Theories and Constructs

Theory development and testing

- Theories as organizations of observables
- Constructs, latent variables and observables
  - Observables
    - Multiple levels of description and abstraction
    - Multiple levels of inference about observables
  - Latent Variables
    - Latent variables as the common theme of a set of observables
    - Central tendency across time, space, people, situations
  - Constructs as organizations of latent variables and observed variables

Theories as metaphors and analogies-1

- Physics
  - Planetary motion
    - Ptolemy
    - Galileo
    - Einstein
  - Springs, pendulums, and electrical circuits
    - Models of simple harmonic motion
  - The Bohr atom
- Biology
  - Evolutionary theory
  - Genetic transmission

Theories as metaphors and analogies-2

- Business competition and evolutionary theory
  - Business niche
  - Adaptation to change in niches
- Learning, memory, and cognitive psychology
  - Telephone as an example of wiring of connections
  - Digital computer as information processor
  - Parallel processes as distributed information processor

Examples of psychological constructs and their operationalization as observables

- Anxiety
  - Trait
  - State
- Love
- Conformity
- Intelligence
- Learning and memory
  - Procedural - memory for how
  - Episodic -- memory for what
    - Implicit
    - explicit

Models and theory

- Formal models
  - Mathematical models
  - Dynamic models - simulations
- Conceptual models
  - As guides to new research
  - As ways of telling a story
    - Organizational devices
    - Shared set of assumptions

Psychological Theories: the organization of constructs

- Examples from Cognitive Psychology
  - Ratcliff's diffusion model
  - Atkinson and Shiffrin model of memory
  - Broadbent's Maltese Cross metaphor
- Examples from Personality and Motivational Psychology

  Revelle and Humphreys personality-motivation-performance model

Ratcliff Diffusion model

- Basic description of speed of processing and errors in decision making
- Unification of speed and accuracy
- Accuracy as a tradeoff between willingness to say yes, and willingness to say no
  - Signal detection theory of Yes/No judgments
  - Sensitivity (d') and bias (ß) of decision making

Semantic Priming and word recognition

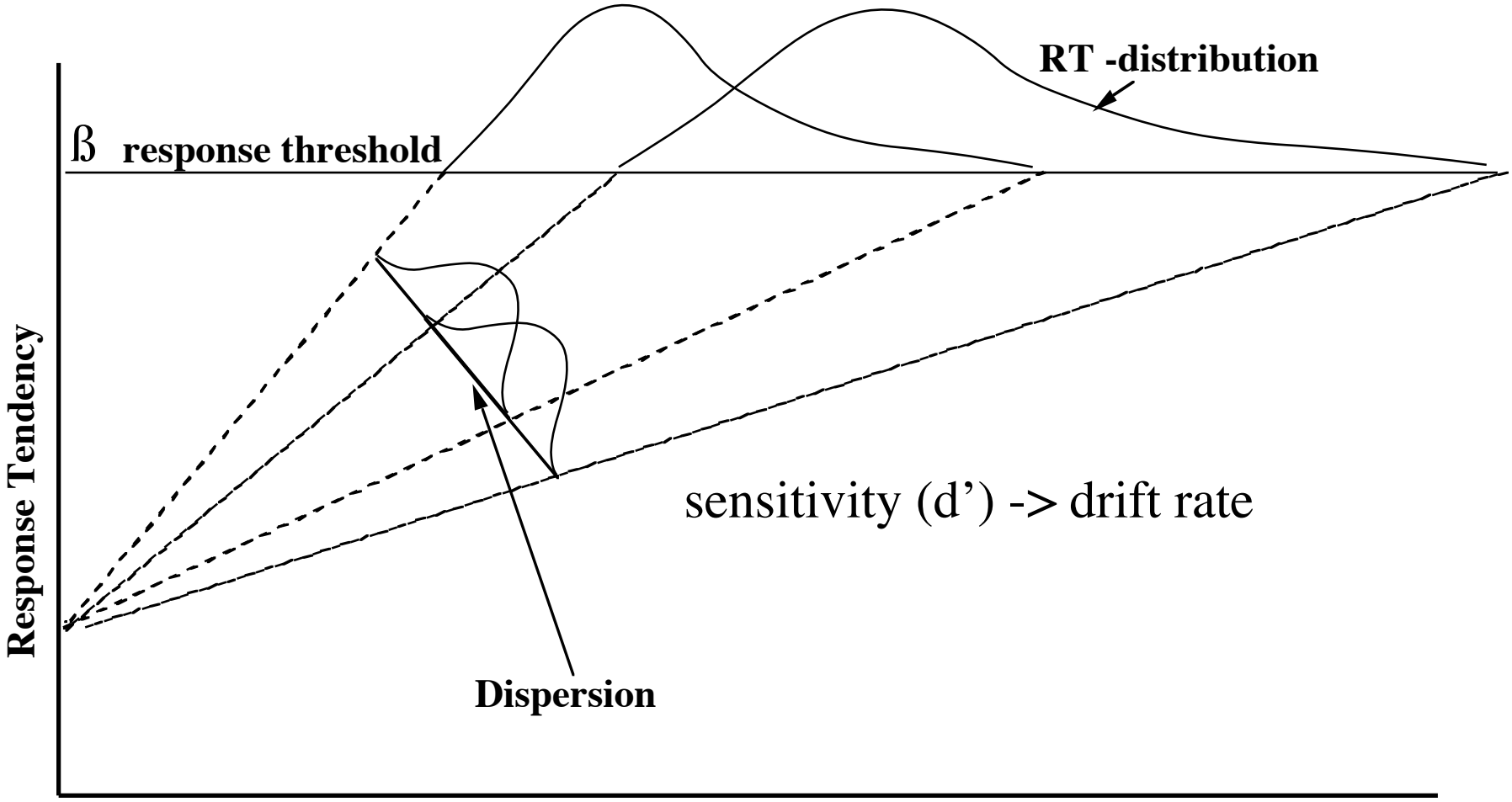
- You will be shown a series of slides, some of them are words, some are non-words.
- Say yes if it is a word, no if it is a non-word

death

exam

daeth

fail



Random Walk - Diffusion Model of Reaction Time

RT distributions resulting from identical normal error dispersion and differing drift rates

Example of limited sensory register from Sperling

- What is the size of the sensory register?
- How many items can you detect at one time?

