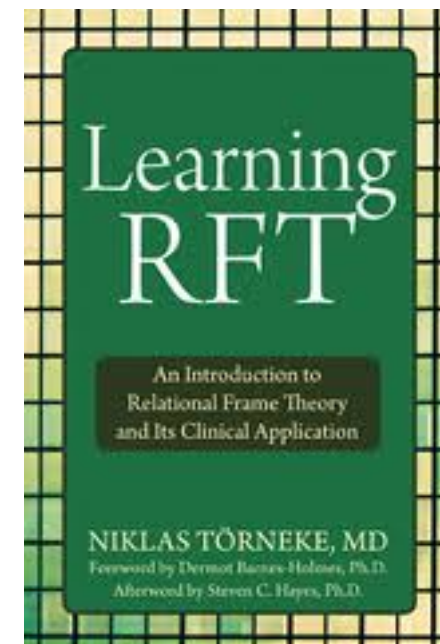
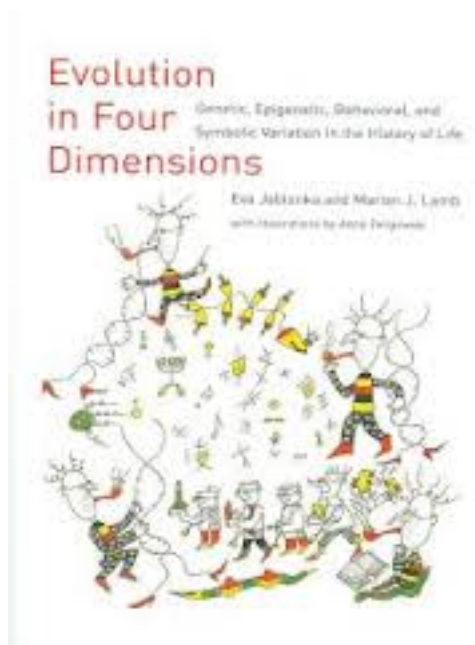


# Symbolic Inheritance and Derived Relational Responding



# Jablonka four inheritance systems

- Genetic
- Epigenetic
- Learning
- Symbolic thought

# Wallace - Pinker

- ‘that abstract intelligence was of no use to ancestral humans and could only be explained by intelligent design’
- Intelligence is an adaptation to a knowledge-using, socially interdependent lifestyle, the “cognitive niche.”



# Pinker

Hominids evolved to specialize in the cognitive niche, which is defined by:

- 1. Reasoning about the causal structure of the world
- 2. Cooperating with other individuals
- 3. Sharing that knowledge and negotiating those agreements via language

# Classical conditioning and operant conditioning

- ‘Instrumental and classical conditioning are not adequate for an analysis of language’
  - Seligman (1970)
- Relatively limiting
- Rapid transformations of environment

# Contingency Learning -Classical Conditioning and ToF

15 normal subjects

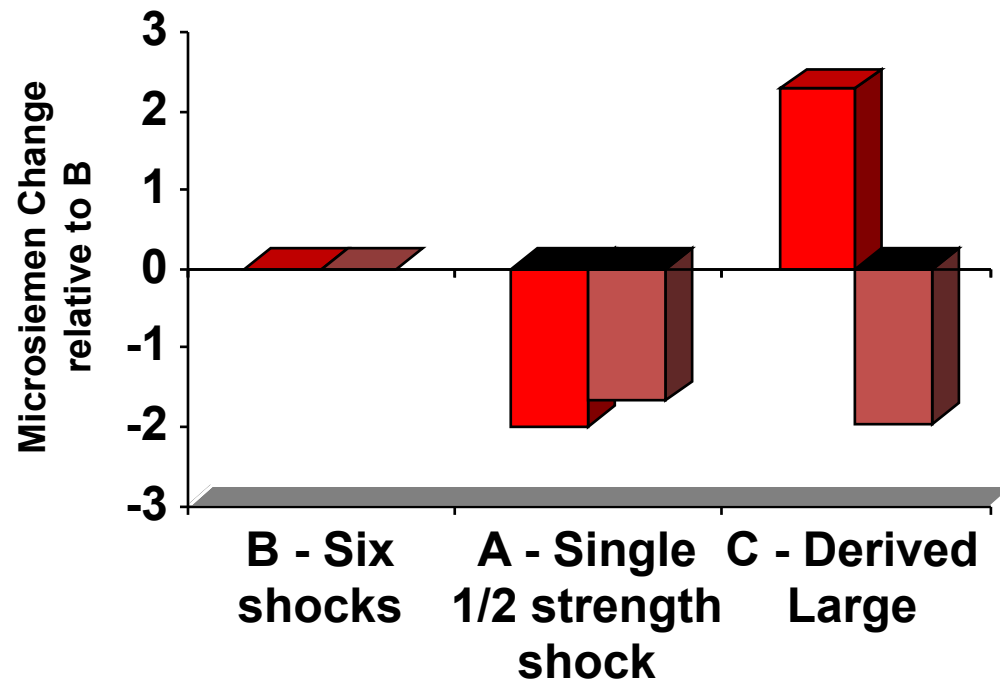
Establish this relational network in half of them using arbitrary stimuli:

