 1) an automatic effect of perception on action (which involves attentional processes); 2) an automatic goal pursuit; and 3) a continual automatic evaluation of experience(s). This analysis characterizes attention as an automatic behavior rather than an intentional and self-directed one.

Bargh, J. A. and M. Ferguson. (2000) "Beyond Behaviorism: On the Automaticity of Higher Mental Processes." *Psychological Bulletin*. v126, p. 925-945.

The authors critically assess the shift from behaviorism to cognitive science in the field of experimental psychology during the mid-20th century. They depart from prevailing opinion and state that both fields, while often regarded as distinct, actually share a deterministic conception of human behavior. This deterministic conception, they note, allows for the possibility for free will as an explanation for behavior that cannot be causally determined. The authors reject this conception and argue that all human behavior – even personal choices/decisions – is caused behavior. They review evidence showing that higher mental processes, both information-processing oriented and behavior oriented, occur automatically, often triggered by environmental events. Notably, they argue that in his chapter on free will in *Principles*, James stated that "thinking is for doing" and thus believed that it is relatively rare for a choice or decision to precede an act.

See also:

Bargh, J. A. (1982) "Attention and Automaticity in the Processing of Self-Relevant Information." *Journal of Personality and Social Psychology*. v.43, p.425-436.

Bargh, J. A. (1994) "The Four Horsemen of Automaticity: Awareness, Efficiency, Intention, and Control in Social Cognition." *Handbook of Social Cognition* v.2, eds. R. S. Wyer, Jr. and T. K. Srull. Hillsdale, NJ: Erlbaum, p.1-40.

Bargh, J. A. (1997) "The Automaticity of Everyday Life." *The Automaticity of Everyday Life: Advances in Social Cognition*, v.10, ed. R. S. Wyer, Jr. Mahwah, NJ:

Berger, A., A. Henik, and R. Rafal. (2005) "Competition Between Endogenous and Exogenous Orienting of Visual Attention." *Journal of Experimental Psychology: General*. v.134, i. 2, p.207-221.

The authors examine the relation between exogenous attention (reflexive in response to a stimulus) and endogenous attention (voluntary or arising from within). They conducted four experiments that all featured exogenous and endogenous cues: a simple detection task, a localization task, an eye saccade task, and an identification task manipulated by obstacles. In the first three experiments, the exogenous and endogenous mechanisms remained separate and independent, and in the fourth the cues competed against one another as the task grew difficult, confirming the authors' hypothesis that the two forms of attentional orienting are mediated by dissociable mechanisms arising from different parts of the brain. This article is a useful overview of exogenous and endogenous attention and it discusses Posner's work, the inhibition of return, and other key aspects of visual attention.

Berry, C., A. Scheffler, and C. Goldstein. (1993) "Effects of Text Structure on the Impact of Heard News." *Applied Cognitive Psychology*. v.7, i.5, p.381-395.

The authors present results from two experiments in which subjects were presented with audio re-recordings of television news broadcasts. In both experiments, the broadcasts presented to the subject were either a) presented in bulletin form as initially read on the air; or b) re-organized in a way that restored a chronological sequence to the narrative. The reorganized broadcasts improved attention and learning in both experiments.

Bishop, S. J., J. Duncan, and A. D. Lawrence. (2004) "State Anxiety Modulation of the Amygdala Response to Unattended Threat-Related Stimuli." *Journal of Neuroscience*. v.24, i.6, p.10364-10368.

The authors hypothesize that threat-related stimuli is processed through the amygdala and is affected by the subject's anxiety level. They conduct an fMRI study; the results suggest that anxiety may interact with attentional focus to determine the magnitude of the amygdala response to threat-related stimuli. This article supports the connection between the limbic system (which includes the amygdala) and attentional processing, and it explores the link between emotional states and attention capability.

“The data indicated that negative messages received more attention than positive ones.”



“Contrary to previous studies, their results indicated that children generally had positive associations with the color red.”

Bolls, P. D., A. Lang, and R. Potter. (2001) “The Effects of Message Valence and Listener Arousal on Attention, Memory, and Facial Muscular Responses to Radio Advertisements.” *Communication Research*. v.28, n.5, p.627-651.

The authors present results from an experiment that used facial electromyography (EMG) to explore the effects of radio advertisements on radio listeners’ attention and memory. The physiological measurements of facial expressions were coupled with heart rate tests and follow-up recall and recognition memory tests. The data indicated that negative messages received more attention than positive ones. See Knobloch, et al., regarding visual imagery and attention.

Bourke, P. A., H. Partridge, and P. M. J. Pollux. (2006) “Additive Effects of Inhibiting Attention to Objects and Locations in Three-Dimensional Displays.” *Visual Cognition*. v.13, i.5, p.643-654.

The authors present results from two experiments in which rectangles were presented a) in similar positions horizontally and vertically but at a different depth; and b) as parts of a single three-dimensional cuboid. Their results indicate that inhibition of return (in which attention is biased away from a recently-examined object to a new object) is enhanced in the three-dimensional setting, where the rectangles share both spatial and object codes. Their experiments indicate that the introduction of a new element into an already-viewed object enhances the degree to which attention is biased away from the rest of the object. Thus, inhibition of return can occur within the physical/spatial makeup of an object.

