Max Wertheimer Minerva Center for Cognitive Processes and Human Performance

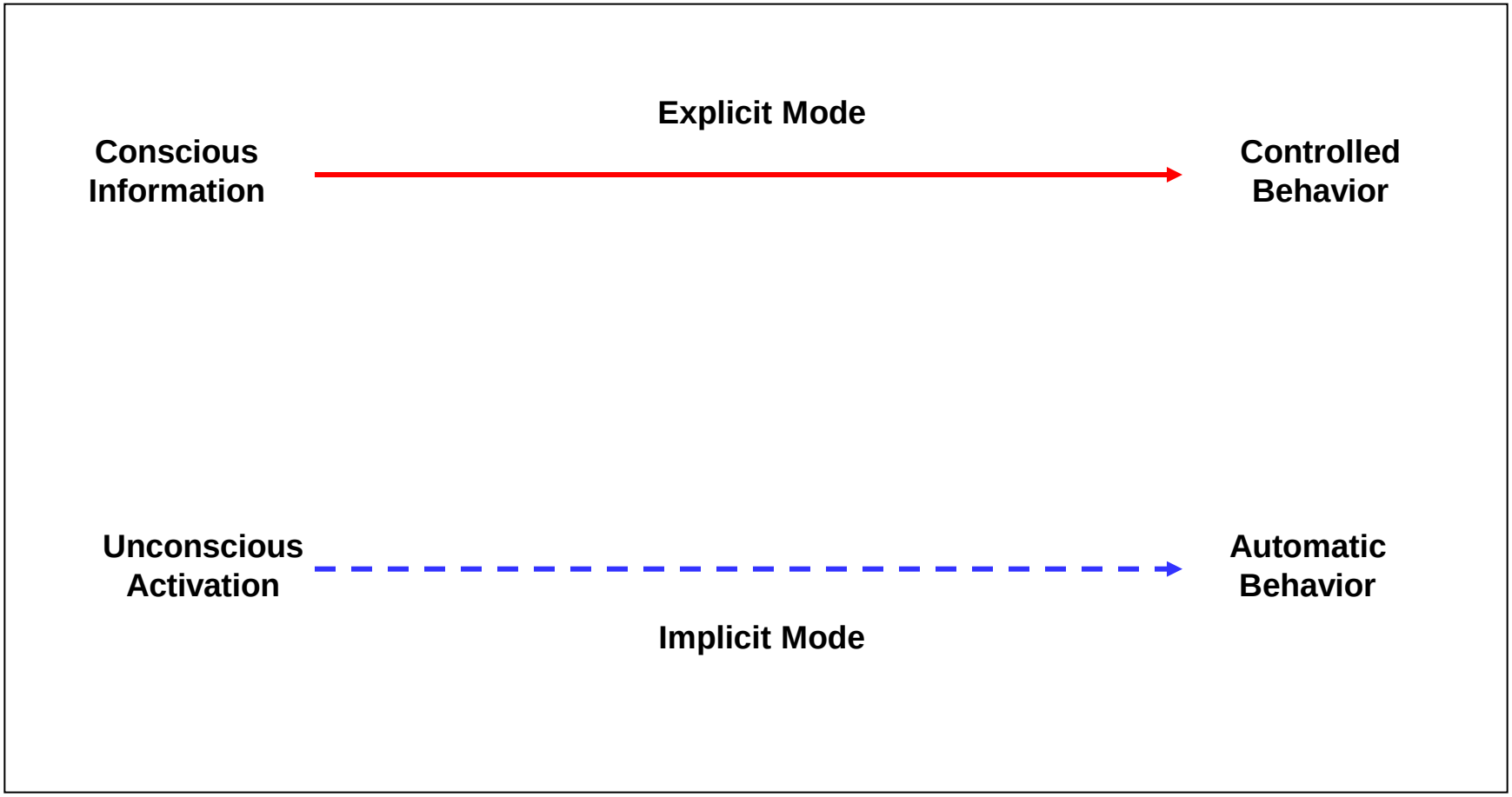
How do we know that we know?

Some observations from metacognition

Asher Koriat

University of Haifa

The crossover model of subjective experience


Explicit Mode
Conscious Information
Controlled Behavior
Unconscious Activation
Automatic Behavior
Implicit Mode

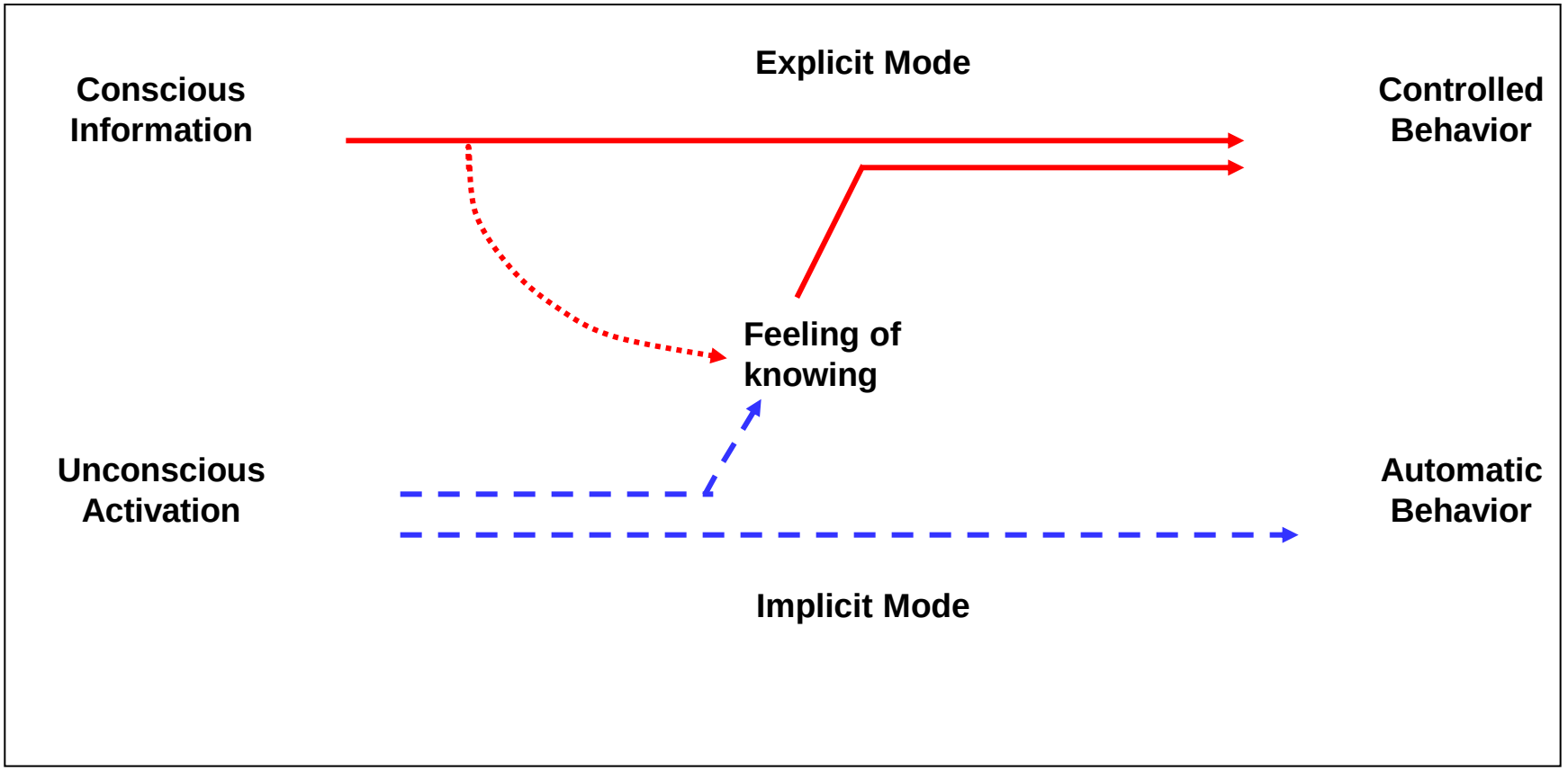
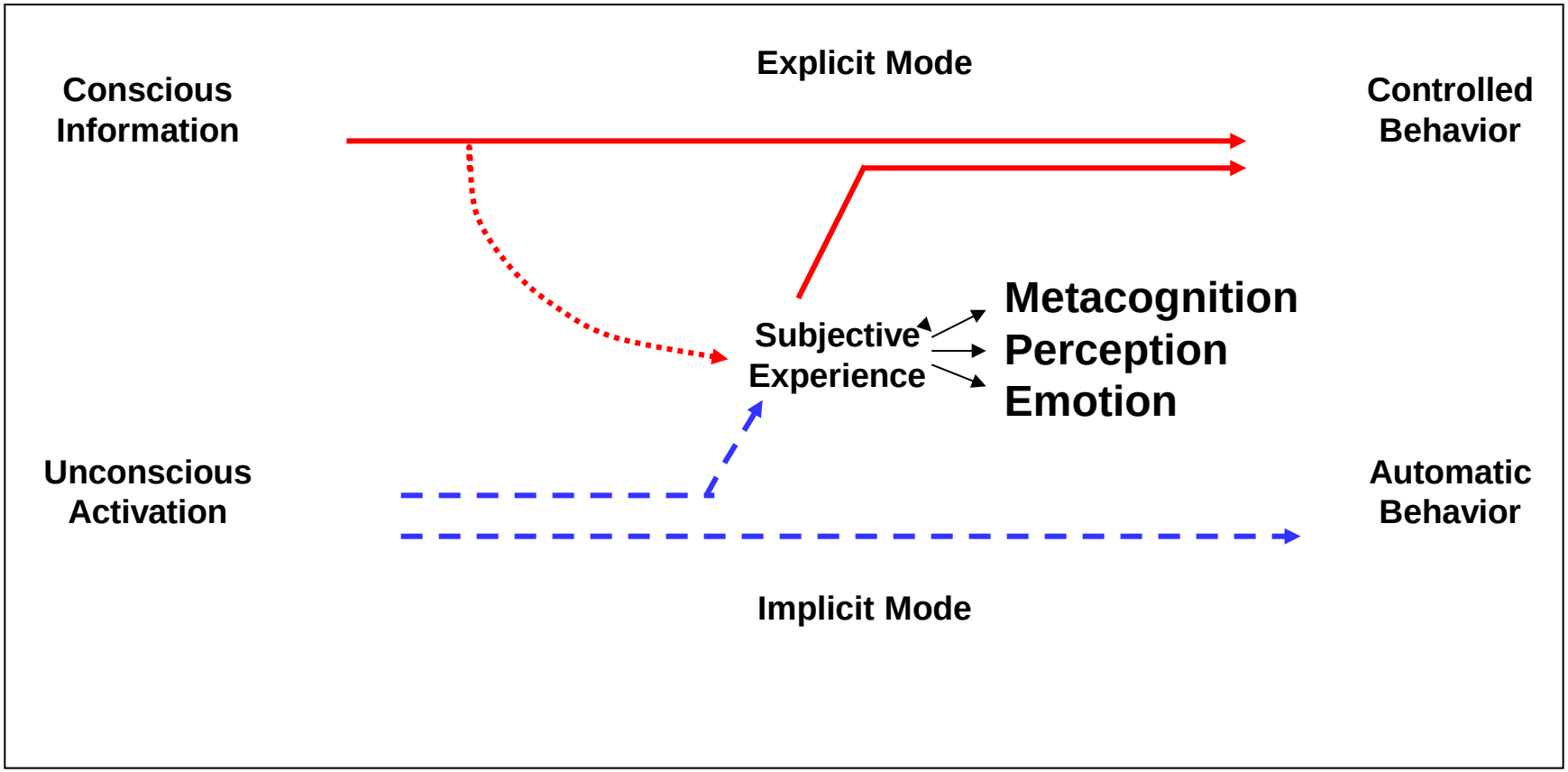


Figure 2. The Crossover model of subjective experience and conscious/unconscious influences on behavior (Koriat, 2000).

The crossover model of subjective experience



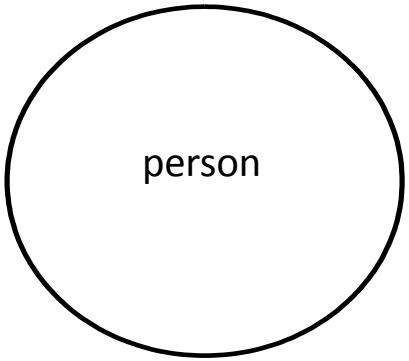
The Bases of Metacognitive judgments

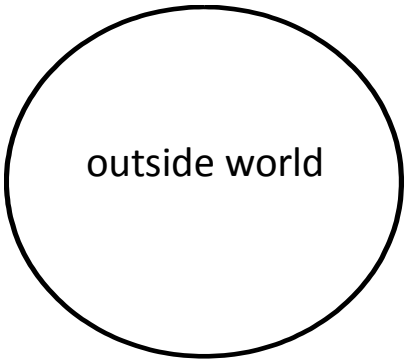
Three types of theories:

(1) Trace Access

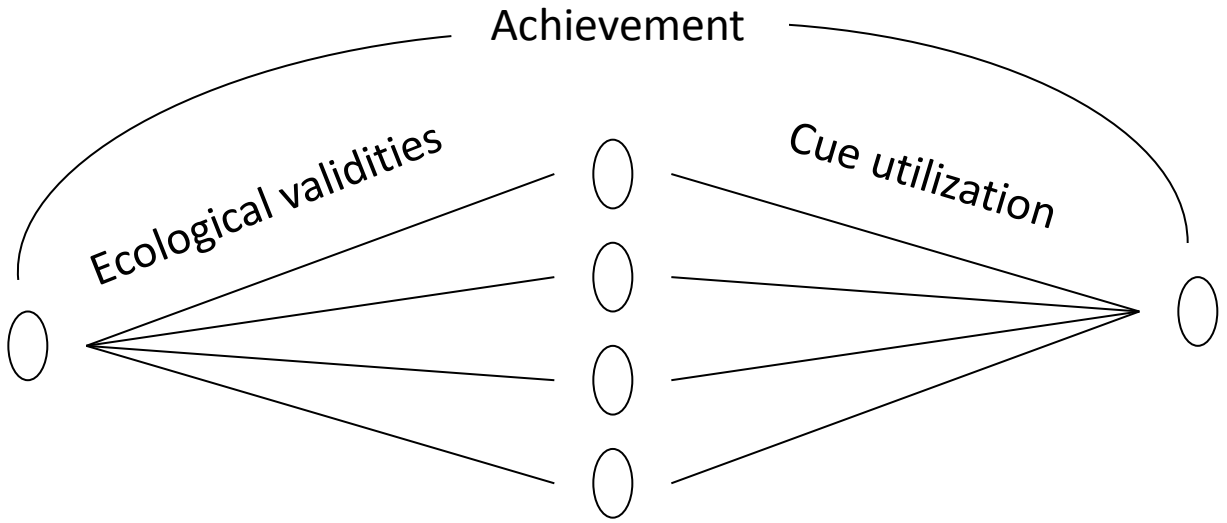
(2) Information/theory based

(3) Experience based


person


outside world

Brunswik's lens model



Distal variable

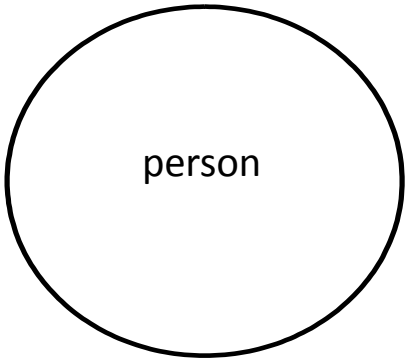
Proximal cues

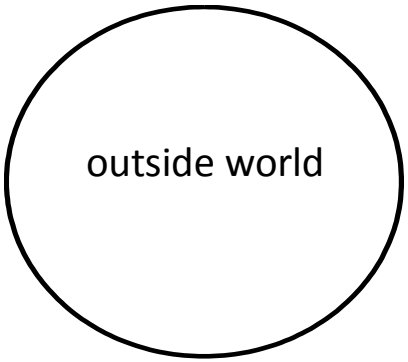
Central response

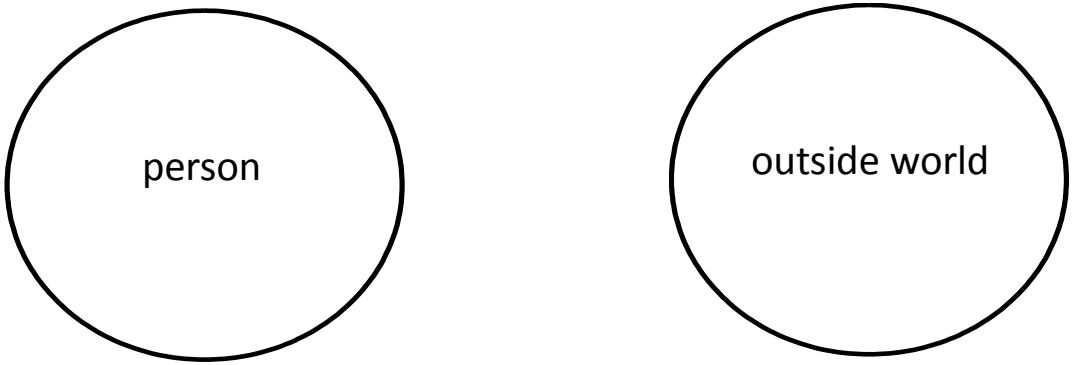
Actual Depth

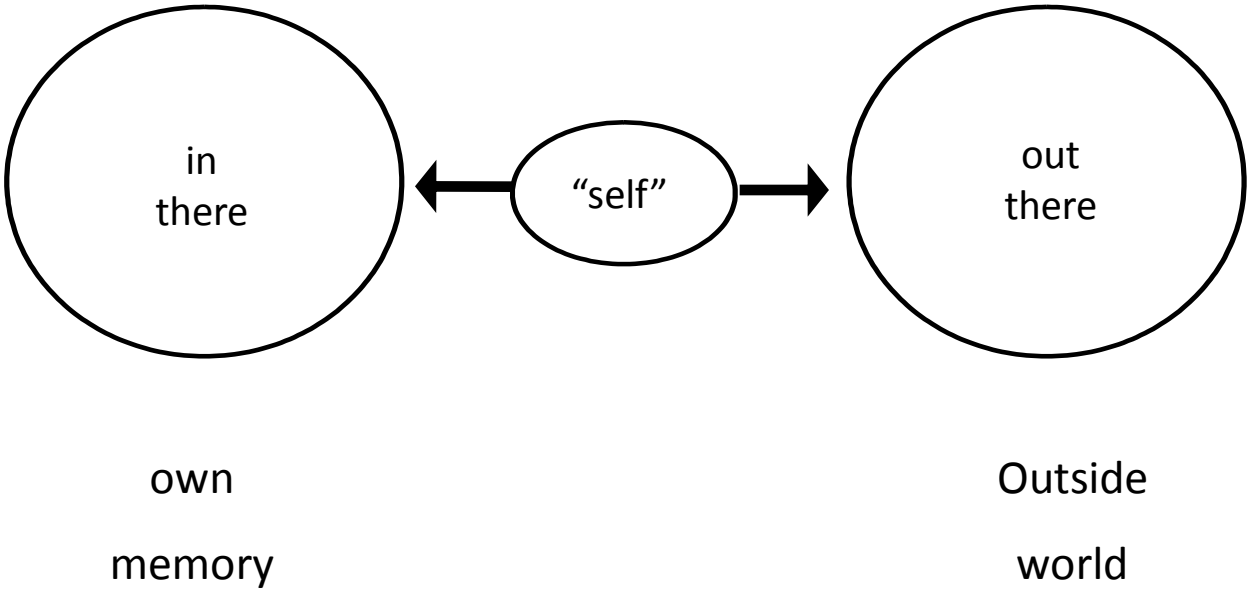
Binocular Disparity
Linear Perspective
Interposition