$$A < B < C$$

Give B a CS shock function and then present a single 1/2 strength shock in the presence of A

Test the C stimulus . . .

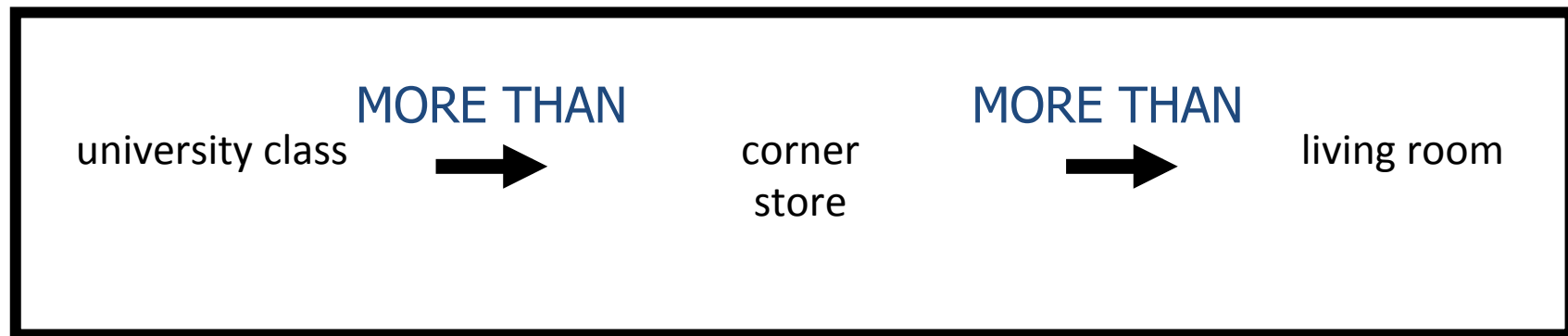
■ Relational Training ■ No Relational Training



