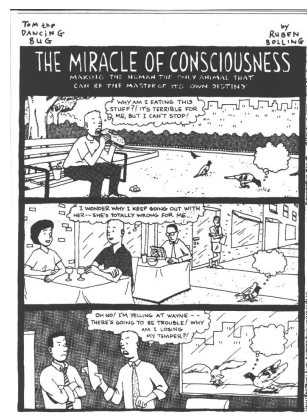
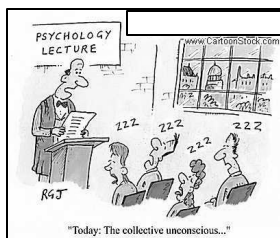


## Non-conscious Processes in Perception, Emotion, and Movement

Skeptic's Toolbox 2004  
The University of Oregon

Barry Beyerstein  
Brain Behaviour Laboratory  
Department of Psychology  
Simon Fraser University



Do we have access to the causes of our feelings and our behaviour?

- Always?
- Never?
- Sometimes?

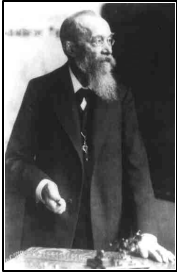
## The Doctrine of Concordance



Endel Tulving,  
University of Toronto

- The term used by the psychologist Endel Tulving to describe the age-old tenet of folk-psychology that conscious awareness always accompanies (and is always necessary for) perception, memory, decision-making, and for the enactment and control of our behavior.
- The notion that we always know what we are doing and why (i.e., what the causes were)

## Is introspection a reliable guide to what is controlling our behaviors?



- Wilhelm Wundt (1832-1920) and the structuralists held that introspection was a valid procedure for observing the workings of one's own mind.

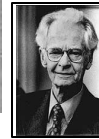
## A two-pronged attack on the validity of introspection



Ivan Pavlov  
(1849-1936)



John B. Watson  
(1878-1958)



B.F. Skinner  
(1904-1990)

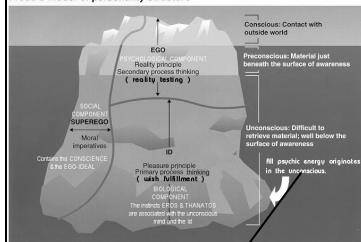


Sigmund Freud (1856-1939)

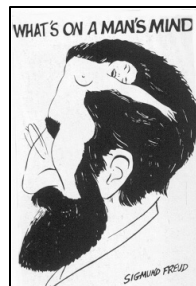
**BEHAVIORISM**

**PSYCHOANALYSIS**

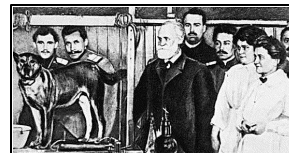
Freud's model of personality structure



Peit Hein: *Ode to Freud*



**STIMULUS-RESPONSE PSYCHOLOGY**



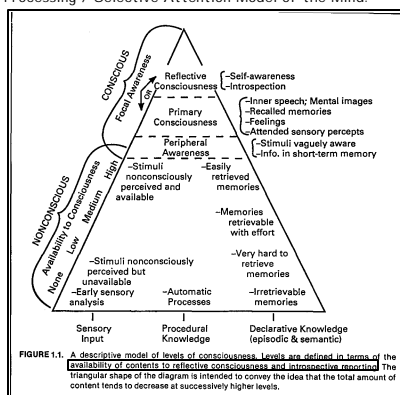
## The Modern View of the Unconscious

- Although most psychologists and neuro-scientists reject both Freud's peculiar conceptualization of the unconscious and the Behaviorists' dismissal of any causal role for conscious awareness, there is much compelling clinical and experimental evidence to support the claim that much of what we do is influenced, planned, chosen, and initiated by brain processes operating outside of conscious awareness.

## Evidence for Non-conscious Processing

- Implicit versus explicit knowledge
- Performance of highly practiced ("overlearned") behaviors---e.g., driving, sports and dance movements
- "Blindsight" and prosopagnosia
- Ideomotor activities
- Semantic priming effects
- Non-conscious effects of unattended stimuli on choices, moods, social behaviours, etc.
- Conditioning (learning) without awareness
- The "mere exposure effect"
- Source amnesia and cryptomnesia
- The Implicit Associations Test
- Dissociated behaviors, automatisms

An Information Processing / Selective Attention Model of the Mind.



