Attention and Automaticity

Spring 2014

1

Psychological Interpretations of Consciousness

- As Attention
  - Bringing Some Object into Awareness
- As Primary Memory
  - Short-Term Memory, Working Memory
  - Maintaining that Object in Awareness
- Attention as the Pathway to Primary Memory

2

William James on Attention
Principles (1890), Chapter 11

Everyone 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 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.

3

Varieties of Attention
James, Principles (1890), Chapter 11

- Sensorial vs. Intellectual
  - Directed toward Objects of Sense
  - Directed toward Ideal or Represented Objects
- Immediate vs. Apperceptive
  - Object Intrinsically Interesting
  - Derived from Interest in Some Other Thing
- Passive vs. Active
  - Reflexive, Involuntary
  - Voluntary

4

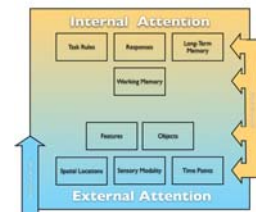## Aspects of Attention
Chun et al. (2011)

- Limited Capacity
  - Environment Presents More Information Than Can Be Processed
- Selection
  - Multiple Stimuli Compete for Attention
- Modulation
  - Facilitates/Inhibits Processing
- Vigilance
  - Sustain Attention Over Period of Time

5

Architecture of Attention 1
Chun et al. (2011)

- External
  - Sensory Modality
  - Spatial Location
  - Temporal
  - Features and Objects
- Internal
  - Task and Response Selection
  - Long-Term Memory
  - Working Memory

6

Architecture of Attention 2
Prinzmetal & Landau (2010)
After Posner (1978) and Wundt (1902)

- Voluntary (Endogenous)
  - *Paid to* External Cue
    - Goal-Directed
      - External and Internal
  - Affects Accuracy and Response Latency
- Involuntary (Exogenous)
  - *Captured by* External Cue
    - Stimulus-Driven
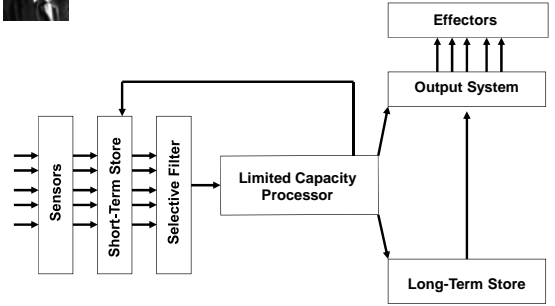   - External Only
  - Affects Only Response Latency

7

Early Studies of Attention and "Short-Term" Memory

- Span of Apprehension (Woodworth)
- Applications
  - Air Traffic Control
  - Telephone Numbers
- "First Facts"
  - Attention is Limited
  - Attention Can Be Controlled
    - Deployed as Well as Captured
- Attention as the Path to Short-Term Memory
  - "Working Memory"

8

Filter Model of Attention
Broadbent (1958)

9

Dichotic Listening
Cherry (1953)

- The Cocktail-Party Phenomenon
- Shadowing
- Memory for Unattended Channel
  - Switch in Language
  - Switch between Forwards and Backwards
  + Switch between Male and Female Voice

10

Filter Theory of Attention
Broadbent (1958)

- Attention as a Bottleneck or Filter
- Sensory memory
  - Icon, Echo, etc.
- Attend to Single Communication Channel
  - Serial Information Processing
- Selection Based on Perceptual Features
  - Semantic Analysis After the Bottleneck
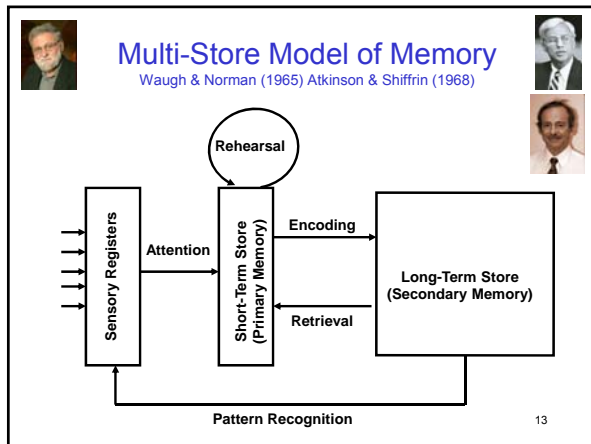- Attention is Flexible
  - Attentional Processing is Serial

11

Filter Theory: Implications for Consciousness
Broadbent (1958)