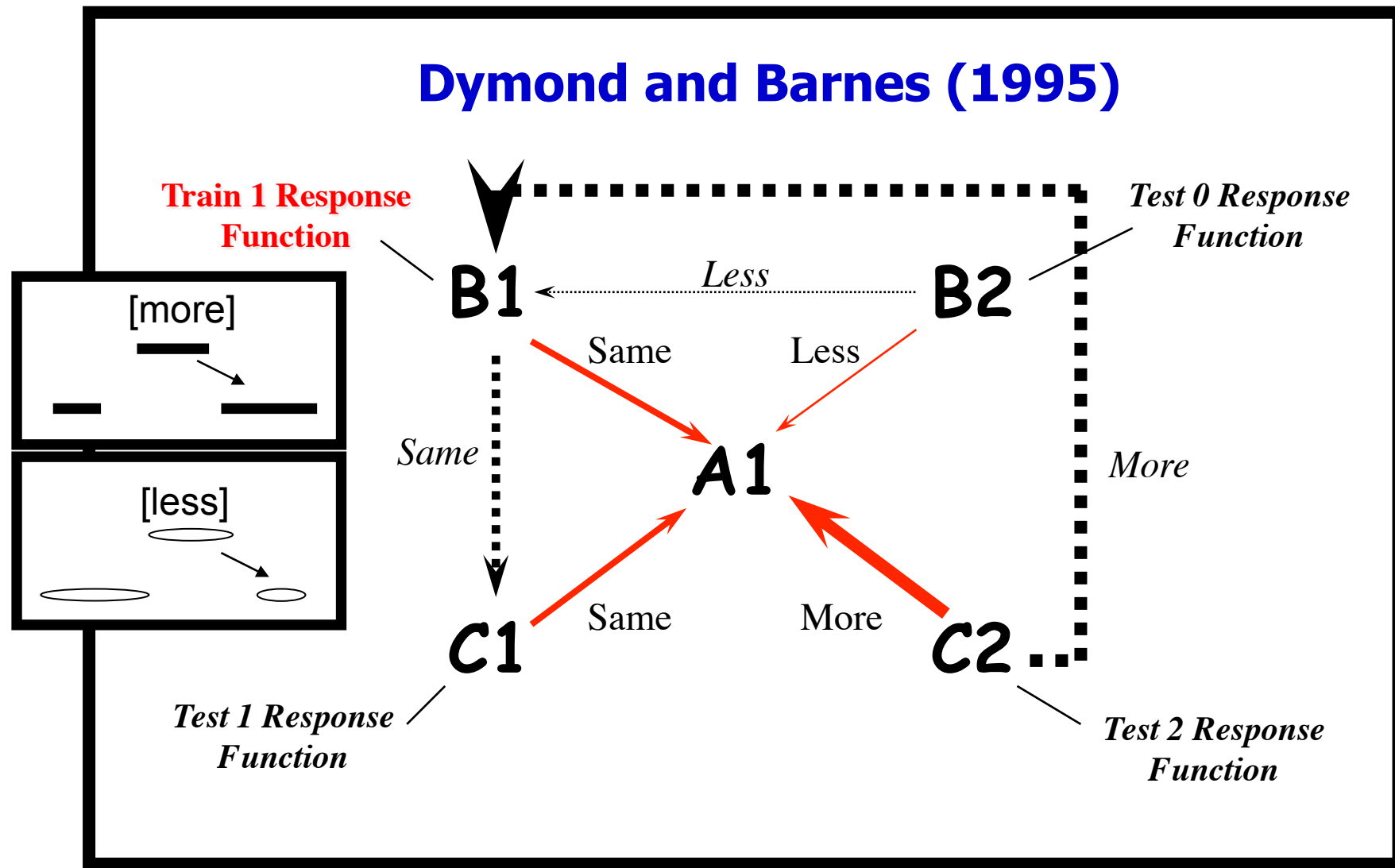
Dougher, Hamilton, Fink, & Harrington (2007)

## Derived Relations of Comparison

Panic attack in one's own living room results in increased arousal and avoidance of corner store and university class