- 2 8 5 3 9 6 1 7 4

- report

8 1 7 2 5 6 3 4

Report

2 8 5 3 9 6 1 7 4

Report

Example of limited sensory register from Sperling

- What is the size of the sensory register?
- How many items can you detect at one time?
- Did the previous slides assess the size of the sensory store or were they affected by the recall process?
- How could we separate the two?

Example of limited sensory register from Sperling

- What is the size of the sensory register?
- How many items can you detect at one time?
- Confounding sensory store with ability to dump from sensory store (short term memory)
- Present a series of slides, each with 3 rows of numbers, following the slide, cue which row to report

Example of limited sensory register from Sperling

3 8 7 4

4 5 6 3

6 4 7 2

- high, medium, low tone to signal row to report

3 7 2 1

5 4 6 2

1 5 3 8

3 7 2 1

5 4 6 2

1 5 3 8

Report

7 6 9 4

3 1 5 4

2 8 3 5

Report

Sperling study of sensory store

List 1:

7 6 9 4

3 1 5 4

2 8 3 5

List 2

3 7 2 1

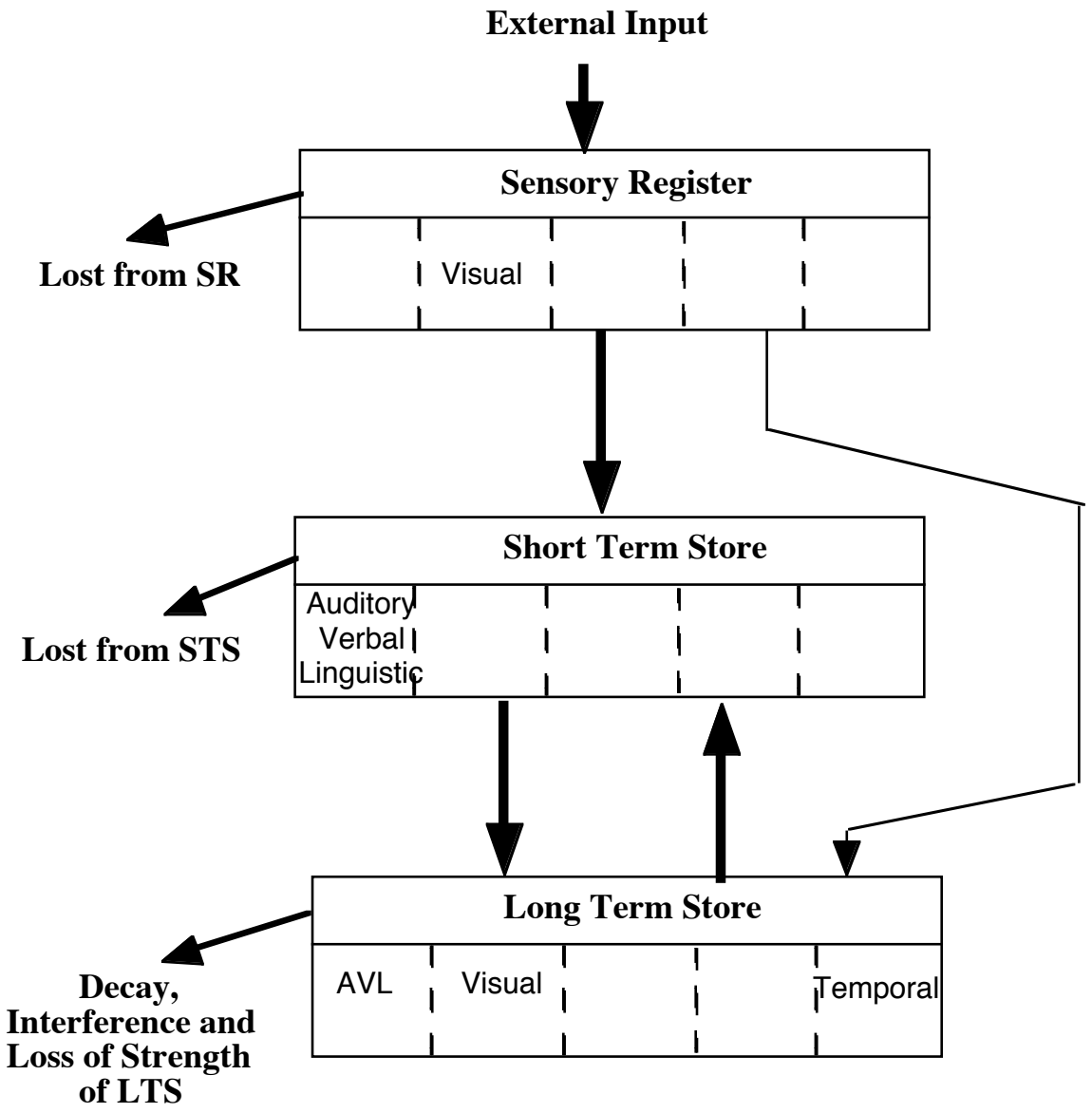
5 4 6 2

1 5 3 8

Theoretical integration

- Atkinson and Shiffrin combined studies from sensory memory, working/short term memory and long term memory and suggested a multiple store model of memory