Depth Perception

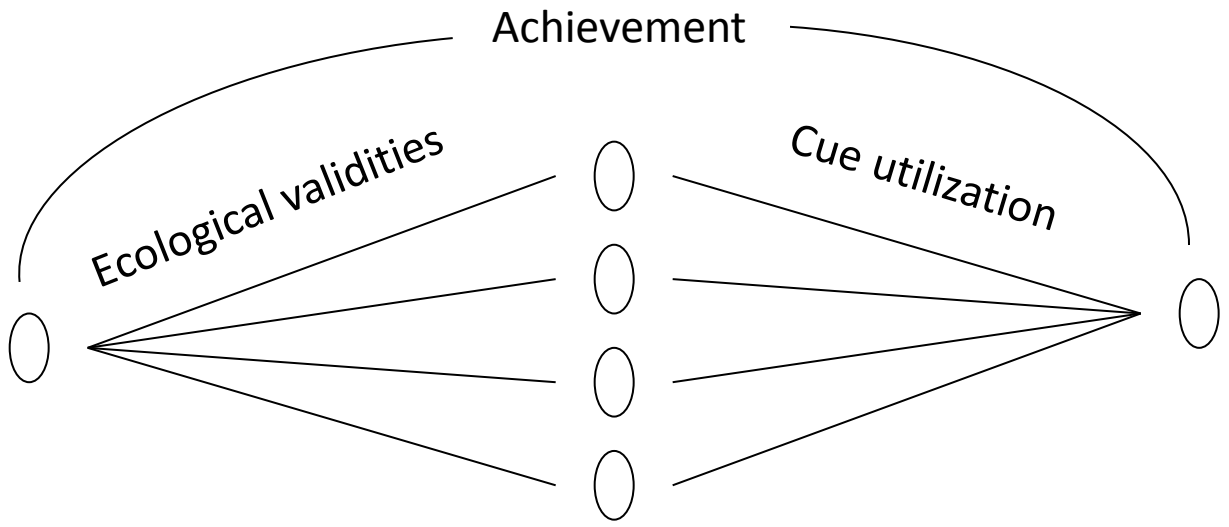

person


outside world


person
outside world


in
there
“self”
out
there
own
memory
Outside
world

Brunswik's lens model applied to subjective monitoring



Availability

in Store

Familiarity

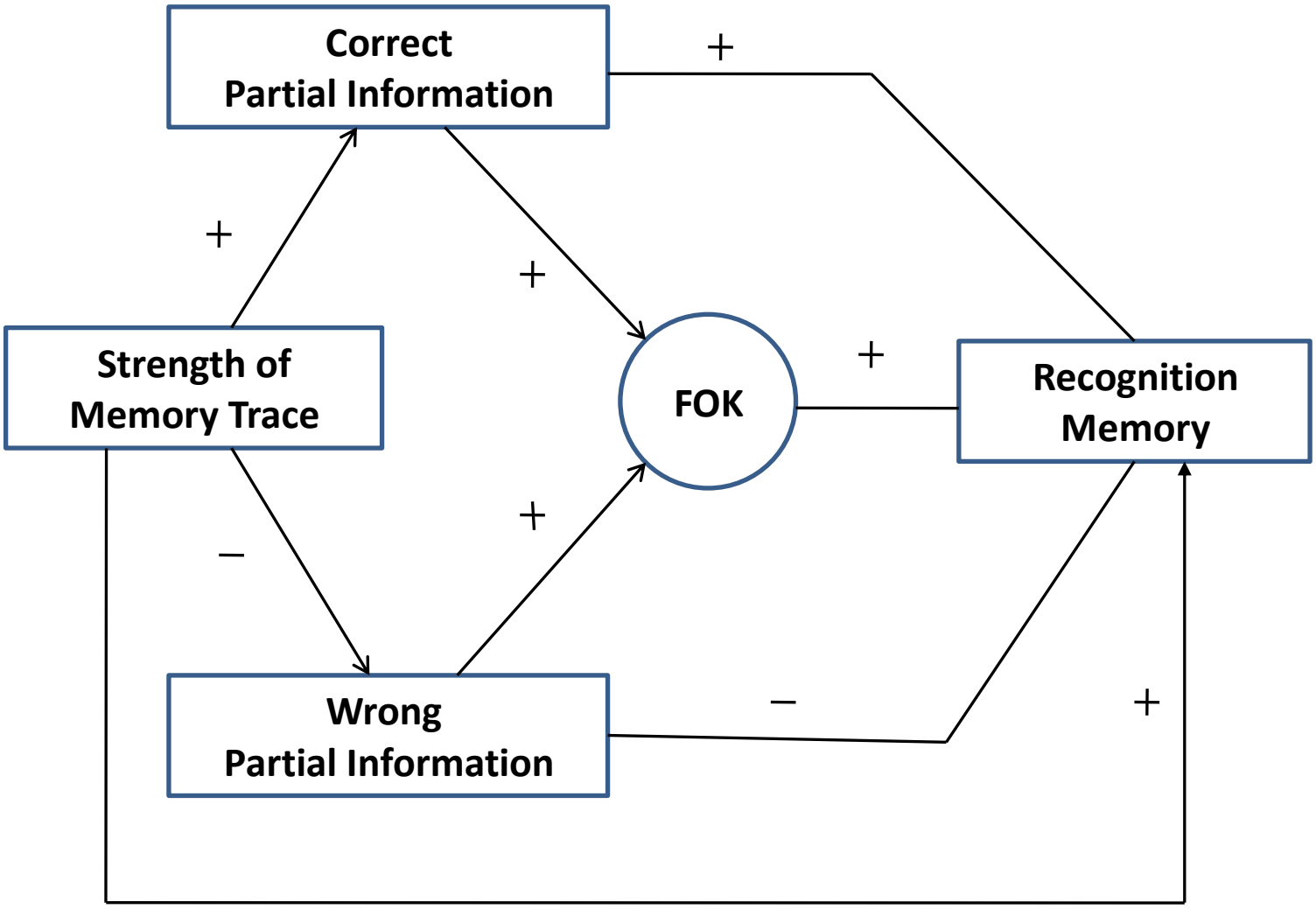
Amount of Accessible Clues

Ease of Processing

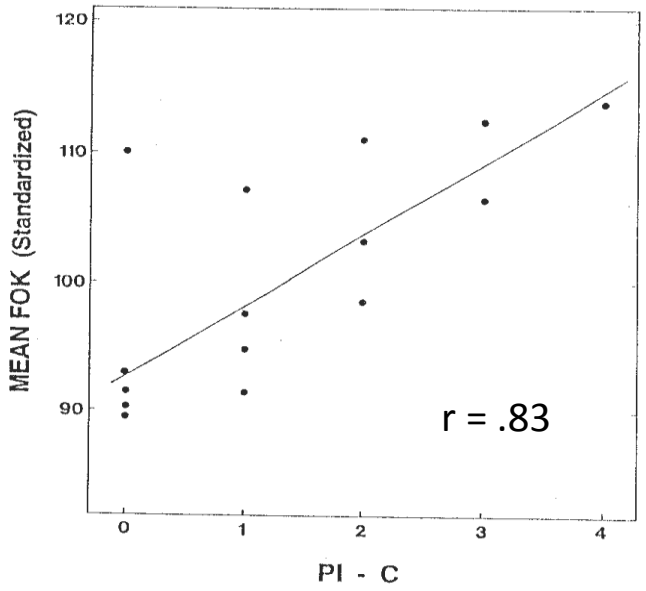
FOK

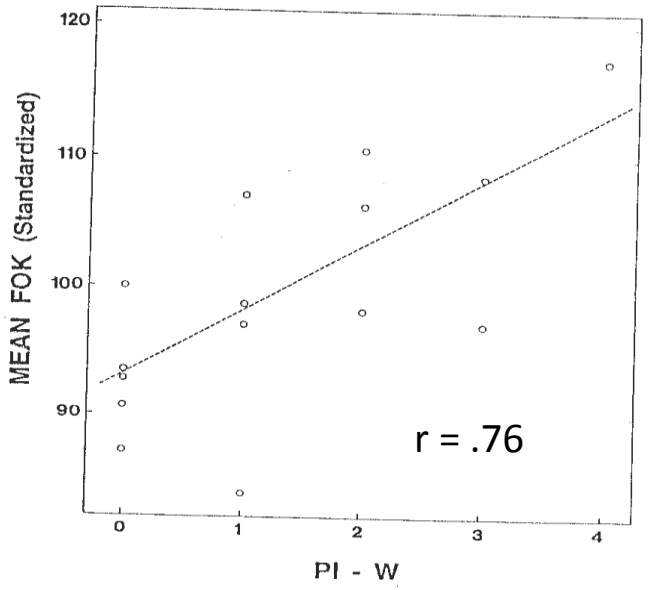
The feeling of knowing

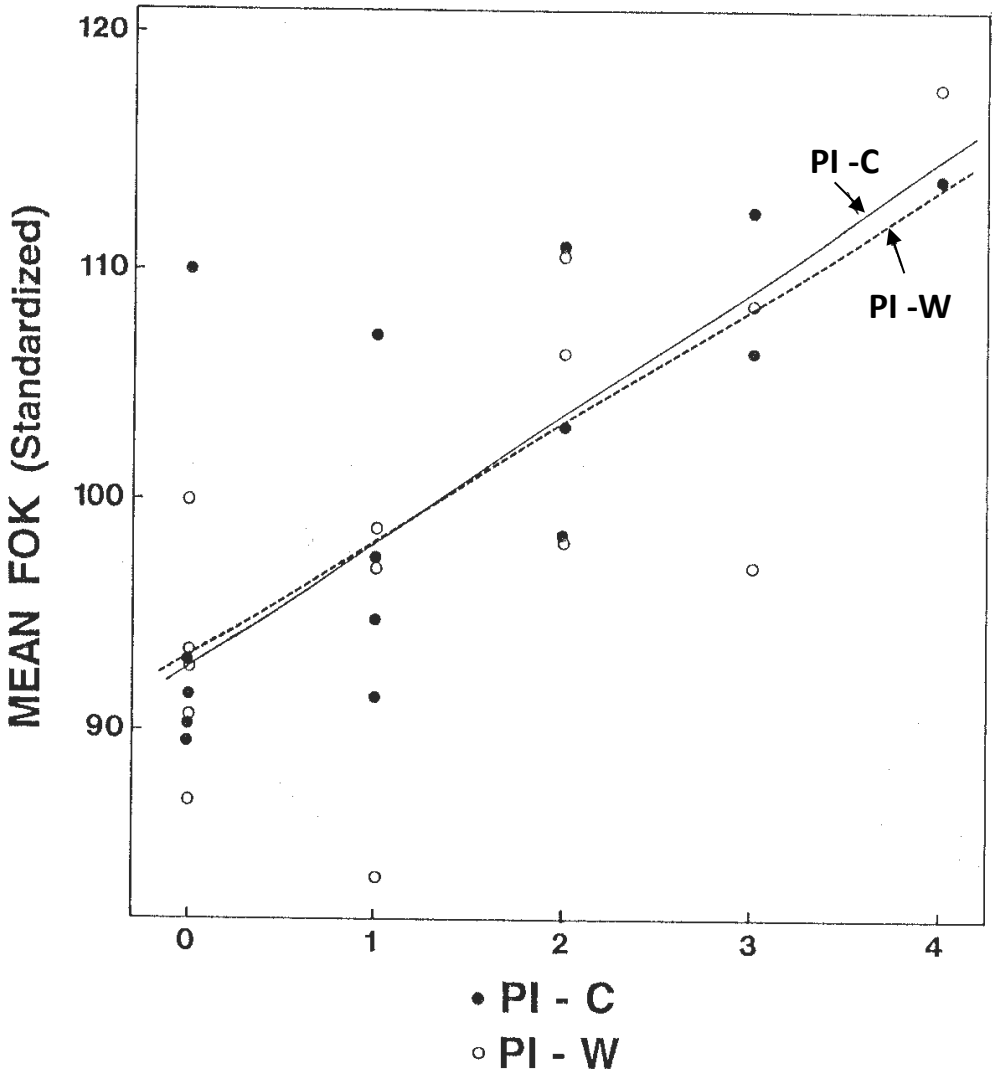
The feeling of knowing

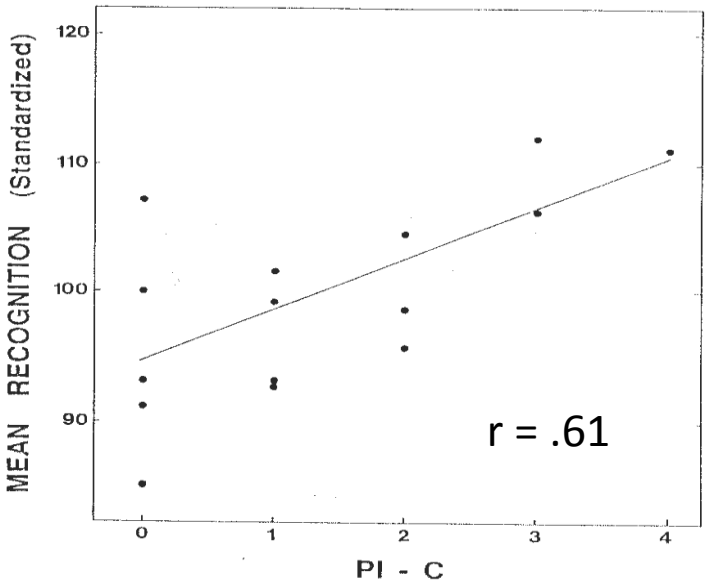


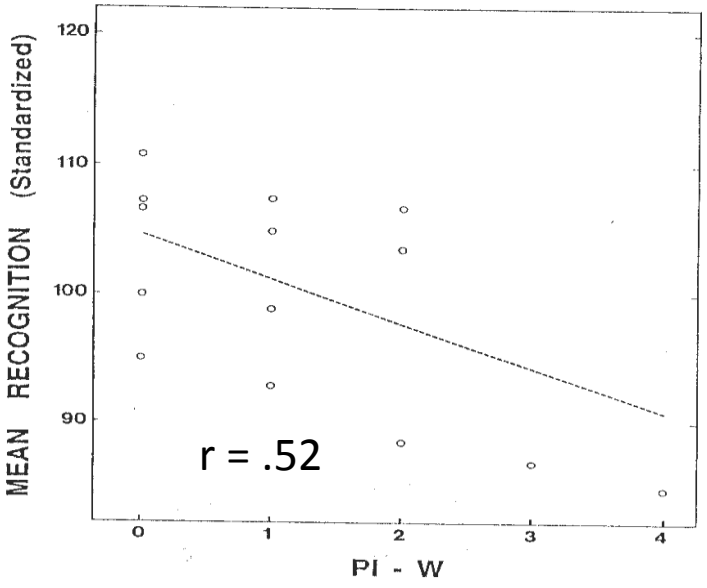
Koriat, 1993

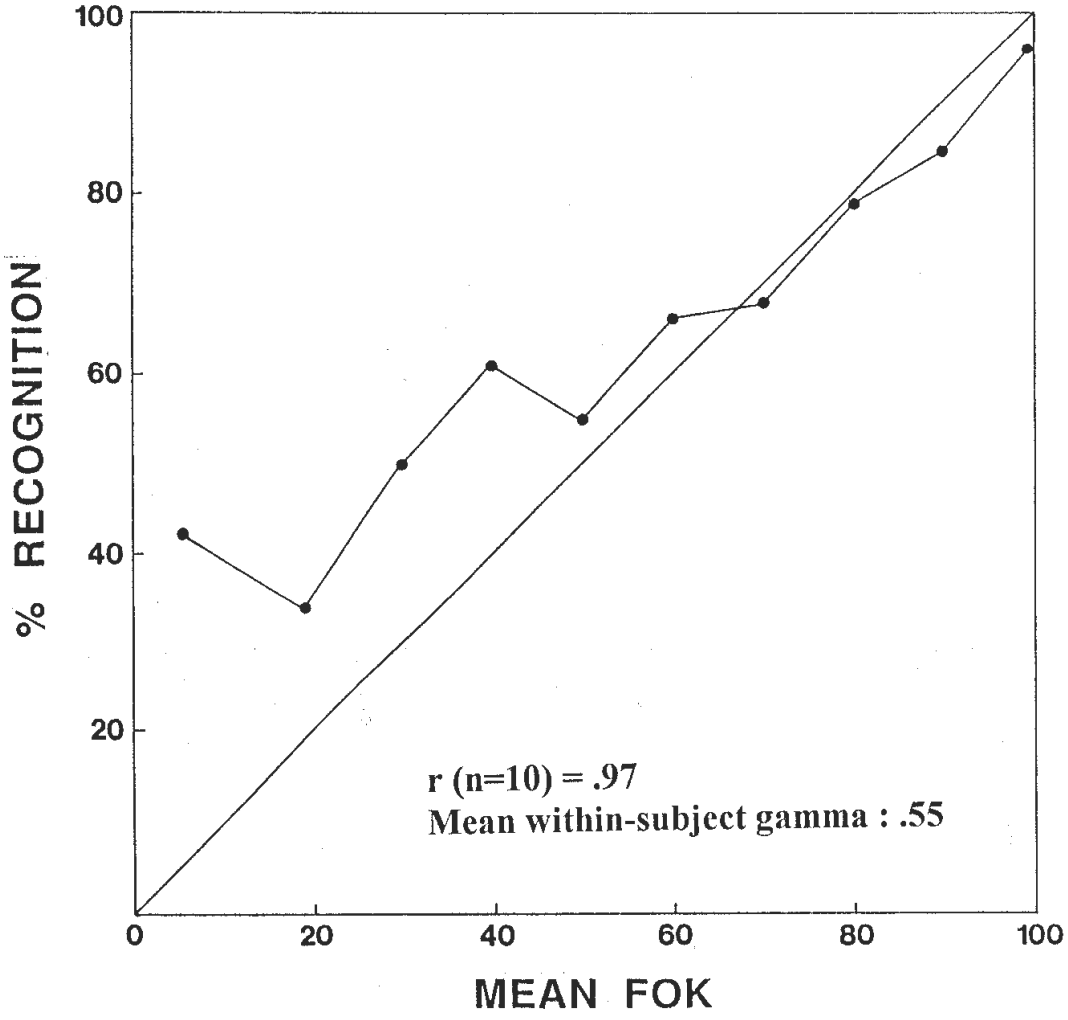

MEAN FOK (Standardized)
120
110
100
90
0
1
2
3
4
PI - C
r = .83


MEAN FOK (Standardized)
120
110
100
90
0
1
2
3
4
PI - W
r = .76


MEAN FOK (Standardized)
120
110
100
90
0
1
2
3
4
PI -C
PI -W
• PI - C
○ PI - W

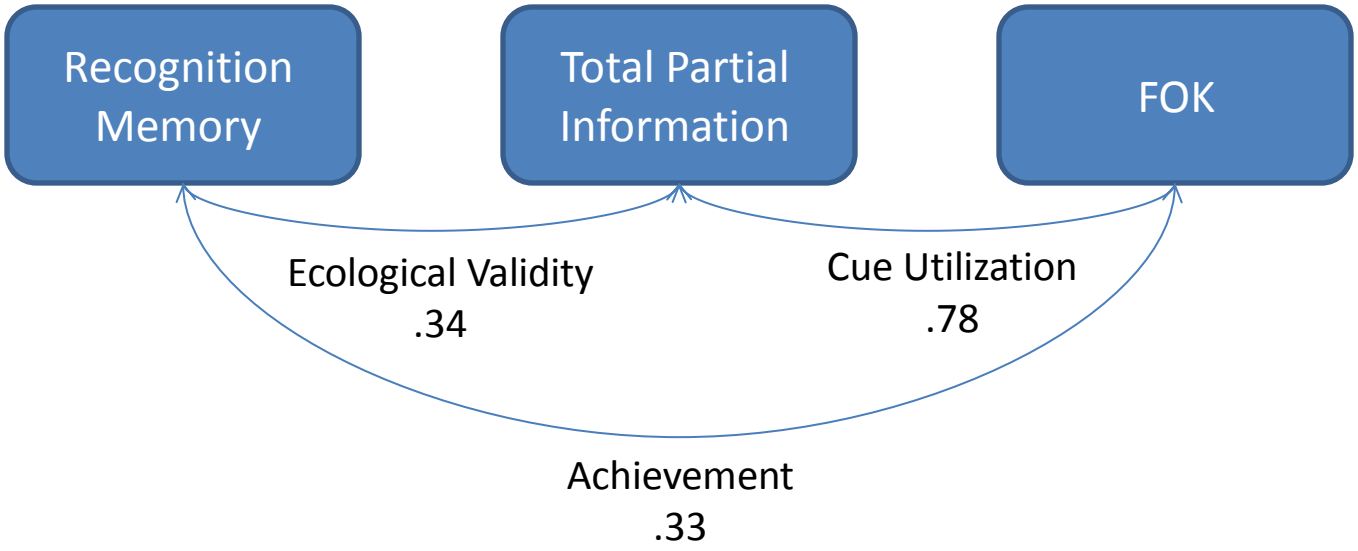

MEAN RECOGNITION (Standardized)
120
110
100
90
0
1
2
3
4
PI - C
r = .61

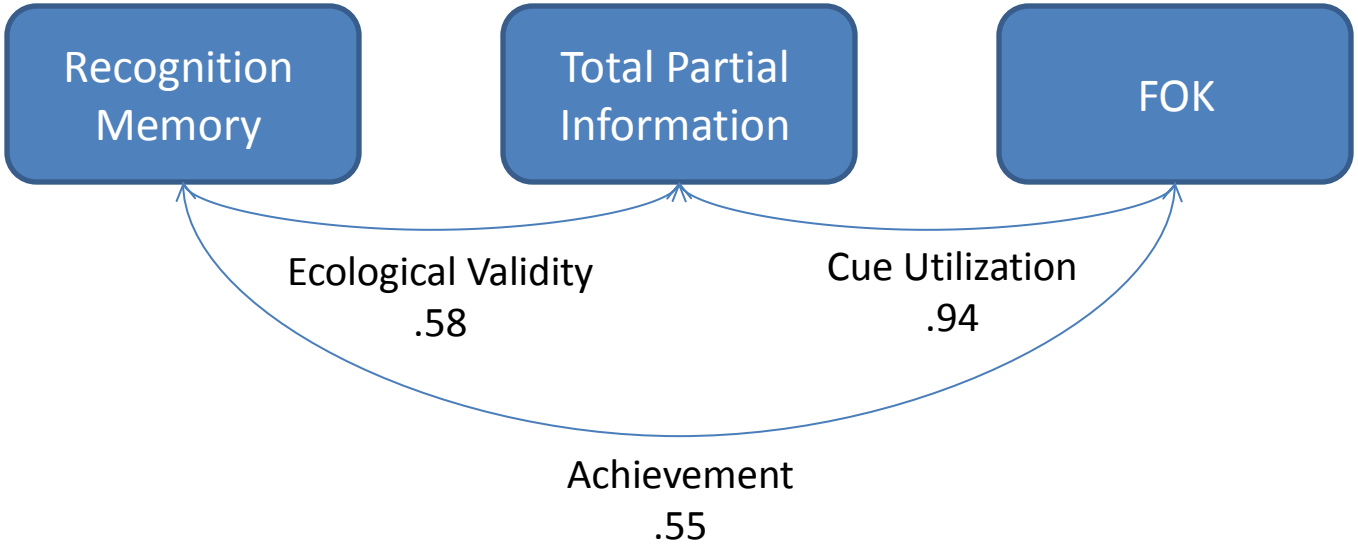

MEAN RECOGNITION (Standardized)
120
110
100
90
0
1
2
3
4
PI - W
r = .52

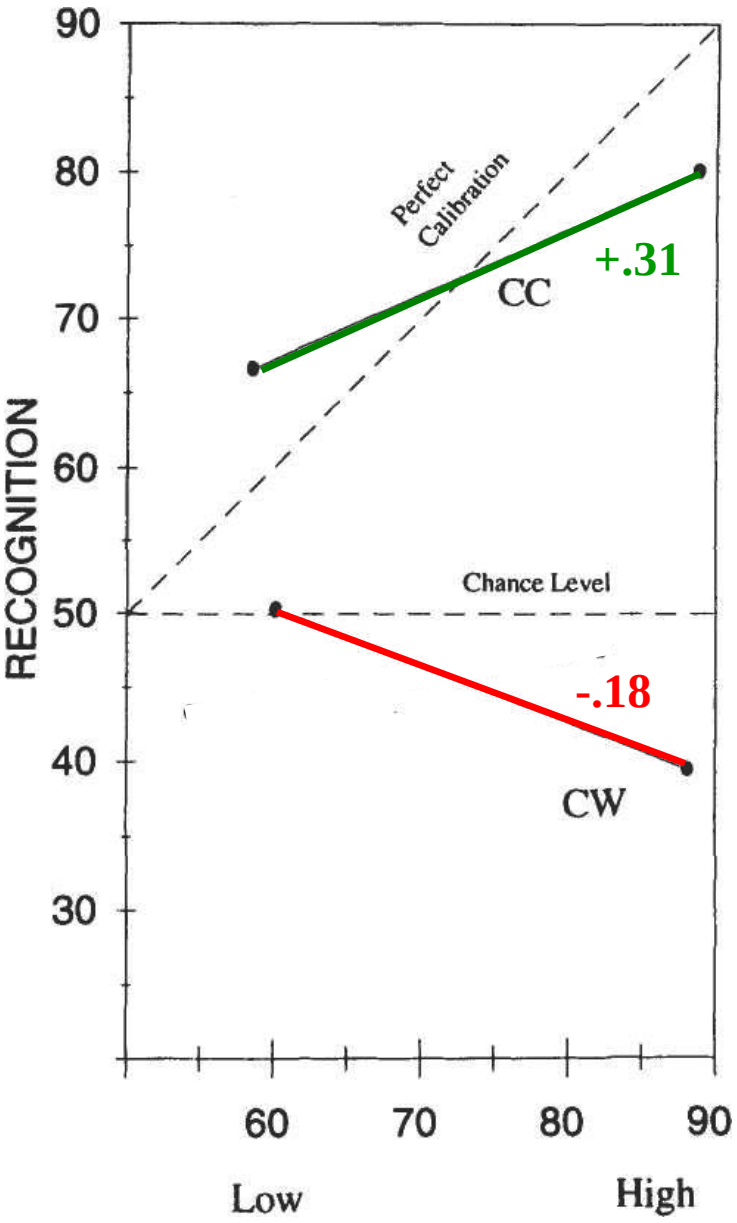


Koriat, 1993; Exp. 1

Cue : Accessibility (Number of Letter Retrieved)