Boyatzis, C. J. and R. Varghese. (1994) “Children’s Emotional Associations with Colors.” *Journal of Genetic Psychology*. v.155, i.1.

Authors report on a survey investigating children’s emotional association with colors and how these associations differed by gender and age. The results indicate that the children surveyed (ranging from five to six and a half years of age) generally associated positive feelings with bright colors (blue, pink, red) rather than dark ones (brown, black, gray) and that these associations increase with age and are more discernible in girls than in boys. 26% of boys cited blue as their favorite color, while 50% of girls cited pink. Contrary to previous studies, their results indicated that children generally had positive associations with the color red. See Pomerlau et. al.

Chambers, C. D., M. G. Stokes, and J. B. Mattingly. (2004) "Modality-Specific Control of Strategic Spatial Attention in Parietal Cortex." *Neuron*. v.44, i.6, p.925-930.

The authors present results from an experiment that used transcranial magnetic stimulation (TMS) in order to identify certain regions of the brain that mediate goal-directed attention in multiple sensory modalities (sight and touch). TMS was delivered to the right hemisphere of the brain during visual and somatosensory (touch) orienting tasks. Their results indicate that the inferior parietal cortex played a crucial role in the ordering of attention to visual events, but not to somatosensory events. This research identifies the specific regions of the brain responsible for attention. The authors' findings contrast with previous research which indicates that the parietal cortex is part of a "supramodal" network in the brain that can direct attention in various sensory modalities; their results provide evidence that the parietal cortex is only involved with the mediating of visual attention.

Clark, E. M., T. C. Brock, and D. W. Stewart. *Attention, Attitude, and Affect in Response to Advertising*. Hillsdale, NJ: L. Erlbaum Associates, 1994.

Cohen, J. D. and J. W. Schooler, eds. *Scientific Approaches to Consciousness*. Mahwah, NJ: L. Erlbaum, 1997.

This book offers an overview of various scientific approaches to cognition and consciousness. Section II, "Attention and Automaticity," contains three chapters by different authors. Walter Schneider and Mark Pimm-Smith present a model of consciousness as a "message control aware" mechanism and suggest that consciousness may have evolved as an extension of attentional control. Richard Shiffrin explores the degree to which attentional processing forms consciousness (or whether automatic attentional processing indicates a failure to reach consciousness). Other sections focus on subliminal perception and neurobiological approaches to consciousness. This book offers helpful information about the automaticity vs. controlled/conscious attention debate. Shiffrin concludes that the similarity between consciousness/unconsciousness and attentive/automatic processing, which are often compared, is far from clear and that the "mapping between the two conceptual frameworks is quite poor."

Coull, J. T. (2004) “fMRI Studies of Temporal Attention: Allocating Attention Within, or Towards, Time.” *Cognitive Brain Research*. v.21, i.2, p.216-226.

The author discusses the temporal aspects of attention, and argues that orienting attention to particular moments in time, or selectively attending to temporal rather than non-temporal stimulus features, improves behavioral measures of performance. The author’s research, supplemented by fMRI scans, indicates that the brain’s frontal operculum and putamen both play a pivotal role in generating the interaction between time and attention. The scans also revealed that subjects’ attentional mechanisms were enhanced when they detected targets that were preceded by temporally-oriented cues. This article provides a useful overview of the temporal aspect of attention – what parts of the brain are involved and how it improves performance. The authors maintain that “knowing when to expect a target is as helpful as knowing where to expect it.” This research could be applied to a discussion of time cues in advertising, in news broadcasts, in sports events, and in testing procedures.

“Pop-up ads elicited better ad recognition among viewers than banner ads.”

Davenport, T. H. and J. C. Beck. (2001) *The Attention Economy: Understanding the New Currency of Business*. Cambridge, MA: Harvard Business School Press.



Diao, F. and S. S. Sundar. (2004) “Orienting Response and Memory for Web Advertisements.” *Communication Research*. v.31, n.5, p.537-567.

The authors present results from a study investigating the effects of pop-up windows and animation in online advertisements on viewers’ orienting responses and memory. Using electrocardiogram measurements and post-exposure questionnaires, they found that pop-up ads elicited better ad recognition among viewers than banner ads.

Donnelly, M. E., ed. (1993) *Reinterpreting the Legacy of William James*. Washington, DC: American Psychological Association.

Dukas, R. (2004) “Causes and Consequences of Limited Attention.” *Brain, Behavior & Evolution*. v.63, i.4, p.197-210.



“fMRI scans on primates indicate that the optical nerve transmits only 2% of the information captured by the retinas when observing a visual scene.”

“If subjects were distracted by an image or a brand when performing an intellectually demanding task, they tended to instantly form a negative impression of the image/brand.”