- Perceptual Analysis is Unconscious
  - Can Occur Preattentively
- Semantic Analysis Requires Consciousness
  - Must Occur Post-Attentively

Preattentive = Preconscious = Perceptual
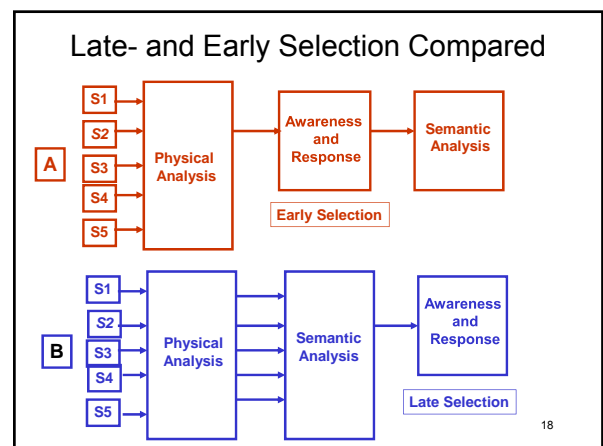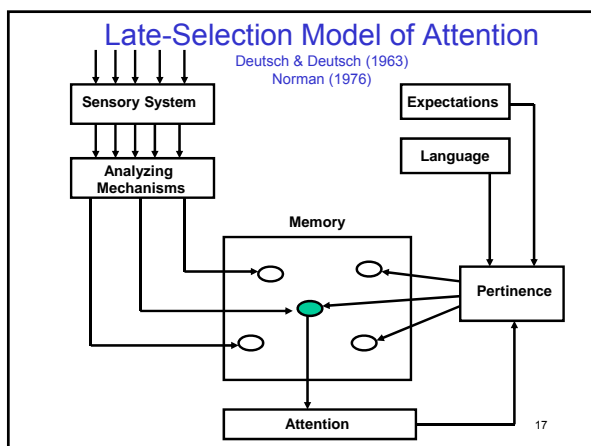Attentive = Conscious = Semantic

12

Multi-Store Model of Memory
Waugh & Norman (1965) Atkinson & Shiffrin (1968)

Rehearsal

Sensory Registers → Attention → Short-Term Store (Primary Memory) → Encoding → Long-Term Store (Secondary Memory)

Retrieval

Pattern Recognition

13

Problems with the Filter Model

- Moray (1952)
  - Attention to One's Own Name
- Treisman (1960)
  - Shift Shadowed Message Between Ears
- Preattentive Semantic Analysis
  - Can Go Beyond Physical Structure

14

Modified Filter Theory
Treisman (1964)

- Attenuator, Not Filter
- Contextual Tuning
- Attention Not Determined by Physical Attributes Alone
  - Goals
  - Signal-Detection Theory
- *Cognitive* Theory of Attention
  - Bottom-up vs. Top-down processing
  - Stimulus vs. Meaning

15

Late-Selection Theories
Deutsch & Deutsch (1963); Norman (1968)

Abandon the Filter

- Input Channels Processed in Parallel
- Attention Based on *Pertinence*
  - Required for Response Selection
  - Not for Input Selection
- Implications for Consciousness
  - Preattentive Analysis is Complete
    - Includes Meaning as well as Structure

16

Late-Selection Model of Attention
Deutsch & Deutsch (1963)
Norman (1976)

Sensory System → Analyzing Mechanisms → Memory

Expectations

Language

Pertinence

Attention

17

Late- and Early Selection Compared

A: S1, S2, S3, S4, S5 → Physical Analysis → Awareness and Response → Semantic Analysis

Early Selection

B: S1, S2, S3, S4, S5 → Physical Analysis → Semantic Analysis → Awareness and Response

Late Selection

18

Problem:
Extent of Preattentive Processing

- Analysis Without Conscious Attention
 - Limited to Perceptual Structure?
  - Extends to Semantic Meaning?