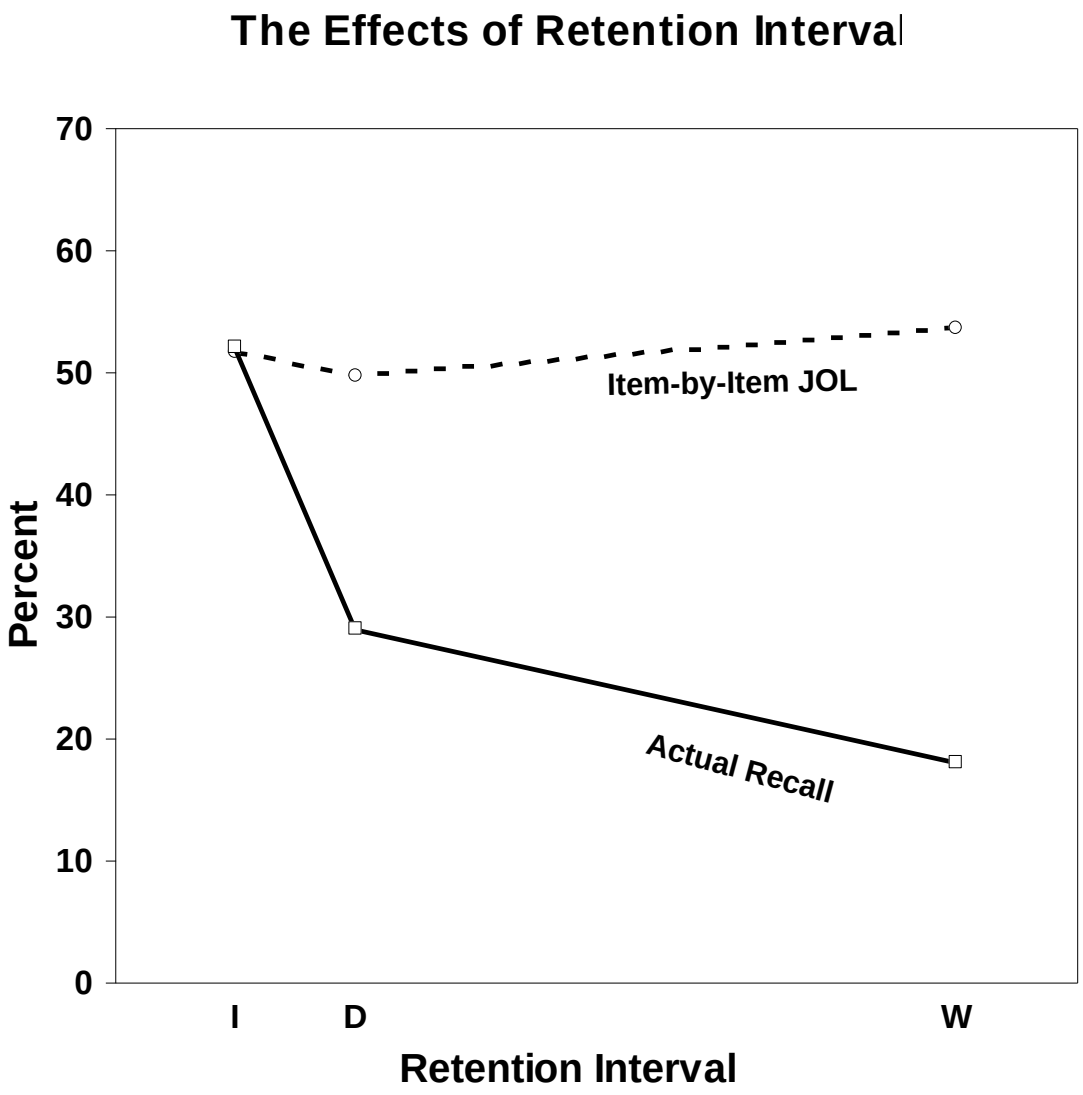





90
80
70
60
50
40
30
RECOGNITION
Perfect Calibration
+.31
CC
Chance Level
-.18
CW
60
70
80
90
Low
High

Koriat, 1995

Judgments of learning



Koriat et al., 2004

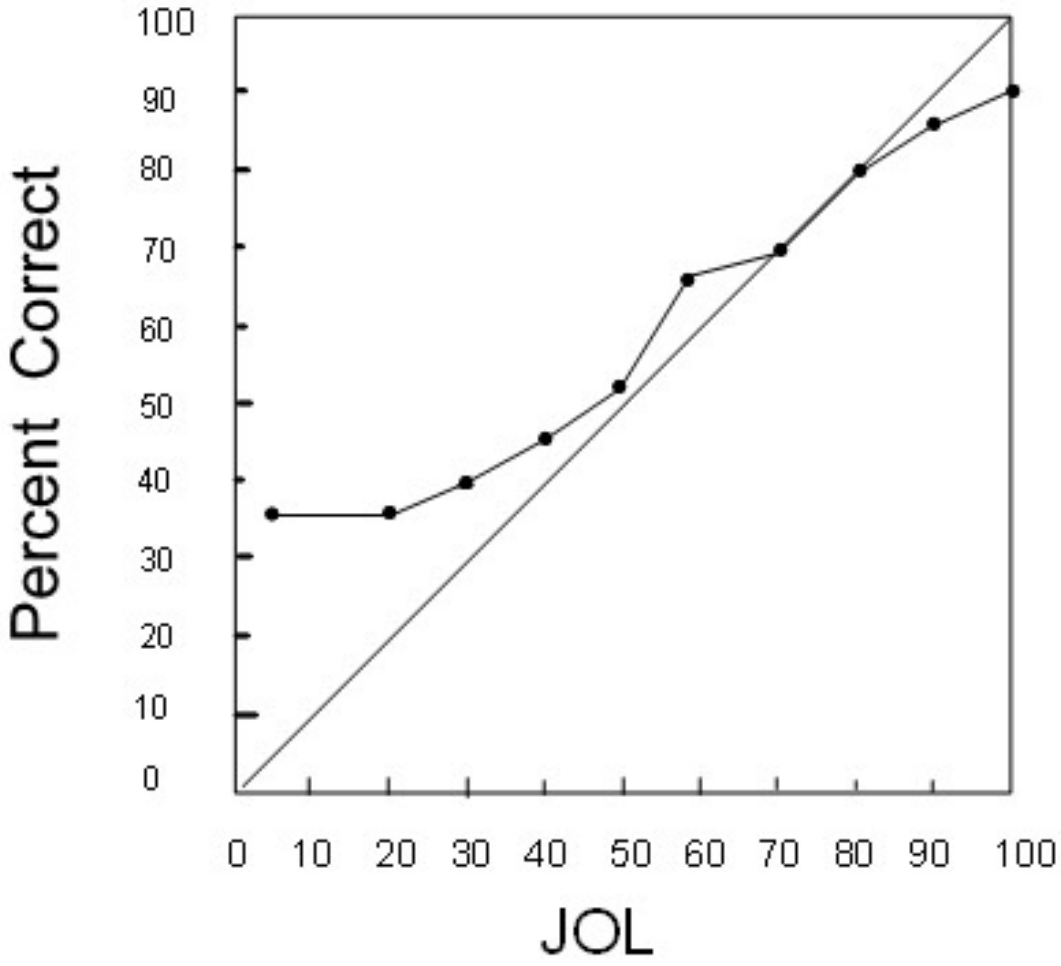
Forgetting Framing

How many words will people forget?

	10 minutes	One Week	One Year
Estimate	52.6% n = 28	66.7% n = 26	81.3% n = 26

F (2,77) = 17.56, p < .0001

Monitoring Accuracy



Koriat, 1997 ; Exp. 1

The control function of judgments of learning

JOL ⟶ Study Time ⟶ JOL

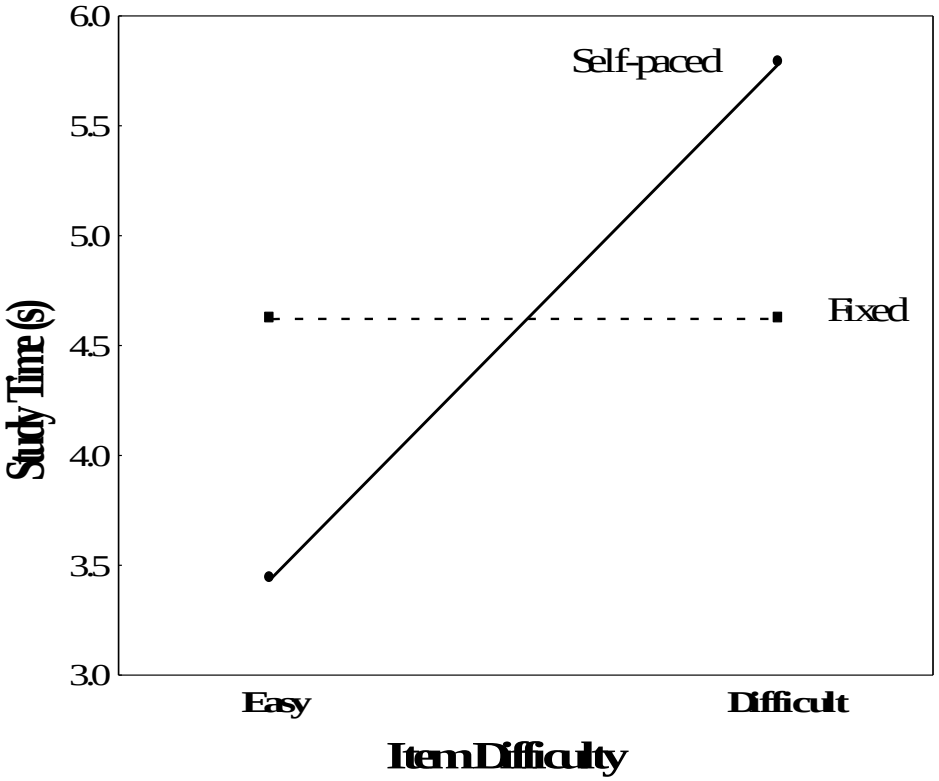
Study time is used in the service of self-regulation

Fear ⟶ Running Away ⟶ Fear

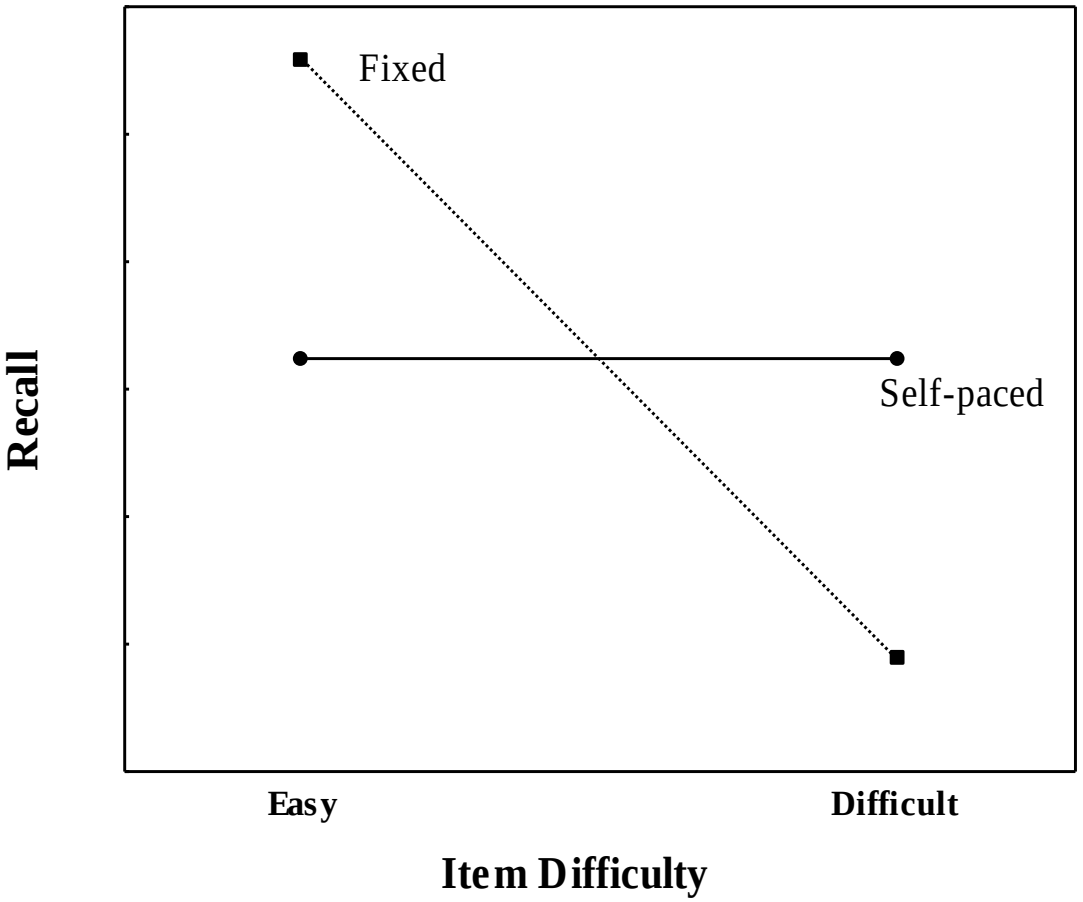
The effects of study time on recall and JOL