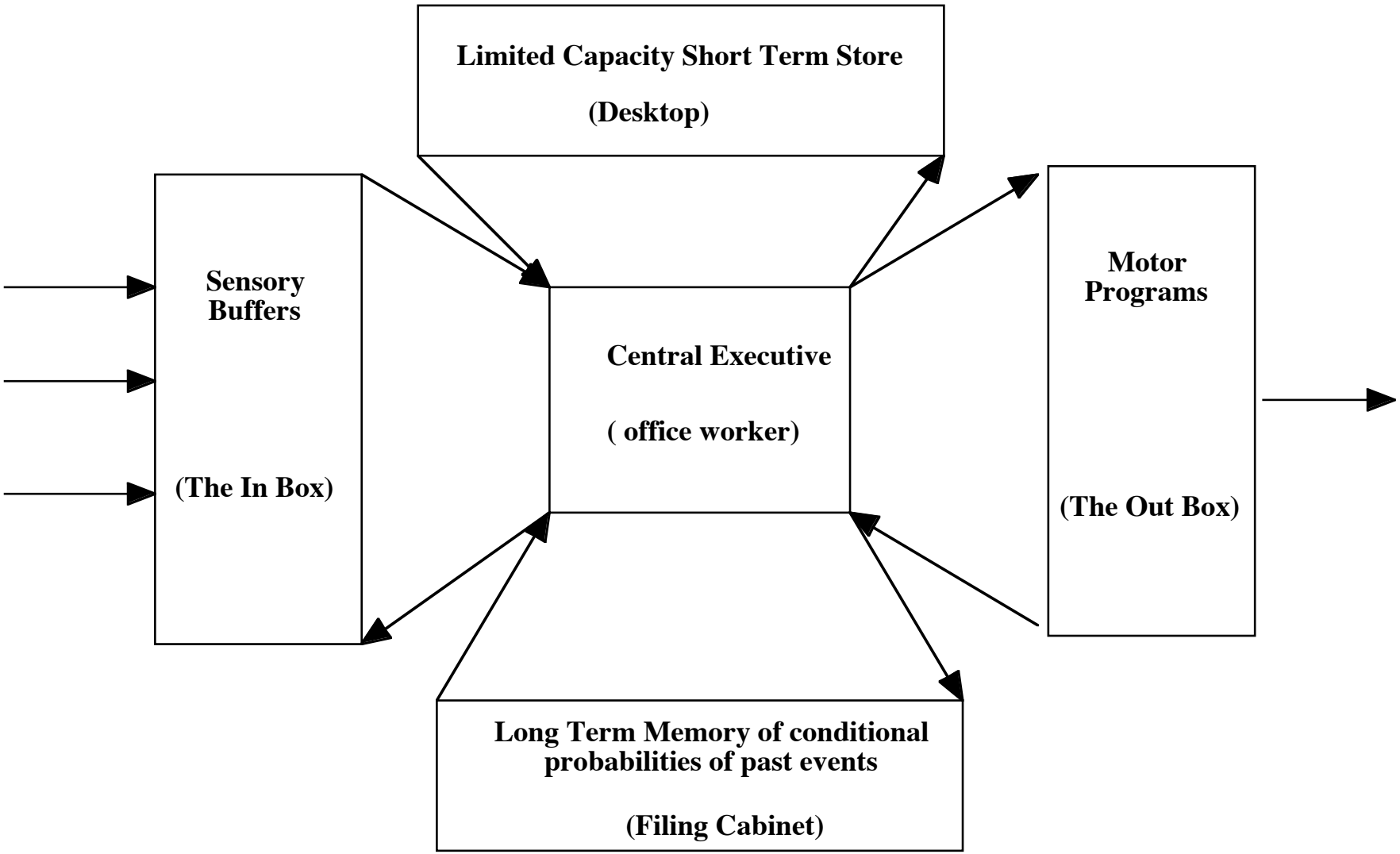
Atkinson and Shiffrin, 1968
Human Memory: A proposed System



Donald Broadbent and the "Maltese Cross"

- Donald Broadbent:
  - One of the intellectual founders of Cognitive Psychology
  - Applied Psychology Unit at Cambridge, then Oxford
    - what were the determinants of efficient performance
  - known for elegantly simple models of cognition
  - Attention and Stress

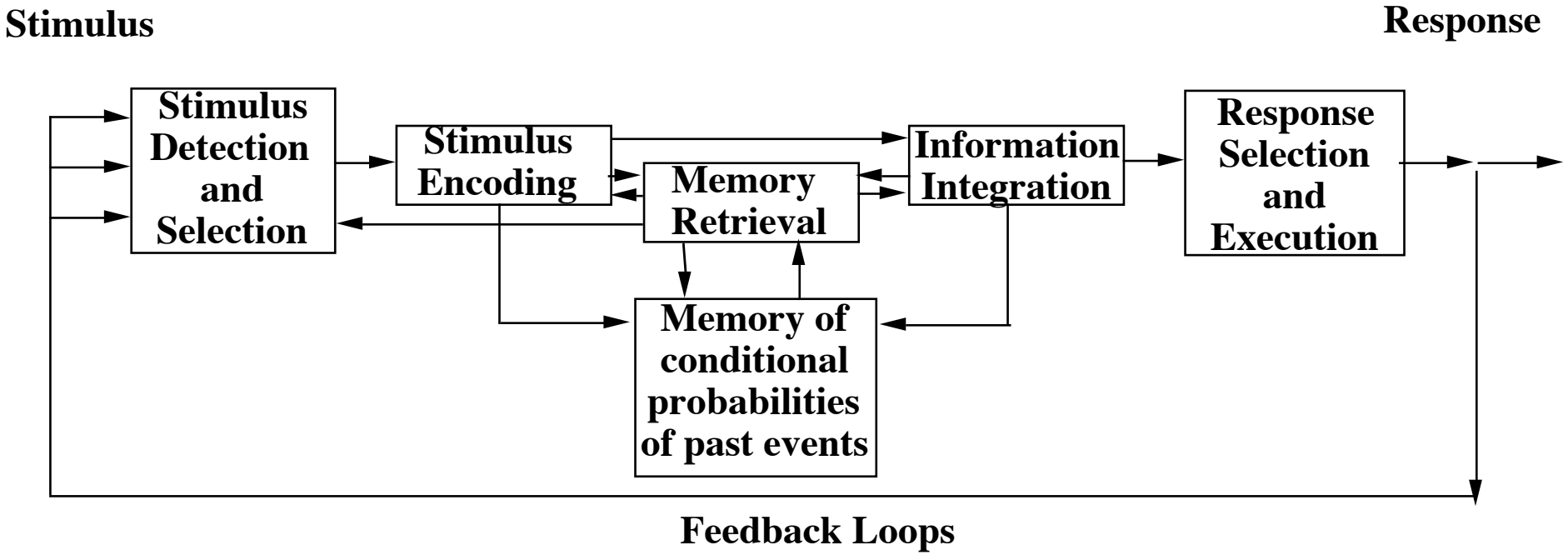
Broadbent's Maltese Cross model of information processing