G. William Farthing (1992)

## Kenneth Bowers University of Waterloo

- First-Order Consciousness (~Farthing's "Primary Consciousness")
  - Found in all higher mammals
  - Awareness of events due to attending to them or "noticing" them
- Second-Order Consciousness (~Farthing's "Reflective Consciousness")
  - Awareness of being aware
  - Comprehension of things that have been noticed
  - Integrates beliefs, knowledge, concepts, theories about how the world works

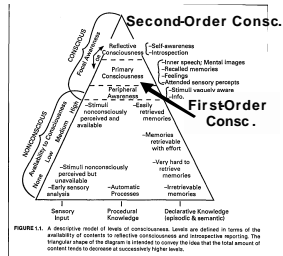
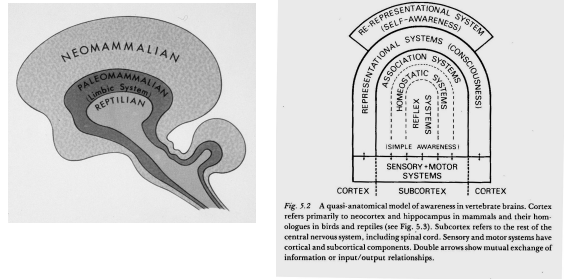
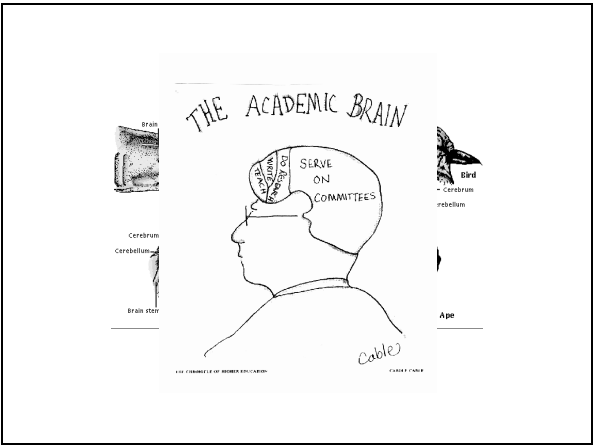
[illegible]

Figure 5.2 consists of two parts. The left part is a sagittal cross-section of a brain, showing three nested regions: the outermost 'NEOMAMMALIAN' region, the middle 'PALEOMAMMALIAN' region, and the innermost 'REPTILIAN' region. The right part is a hierarchical diagram of systems. At the bottom, 'CORTIX' and 'SUBCORTIX' are separated by a vertical line. Above 'SUBCORTIX' is 'SENSORY-MOTOR SYSTEMS'. Above 'SENSORY-MOTOR SYSTEMS' is '(SIMPLE AWARENESS)'. Above '(SIMPLE AWARENESS)' is 'REPRESENTATIONAL SYSTEMS (COMPLEXNESS)', which contains 'ASSOCIATION SYSTEMS' and 'HOMOLOGIC SYSTEMS'. At the top is 'RE-REPRESENTATIONAL SYSTEM (SELF-AWARENESS)'. Double-headed vertical arrows connect 'CORTIX' to 'SUBCORTIX', 'SUBCORTIX' to 'SENSORY-MOTOR SYSTEMS', 'SENSORY-MOTOR SYSTEMS' to '(SIMPLE AWARENESS)', '(SIMPLE AWARENESS)' to 'REPRESENTATIONAL SYSTEMS (COMPLEXNESS)', and 'REPRESENTATIONAL SYSTEMS (COMPLEXNESS)' to 'RE-REPRESENTATIONAL SYSTEM (SELF-AWARENESS)'.