# Contingency Learning - Operant Conditioning and ToF

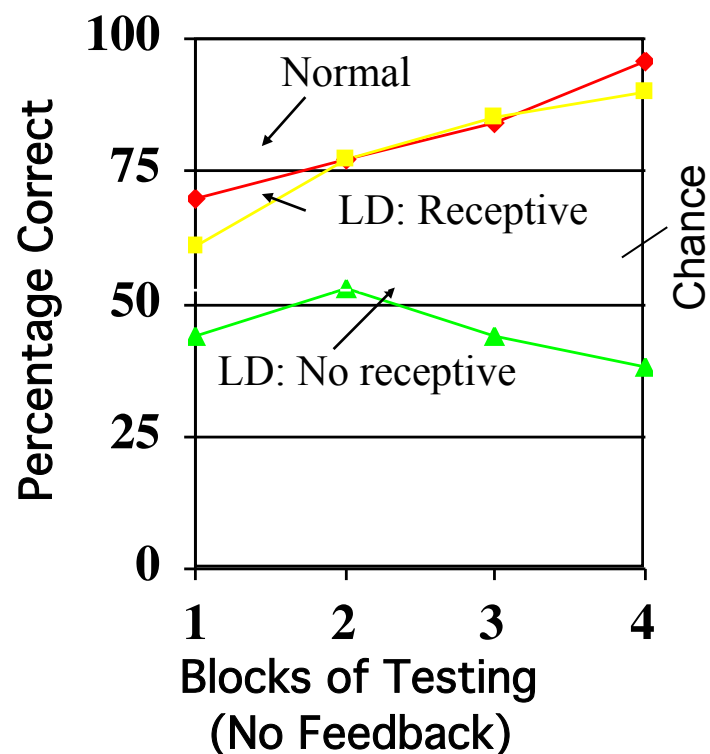




## Evidence that DRR and language are closely linked

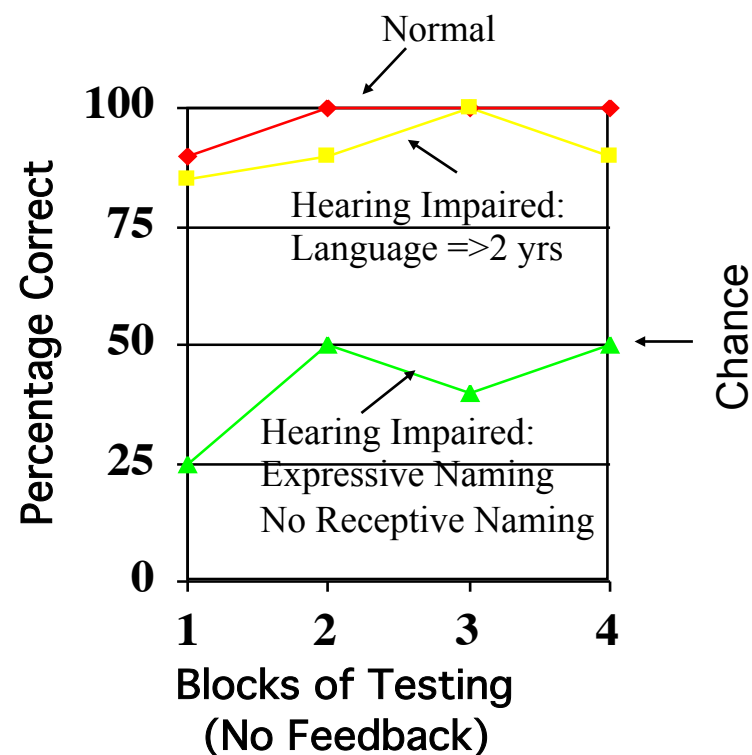
### Developmental

- DRR correlates with cognitive / verbal ability



Devany, Hayes, & Nelson (1986)

- ...and with the development of specific verbal skills



Barnes, McCullagh, & Keenan (1990)

## Evidence that DRR and language are closely linked

# Comparison with alternative paradigms

Hayes & Bissett (1998)

Derived relations produce priming effects

Priming Among Equivalent and Non-Equivalent Stimuli

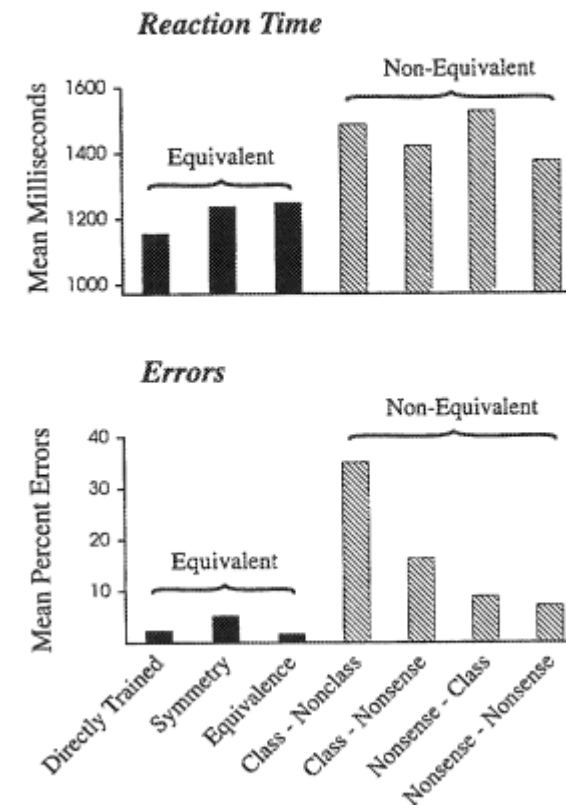


Figure 1. Priming, as measured by reaction time and percentage of errors, for equivalent and nonequivalent stimuli. Priming is indicated by lower scores in each case.