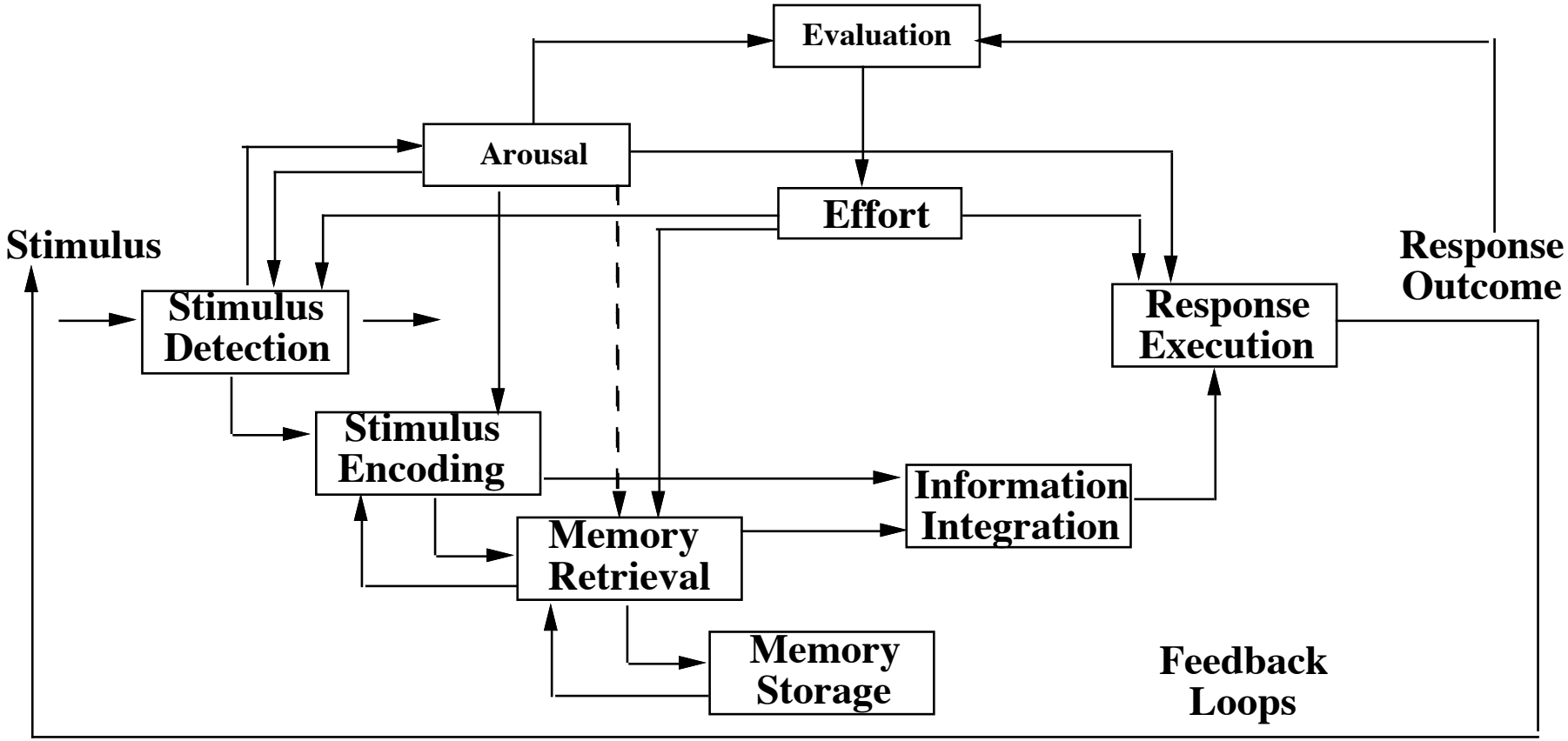


Stage models of Processing

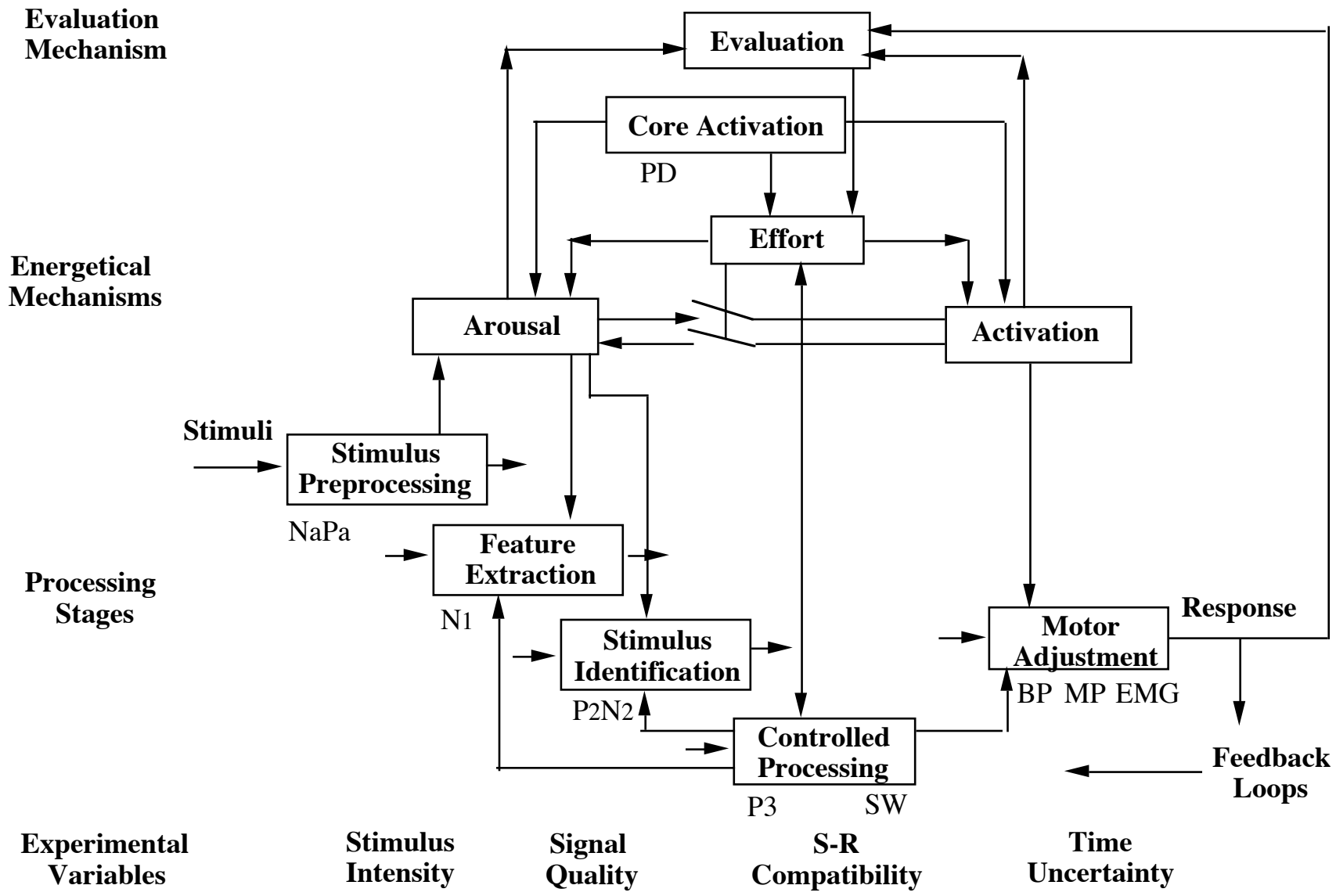
- Information flow models (“boxology”)
- Psychophysiology and Cognition
  - Mulder/Sanders/Gopher
- Levels of control (derived and extended from Broadbent)