This article provides an overview of the evolutionary causes and consequences of limited attention in animals and humans. It includes interesting information from experiments on monkeys, such as: 1) results from positron emission topography (PET) and functional magnetic resonance imaging (fMRI) scans on primates indicate that the optical nerve transmits only 2% of the information captured by the retinas when observing a visual scene; and 2) approximately 60% of the primate neurocortex is devoted to vision but the visual cortex processes only 1% of the information transmitted by the optical nerve at any given time. The author notes that limited attention span in animals is a major restraint on their search for food and that it reduces their ability to detect predators while conducting challenging tasks such as searching for food. The significant consequences of limited attention include the preservation of the ecosystem to the food chain itself.

Fisher, R. (2005) “Flogging a Dead Horse; the Harder Advertisers Strive to Get Your Attention, the More Your Brain Ignores Them.” *New Scientist*, 24 December.

This article discusses the relationship between advertising techniques and attention and focuses specifically on the work of Jane Raymond, a consumer psychologist at the University of Wales. Raymond located the phenomenon known as “attentional blink” in the early 1990s: subjects who were asked to locate a white letter or an “x” could not locate one or the other when they were presented within a half-second apart. This quirk in the brain’s attentional system flies in the face of much of modern advertising’s methods, Raymond argues. In 2003, Raymond also found in an experiment that if subjects were distracted by an image or a brand when performing an intellectually demanding task, they tended to instantly form a negative impression of the image/brand.

See also:

Raymond, J. E., K. L. Shapiro, and K. M. Arnell. (1992) “Temporary Suppression of Visual Processing in an RSVP Task: An Attentional Blink?” *Journal of Experimental Psychology: Human Perception and Performance*. v.18, p.849-860.

“The subjects’ attitude toward a celebrity was positively associated with attitude toward the product brand when the subjects could not identify the celebrity.”



Folkes, V. and S. Matta. (2004) “The Effect of Package Shape on Consumers’ Judgments of Product Volume: Attention As a Mental Contaminant.” *Journal of Consumer Research*. v.31, p. 390-401.

The authors conduct experiments that indicate that product containers with unusual shapes: a) attract attention more than ones with more familiar or common shapes; and b) are perceived to contain a greater volume than packages of the same size that attract less attention.

Forehand, M. R. and A. Perkins. (2005) “Implicit Assimilation and Explicit Contrast: A Set/Reset Model of Response to Celebrity Voiceovers.” *Journal of Consumer Research*, v.32, i.3.

The authors present results from an experiment measuring the effectiveness of celebrity voice-overs in advertisements. The subjects’ attitude toward a celebrity was positively associated with attitude toward the product brand when the subjects could not identify the celebrity (i.e., an implicit endorsement), but negatively associated when they could identify the celebrity (explicit endorsement). This is attributed to the “resetting” phenomenon, in which a subject will make a correction in his/her association due to what is perceived as an irrelevant cue (i.e., the person will reformulate their response to indicate that a celebrity’s affiliation with a brand is not persuasive once he or she is made aware of the celebrity’s identity). When a celebrity’s voice is implicitly associated with a product, a positive relationship between celebrity and brand attitude was observed. The research seems to indicate that a subtle approach is more effective – once the celebrity’s identity is established, a voiceover ad becomes similar to a typical endorsement ad in which the celebrity is visually present and hawking a product.

Friedman, R. S. and J. Förster. (2005) “The Influence of Approach and Avoidance Cues on Attentional Flexibility.” *Motivation & Emotion*. v.29, i.2, p.69-81.

The authors present results from two experiments which tested whether motivational cues bolster attentional flexibility. The motivational cues used were “approach” rather than “avoidance” and the two attentional tests employed in the experiments were the classic Stroop test and the 2-back test. Results confirmed the authors’ hypothesis that “approach” motivational cues enhance the ability to shift attention in response to task demands. These results can be used as the basis for a larger argument that cues used in rhetorical communication, pedagogy, and advertising serve to direct attention by motivating certain behavioral responses.

Geer, J. H. and Bellard, H. S. (1996) "Sexual Content Induced Delays in Unprimed Lexical Decisions: Gender and Context Effects." *Archives of Sexual Behavior*. v.25, p.379-395.

The authors present results from a study in which sexual information was introduced into lexical decision and reading tests. They report of a delay in decision-making once sexual information is introduced; this is labeled Sexual Content-Induced Delay (SCID). The authors provide two possible explanations for this delay. The response bias hypothesis posits that when a decision about a socially-unacceptable stimuli is made, responses are delayed because participants do not want to make an error. The second hypothesis correlates closely with attention; this appraisal hypothesis states that the delay is the result of cognitive appraisal of emotional stimuli, which calls on additional processing and interferes with the decision-making process.

See also:

Geer, J. H. and J. S. Melton. (1997) "Sexual Content-Induced Delay with Double Entendre Words." *Archives of Sexual Behavior*. v.26 p.295-316.

Glimcher, Paul. (2003) *Uncertainty and the Brain: The Science of Neuroeconomics*. MIT Press.

Goldhaber, M. (1997) "Attention Shoppers!" *Wired*. v.5, n.12.

The author describes the burgeoning "attention economy" in which attention has become a scarce resource and therefore an elusive target for various purveyors of information. The author offers several forecasts on the future of the Internet in particular, as it becomes a key agent in drawing and directing attention.