## Evidence that DRR and language are closely linked

# Neuropsychological

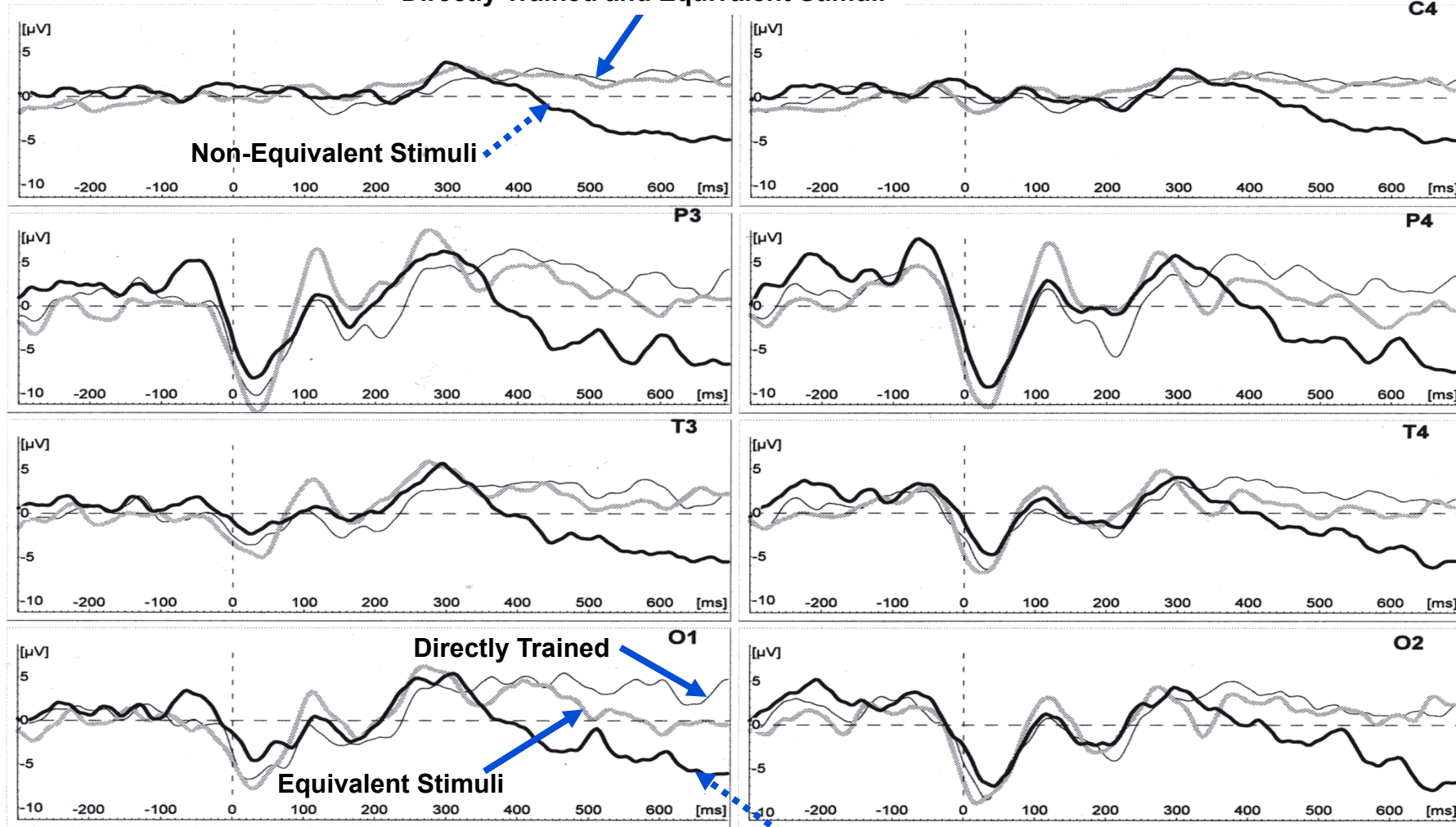
Derived relations produce differential ERPs