The Evolution of the Cerebrum\*





The modularity of consciousness: Different specialized “modules” can work in the background without conscious awareness

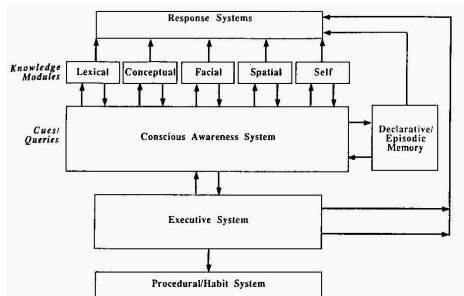
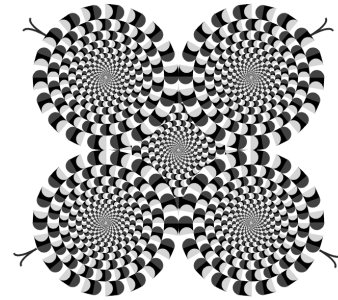


FIGURE 8.2. A schematic depiction of Schacter's DICE model. Conscious awareness of specific types of information depends on intact connections between the Conscious Awareness System (CAS) and individual knowledge modules or declarative/episodic memory. [From Schacter, D. L. (1988). On the relation between memory and consciousness.]

Let's talk about perception



Even relatively simple perceptions are complex cognitive constructions

- They are not just a one-to-one rendition of what's on the retina
- “Perception is sensory reasoning.”
- That reasoning, inferring, etc., is done unconsciously, before the final result is served up to conscious awareness.

The visual system encodes relatively few key details from the retinal stimulus, which are then “filled in” by the brain, using inference and information from memory about what we know about how the world usually works.



What did you just see?

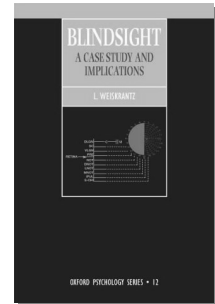
Answer: 2 Bill Clintons



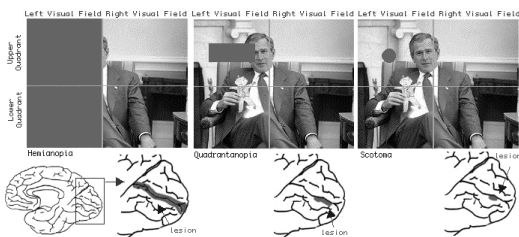
Stuff going on in the  
visual system that we're  
not aware of

## BLINDSIGHT

- Lawrence Weiskrantz, University of Oxford



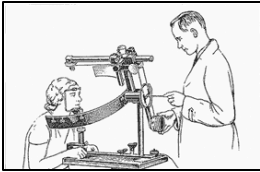
## "Blindsight"



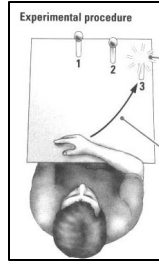
What does a page of text  
look like when viewed  
through a scotoma?



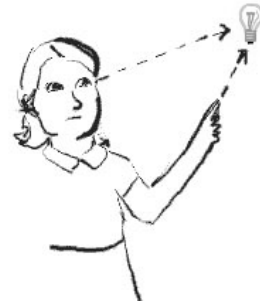
## Testing for Blindsight



1. Determine extent of blind area



2. Present stimuli in the blind part of the visual field
3. Require a behavioral response; e.g., pointing

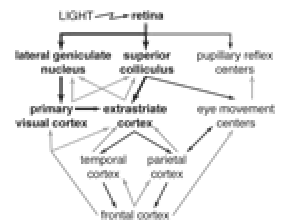
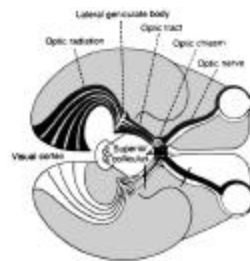


Pointing at objects inside the blind spot (that the patients cannot see consciously) is more accurate than the hit rate predicted by chance.

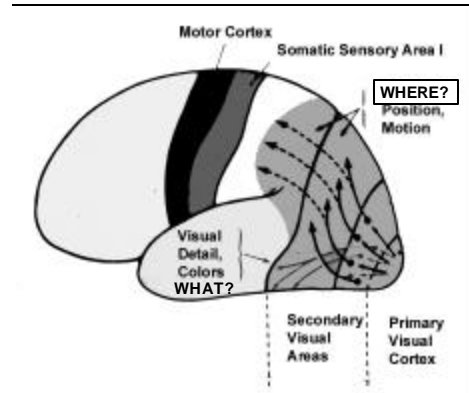
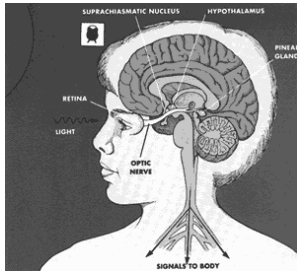
## How could such a thing happen?