Available online at:

http://www.wired.com/wired/archive/5.12/es_attention.html?topic=&topic_set=

See also:

Goldhaber, M. H. (1998) "The Attention Economy Will Change Everything." *Telepolis*. May.

"Attention has become a scarce resource and therefore an elusive target for various purveyors of information."

“Playing effects-heavy, action-oriented video games increases the capacity of the visual attentional system.”



Green, C. S. and D. Bavelier. (2003) “Action Video Game Modifies Visual Selective Attention.” *Nature*. v.423, p.534-537.

The authors conduct five experiments that support their hypothesis that playing effects-heavy, action-oriented video games increases the capacity of the visual attentional system. Their results, which compared attentional focus between video game players and non-video game players, indicate that the rapid pace and complex imagery in video games improves the subjects’ ability to process distracting images and yet remain focused on their primary target/task. This research suggests that modern technology has impacted attentional focus – in this case, enhancing it.

Hall, M. D. and D. G. Blasko. (2005) “Attentional Interference in Judgments of Musical Timbre: Individual Differences in Working Memory.” *Journal of General Psychology*. v.132, i.1, p.94-112.

The authors present results from an experiment that tested the hypothesis that working memory plays a crucial role in attentional control. Their results support previous studies that show that working memory is related to various high-level cognitive processes. In their experiment, subjects were told to monitor one ear for a clarinet or violin tone and ignore any information in the other ear. In proceeding trials, the same instrument was played in both ears, or different instruments were played in the ignored ear. Results indicated that listeners who exhibited more attentional interference (heard more than one tone/instrument) had lower working-memory scores. This study demonstrates how selective attention works and shows how working memory involves the ability to control attention and to inhibit irrelevant information.

Hawkins, R. P., S. Pingree, J. Bush Hitchon, et al. (2002) “What Holds Attention to Television? Strategic Inertia of Looks at Content Boundaries.” *Communication Research*. v.29, p.3-30.

The authors examine visual attention to television and, in particular, they explore a process labeled “attentional inertia,” whereby the viewer initially glances at a television program (for a length of approximately 1-2 seconds) and then, based on his or her comprehension of the content either continues to watch (thus the “inertia”) or changes channels. As a viewer holds attention to a program, cognitive engagement deepens. The researchers cite a previous study, which indicates that this process develops early in life; 6- to 24-month old children exhibited the same distributions of look length to “Sesame Street” as did older children and adults. According to the authors, the deciding factor in engaging with a program is one’s familiarity with the content (in terms of narrative, formal qualities, etc.) This comprehension occurs rapidly and unconsciously.



Janssen, E., W. Everaerd, M. Spiering, and J. Janssen. (2000) "Automatic Processes and the Appraisal of Sexual Stimuli: Toward an Information Processing Model of Sexual Arousal." *Journal of Sex Research*. v.37, i.1, p.8-23.

The authors present a model of sexual arousal that encompasses both automatic and subjective responses to sexual stimuli. They note that the distinction between automatic and controlled attentional processes was first established by Michael Posner in the 1970s, and they also observe that many of the studies on sexual arousal during the 1980s and 1990s have not adequately explored the role of automatic processes. Their model divides the process of sexual arousal into two stages: an appraisal stage and a response generation stage. Overall, they argue that sexual arousal occurs automatically in the appraisal stage, and then is either maintained or discontinued once subjective feelings about the sexual nature of the target content are applied in the response generation stage. Their main objective is to prove that sexual arousal is automatic and occurs quickly, and in one experiment (in which subjects were presented with a sexual prime followed by a sexual target and then presented with a neutral prime followed by a sexual target) this hypothesis was confirmed. This research can be applied to discussion about the use of sex in visual media; most media forms that use sex rely on basic, visual sexual stimuli to initially attract attention before introducing cultural representations of sexuality (e.g., narrative tropes, seductive music, etc.)

Johnson, M. G. and T. B. Henley, eds. (1990) *Reflections on "The Principles of Psychology: William James After a Century."* Hillsdale, NJ: Erlbaum.

Johnston, W. A. and V. J. Dark. (1986) "Selective Attention." *Annual Review of Psychology*. v.37.

Authors present overview of selective attention theory up to the mid-1980s. They agree with William James' assessment of attention in that it is primarily an effect or by-product of sensory impulses, a consequence of natural priming effects. They conclude their article by speculating that James abandoned the study of psychology due to the difficulty of comprehending attention. This article is a useful overview of attention theory and it explains how James' ideas fit into a late 20th-century assessment of the attentional process.



Johnston, W. A., K. J. Hawley and J. M. Farnham. (1993) “Novel Popout: Empirical Boundaries and Tentative Theory.” *Journal of Experimental Psychology: Human Perception and Performance*. v.19, p.140-153.