### Grand Averages for Each of the Eight Electrode Sites

Left Hemisphere

Directly Trained and Equivalent Stimuli

Right Hemisphere



Non-Equivalent Stimuli

BARNES-HOLMES ET AL. (2005)

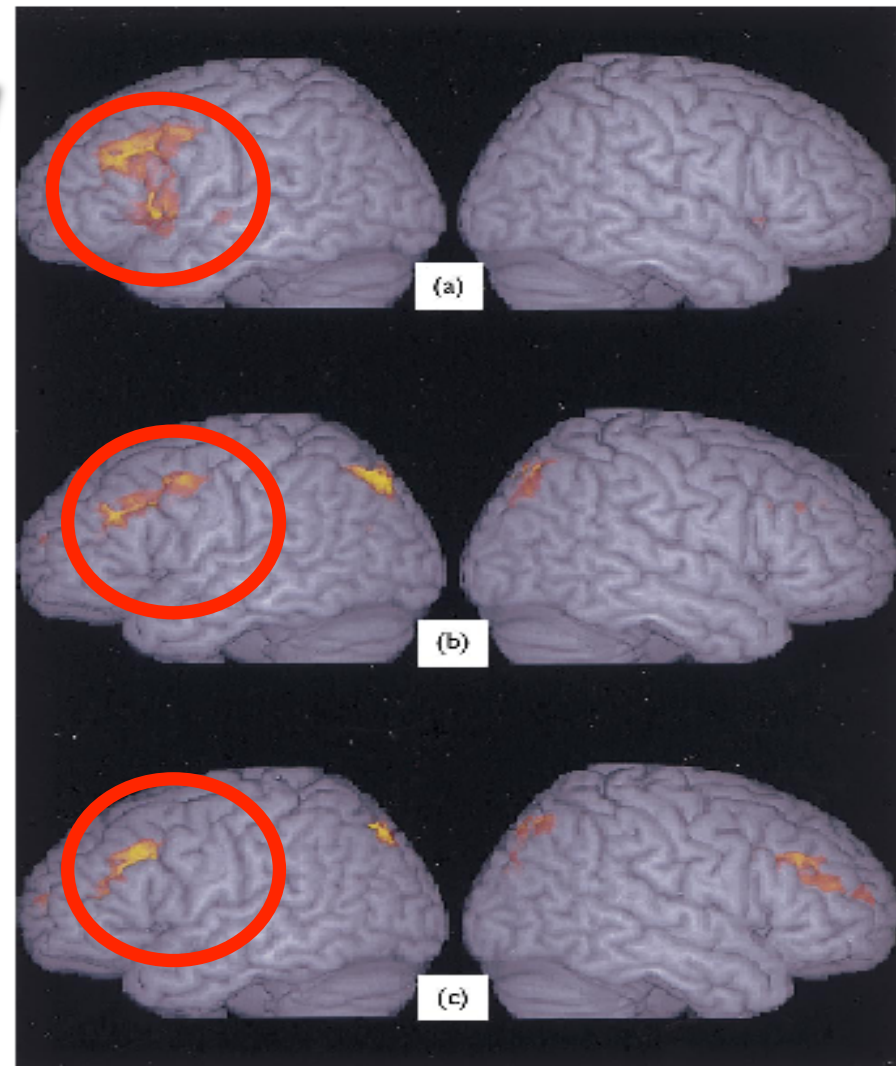
# ***Neuropsychological***

VERBAL FLUENCY

DERIVED RELATIONS (SUCCESS)

DERIVED RELATIONS (FAILURE)

Derived relations produce fMRI activation patterns that resemble those involved in semantic processing



**Fig. 2.** Lateral views of the SPM group activation maps. Each map is shown superimposed on an individual template brain, which has been spatially normalised into the SPM Talairach space. Colours represent the T statistic, thresholded at  $p < 0.05$  (corrected). In (a) the activation map is shown for the verbal fluency paradigm. In (b) the results are shown for transitivity, for successful subjects only. In (c) the activation map is for transitivity, for subjects who failed at this condition.