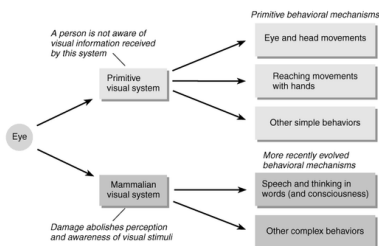
## We have several visual systems



There's even another branch of the visual system that controls our biological clock

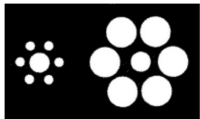


#### ► Explanation of the Blindsight Phenomenon

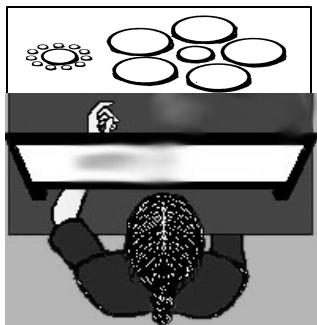


EVIDENCE FOR SIMILAR  
NON-CONSCIOUS  
PROCESSESSING OF  
INFORMATION IN NON-  
BRAIN INJURED PEOPLE?

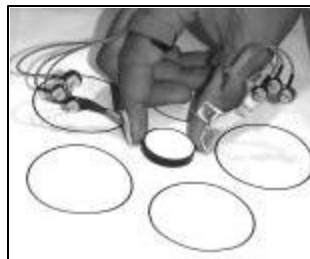
Is the left center circle bigger?



No, they're both the same size



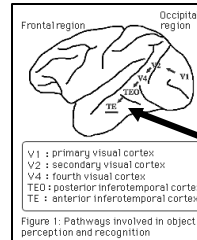
Mei Goodale,  
Univ. of Western  
Ontario



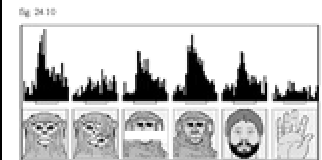
When people who can't see their hand and reach out to grasp the 3-D stimulus that LOOKS to be a different size because of the visual illusion, they still position the gap between their fingers to match the REAL size of the cylinder.

## PROSOPAGNOSIA

- Loss of the ability to recognize faces without the loss of visual ability in general



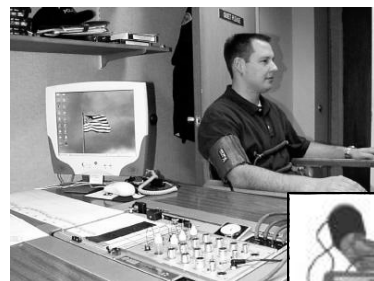
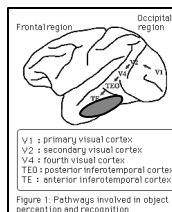
"Face Cells" in temporal cortex



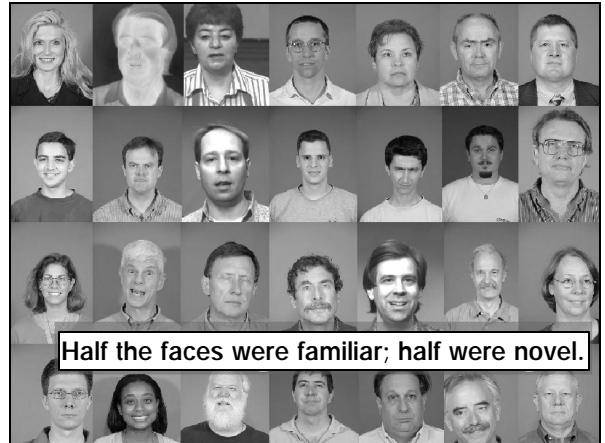
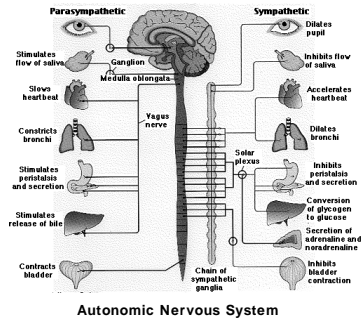
Could part of the brain still be able to recognize faces, even though there is no conscious awareness of their familiarity?