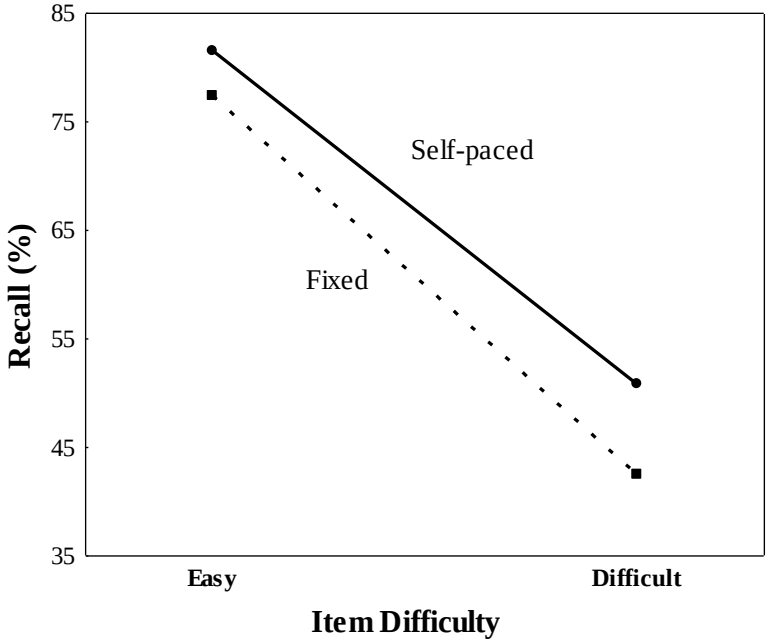
Self-Paced: Control over study time

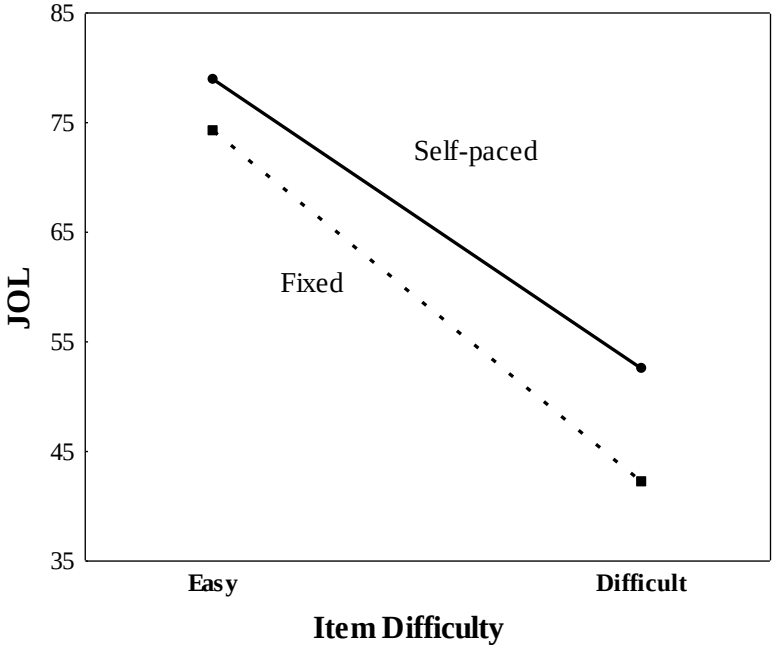
Fixed: Equal study time for all items



Expected Effects on Recall




85
75
65
55
45
35
Recall (%)
Self-paced
Fixed
Easy
Difficult
Item Difficulty


85
75
65
55
45
35
JOL
Self-paced
Fixed
Easy
Difficult
Item Difficulty

Monitoring → Control

Control → Monitoring

Subjective Experience → Behavior

Behavior → Subjective Experience

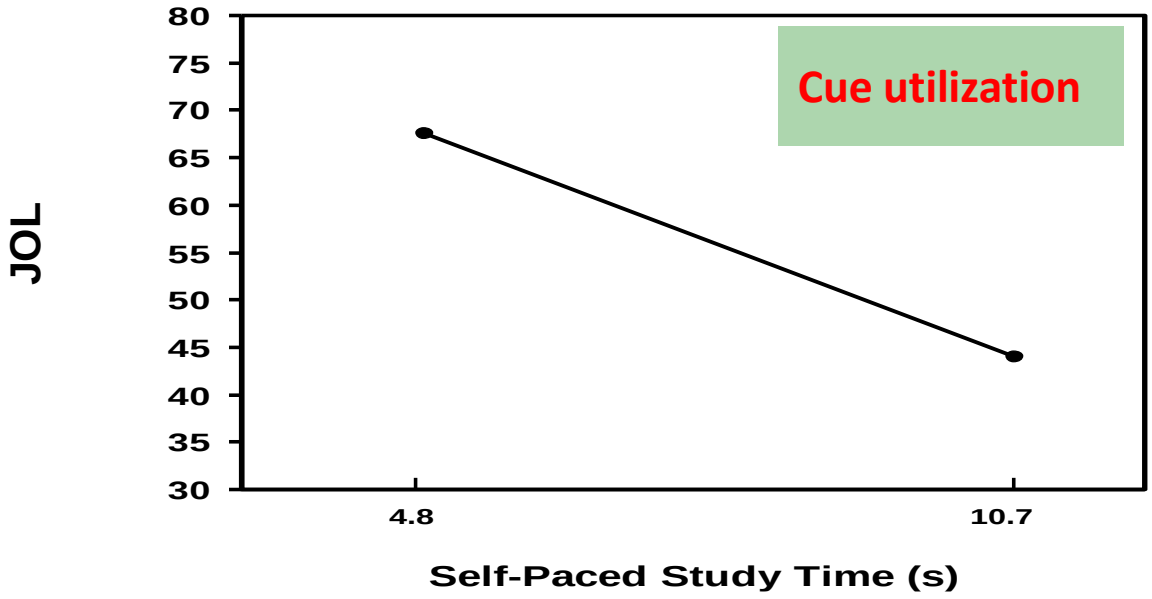
William James (1884)

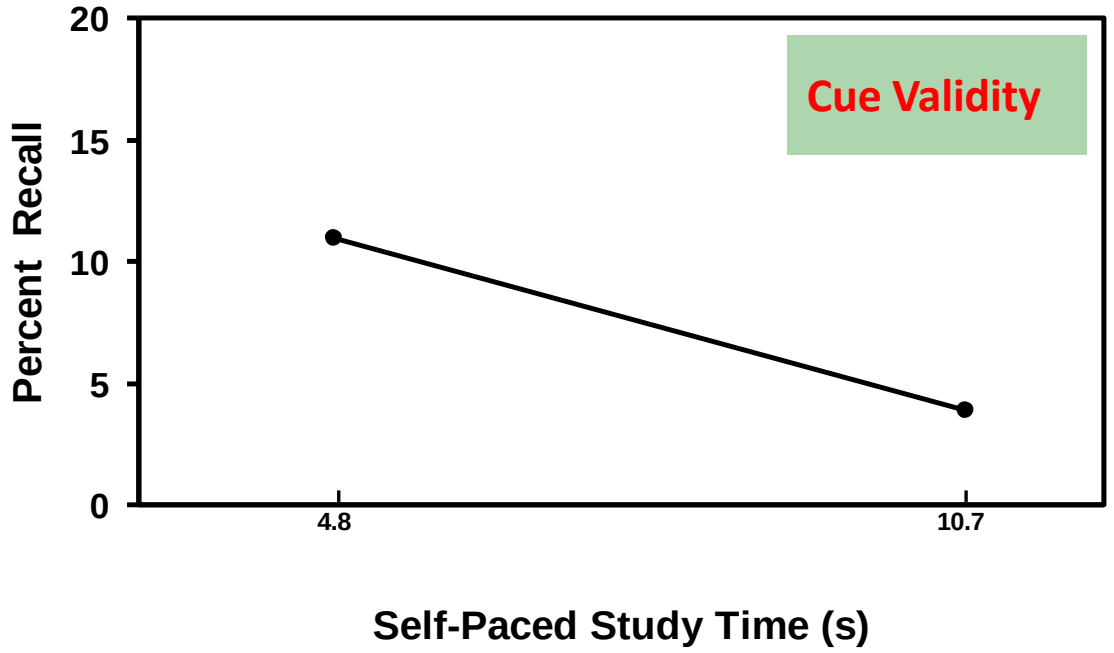
Common sense says

we lose our fortune, are sorry and weep;
we meet a bear, are frightened and run;
we are insulted by a rival, are angry and strike.

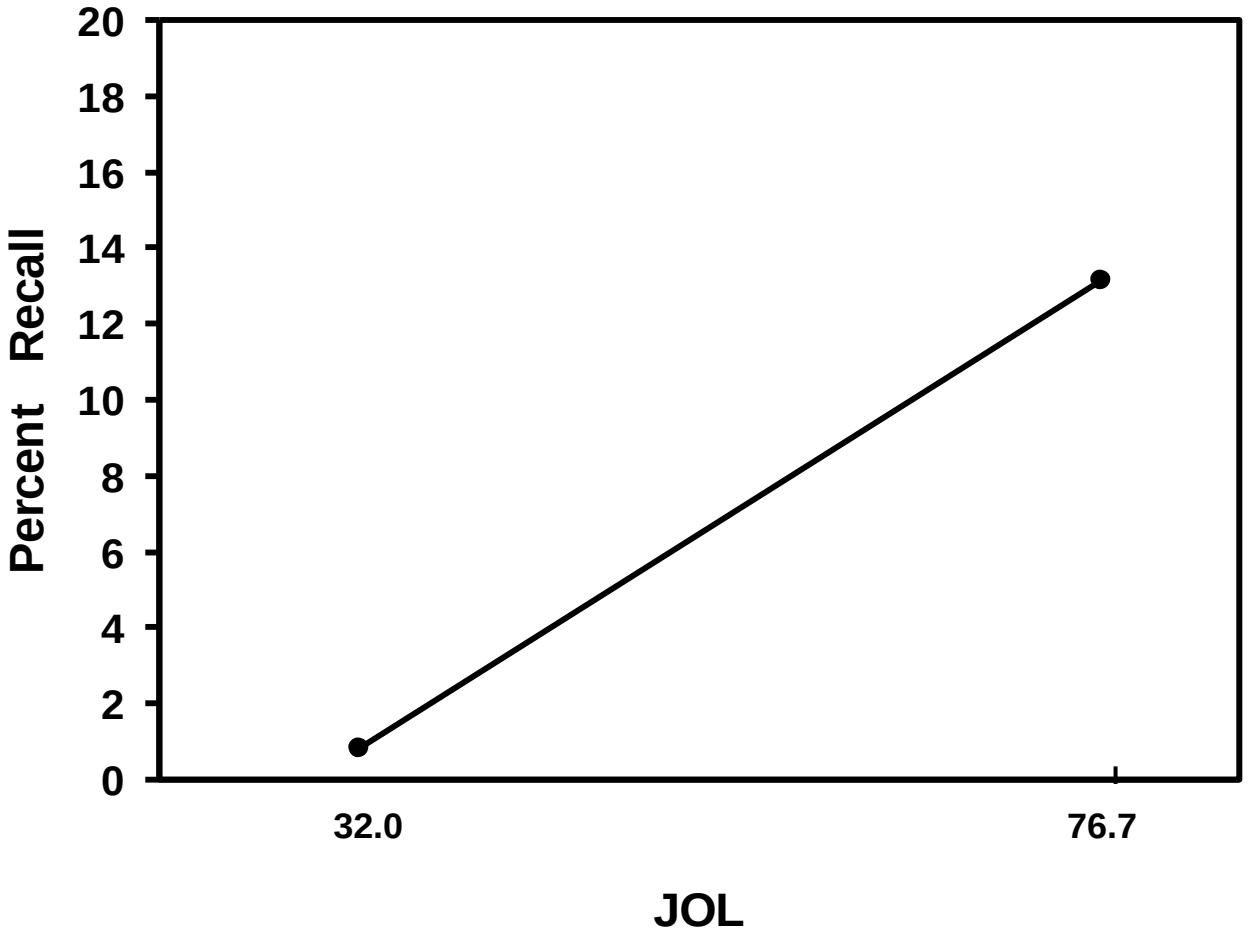
The hypothesis here to be defended

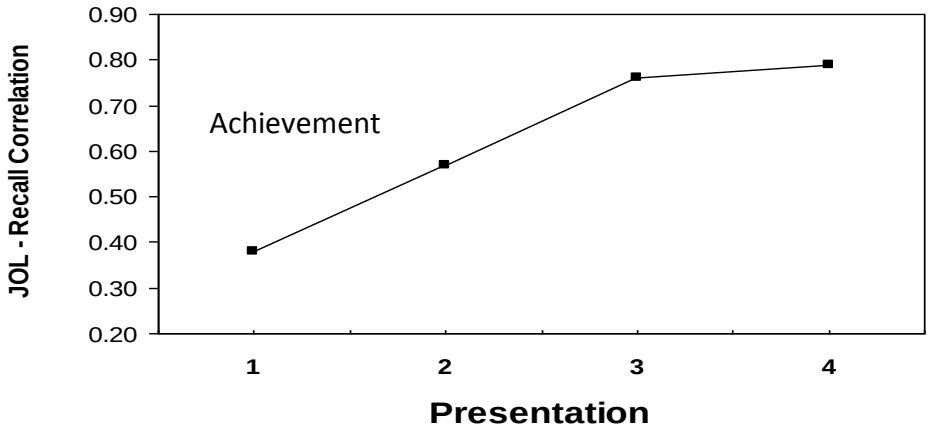
we feel sorry because we cry,
angry because we strike,
afraid because we tremble.

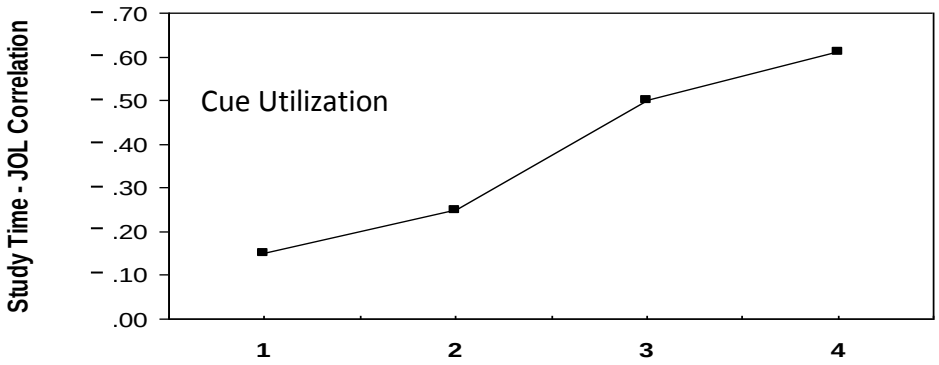

JOL
80
75
70
65
60
55
50
45
40
35
30
4.8
10.7
Self-Paced Study Time (s)
Cue utilization

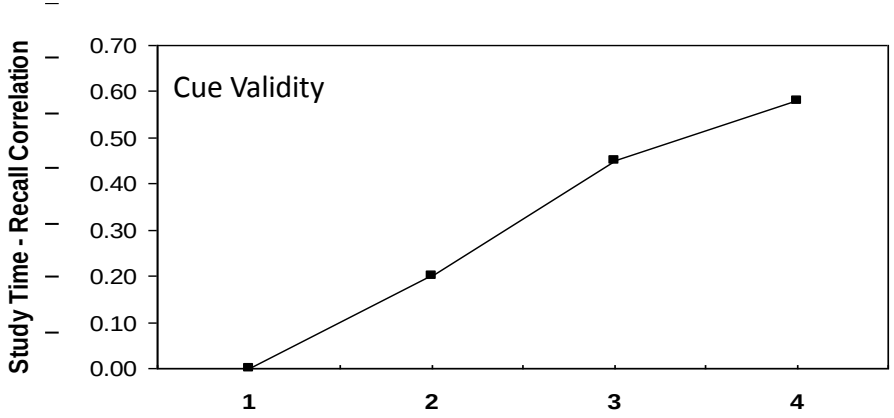

Percent Recall
20
15
10
5
0
4.8
10.7
Self-Paced Study Time (s)
Cue Validity

Achievement



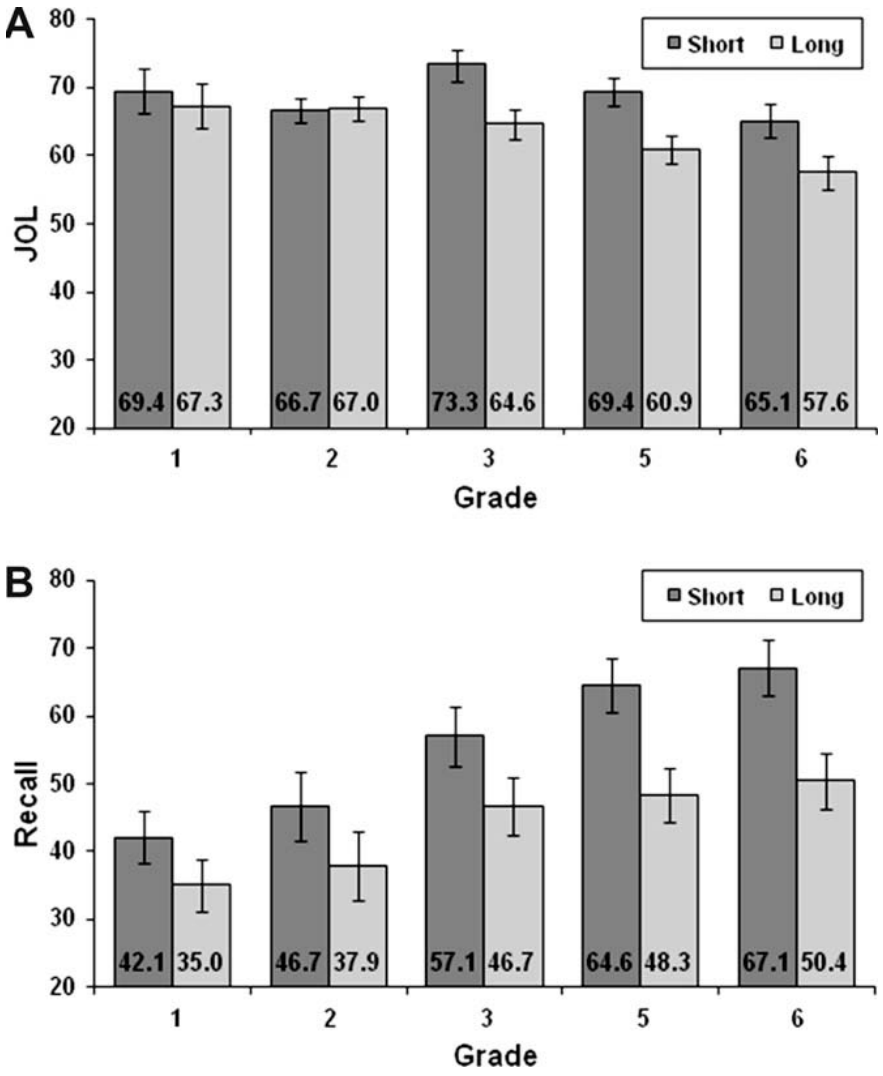

JOL - Recall Correlation
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
Achievement
1
2
3
4
Presentation