19

Capacity Theory of Attention
Kahneman (1973)

- Attention = Mental Effort
  - Arousal
- Cognitive Resources are Limited
- Determinants of Allocation Policy
  - Automatic Enduring Dispositions
  - Conscious Momentary Intentions
- Attention and Task Demands
  - Undemanding, Parallel
  - Demanding, Serial

20

Capacity Model of Attention
Kahneman (1973)

21
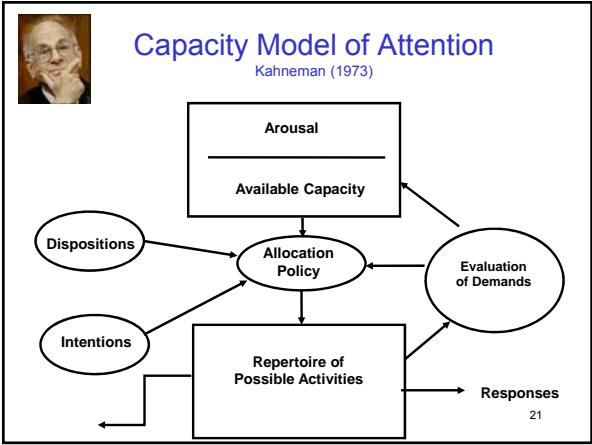
Views of Attention and Automaticity

- Traditional View
  - Elementary Processes are Preattentive
    - Performed Unconsciously or Preconsciously
  - Complex Processes Must Be Post-Attentive
    - Performed Consciously
- Revisionist View
  - Elementary Processes Can Be Preattentive
    - Performed Unconsciously or Preconsciously
  - Complex Processes Can Be Unconscious *Too*
    - So Long As They Are Performed Automatically

22

Automaticity in Skilled Performance
LaBerge & Samuels (1974); LaBerge (1975)

- Many Complex Tasks Cannot be Performed Consciously
- Some Components of Skilled Performance Must be Unconscious
- Definition of Automaticity
  - Immediately Processed into Long-Term Memory
    - Even if Attention is Deployed Elsewhere

23

Automaticity in Reading
Hierarchical Coding of Stimulus Input

Graphemic Information   I S R Q P

- Feature Detectors   • Intrinsically Automatic
- Letter Codes   • Initially Effortful
- Spelling-Pattern Codes   • but Automatized
- Word Codes   • Through
- Word-Group Codes   • Practice

24

Attention and Automaticity
Kahneman (1973)

- Identification of Consciousness with Attention
  - Preattentive = Preconscious
    - Early Selection: Perceptual, Physical
    - Late Selection: Semantic, Meaning
- Attention Redefined as Mental Effort
  - Automatic Processes Don't Require Effort
    - Executed Outside Scope of Conscious Attention
      - No Conscious Awareness
      - No Conscious Control
  - Sources of Automatization
    - Innate
    - Extensive practice

25

Automaticity Defined
Bargh, "Four Horsemen of Automaticity" (1994)
After LaBerge & Samuels (1974); Posner & Snyder (1975);
Schneider & Shiffrin (1977); Schiffrin & Schneider (1977)

- Inevitable Evocation
- Incorrigible Completion (Ballistic)
- Efficient Execution
- Parallel Processing
- *Unconscious* in the Strict Sense of the Term
  - Operate Outside Phenomenal Awareness
  - Operate Outside Voluntary Control

26

Automaticity Extended
Hasher & Zacks (1979, 1984)

- Inevitable Evocation, Efficient Execution

- No Improvement with Training or Feedback
- No Individual Differences
- Age Invariance
- Independent of Arousal

27

Roots of Automaticity

- Innate Behaviors
  - Reflex, Taxis, Instinct
- Conditioned Responses
  - Classical Conditioning
  - Instrumental (Operant) Conditioning
- Automaticity Acquired Through Learning
  - Extensive Practice with Task
- But Can't Be Overcome
  - Even with Extensive Practice (?)

28

Dual-Process Theories in Psychology
Chaiken & Trope (1999); Smith & DeCoster (1999, 2000)

- Conscious or Effortful or Controlled
  - Symbolically Represented Rules
    - Structured by Language, Logic
    - Learned in One Trial (or Very Few)
  - Conscious
    - Optional, Depending on Capacity, Motivation
    - Conscious Awareness of Steps in Processing
- Automatic or Unconscious
  - Associative
    - Structured by Similarity, Contiguity
    - Learned Over Many Trials
  - Automatic (As Defined Previously)
    - Preconscious, with Conscious Awareness of Result

29

Two Systems in Judgment and Decision-Making
Kahneman, *Thinking, Fast and Slow* (2011)

- System 1
  - Automatic, Fast, Unconscious
  - Heuristic, "Hot"
    - Emotions, Stereotypes
- System 2
  - Controlled, Slow, Conscious
  - Algorithmic, "Cold"
    - Logical, Systematic
- System 1 Wins the Race

30

Controlled and Automatic
Conscious and Unconscious
Components in Task Performance
Jacoby (1991);

- Tasks Cannot be Classified as Automatic or Controlled
- Every Task has Automatic and Controlled Components
- How to Separate Them Experimentally?