The authors present results from experiments in which subjects were asked to locate words presented in arrays of four at a time. The arrays consisted of a) four familiar words; b) three novel words; or c) four familiar words and one novel word. The subjects’ location accuracy was better for familiar versus novel arrays, but when a novel word was introduced into a familiar array, accuracy improved for the novel word and diminished for the familiar words. These phenomena are labeled “novel popout” and “familiar sink-in,” respectively. When array exposure time was shortened from 200 milliseconds to as little as 33 milliseconds, novel popout remained intact while familiar sink-in increased (that is, the familiar words became even more difficult to locate). This research can be used to underscore the effectiveness of novelty in advertising, entertainment, visual art, and other forms of visual communication.

Kahle, L. R. and C. H. Kim. (2006) *Creating Images and the Psychology of Marketing Communication*. Mahwah, NJ: Lawrence Erlbaum.

The authors, who come from a marketing/advertising perspective, recognize the impact of visual images on attention but also the various limitations on attentional capacity. They propose a cognitive resources model to more accurately detect the ways in which attention can be enhanced or depleted by advertising and marketing techniques.



“Articles that incorporated threatening images were preferred over those with non-threatening images.”

Kardes, F. R., P. M. Herr, and J. Nantel. (2005) *Applying Social Cognition to Consumer Focused Strategy*. Mahwah, NJ: L. Erlbaum.

With chapters on attribution research and subliminal priming, this book has a broader focus than creating images and the psychology of marketing communication. In a chapter on the unintended consequences of consumer research, Jane E. Machin includes interesting citations of prior research on the impact of primes on influencing subsequent attention and behavior (i.e., studies from the 1990s showing that introducing an arbitrary number into a cognitive task can subsequently anchor judgment in the performance of subsequent tasks). Bargh’s work is cited in several chapters.

Knobloch, S., M. Hastall, D. and C. Callison. (2002) “Imagery Effects on the Selective Reading of Internet Newsmagazines.” *Communication Research*. v.29, i.5, p.537-563.

The authors conducted a study in which they created an Internet newsmagazine involving various interactive features along with images and text. In an experiment, the authors presented the newsmagazine to readers/ subjects with the text of all reports consistent and the images of a subset of reports manipulated. The manipulated images were presented either without images, with text-related innocuous images, or with text-related threatening images. The experiment, in which readers’ article selection choices were tabulated, revealed that articles that incorporated threatening images were preferred over those with non-threatening images. This research supports the argument that sensational images capture and hold attention better than familiar ones, which can be applied to visual news media (print and television) in general.

LaBerge, D. (1995) *Attentional Processing: The Brain’s Art of Mindfulness*. Cambridge, MA: Harvard University Press.

Lloyd, D. M., S. J. Bolanowski, Jr., L. Howard, and F. McGlone. (1999) "Mechanisms of Attention in Touch." *Somatosensory & Motor Research*. v.16, i.1, p.3-10.

The authors present the results of two experiments which investigated the relationship between visual attention and tactile sensation. In both experiments the same tactile stimulus was applied to the same area of the body. In the first experiment, the subjects were not directed to pay attention to the stimulus, and after their attention was automatically oriented to the stimulus upon its presentation, subsequent stimuli at the body site were inhibited (Posner's inhibition of return). However, when the subject strategically oriented attention to the stimulus, the processing of subsequent stimuli was facilitated. The authors conclude that tactile processes are facilitated when visual attention is oriented toward the body site receiving stimulation. This research on how visual attention increases tactile sensation can be applied usefully to discussions of virtual reality. The authors also review previous research into the link between visual attention and tactile sensation.

Lund, N. *Attention and Pattern Recognition*. London and Philadelphia: Routledge, 2001.

Part of the Routledge Modular Psychology series, this book supplies an overview of leading theories on attention and pattern recognition up to 2001. It is useful as an accessible sourcebook on theories of attention and pattern/face recognition. It does not go into great depth, since it is geared toward university-level instruction, but does touch on a wide range of theories including those by Broadbent and Triesman.

Milliken, B., S. Joordans, P. M. Merikle, and A. Sieffert. (1998) "Selective Attention: A Reevaluation of the Implications of Negative Priming." *Psychological Review*. v.105, p.209-229.

The authors examine the attentional phenomenon known as negative priming, in which subjects delay responses to a probe stimulus that is identical or related to a previously ignored stimulus. The authors' research and experiments cause them to argue against much of the previous literature on negative priming and selective attention and situate the negative priming phenomenon as a product of working memory and attention combined. The article also examines the appeal of negative priming as an "empirical window to a theoretical question that has troubled psychologists from the time of William James: Is the focus of attention a product of active processes (italics mine) that filter, or push into the phenomenal background, information that is irrelevant to current thought and behavior?" The authors' theory posits that negative priming draws on both attentional processes and memory processes and is the result of both automatic and willful engagement.

Myers, G. (1986) *William James: His Life and Thought*. New Haven, CT: Yale University Press.



“Results consistently indicated that participants showed faster and more accurate detection of threatening than friendly targets.”

“The mechanisms of emotion and cognition are intertwined in all stages, from early perception to reasoning.”

Ohman, A., D. Lundqvist and F. Esteves. (2001) “The Face in the Crowd Revisited: A Threat Advantage with Schematic Stimuli.” *Journal of Personality and Social Psychology*. v.80, i.3, p.381-396.