Study Time - JOL Correlation
.70
.60
.50
.40
.30
.20
.10
.00
Cue Utilization
1
2
3
4

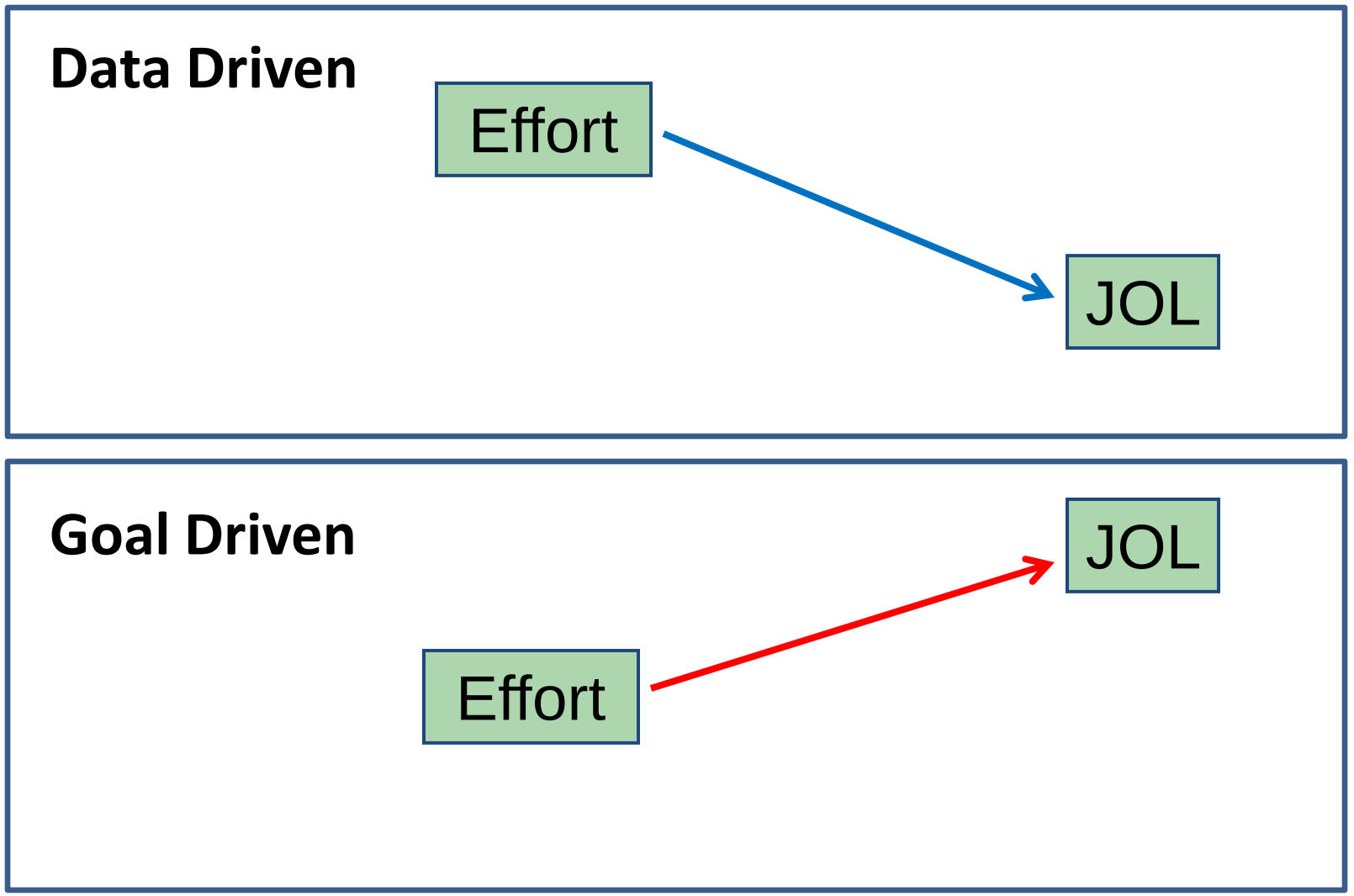

Study Time - Recall Correlation
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Cue Validity
1
2
3
4

The Memorizing Effort Heuristic: Development

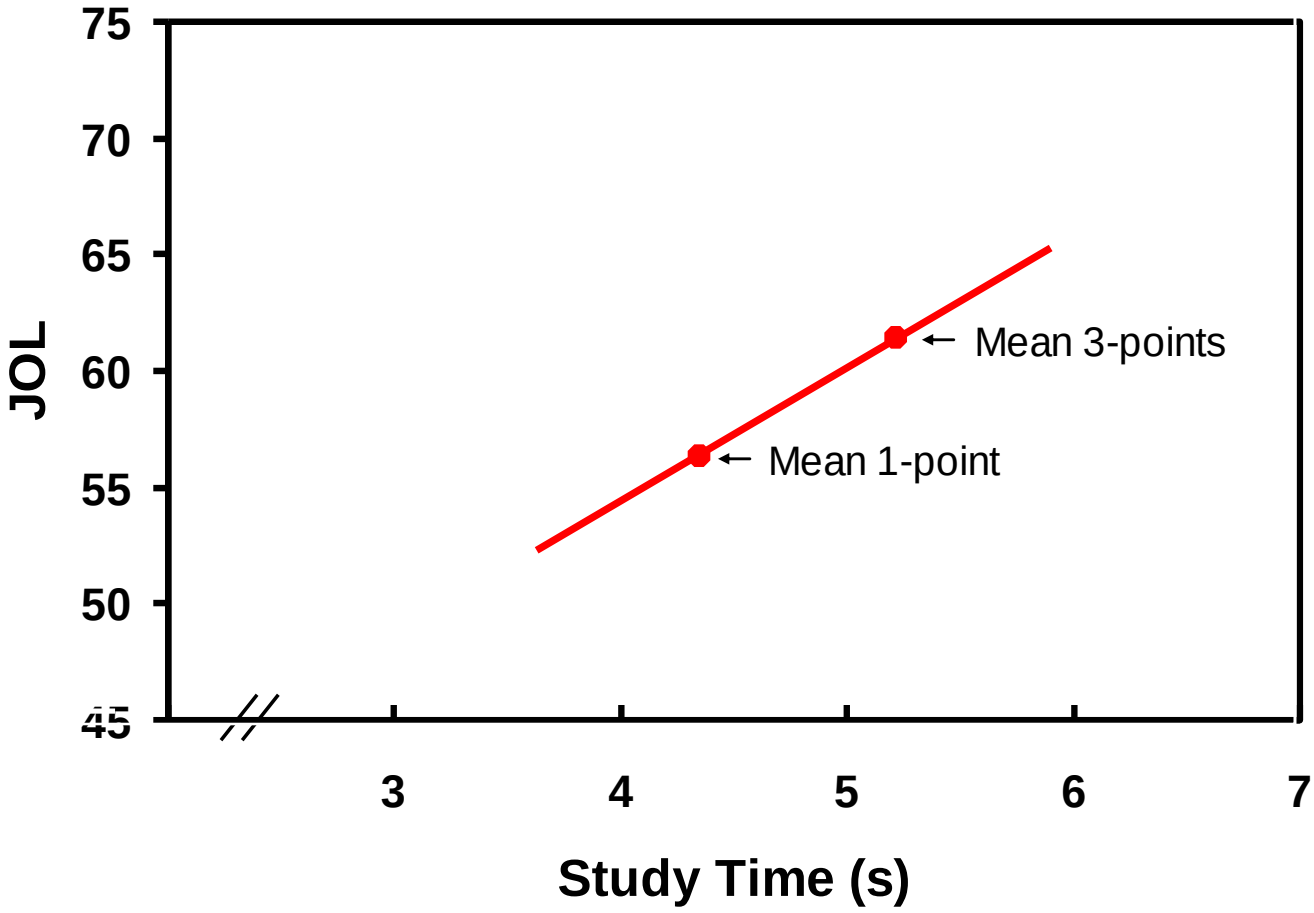
(Koriat, Ackerman, Lockl, & Schneider, 2009a)