31

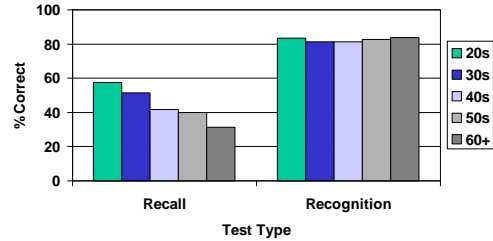## Age Differences in Memory
Schoenfield & Robertson (1966); Schoenfield & Stones (1979)

Legend: 20s, 30s, 40s, 50s, 60+
Y-axis: % Correct
X-axis: Test Type (Recall, Recognition)

32

Controlled and Automatic
Conscious and Unconscious
Components in Memory
Mandler (1980); Jacoby (1991)

- Recall a Function of Retrieval
  - Conscious, Deliberate, Controlled
- Two Processes in Recognition
  - By Retrieval
    - Item Consciously Remembered
  - By Familiarity
    - Item Automatically "Rings a Bell" (Priming)
- Aging Impairs Conscious Recollection
  - But Spares Unconscious Priming

33

Priming Effect on Stem-Completion

- Study list of Words   *density*
- Stem-Completion Test
  - Old studied targets   *den____*
  - New unstudied lures   *nec____*

34

Method of Opposition
Jacoby (1991)

- Study list of Words   *density*
- Stem-Completion Test
  - Old studied targets   *den____*
  - New unstudied lures   *nec____*
- Inclusion Condition
  - Complete each stem with item from study list
    - or, the first word that comes to mind *density*
- Exclusion Condition
  - Complete each stem with any item *except* one from the study list *dentist* 35

Age Differences in Memory
Jacoby et al. (1997)

Legend: Young, Old
Y-axis: Proportion of Targets
X-axis: Test Type (Inclusion, Exclusion)
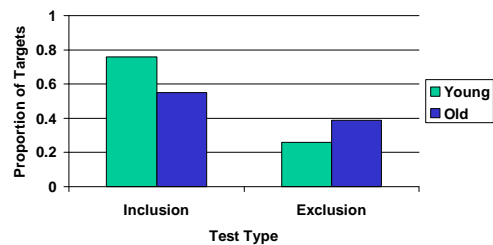
36

Process Dissociation Procedure
Jacoby (1991)

- Inc $= C + A(1 - C)$
  - Inc $= p$ Targets Produced on Inclusion task
  - C $= p$ Targets Consciously Recognized
  - A $= p$ Targets Automatically Generated
  - (1 - C) $= p$ Targets *Not* Consciously Recognized
- Exc $= A(1 - C)$
- C $=$ Inc - Exc
- A $=$ Exc $/ (1 - C)$

37

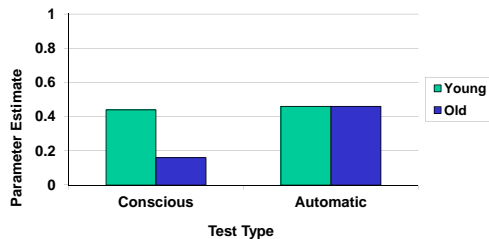## Automatic and Controlled Components in Age Differences in Recognition
Jacoby et al. (1997)

Group	Inc	Exc	C	A
Young	.76	.26	.44	.46
Old	.55	.39	.16	.46

The age difference in recognition is due to age differences in the *conscious, strategic* component of recognition. 38

Components of Processing in Stem-Completion
Jacoby et al. (1997)

39

20-Year Retrospective of PDP
Yonelinas & Jacoby (2012)

- Many Applications Beyond Memory
- Criticisms of "Process Independence"
  - Processes May be Redundant/Embedded
  - May Need Multinomial Model (>2 Processes)
- But Converging Evidence
  - Outcomes as Predicted by Process-Independence
  - Alternative Measures of A and C in Memory
    - Remember/Know Judgments
    - Signal-Detection Theory

40

Cognitive Perspective on Social Interaction

- Importance of the *Perception* of the Situation
  - Impression Formation
    - Person Perception
  - Attribution Theory
    - Causal Explanation
  - Impression Management
    - Strategic Self-Presentation

Traditional Focus:

Conscious/Deliberate Thought

41

Revisionist Views of Social Interaction

Reaction to "Cold, Calculating, Deliberation"

- "Hot" Cognition
  - Emotion, Motivation Independent of Cognition
  - Emotion, Motivation Shape Cognition
- Automaticity
  - Situational Influences on Social Interaction
    - Interpretation of Situational Influences as Priming
  - Social Behavior Largely Automatic in Nature

42

"The Automaticity of Everyday Life"
Bargh (1984)

"As Skinner argued so pointedly, the more we know about the situational causes of psychological phenomena, the less need we have for postulating internal conscious mediating processes to explain these phenomena."