The authors present results from five experiments in which schematic threatening, friendly, and neutral faces were presented to participants in a visual search paradigm. Results consistently indicated that participants showed faster and more accurate detection of threatening than friendly targets. The results are discussed in relation to biological imperatives driving attention.

See also:

Ohman, A., A. Flykt, and F. Esteves. (2001) “Emotion Drives Attention: Detecting the Snake In the Grass.” *Journal of Experimental Psychology: General*. v.130, p.466-478.

Parasuraman, R. (1998) *The Attentive Brain*. Cambridge: MIT Press, 1998.

Paschler, H., ed. (1998) *Attention*. Hove, East Sussex, UK: Psychology Press, 1998.

Perry, R. B. (1936) *The Thought and Character of William James: As Revealed in Unpublished Correspondence and Notes, Together with His Published Writings*. Boston: Little, Brown, and Co., 1936.

Phelps, E. (2006) “Emotion and Cognition: Insights from Studies of the Human Amygdala.” *Annual Review of Psychology*. v.57, i.1.

The author explores five topics related to the interplay between emotional sectors of the brain and cognition, including emotion’s influence on attention and perception. The author argues that recent findings in neural research (mainly from studies of the amygdala) indicate that the mechanisms of emotion and cognition are intertwined in all stages, from early perception to reasoning.

“Children’s preferences in clothing and other aspects of their physical environment are primarily due to parental influence.”



Pomerlau, A., D. Bolduc, G. Malcuit, and L. Cossette. (1990) “Pink or Blue: Environmental Gender Stereotypes in the First Two Years of Life.” *Sex Roles*. v.22, p.359-367.

The authors present results from a study involving 120 girls and boys at age groups 5, 13, and 25 months. The subjects’ physical environments were compared. Among their findings: boys were provided with more sports equipment and vehicles, while girls were given more dolls and children’s furniture. The girls were outfitted in clothes that were predominantly pink and/or multi-colored; boys wore clothing in red, white and blue colors. Other color preferences are revealed in children’s furniture and bedding. The authors conclude that children’s preferences in clothing and other aspects of their physical environment are primarily due to parental influence at the earliest stages of development. The study is useful in explaining how children’s color and lifestyle preferences are instilled early in life, predisposing them to various advertising techniques during childhood.

Posner, M. I. (1994) “Attention: The Mechanisms of Consciousness.” *Proceedings of the National Academy of Science USA*. v.91, p.7398-7403.

The author, a leading academic in attention studies, reviews recent findings on attention and links attention to consciousness. The author states upfront that he believes a thorough study of human consciousness must be based on learning more about the brain networks that subserve attention and how they operate. The author provides an overview of the development of attention studies through the early 1990s and discusses in detail the areas of the brain that play a role in the attentional functions of a) orienting to sensory stimuli; b) detecting target events; and c) maintaining the alert state. The author surveys numerous aspects of attention studies concisely and authoritatively – development through infancy, various experiments on primates, development of positron emission topography (PET) and functional magnetic resonance imaging (fMRI) scans. There is also a brief discussion of automaticity vs. “executive” consciousness (aka free will).

Related:

Posner, M. I. and C. R. R. Snyder. (1975) “Attention and Cognitive Control.” *Information Processing and Cognition: The Loyola Symposium*. ed. R. L. Solso. Hillsdale, NJ: Erlbaum, p.55-85.

Rayner, K., et al. (2001) "Integrating Text and Pictorial Information: Eye Movements When Looking at Print Advertisements." *Journal of Experimental Psychology: Applied*. v.130, i.3, p.219-226.

The authors report on experiments in which viewers looked at print advertisements that contained both text and pictures. The findings (measured in eye saccade movements) indicate that viewers tend to seek out textual information before pictorial information when reading materials that contain both. The findings were also consistent with prior research in that the viewers did not spend much time switching their attention back and forth between image and text. The authors conclude that the primary reason viewers spent more time concentrating attention on textual information was due to the fact that viewers could encode much more information per fixation from the pictorial information than from the text. These experiments shed light on how consumers/viewers/readers respond to advertising images, and how pictorial information and textual information attract and compete for attention. The authors dismiss much of the advertising industry's sponsored, proprietary research as "superficial in approach."

Pringle, H. (2004) *Celebrity Sells*. Hoboken, NJ: J. Wiley.

Reed, C. L., Grubb, J. D. and C. Steele. (2006) "Hands Up: Attentional Prioritization of Space Near the Hand." *Journal of Experimental Psychology: Human Perception and Performance*. v.32, i.1, p.166-177.

The authors present results from experiments that placed a human hand next to several visual cues and then presented several cues a distance away from the hand. Hand presence facilitated the detection of the nearby cues relative to the distant cues. The authors conclude that hand presence does not shift attention, but rather prioritizes spatial areas to which attention can be directed. In this study, the hand does not serve as a cue per se, but highlights possible areas in which cues for targets will appear.

Rees, G. and R. Frackowiak. (1997) "Two Modulatory Effects of Attention that Mediate Object Categorization in Human Cortex." *Science* v.273, i.5301.