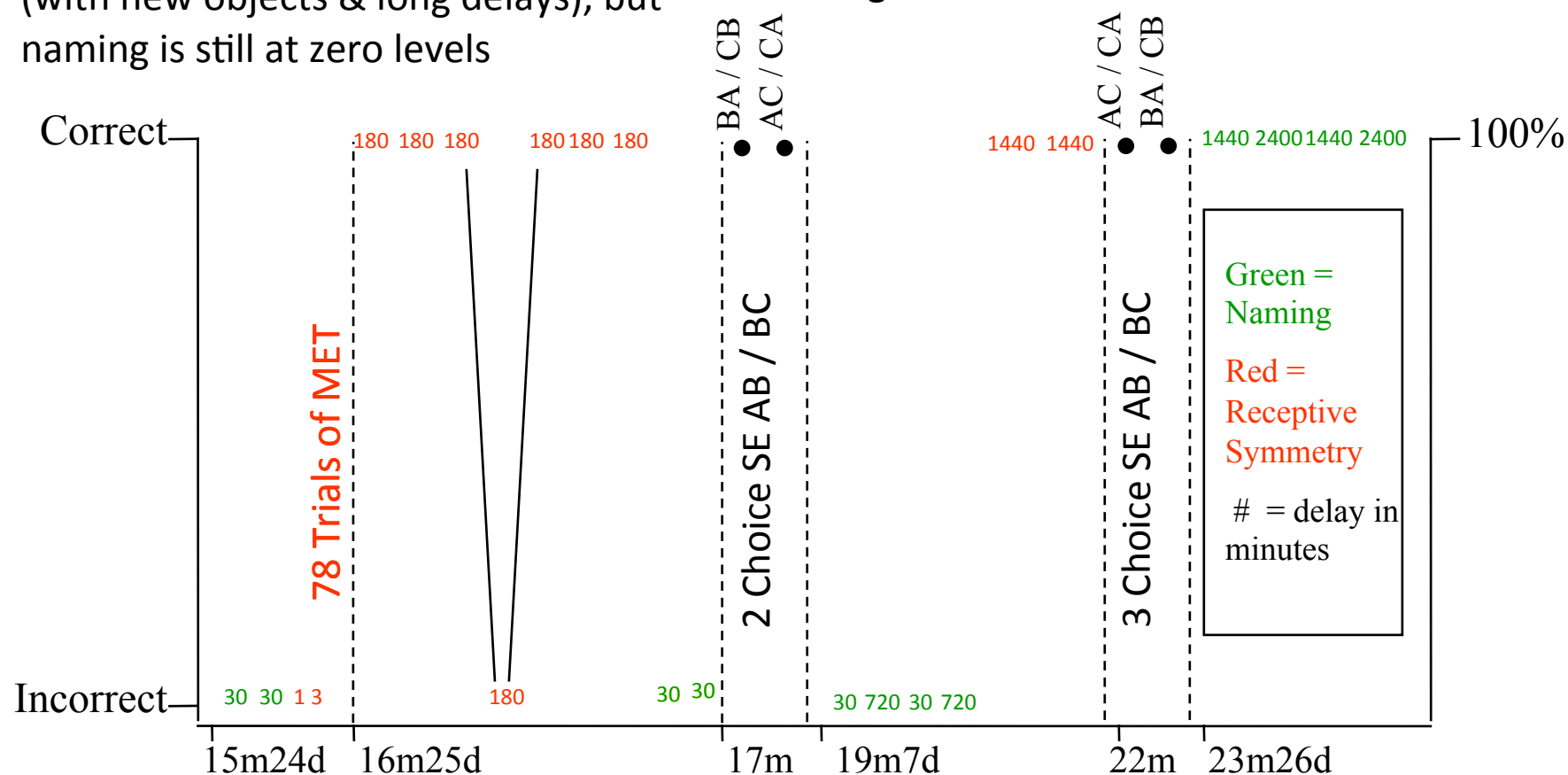
## Evidence that DRR and language are closely linked

### Developmental

MET produces receptive symmetry (with new objects & long delays), but naming is still at zero levels

