

Attention and Performance

Historical notes:

William James: Principles of Psychology 1890

mind is purposive
pragmatism

beginning of chapter XI "Attention" (emphasis added)

<http://www.des.emory.edu/mfp/james.html#talks>

"Strange to say, so patent a fact as the perpetual presence of selective attention has received hardly any notice from psychologists of the English empiricist school. The Germans have explicitly treated of it, either as a faculty or as a resultant, but in the pages of such writers as Locke, Hume, Hartley, the Mills, and Spencer the word hardly occurs, or if it does so, it is parenthetically and as if by inadvertence.[1] The motive of this ignoring of the phenomenon of attention is obvious enough. These writers are bent on showing how the higher faculties of the mind are pure products of 'experience:' and experience is supposed to be of something simply given . Attention, implying a degree of reactive spontaneity, would seem to break through the circle of pure receptivity which constitutes 'experience,' and hence must not be spoken of under penalty of interfering with the smoothness of the tale.

But the moment one thinks of the matter, one sees how false a notion of experience that is which would make it tantamount to the mere presence to the senses of an outward order. Millions of items of the outward order are present to my senses which never properly enter into my experience. Why? Because they have no interest for me. My experience is what I agree to attend to . Only those items which I notice shape my mind - without selective interest, experience is an utter chaos. Interest alone gives accent and emphasis, light and shade, background and foreground - intelligible perspective, in a word. It varies in every [p. 403] creature, but without it the consciousness of every creature would be a gray chaotic indiscriminateness, impossible for us even to conceive. Such an empiricist writer as Mr. Spencer, for example, regards the creature as absolutely passive clay, upon which 'experience' rains down. The clay will be impressed most deeply where the drops fall thickest, and so the final shape of the mind is moulded. Give time enough, and all sentient things ought, at this rate, to end by assuming an identical mental constitution - for 'experience,' the sole shaper, is a constant fact, and the order of its items must end by being exactly reflected by the passive mirror which we call the sentient organism. If such an account were true, a race of dogs bred for generations, say in the Vatican, with characters of visual shape, sculptured in marble, presented to their eyes, in every variety of form and combination, ought to discriminate before long the finest shades of these peculiar characters. In a word, they ought to become, if time were given, accomplished *connoisseurs* of sculpture. Anyone may judge of the probability of this consummation. Surely an eternity of experience of the statues would leave the dog as inartistic as he was

at first, for the lack of an original interest to knit his discriminations on to. Meanwhile the odors at the bases of the pedestals would have organized themselves in the consciousness of this breed of dogs into a system of 'correspondences' to which the most heredity caste of *custodi* would never approximate, merely because to them, as human beings, the dog's interest in those smells would for ever be an inscrutable mystery. These writers have, then, utterly ignored the glaring fact that subjective interest may, by laying its weighty index-finger on particular items of experience, so accent them as to give to the least frequent associations far more power to shape our thought than the most frequent ones possess. The interest itself, though its genesis is doubtless perfectly *natural*, makes experience more than it is made by it.

Every one knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains [p. 404] of thought. Focalization, concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others, and is a condition which has a real opposite in the confused, dazed, scatterbrained state which in French is called *distraction*, and *Zerstreutheit* in German.

□ □ □ Meanings of attention:

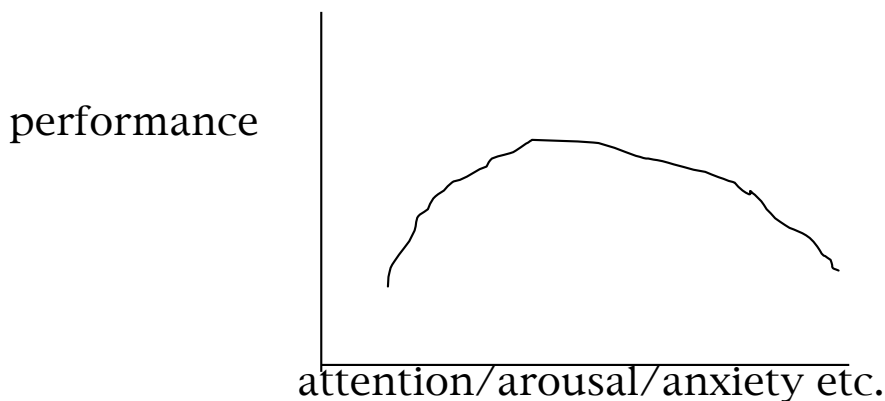
□ □ □ □ □ alertness

□ □ □ □ □ selection

□ □ □ □ □ interpretation

Yerkes-Dodson Law 1908

□ □ □ □ (practical implications)



A major focus of early research, motivated by WWII, □ □ □ that lead to cognitive approach

Selective Attention

- issues:
 - parallel vs. serial processing
 - serial bottleneck
 - early vs. late selection

Auditory Attention

dichotic listening task

- Cherry 1953, Moray 1959
- little is reportable from unattended ear

Filter Theory

Broadbent 1958

- Split Span
- 2 series of numbers, 3 digits per ear
- *recall ~4
- *recall by ear

models:

- 1. as if nature:
 - metaphor, analogy, imagery
- 2. purposes:
 - organize thinking
 - suggest research questions, via predictions

Problems for Early Selection:

Grey and Wedderburn 1960

switch to semantic continuation on unshadowed ear:

rail yon train

may road noise

Treisman 1960 (follow up)

switch w/o switching back

Graded differences in

Simultaneous Messages

tell apart using:

direction, pitch, speed, gender, accent

Shadowing

what can you tell about rejected message?

whether its speech, sex of speaker, tone

sort of: whether backwards

can't tell: words, what language

Treisman Attenuation Model

hierarchical series of processors

flexible, attenuation

problem?

Late Selection □□□ Deutsch & Deutsch 1963

Treisman & Geffen 1967

□□□ (attenuation vs. late selection)

□□□ filter on message attended to vs. after analysis

□□□ shadowing task: □ respond to target word with a tap

□□□ □□□ predictions:

□□□ □□□ □□□ late: detect either equally

□□□ □□□ □□□ early/attenuation: nonshadowed worse

□□□ □□□ results:

□□□ □□□ □□□ shadowed □□□ □□□ 87% □□□ □□□ detected

□□□ □□□ □□□ nonshadowed □□□ 8% □□□ □□□ detected

Visual Attention

Visual Selective Attention

Neisser & Becklen 1975

developed out of audio tradition

lead to rethinking- why?

focus of attention vs. direction of fovea

Posner et al., 1978

fixate point

identify stimulus 70 left or right

expected, no expectancy, unexpected

~235 ~265 ~305

Posner et al., 1980 can attend 240 from fovea

Pattern Recognition and Attention

Treisman & Gelade 1980

feature integration theory

detecting a T among I and Y

among I and Z

detecting a conjunction of features requires
knowing position, can't be done in parallel

The binding problem

Treisman & Schmidt 1982

primary task: identify black digits in one place
secondary: identify colored letters in another

-> illusionary combinations

Friedman-Hill, Robertson & Treisman (1995)