Antonio Damasio  
University of Iowa

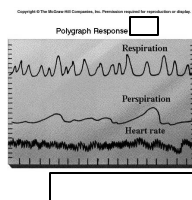


Polygraphs ARE sensitive detectors of A.N.S. responses



## In Tranel and Damasio's experiment

- The prosopagnosic patients couldn't recognize faces of people who were quite familiar to them
- At the same time they were denying they knew who the familiar faces were, their autonomic nervous systems were showing a bigger response on the polygraph to the familiar faces than they gave to non-familiar faces—all without the patients' awareness



SOME EXAMPLES OF  
NON-CONSCIOUS  
INFLUENCES ON  
BEHAVIOUR



## The mere exposure effect

- Robert Zajonc, University of Michigan
- Kunst-Wilson, W. R. and Zajonc, R. B. (1980). Affective discrimination of stimuli that cannot be recognized. *Science*, 207, 557-558



The "Mere-Exposure Effect" (Robert Zajonc)

1. A series of nonsense figures, like those above, is presented, very rapidly (tachistoscopically), to observers—appears to be not much more than a brief flash.
2. A series of similar, paired figures is presented to the same people. One member of each pair was in the previous "flashed" series, the other was new.

3. Observers were asked after each presentation:

(a) "Which one was in the previous series?"

*Performance was approximately 50% correct.*

Then they are asked,

(b) "Which member of the pair do you like better?"

*Performance was slightly above chance (>50%) in choosing the member of the pair that was in the first, flashed series.*

Evidence for a sort of "subliminal" effect:

An emotional response was affected by exposure to a stimulus, without conscious awareness of the stimulus.



L'ODORAT.

## unconscious odor conditioning



## UNCONSCIOUS ODOR CONDITIONING

- Kirk-Smith, Van Toller, & Dodd  
University of Warwick, U.K.
- *Biological Psychology*, 1983, Vol. 17, pp. 221-231

## The Warwick Lab

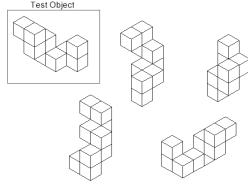
- Set out to determine if unconscious conditioning to unobtrusive odors in the environment can produce subtle effects on mood or emotions at some later time (unbeknownst to the person experiencing these feelings).
- To say that the conditioning was unconscious, after the experiment, people must report having had no awareness of the smell when they were exposed to it earlier and/or no awareness that it had in any way affected their emotional responses at the later time.

- Two sessions, ostensibly unrelated to one another, one announced as a problem-solving experiment, the second one (about a week later) was billed as a task requiring rating of one's own emotions and those being expressed in photographs of people's faces.

- Experimental demonstration of the unconscious odor conditioning effect requires a subtle, relatively neutral (neither "good" nor "bad"), smell that people in the study are unlikely to have been exposed to before.
- The Warwick group chose TUA (Trimethylundecylenic aldehyde, a neutral "base" used in the perfume industry)
- They subtly insinuated TUA, unannounced, into the room environment for half their participants during the first session.
- There was a "sham task" in the first session to divert attention from the real independent and dependent variables.

## SESSION ONE: TASK ONE:

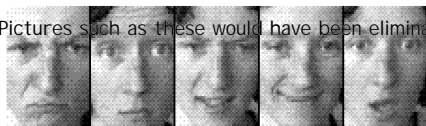
- Problem solving task done with the subtle odor of TUA present for half the participants. The odor was weak; no attention was drawn to it.
- Very difficult problems to solve.
- Participants were treated brusquely.
- They were frustrated, angry, and made to feel inadequate for not performing better.



## SESSION TWO:

- Occurred about a week later, seemingly unrelated to the first experiment: different experimenters, different lab room, different task, etc.
- TASK TWO:
  1. Complete a self-report mood scale before and after the photo-judging task.
  2. Rate the emotions being expressed in a series of facial photographs.

Pictures such as these would have been eliminated



Anger      Raising eyebrows      Disgust      Happiness      Surprise

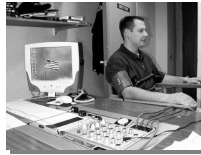
- Participants did not know that the pictures had actually been pre-selected to remove any photos that a previous group of judges had rated as showing any emotion
- In session two, all the experimental subjects had the TUA odor present in the room.