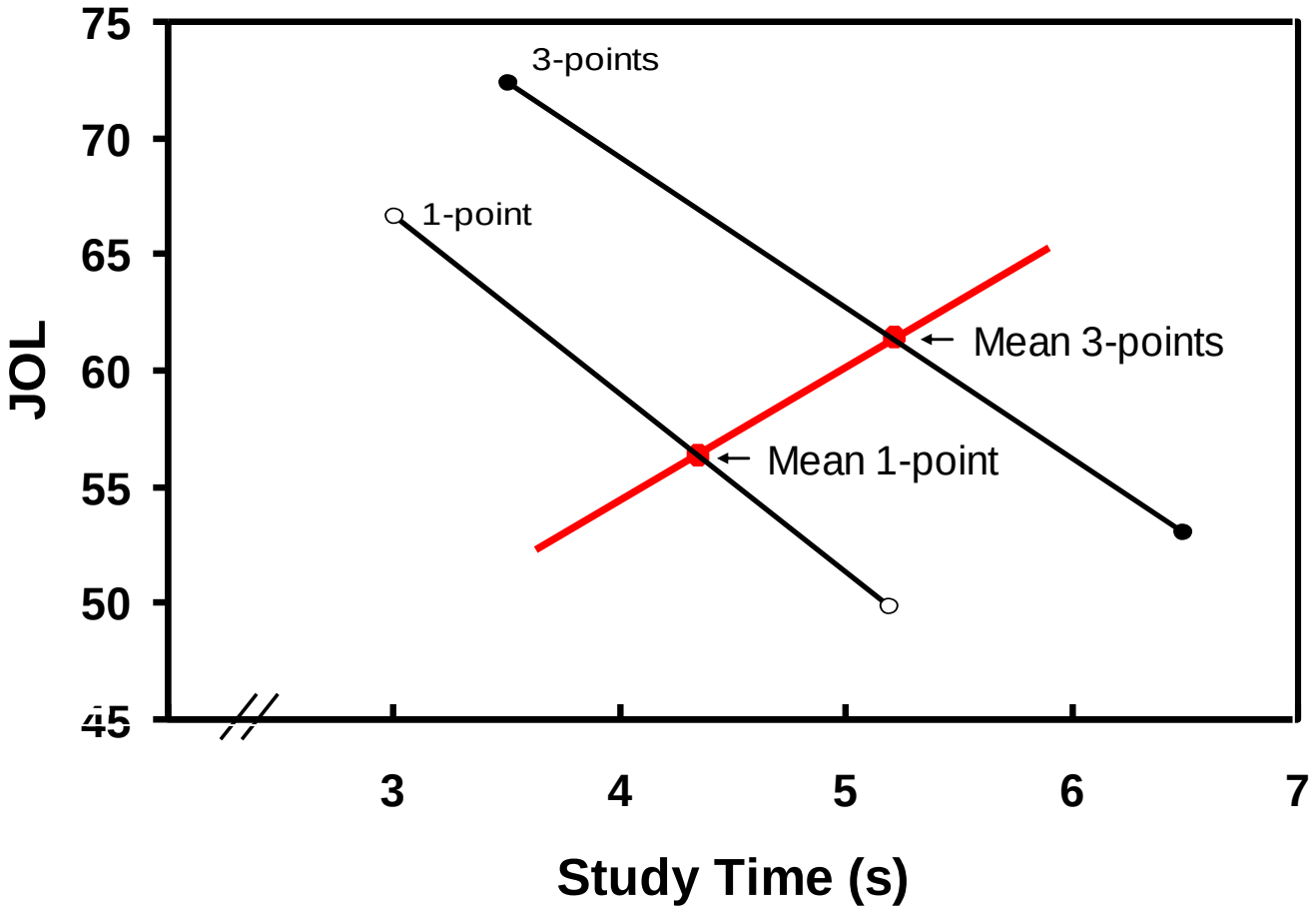
Regulation



The effects of goal-driven regulation



The combined effects of goal-driven and data-driven variations in study time

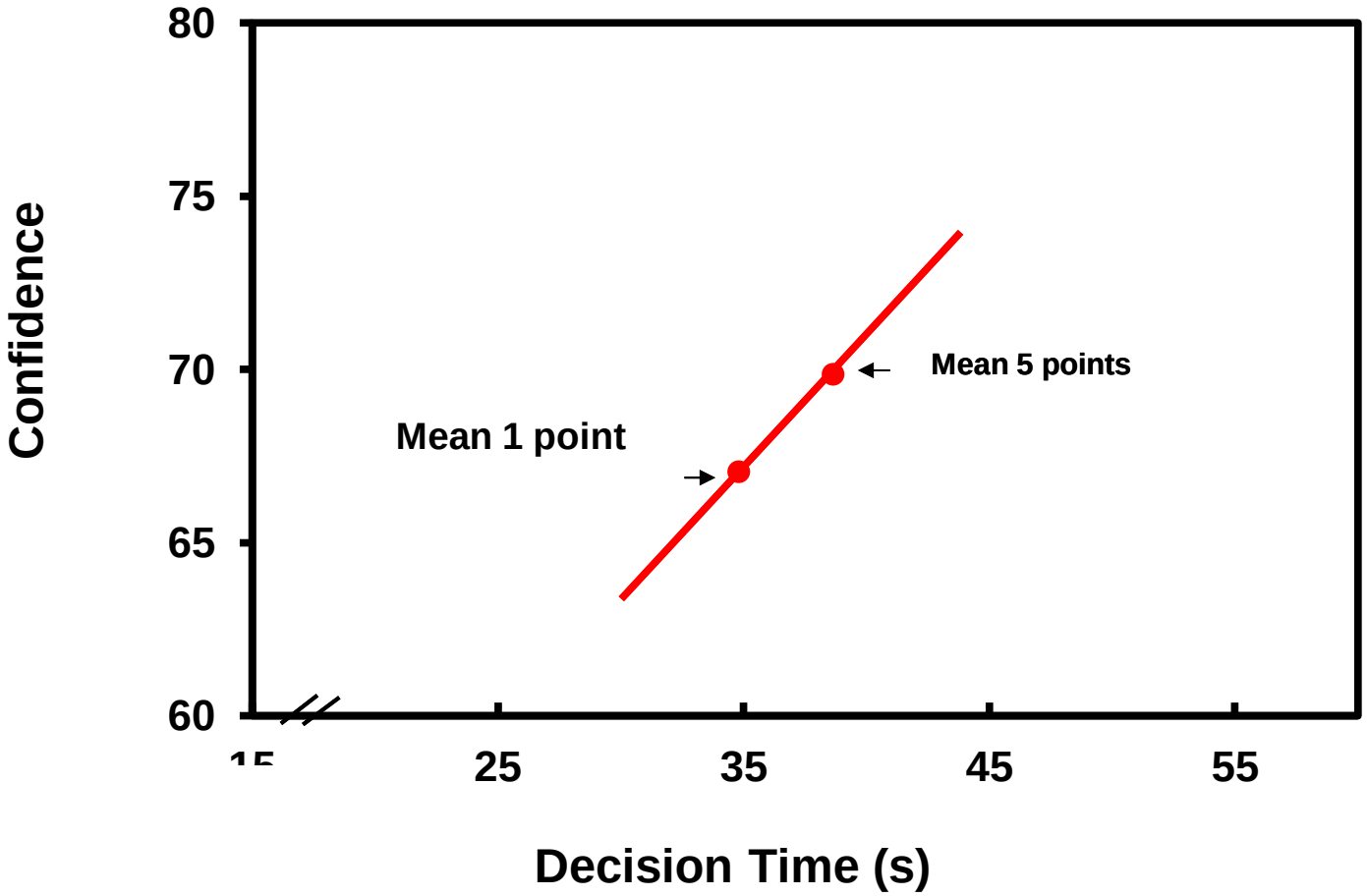


Attribution

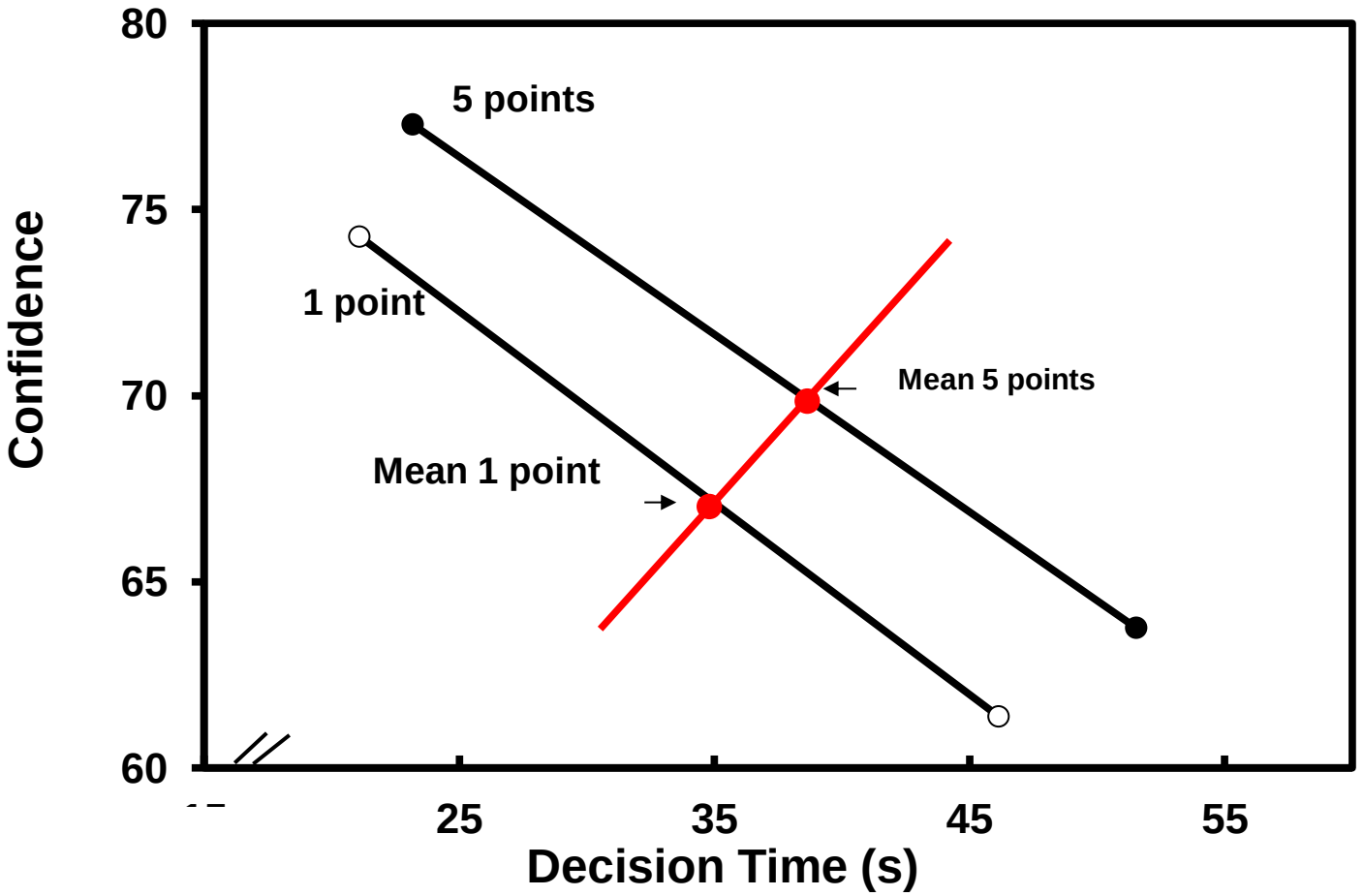
The effects of study time on JOLs differ depending on the source of the variations in study time

This implies an attribution process: Variations in study time are first attributed either to data-driven or goal-driven processes before they affect JOLs

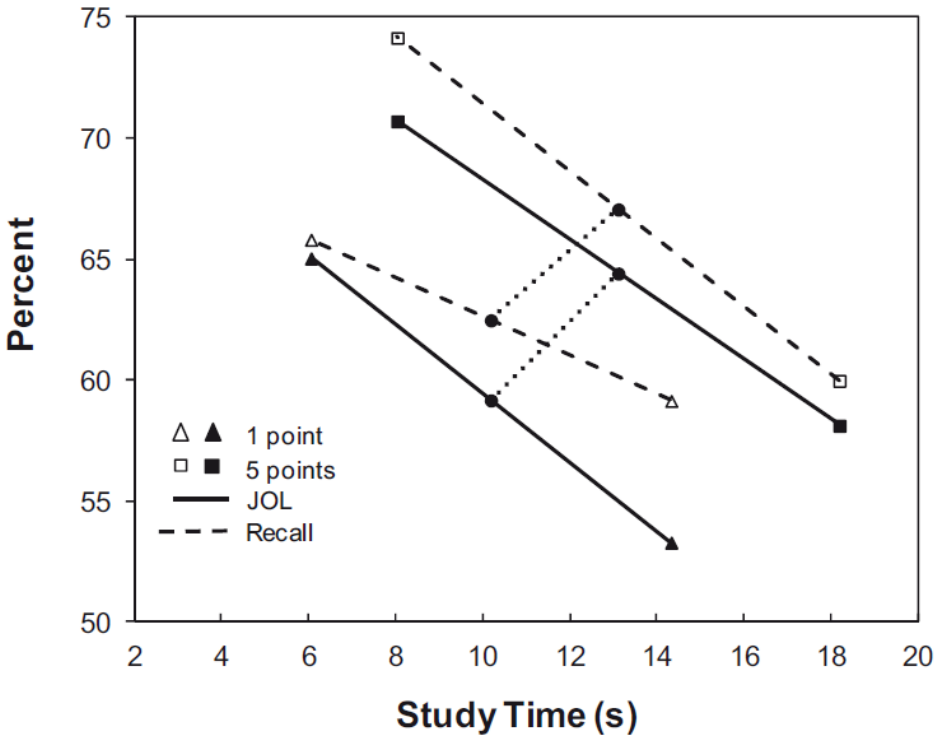
Subjective confidence as a function of decision time



Subjective confidence as a function of decision time



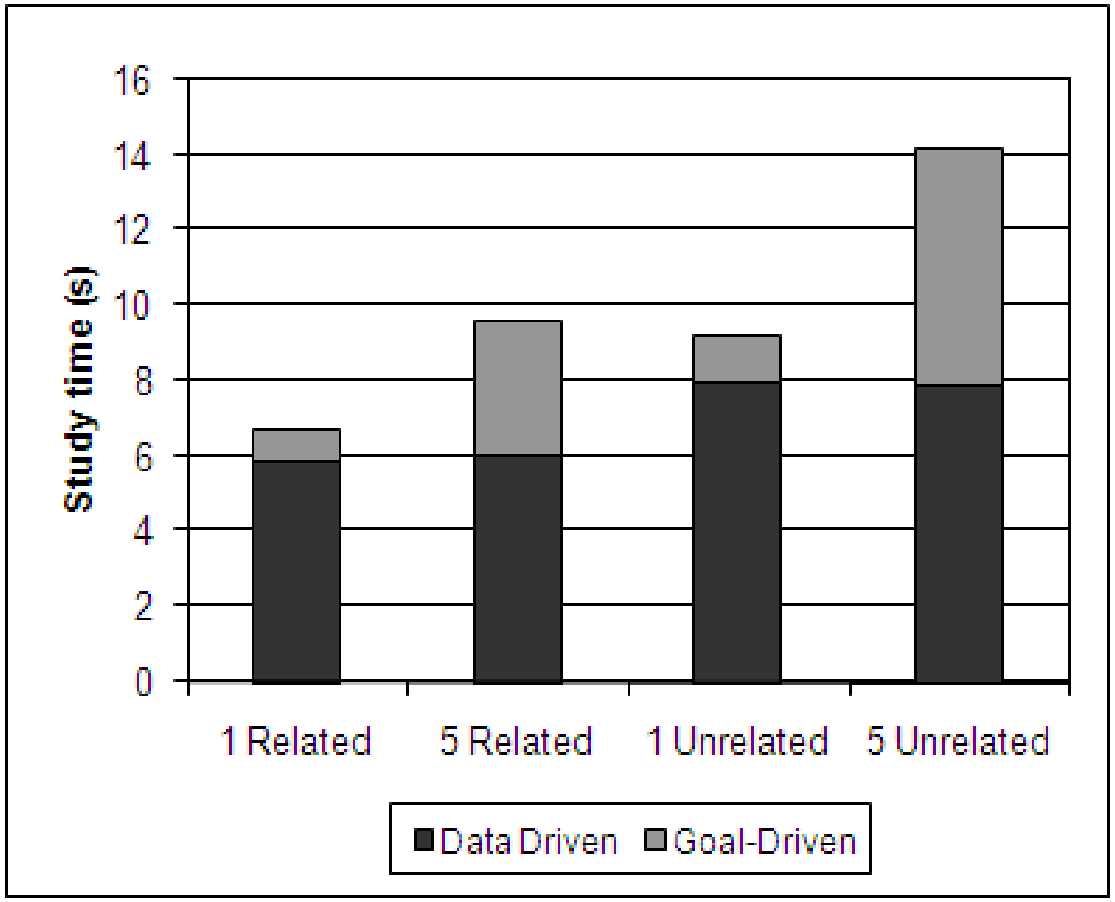
9th graders



(Koriat, Ackerman, Adiv, Lockl, & Schneider, JEPG, 2013)