parietal cortex damage ->

confusion in above with up to 10 second presentations

Attention affects on neural mechanisms

Kuck et al. 1997

single cell receptive field shown
blue vertical bar and green horizontal bar

rate of firing depends on what is attended to

Kastner et al. 1998

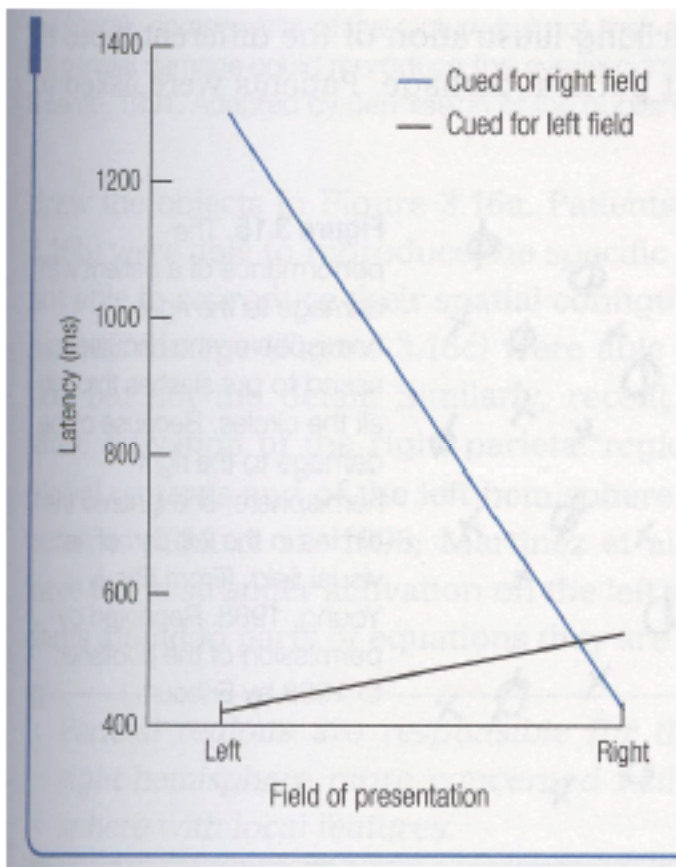
fMRI, target alone or with additional stimuli