## RESULTS:

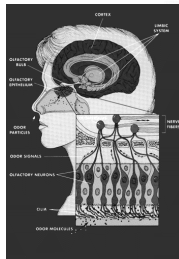
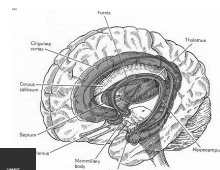
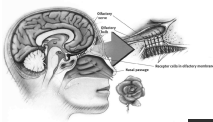
- In the second session, participants who had the odor present in both sessions tended to rate their own mood, and the emotions supposedly depicted in the photos, more negatively than those who did not have TUA present during the emotionally-disturbing first session.
- Debriefing subjects after Session Two revealed very little awareness of *ever* having smelled TUA before or that it had anything to do with the purposes of the experiments in which they had participated.

## Follow-up Experiment

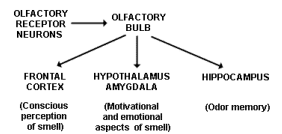
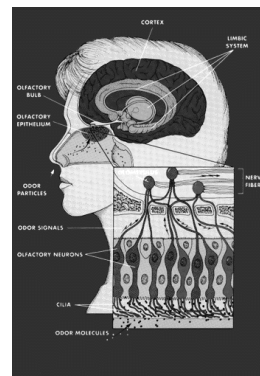
- Van Toller and Dodd used a similar experimental paradigm, but this time the measure was autonomic nervous system response to the unconscious odour (similar to Damasio's experiment with prosopagnosics)
- In this experiment, people showed heightened emotional responses on the polygraph to TUA that had been present but unnoticed in a previous, emotionally unsettling situation.



- The authors concluded that subtle conditioning of odors to emotional situational variables can occur without awareness.
- When these odor stimuli are encountered later, they may "reinststate" part of the negative emotional state without the experimenter knowing where it came from.
- My extension: This may be a common source of vague feelings, premonitions, unexplained attractions, repulsions, emotional reactions, subtle and sudden changes in moods, etc., in everyday life.



How might it work?



Enough smell stuff already . . .



One of the jobs of  
consciousness is to make as  
many operations as possible  
unconscious

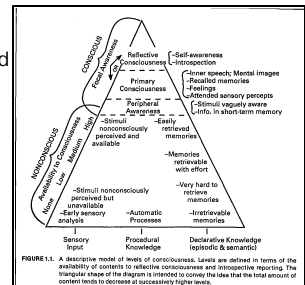


## PRACTICE



The capacity of "focal  
awareness" is limited

- Conscious decision-making and monitoring of behaviour is reserved for novel tasks that require moment-to-moment attention (feedback control).
- As a task is practiced and mastered it becomes automatized; i.e., a habit that can be controlled outside of awareness.



## Automatic Behaviours

- Over-learned “programs” that can operate autonomously (outside awareness)
- This frees the self-aware “executive level” of consciousness to attend to problem solving, long-range planning, escapist fantasies, self-gratification...

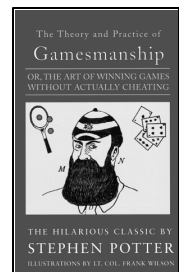
Probably the most familiar example is driving an automobile.

- When you are learning, it requires rapt attention to every aspect of the process.
- Eventually, it becomes so routine that we can “multi-task”; i.e., drive and attend to other things---as long as the driving task demands remain routine.
- We may have to switch back from automatic to controlled processing if a novel demand presents itself.

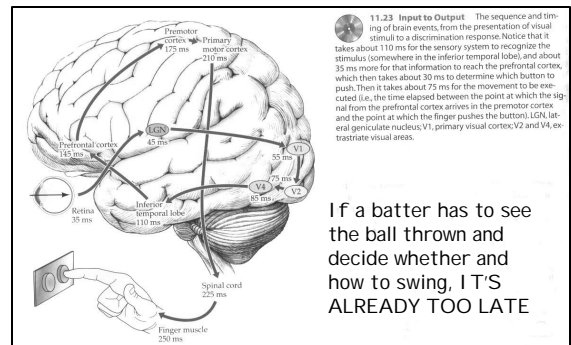
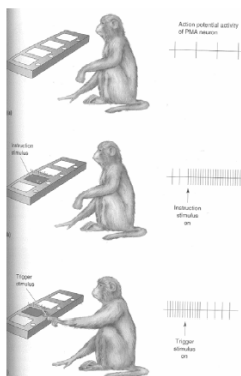


Once a behavioural routine has become automatized . . .