The authors present results from a series of fMRI brain scans measuring regional cerebral blood flow in various parts of the brain in response to a single stimulus. Their results support a model of attention in which the prefrontal cortex modulates activity in a distributed network of cortical and cerebellar structures that are collectively relevant to the processing of sensory signals and to motor output. This experimental evidence supports a model of attention in which various parts of the brain contribute to the overall attentional process, which in turn plays an important role in directing motor activity.

"Viewers tend to seek out textual information before pictorial information when reading materials that contain both."

Richards, J. E., ed. (1998) *Cognitive Neuroscience of Attention: A Developmental Perspective*. Mahwah, NJ: L. Erlbaum.

The article is a comprehensive overview of attention and how it has been investigated and analyzed by cognitive neuroscientists during the last quarter of the 20th century. Chapters discuss the orienting of visual attention, spatial vs. object-based attention, and selective attention over the life span, among other topics. Good discussion of several of the major theories of attention, including inhibition of return, exogenous vs. endogenous orienting, etc.

Reynolds, J. H., L. Chelazzi and R. Desimone. (1999) "Competitive Mechanisms Subserve Attention in Macaque Areas V2 and V4." *Journal of Neuroscience*. v.19, p.1736-1753.

"Competition between stimuli enhances attentional capacity."



The authors present results from several experiments involving fMRI scans performed on macaque monkeys. They measured neuronal response to a single stimulus within the monkeys' field of perception and then measured response to a pair of stimuli with attention directed toward one of the pair. Their results indicate that neuron activity is increased when there are competing stimuli and when attention is directed toward a particular stimuli among several. Thus, attention biases neuronal response toward a selected stimuli. This study supports an argument that attentional focus is sharpened when multiple stimuli are present—competition between stimuli enhances attentional capacity. Experiments on macaque monkeys have been a key component of late 20th-century attention studies.

Ryan, G. and M. Valverde. (2003) "Waiting Online: A Review and Research Agenda." *Internet Research*. v.13, i.3, p.195-205.

The authors present a review of academic literature that examines various aspects of waiting online as Internet pages load. Several sources detail experiments that focus on download time; the results are compiled and discussed. Results: experienced users are less tolerant of delay in downloads; users that pay for Internet time by the minute are less tolerant of delay; tolerance for delay decreases the longer a user is online; and users seeking information are more tolerant of delay compared to users making a purchase. This overview of research on Internet habits indicates that the presence of download-burdening advertisements such as pop-up ads actually inhibits attention.



“The impact of advertising can be lasting and profound even if persons do not fully attend to a particular ad.”

Shapiro, S. (1999) “When an Ad’s Influence Is Beyond Our Conscious Control: Perceptual and Conceptual Fluency Effects Caused by Incidental Ad Exposure.” *Journal of Consumer Research*. v.26, i.1, p.16-36.

The author conducted four experiments investigating the degree to which incidental exposure to advertisements impacted attention and memory and to what degree the processing of incidental ad exposure was driven by unconscious mechanisms. In the experiments, features of a product described in an incidentally-attended advertisement were included in a subsequent subject-generated consideration set of products. This indicates that even an advertisement upon which minimal attention is paid can influence subsequent cognitive processing. The results indicate that the ad’s influence is subconscious due to the fact that the products were likely to be included in the consideration set even when subjects were explicitly trying to avoid selecting products that were depicted in ads. According to this study, the impact of advertising can be lasting and profound even if persons do not fully attend to a particular ad.

Simon, L. (1998) *Genuine Reality: A Life of William James*. New York: Harcourt Brace & Co.

Spiering, M., W. Everaerd and E. Laan. (2004) “Conscious Processing of Sexual Information: Mechanisms of Appraisal.” *Archives of Sexual Behavior*. v.33. i.4, p. 369-380.

The authors present results from two experiments involving the processing of sexual information, one of which directly involves attention. Participants were asked to categorize randomly-presented “target” stimuli of either a sexual or non-sexual nature. The “target” stimuli was preceded by “prime” stimuli that also was of a sexual or non-sexual nature. Categorization of sexual targets was delayed when they were preceded by sexual primes compared to neutral primes. This was interpreted as an inhibitory process (e.g., Posner’s inhibition of return) and compared with the Sexual Content-Induced Delay (SCID) phenomenon detailed by Geer and other researchers in the 1990s.

Tipper, S. P. and B. Weaver. (1998) "The Medium of Attention: Location-Based, Object-Centered, or Scene-Based?" *Visual Attention*, ed. R. Wright. New York and Oxford: Oxford University Press.

Informative discussion of visual attention that examines the process from several theoretical perspectives. The authors are concerned with how attention functions in ecologically valid real-world settings. They cite research indicating that focusing attention on quickly-approaching objects is due to biological hard-wiring as humans (along with other animals) are constantly assessing and re-assessing their environmental surroundings. The authors generally disagree with previous research (e.g., Broadbent) that posits that attention is primarily spatially-oriented; they cite research (on inhibition of return, for example) which indicates that attention is more flexible and can be object-based.