fMRI depends on which attended to

Neglect of the Visual Field

Posner et al. 1982

right parietal damage



Albert, 1973

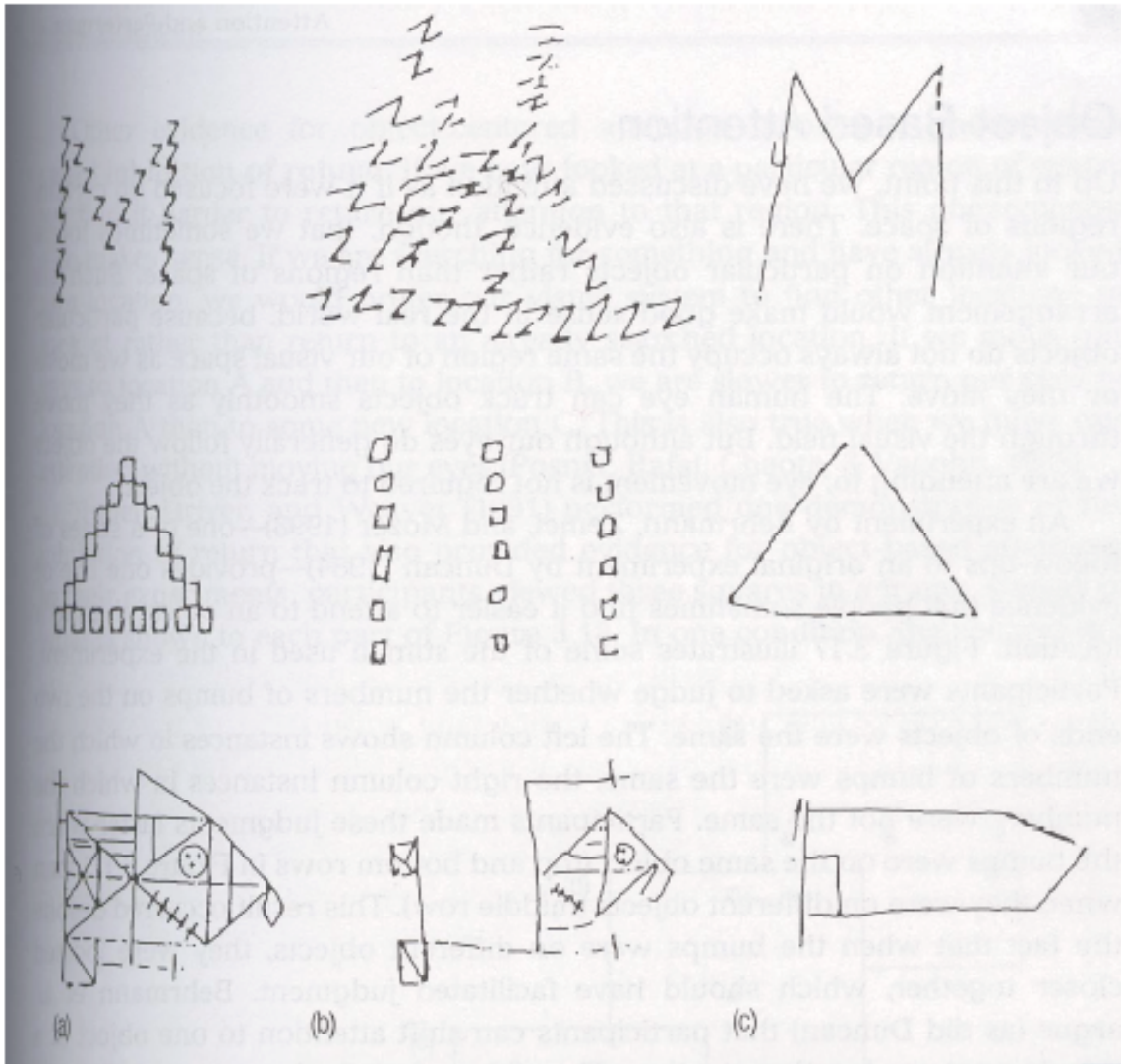
unilateral visual neglect

right vs. left parietal lobes

Robertson & Lamb, 1991

left - detail, right - shape

- a) stimuli
- b) right damage
- c) left damage

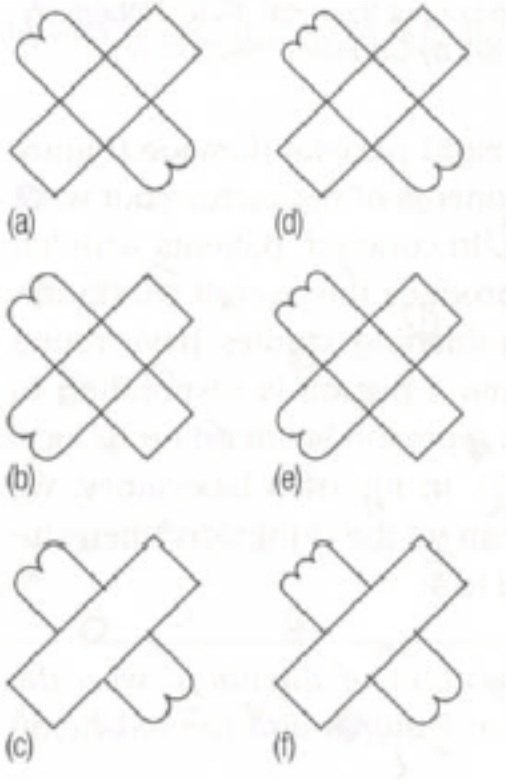


Object-based Attention

Behrmann et al., 1998

same # bumps vs. different

same vs. different object (same is closer comparison)



inhibition of return

Tipper et al., 1991

inhibition of return to object, not place

visual neglect of left side of objects, rather than field

Central Attention

task/time sharing

Byrne & Anderson, 2001

multiplication and addition

Schumacher et al. 2001

perfect time sharing:

determine where a letter was presented (button press)

whether tone was high, medium or low (verbal report)

task analysis

(resource -limited vs. data-limited tasks)

automaticity

Spelke et al. 1976

reading and stenography

Stroop Effect 1935