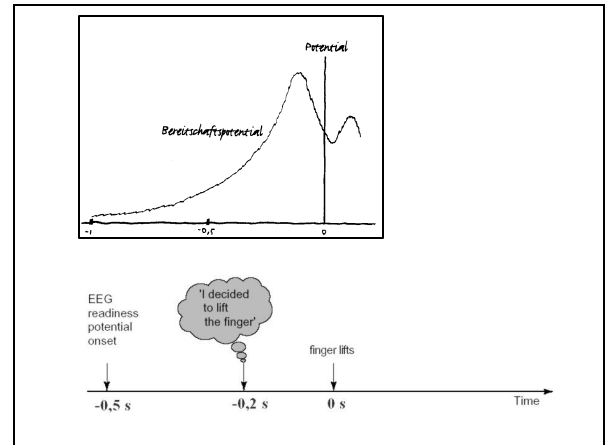
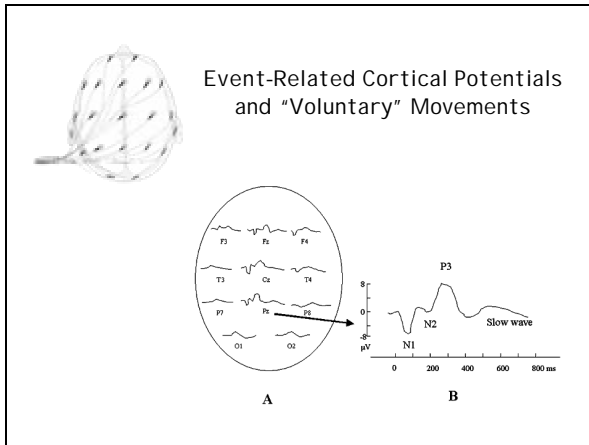
- Drawing attention to it or asking a person to attempt to control it voluntarily usually results in a deterioration rather than an improvement in the behaviour.



## Ballistic movements in sports



If a batter has to see the ball thrown and decide whether and how to swing, IT'S ALREADY TOO LATE



What makes a superior athlete?

Are the *very best* better in:

- Strength?
- Stamina?
- Eye-hand coordination, reaction time?
- Speed?
- Agility?
- Practiced skills?

YES—TO SOME DEGREE, **BUT** . . .





Superstars must be very good on all these relevant parameters

- But usually they aren't all that much better in these categories than the next echelon of highly skilled players
- So, what's the secret ingredient?

What distinguishes the super elite athletes from the merely very good?

- They are always a step ahead of the play
- They are in position BEFORE the ball or puck gets there
- They have (subconsciously) read and extrapolated from the current field set-up and are already reacting before the actual play develops.

The brains of  
batters who  
are any good  
at it have  
already begun  
the swing  
before the  
ball leaves the  
pitcher's hand



IT'S THE



So what does all this have to do  
with skepticism?



Most people are unaware of how much  
information processing typically goes on  
outside of focal awareness.

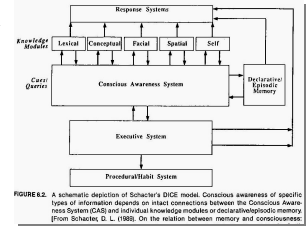
- They are prone to assume that if they
  - Know something and can't remember having learned it or even having been exposed to it
  - Have a sudden, unexplained emotional experience
  - Have a strong hunch, premonition, feeling of familiarity, "vision" or reverie, or "novel" idea that, "just popped into my head" from "out of the blue"
  - Seem to have done something without willing it
- This must be evidence for divine inspiration, tapping into some kind of "universal mind", spiritual possession or guidance, etc.



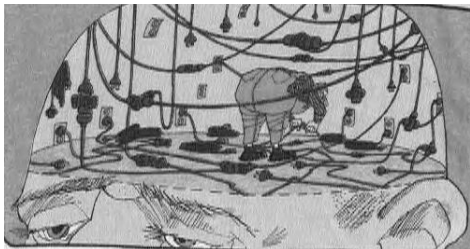
## Not necessarily



- These seemingly spooky things could just be the result of processing in an unattended module of the brain or one that operates autonomously, without awareness.



We don't always know what's going on in there . . .



Consciousness:  
That annoying time  
between naps.