Conceptual Stages of Information Processing

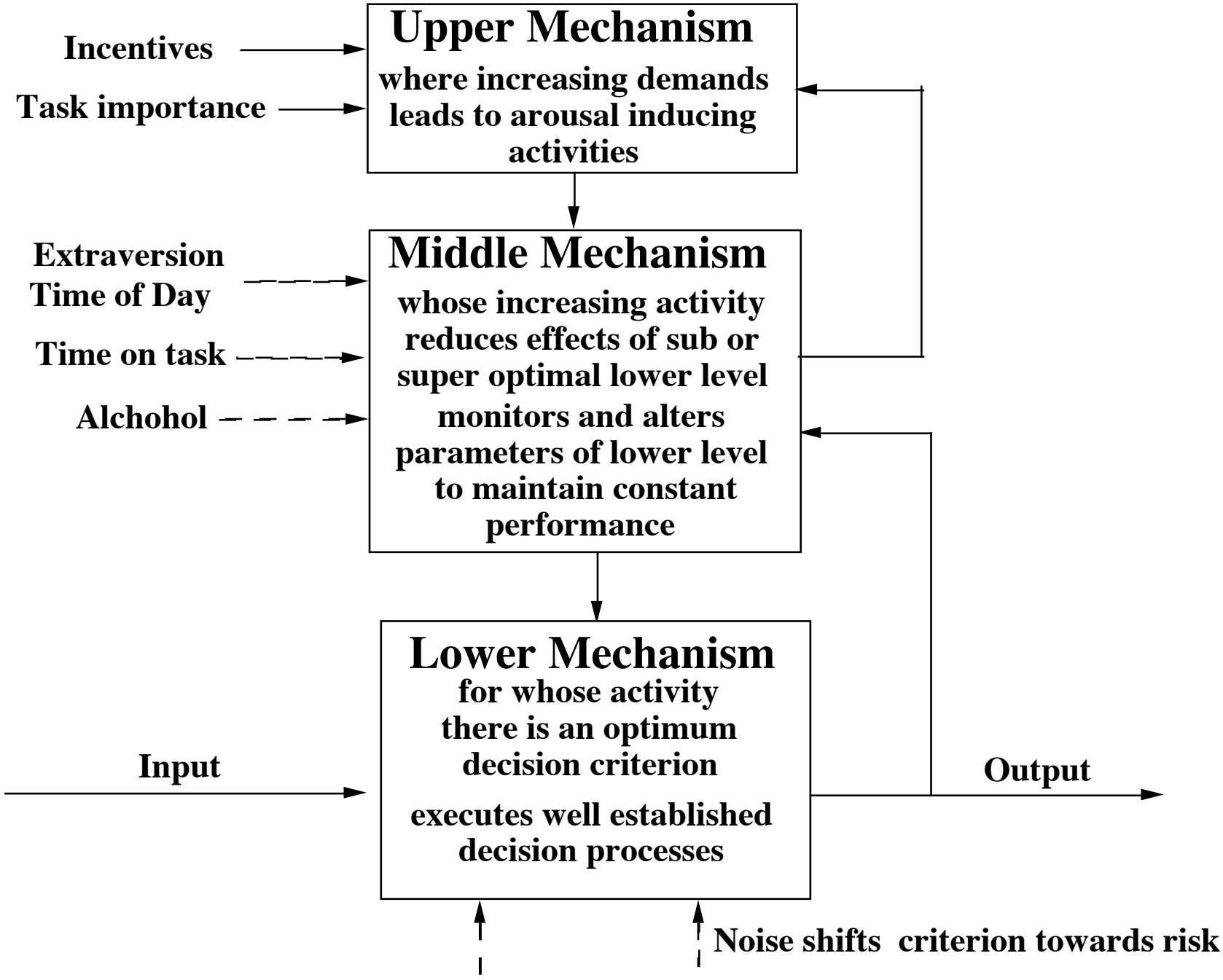



Evaluation
Arousal
Effort
Stimulus
Stimulus Detection
Response Execution
Response Outcome
Stimulus Encoding
Information Integration
Memory Retrieval
Memory Storage
Feedback Loops