Treisman, A. M. and G. Gelade. (1980) "A Feature Integration Theory of Attention." *Cognitive Psychology*. v.12, p.97-136.



The authors introduce the influential feature integration theory of attention, which posits that humans process several primary visual features into feature maps that are then integrated into an overall saliency map, which is subsequently accessed in order to direct attention to important areas. This theory is useful in explaining the development of attention theory in the late 20th century and in examining how the human brain attends to and processes information by selecting and then prioritizing visual features.

Triesman, A. M. and N. G. Kanwisher. (1998) "Perceiving Visually Presented Objects: Recognition, Awareness, and Modularity." *Current Opinion in Neurobiology*. n.8, p.218-226.

The authors develop Treisman's feature integration theory regarding the attentional processing of visual information. They cite previous scholarship and emerging experiential evidence that indicate that the recognition and processing of visual information are achieved through partially-segregated brain regions (including the visual cortex and the lateral occipital cortex).

Trick, L. M. and Z. W. Pylyshyn. (1993) "What Enumeration Studies Can Show Us About Spatial Attention: Evidence for Limited Capacity Preattentive Processing." *Journal of Experimental Psychology: Human Perception and Performance*. v.19, p.331-351.

The authors present results from experiments which examine an enduring conundrum in attention studies: why enumerating small numbers of items (1 - 4, called subitizing) is rapid and accurate while enumerating large numbers of items (5+, called counting) is slow and error-prone. Their experiments confirm this phenomenon and also indicate that subitizing is hindered when items in a small group possess different qualities. The authors conclude that subitizing relies on a preattentive mechanism that can only process a small number of items at once and relies on the subject's capacity for feature detection and grouping. This research supports an object-based theory of attention (opposed to a spatial theory of attention) and it supports theories on limited attention.

Wheless, L. R. and J. A. Cook. (1985) "Information Exposure, Attention, and Reception." *Information & Behavior: Volume 1*. New Brunswick, NJ: Transaction Publishers.

The authors examine various theories and research related to selective exposure to information and explore various approaches to understanding attention. They list five "truisms" gleaned from their review of literature on attention: 1) attention is engaged due to stimulus and receiver characteristics; 2) attention processing capacity is finite; 3) there is less expended effort on a directional unit of attention as time passes; 4) over time, humans develop a capacity to ignore signal inputs deemed irrelevant; and 5) the growth of attention control peaks and then declines in the latter years of life. This is useful as a compendium of various theories and research studies on attention, including studies indicating that children are more attentive to women's characteristics and to women's and children's voices while watching television. This chapter discusses perceiver-oriented theories and research on attention which argue that perceivers establish a cognitive frame of reference that they use to direct attention, rather than mainly having their attention directed by response to stimuli.

Wright, R., ed. (1998) *Visual Attention*. New York and Oxford: Oxford University Press, 1998.

The first chapter presents an overview of the history of visual attention studies focusing on three eras: mid-18th century, turn of the 19th century (including James), and late 20th century. It traces the first phenomenological approaches to attention back to Greek and Roman thought. James and Titchener's work on attention during the late 19th and early 20th centuries are examined as well as Parasuraman's contemporary work. This book provides a useful overview of attention studies, arguing that the process was being scientifically analyzed as far back as the 18th century.

“Over time, humans develop a capacity to ignore signal inputs deemed irrelevant; and the growth of attention control peaks and then declines in the latter years of life.”

Yantis, S. (1992) "Multielement Visual Tracking: Attention and Perceptual Organization." *Cognitive Psychology*. v.24, p.295-340.



The author presents results from seven experiments in which observers tracked multiple randomly moving visual elements under a variety of conditions. Targets (from one to five elements in each moving group) were pre-established and, after movement ceased, one element was highlighted and viewers were asked to identify if it was a target. In experiments 1-3, factors that influenced the formation of a perceptual group were manipulated; this briefly impacted performance, but only early in the experiment. In experiments 4-7, factors that influenced the maintenance of a perceptual group were manipulated; this continuously impacted performance. The results indicate that the subjects spontaneously grouped the target elements and directed their attention toward this moving, non-rigid group. The author's results support object-based theories of attention rather than spatial or location-based theories of attention. This divide between location-based attention and object-based attention is one of the enduring disputes among academics. In recent years object-based theories have gained more support, due to experiments such as this one.

Young, A. W. (1994) "Conscious and Unconscious Recognition of Familiar Faces." *Attention and Performance XV: Conscious and Unconscious Information Processing*, eds. C. Umiltà and M. Moscovitch. p.153-158.

Experiments were conducted in which subjects were asked to identify famous individuals whose names they could not remember. Subjects were given semantic cues about the individual's significance and, in a separate study, were given a person's initials if they knew the person's occupation. Subjects who knew the individual's face but nothing else responded better to semantic cues, while subjects who knew the individual's occupation were better able to identify the person after the initials were given. These experiments and other studies indicate that the recognition of a familiar face involves sequential access to different types of information. This chapter is helpful for linking patterns of face recognition to advertising techniques involving celebrities.

Zaltman, G. (2003) *How Customers Think: Initial Insights into the Mind of the Market*. Harvard Business School Press.