43

Automaticity in Social Behavior

- Most Social Behavior is Automatic
  - Triggered by Environment
  - Preattentive/Preconscious Processing
- Internal Mental Representations of the Situation are Constructed Automatically
 - Perception "Dumped" in Consciousness

44

Interruptions of Experimenter
Bargh et al. (1996), Experiment 1

- Cover Task: Scrambled Sentences
  - "Rude" Primes
    - *aggressively, rude, bother, disturb, intrude*
  - "Polite" Primes
    - *respect, honor, considerate, appreciate, patiently*
  - "Neutral" Primes
    - *exercising, flawlessly, occasionally, rapidly, gleefully*
- Experimenter Engaged with Confederate
  - Ignores Waiting Subject
- Interruptions During 10-Minute Waiting Period

45

Interruptions of Experimenter
Bargh et al. (1996), Experiment 1
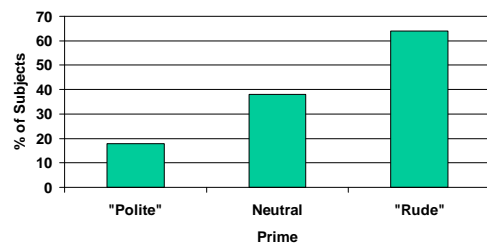
46

Preconscious Analysis of Situation
Bargh (1984)

- Situational Effects
- Social Perception
- Perception-Behavior Interface
- Evaluation
- Evaluation-Behavior Interface
  Social Ignition, not Social Cognition

47

Auto-Motive Model of Social Behavior
Bargh (1990)

- Traditional Model
  - Conscious Selection of Intended Behavior
  - Automatic Execution of Intention
    - Revised Model Automates Selection Process
- Goals and Motives Automatically Invoked
  - Operate Outside Awareness

48

The Automaticity Juggernaut
Kihlstrom (2008)

- Social Behavior Largely Automatized
  - Conscious Percepts, Goals, Emotions Irrelevant
    - Automatically Triggered by Preconscious Analysis
- Consciousness is an Afterthought
  - Give Plausible/Acceptable Reasons for Behavior
- We Are All Zombies After All
  - Not Because Zombies are Conscious Too
    - Dennett
  - But Because Consciousness is Epiphenomenal
    - Plays No Causal Role in Behavior

49

"The Automaticity of Everyday Life"
Bargh (1997, p. 1)

"[T]he more we know about the situational causes of psychological phenomena, the less need we have for postulating internal conscious mediating processes to explain these phenomena….

[I]t is hard to escape the forecast that as knowledge progresses regarding psychological phenomena, there will be less of a role played by free will or conscious choice in accounting for them….

That trend has already begun…, and it can do nothing but continue."

50

"Is Consciousness Riding into the Sunset?"
Bargh (1997), p. 50, 52

"Automaticity pervades everyday life, playing an important role in creating the psychological situation from which subjective experience and subsequent conscious and intentional processes originate….

I emphatically push the point that automatic, nonconscious processes pervade all aspects of mental and social life, in order to overcome what I consider dominant, even implicit, assumptions to the contrary.

51

The Unbearable Automaticity of Being
Bargh & Chartrand (1999, p. 462)

"[M]ost of a person's everyday life is determined not by their conscious intentions and deliberate choices but by mental processes that are put into motion by features of the environment and that operate outside of conscious awareness and guidance."

52

"Naturalization" and Freud's Sorrow

- Copernicus
  - Earth is not Center of Universe
- Darwin
  - Man is Just Another Animal
- ~~Freud~~
  - ~~Man is Fundamentally Irrational~~
- Bargh
  - Man is (Virtually) a Conscious Automaton

Ohme (2000)   53

Unconscious Thought Theory
Dijksterhuis & Nordgren (2006)

- Choice Among Several Alternatives
  - Differ Along Several Dimensions
- UT Superior for Complex Choices
  - Greater Processing Capacity
  - Unconstrained by Attentional Bottleneck
  - More Accurate/Reliable Weighting of Features
    - Less Biased by Contextual Influences (e.g., Availability)
  - Conscious Thought Emphasizes Features Currently in Attentional Spotlight

54

9

Automaticity Pervades Social Cognition
Bargh et al. (2012)