Mulder/Sanders model of energetic-cognitive processing links



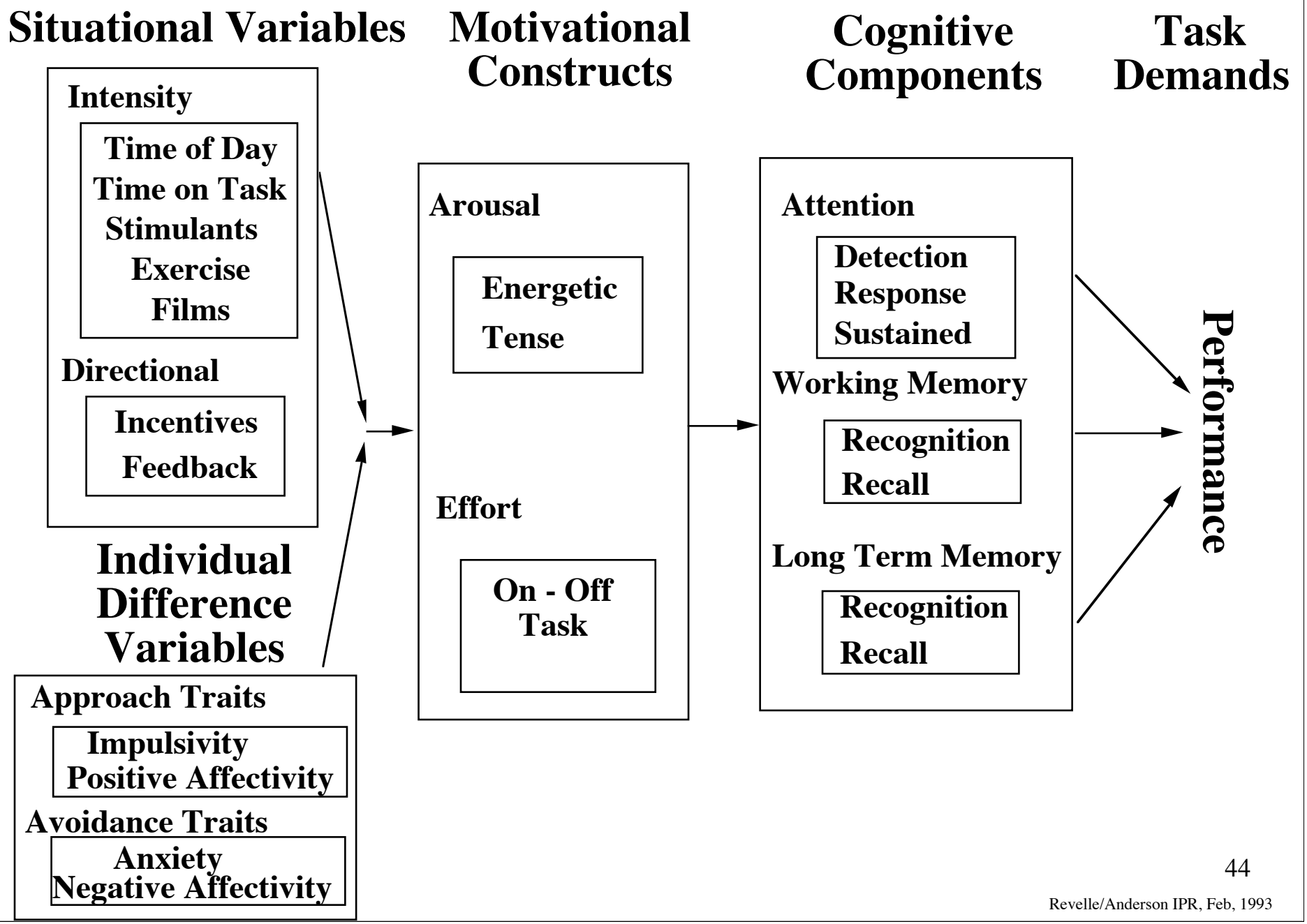
(Adapted from Gopher, 1986 and Mulder, 1986)