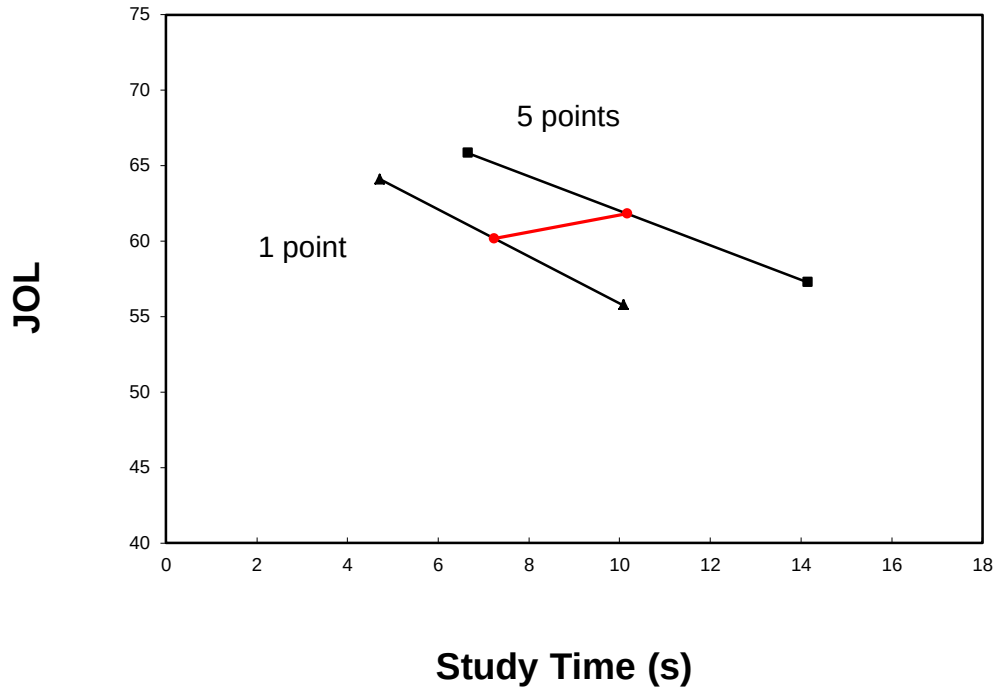
5th-6th Graders

Training

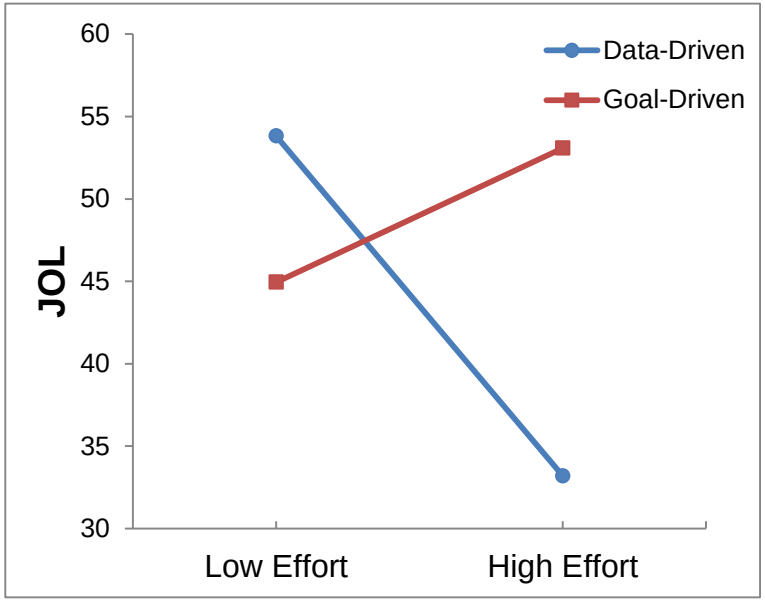


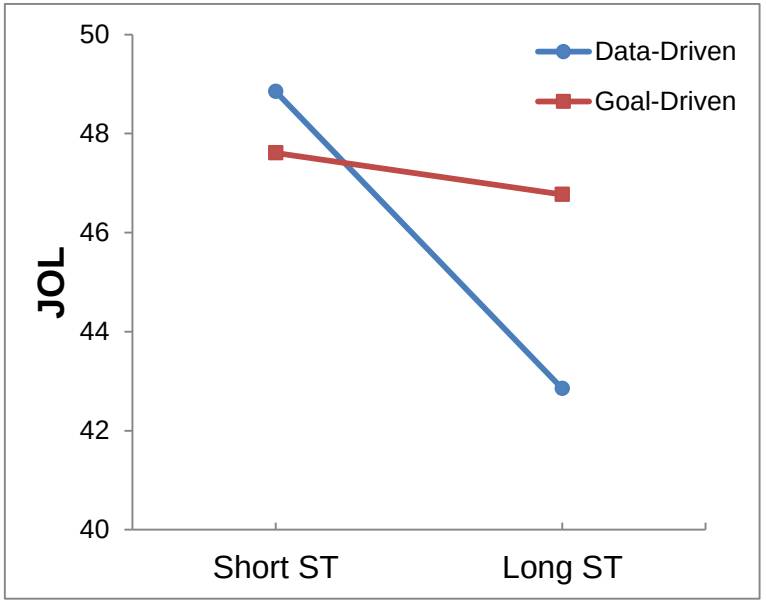
5th-6th Graders

After

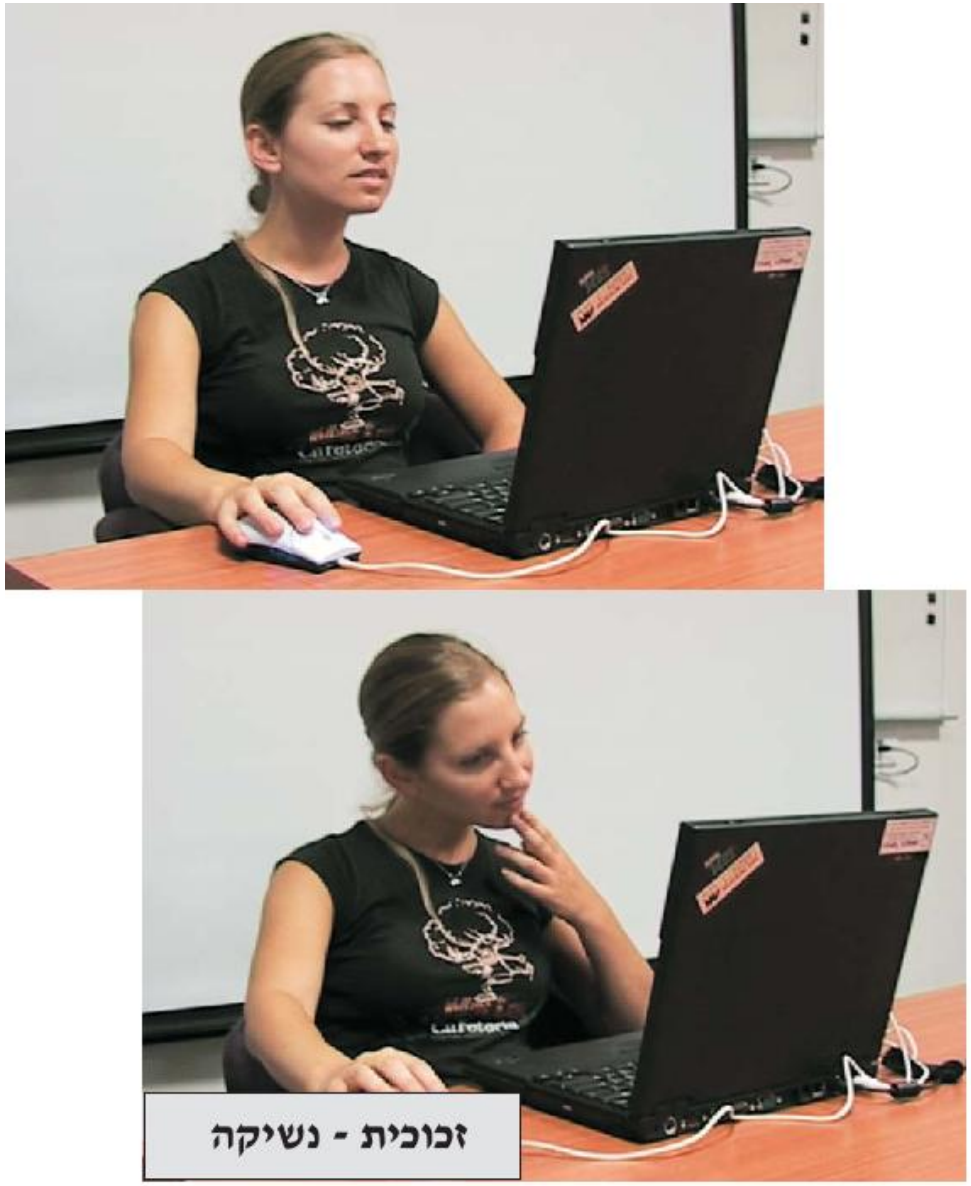


Judgments of leaning depend on how learners interpret study time





(Koriat, Nussinson, & Ackerman, in preparation)



Koriat & Ackerman (2010)

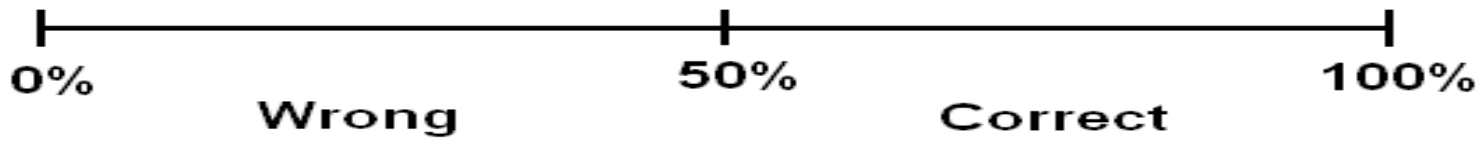
Subjective Confidence

For perceptual judgments and general information:

People discriminate between correct and wrong answers

Testing the confidence/accuracy correlation

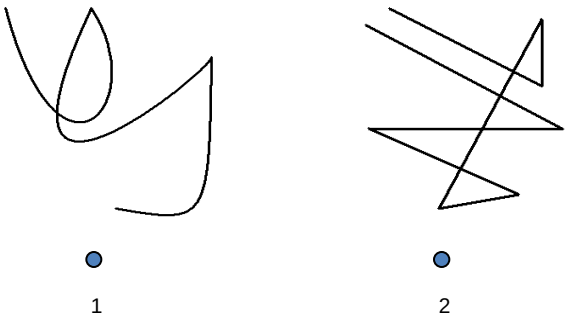
Normative Accuracy for 2AFC items



Perceptual Comparisons: Length

(Koriat, JEPG, 2011)

Which of the two lines is longer?



Confidence: 0 - 100

Perceptual Comparisons: Length

(Koriat, JEPG 2011)

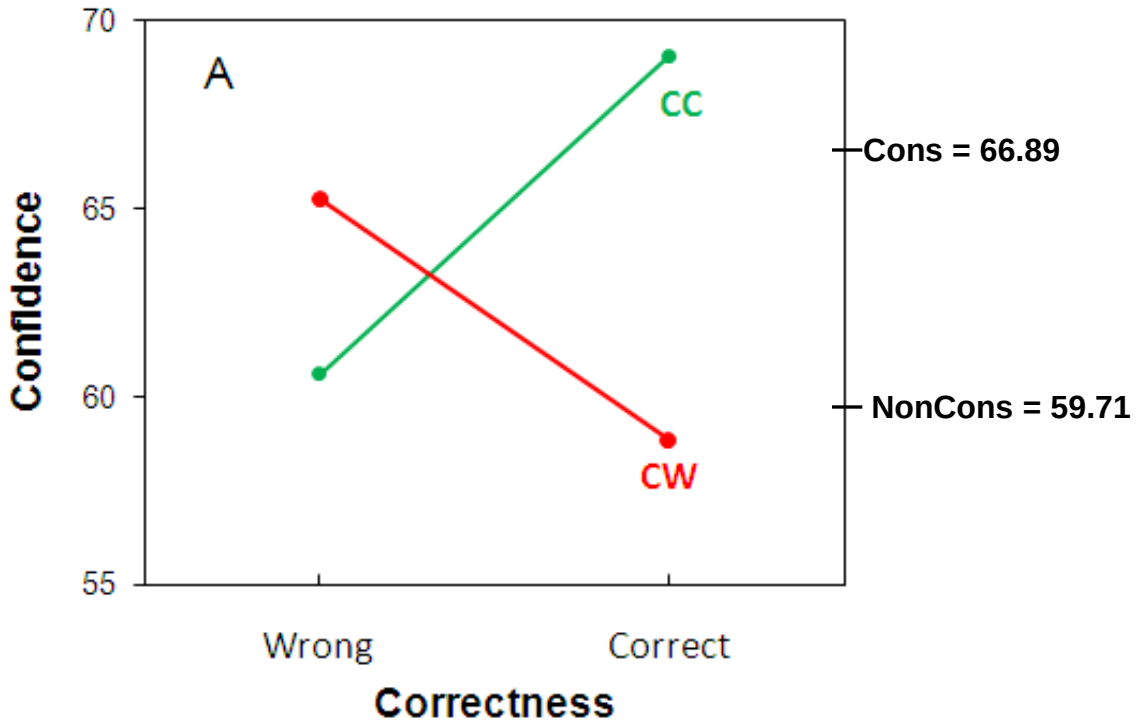
Experiment 1

Consensually Correct items		
Shorter	Longer	% Correct
		83.59
		77.95
		74.87

Consensually Wrong items		
Shorter	Longer	% Correct
		15.38
		15.90
		24.10

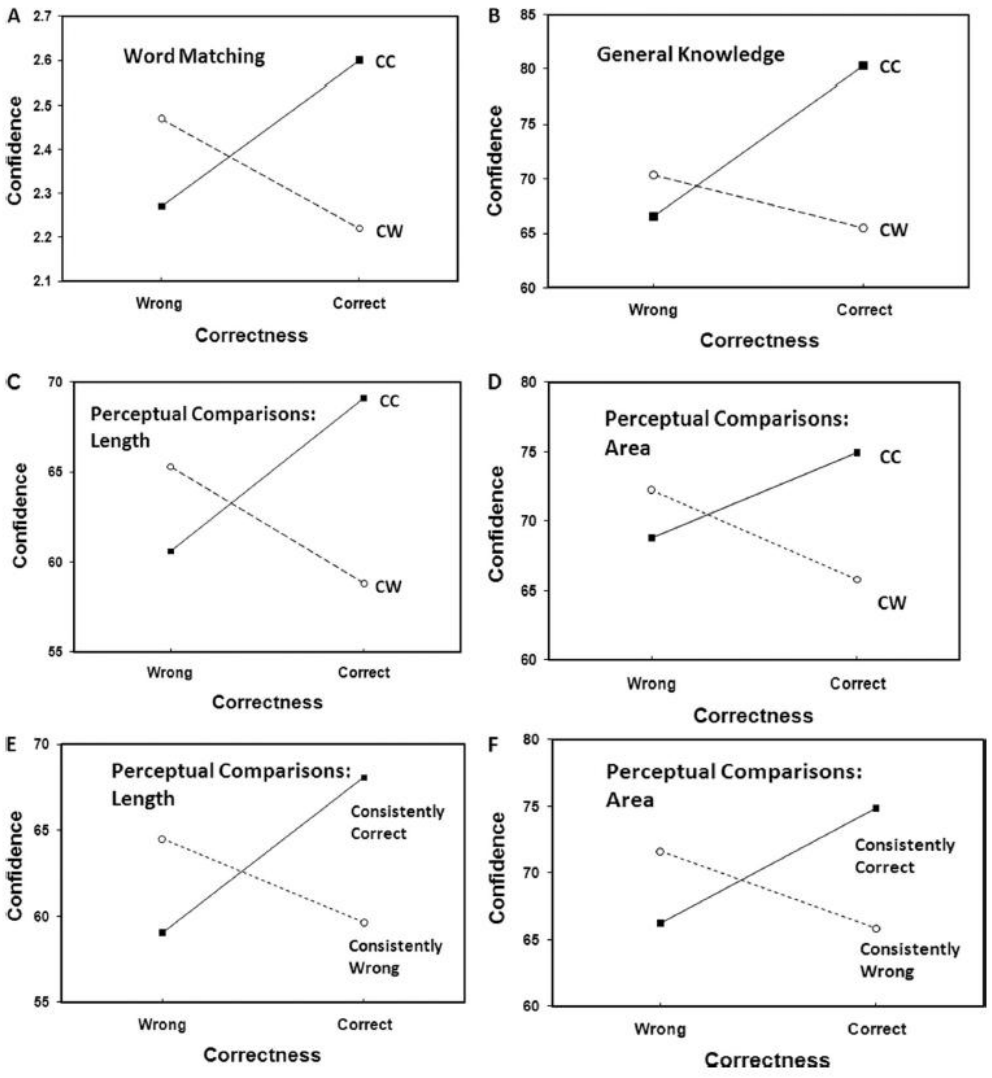
Perceptual Comparisons: Length

(Koriat, JEPG 2011)



Mean confidence for correct and wrong answers, plotted separately for the consensually correct (CC), and for the consensually wrong (CW) items.

The consensuality principle



Koriat, 2012

Implications for Group Decisions

Koriat, A. (2012). When are two heads better than one and why?

***Science, 336*, 360-362.**

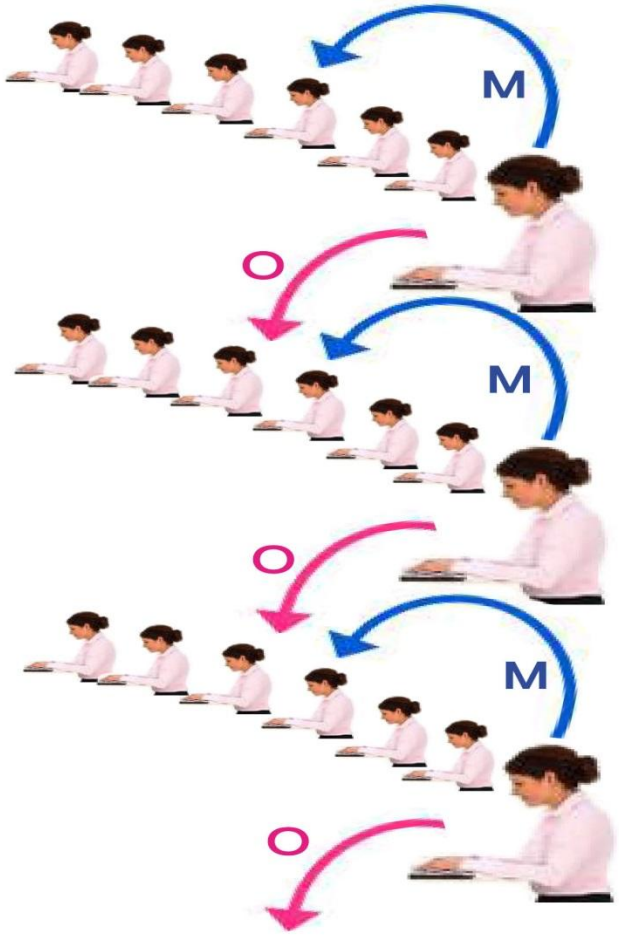
John Maynard Keynes (1936): Beauty Contest as a metaphor of equity markets

"It is not a case of choosing those [faces] which, to the best of one's judgment, are really the prettiest, nor even those which average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practice the fourth, fifth and higher degrees."

Economic predictions

- Mean prediction accuracy: 49.9
- Mean confidence-accuracy correlation:
  .08, $t(28) = .97$, $p = .34$.
- Mean confidence-consensuality correlation:
  .32, $t(28) = 4.02$, $p < .001$

Monitoring object-level and meta-level



Some metatheoretical Issues

1. The genesis of subjective experience
2. The function of subjective experience
3. The cause-and-effect relation between subjective experience and behavior

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Thank you