- Postconscious (Goal-Dependent) Automaticity
  – Dependent on Prior Conscious/Intentional Thought
- Preconscious Automaticity
  – Unconscious Inputs to Conscious Processes
  – Direct Activation of Goal Pursuit/Social Behavior

55

The Automaticity Principle
Huang & Bargh (2013)

- Doubts About Conscious Control
  – Power of Situational Influences
  – Limits of Introspective Access
  – Dual-Process Models
- Effects of Unconscious Processes
  – How a Person Perceives the World
  – How a Person Behaves in Response

56

A Softening of Views?
Bargh et al. (2012)

- "Any process of sufficient complexity to be of interest to social psychologists involves a complex interplay between both controlled (conscious) and automatic processes." (p. 601)
- "Conscious thought is causal and it often puts automatic processes into play; similarly, automatic processes regularly cause and influence conscious thought processes. These two fundamental forms of human information processing work together, hand in glove, and indeed one would not be able to function without the other." (p. 602)

57

The False Fame Effect
Jacoby et al. (1989)

- Study List of Nonfamous Names
  – Memory Test
- 24 Hours Later, Make Fame Judgments
  – Famous, Nonfamous Names
- Previously Studied Nonfamous Names are Now Judged to be Famous
- Explanation
  – Study Primes Names on Judgment Task
  – Priming Increases Availability
    • Biases Judgments of Fame
  – Influence of Priming is Automatic

58

Components of Processing in Fame Judgments
Jennings & Jacoby (1993)
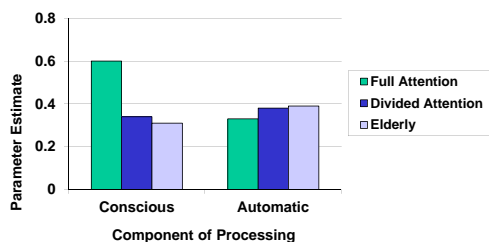

59

Spontaneous Trait Inferences
Uleman et al. (2005)

- Study Photos of Strangers
  – Paired with Behavioral Description
- 2 Days Later, Make Trait Judgments
  – Old, New Photos
- Old Photos Receive Trait Attributions in Line with Behavioral Descriptions
- Behaviors Prime Relevant Traits
  – Priming Increases Availability
- Influence of Priming is Automatic

60

Components of Processing in Spontaneous Trait Inferences
Uleman et al. (2005)
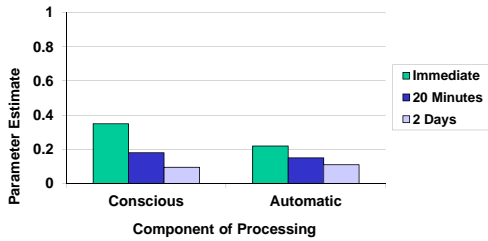

61

The Weapon Bias
Payne (2001)

- Identification Task: Weapon or Tool?
- Primed with Black or White Faces
- Priming Effects
  - Faster to Identify Gun after Black Prime
    - Faster to Identify Tool after White Prime
  - More Misidentification of Tools as Guns
- Faces Prime Racial Stereotypes
  - Stereotype Primes Related Judgment
- Influence of Priming is Automatic

62

Components of Processing in the Weapon Bias
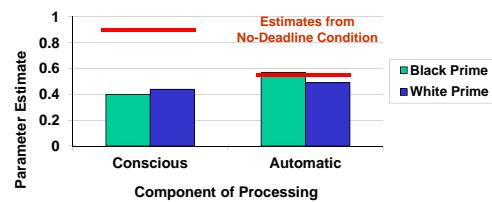Payne (2001); Payne et al. (2005)

No Deadline
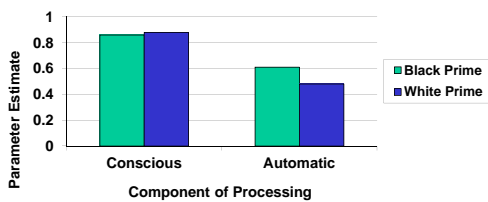
63

Components of Processing in the Weapon Bias
Payne (2001); Payne et al. (2005)

500 msec Deadline

64

Behavior -- It's Involuntary
Park, *American Psychologist* 1999, p. 461

"We perceive ourselves to have far more control over our everyday behavior than we actually do….

[T]he source of behavioral control comes not from active awareness but from… mental activations of which we are unaware and environmental cues to which we are not consciously attending that have a profound effect on our behavior.