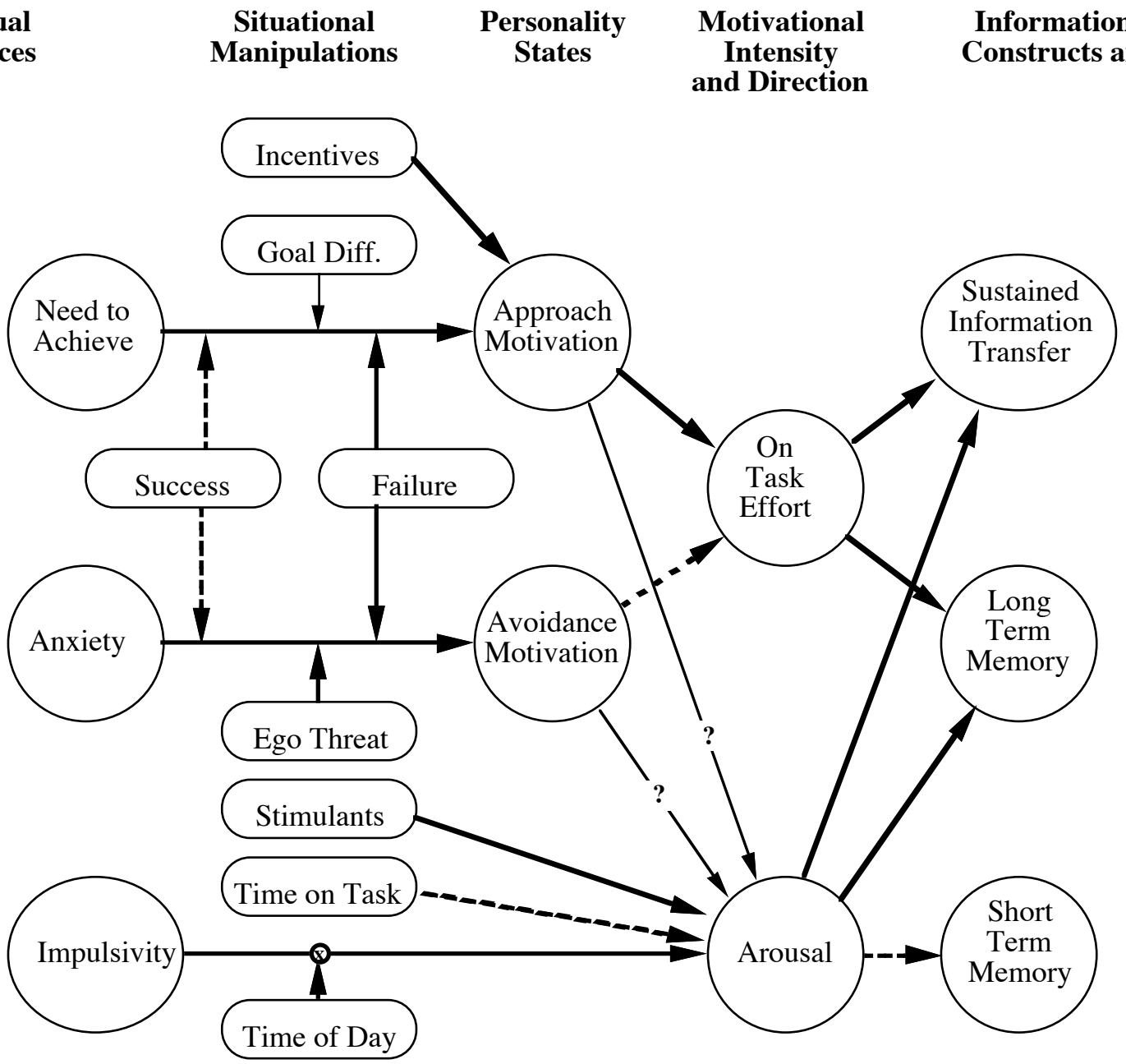

Incentives
Task importance
Upper Mechanism
where increasing demands leads to arousal inducing activities
Extraversion
Time of Day
Time on task
Alchohol
Middle Mechanism
whose increasing activity reduces effects of sub or super optimal lower level
monitors and alters parameters of lower level to maintain constant performance
Lower Mechanism
for whose activity there is an optimum decision criterion
executes well established decision processes
Input
Output
Noise shifts criterion towards risk

Personality and Motivation

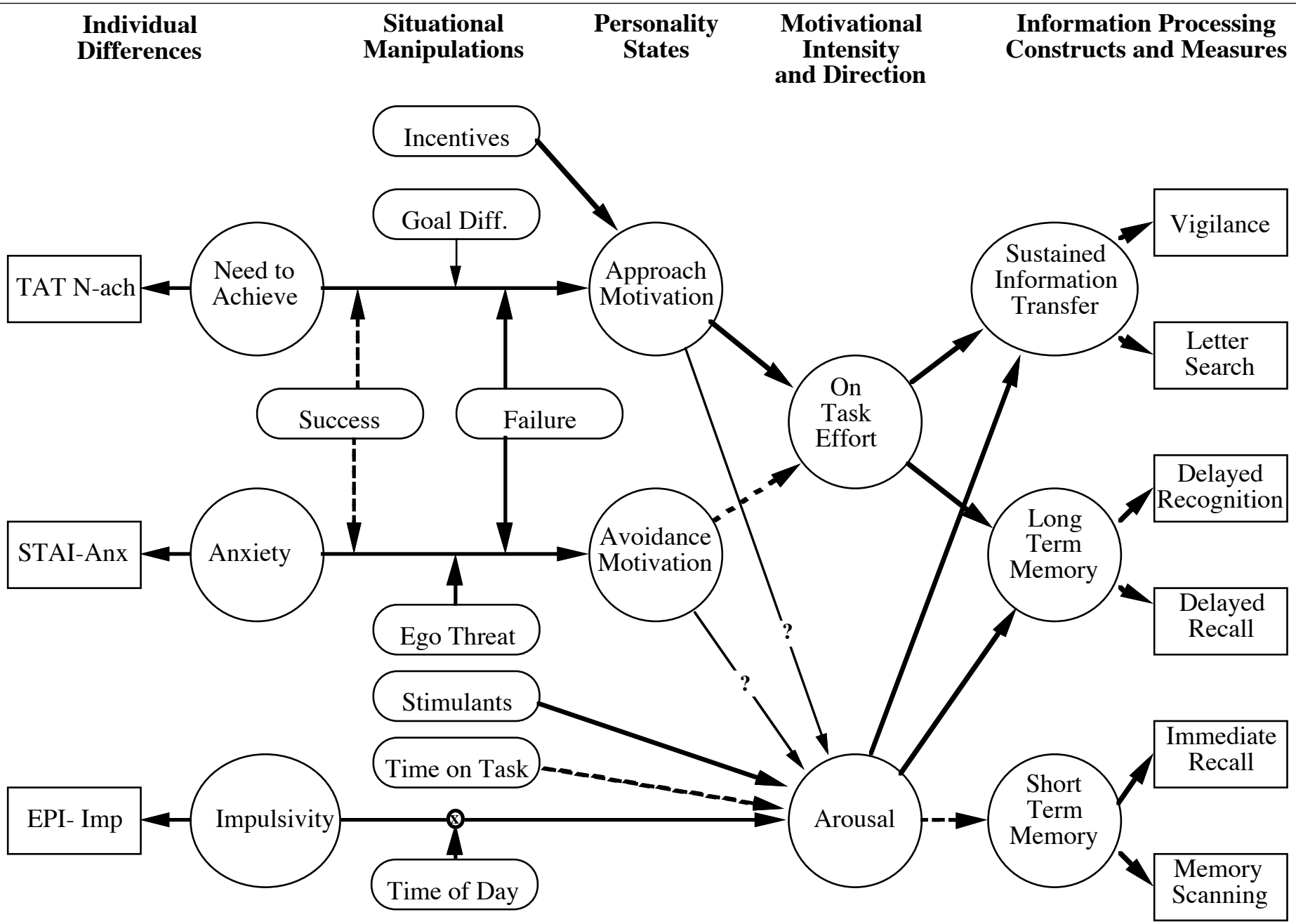
- Individual differences in sensitivity to environmental cues
- Motivational States
  - Approach, Avoidance, and Arousal
- Cognitive Processes
  - Working Memory
  - Sustained Information Transfer