[T]hese articles represent… fundamental breakthroughs in the understanding of motivations, free will, and behavioral control."
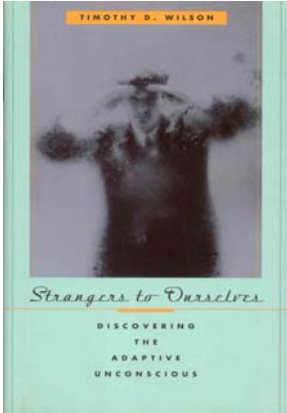
65

Automaticity in the Brain
Blakeslee (2002)

"[T]he brain systems that detect and evaluate [biological and social] rewards generally operate outside of conscious awareness. In navigating the world and deciding what is rewarding, humans are closer to zombies than sentient beings much of the time.
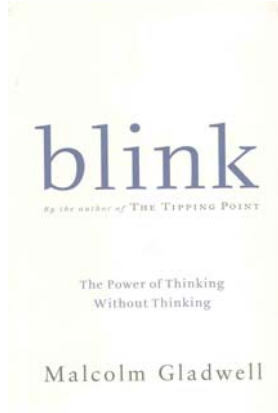
66

Slide 67:

"...Freud's view of the unconscious was far too limited. When he said… that consciousness is the tip of the mental iceberg, he was short of the mark by quite a bit -- it may be more the size of a snowball on top of that iceberg.

"The mind operates most efficiently by relegating a good deal of high-level, sophisticated thinking to the unconscious….

"The adaptive unconscious does an excellent job of sizing up the world, warning people of danger, setting goals, and initiating action in a sophisticated and efficient manner.

"It is a necessary and extensive part of a highly efficient mind."

Wilson (2002), pp. 6-7

67

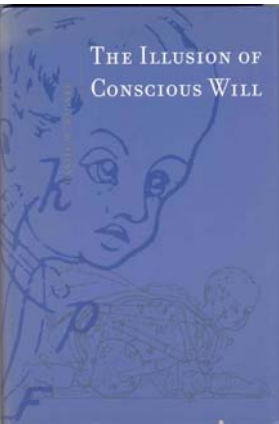Slide 68:

"The part of our brain that leaps to conclusions… is called the adaptive unconscious, and the study of this kind of decision making is one of the most important new fields in psychology.

"The adaptive unconscious is not to be confused with the unconscious described by Sigmund Freud, which was a dark and murky place filled with desires and memories and fantasies that were too disturbing for us to think about consciously.

"This new notion of the adaptive unconscious is thought of, instead, as a kind of giant computer that quickly and quietly processes a lot of the data we need in order to keep functioning as human beings."
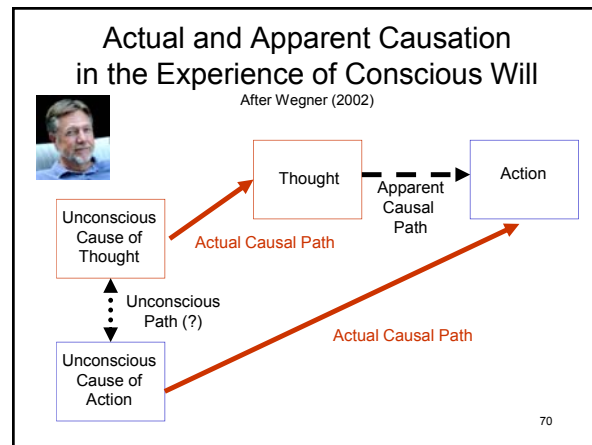
Gladwell (2005), p. 11

68

Slide 69:

"…[T]he real causal mechanisms underlying behavior are never present in consciousness. Rather, the engines of causation operate without revealing themselves to us and so may be unconscious mechanisms of mind.

"Much of the recent research suggesting a fundamental role for automatic processes in everyday behavior (Bargh 1997) can be understood in this light.
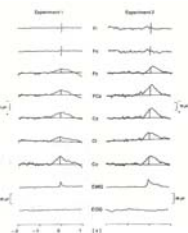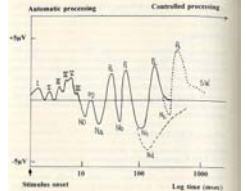
"The real causes of human action are unconscious, so it is not surprising that behavior could often arise-- as in automaticity experiments --without the person's having conscious insight into its causation."

Wegner (2002), p. 97

69

Slide 70:

Actual and Apparent Causation in the Experience of Conscious Will

After Wegner (2002)

70

Slide 71:

The Readiness Potential
(*Bereitschaftspotential*)
Kornhuber & Deecke (1965, 1990)

- Event-Related Potential
  – Recorded in EEG
  – 800 msec Prior to Movement

"The electro-physiological sign of planning, preparation, and initiation of volitional acts" (1990, p. 14)

71

Slide 72:

The Readiness Potential Precedes the Conscious Wish
Libet et al. (1983)

- "Clock-Time" Method
  – Light Revolves 1/2.56 seconds
  – Move Finger
  – Note First Awareness of Wish to Act

- Timing of Voluntary, Spontaneous Acts
  – Awareness of Wish ➔ Act – 200 msec
  – RP ➔ Awareness of Wish – 350 msec

72

Two Types of Readiness Potential
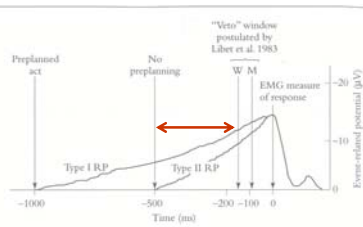### Banks & Pockett (2007), after Libet (1985)

Figure 51.1 Schematic diagram of a readiness potential (RP) showing decision time (W) and reported time of movement (M) relative to the time of the EMG for movement at 0 ms.

Type II Readiness Potential:
The Predecisional Negative Shift

73

"Time-On" Theory of Consciousness
Libet et al. (1983); Libet (1985, 2002, 2006)

- Neuronal Activities Mediate Unconscious Mental Events
- Unconscious Mental Events Become Conscious Only If They Persist for an Adequate Time (≈ 500 msec)
- Behavior is Instigated Unconsciously
- Conscious Control as "Veto"
  - "Veto Window" ≈ 200 msec

74

Critiques of the Libet Experiment
Banks & Pockett (2007)

- Replications
- Variability
- Sources of Error
  - In Determining Onset of Readiness Potential
  - In Determining Onset of Conscious Wish
- Ecological Validity
  - Action is Inconsequential
  - Important Decision Has Already Been Made

75

The Clock Confound
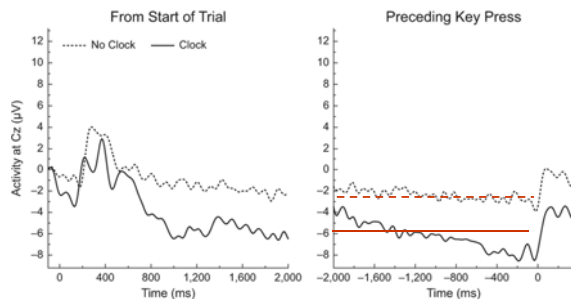### Miller et al. (2011)

- Movement Not Truly Spontaneous
- Subjects Must Watch the Clock
- Compare RPs in Two Conditions
  - Replicate Libet's Experiment
    - Watch Clock, Report Decision Time
  - Simply Make Spontaneous Movement
    - Ignore Clock, No Reports

76

The Clock Effect on the Predecisional Negative Shift
Miller et al. (2011)

77

Conclusions Concerning the Predecisional Negative Shift
Miller et al. (2011)

- Artifact of Attention Paid to Clock
  - Watching Clock, Recording Decision Time
- Does Not Indicate Unconscious Initiation of "Voluntary" Behavior
- Does Not Show that Conscious Will is Illusory
  - (Though Maybe It Is)

78

13

The Automaticity Argument

- **Experimental Evidence:** Automatic Processes Play Some Role, Under Some Conditions, in Social Cognition and Behavior.
- **Theoretical Conclusion:** Automatic Processes are Pervasive, and Consciousness is Largely an Afterthought.
  - But Does Not Follow From the Evidence

79

Sources of the Automaticity Juggernaut
Kihlstrom (2008)

- "Conscious Shyness"
  - Epiphenomenalism

"The Sespe", built 1891 (Fillmore & Western Railway, California)

"The consciousness of brutes would appear to be related to the mechanism of their body simply as a collateral product of its working, and to be completely without any power of modifying that working as the steamwhistle which accompanies the work of a locomotive engine is without influence upon its machinery."   T.H. Huxley (1868)

80

Sources of the Automaticity Juggernaut
Kihlstrom (2008)

- Positivist Reserve
- Physics Envy
  - "Pinball" Determinism
    - "Free Will" Cannot Enter into Closed Causal Sequence
- Alliance of Social Psychology with Behaviorism
  - Traditional Definition as Study of Social Influence
  - Situationism
    - Explain Behavior in Terms of Stimulus
    - Avoidance of Mediating Conscious processes

81