Elaboration of a motivation mediated model of performance





Adapted from Humphreys & Revelle, 1984; Revelle, 1989



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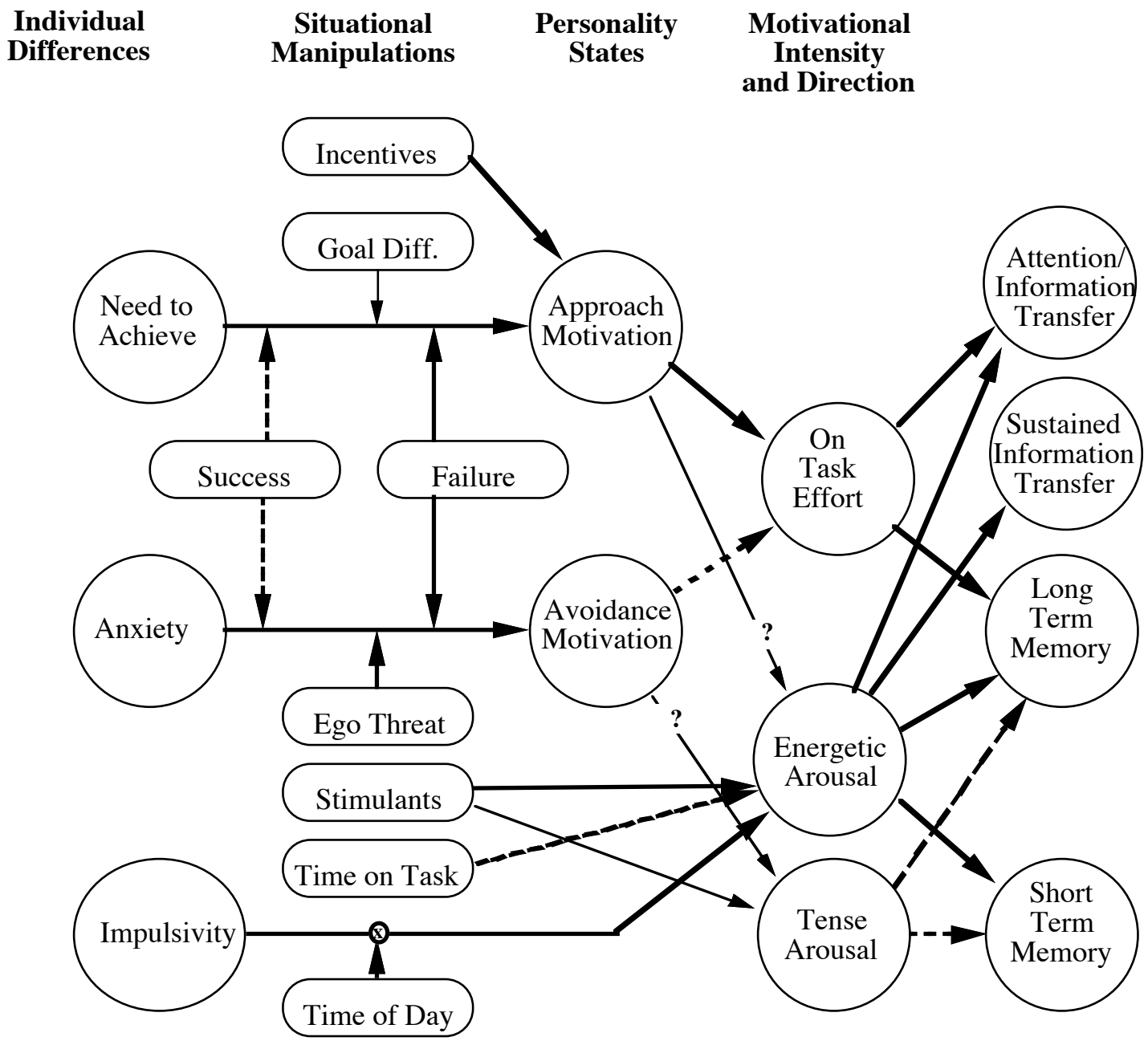
Individual Differences
Situational Manipulations
Personality States
Motivational Intensity and Direction
Incentives
Goal Diff.
Need to Achieve
Approach Motivation
Success
Failure
Anxiety
Avoidance Motivation
Ego Threat
Stimulants
Time on Task
Impulsivity
Time of Day
On Task Effort
Energetic Arousal
Tense Arousal
Attention/ Information Transfer
Sustained Information Transfer
Long Term Memory
Short Term Memory
?
?
x

Theories and Constructs

- Theories as a way of integrating diverse observations into coherent model
- Constructs as unobservables representing common influences on observed variables
- Goal of parsimony in theoretical description
- Goal of testability of theory
  - How can we show the theory is wrong?