& SE is there; +  
receptive sym w/ 12 hr  
delays but no  
naming

3 mo later naming  
finally catches up



Zero baselines in both, even with short delays

Luciano, Gomez & Rodriguez (2007)

# Evidence that DRR and language are closely linked

## Theory of Mind

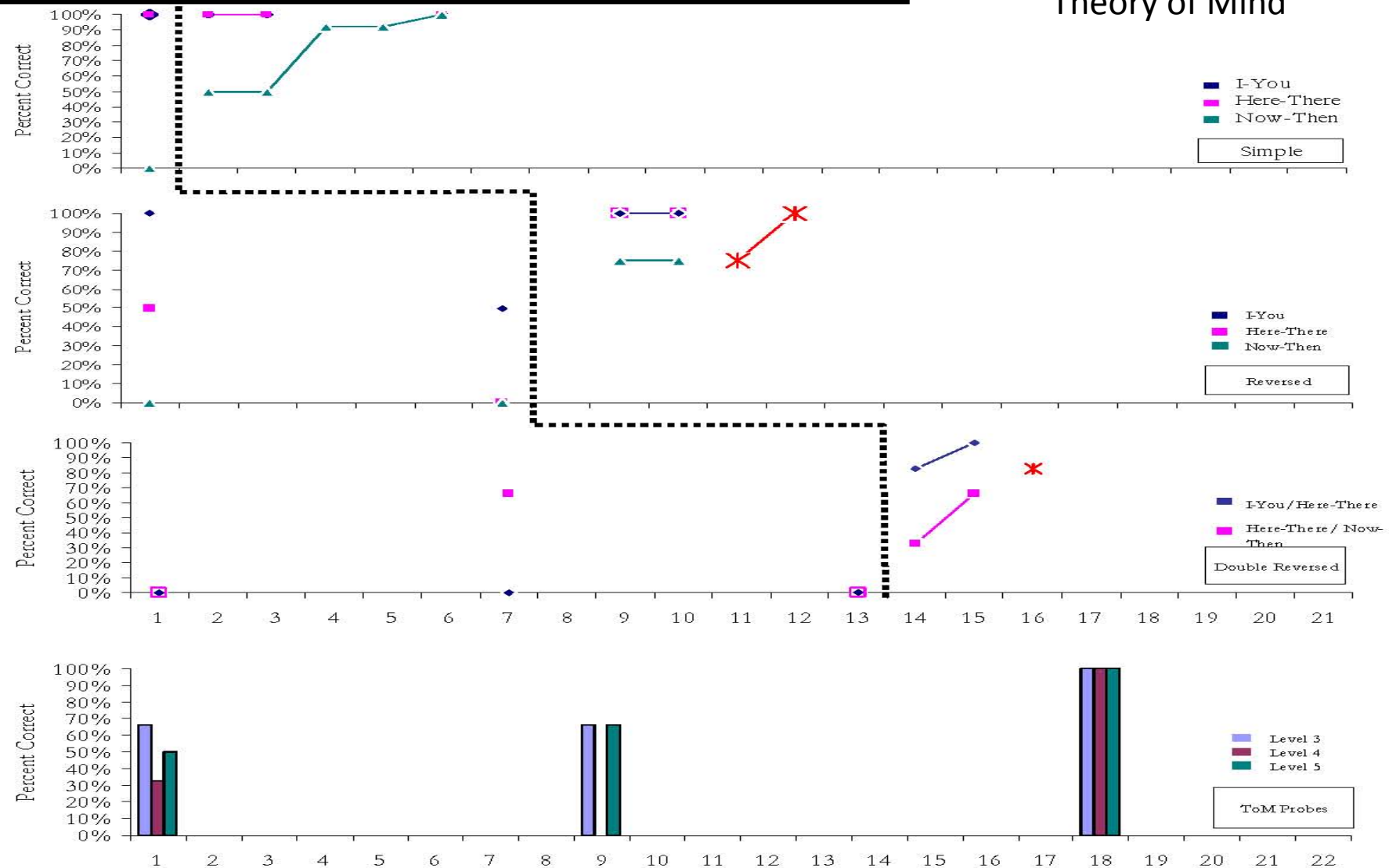
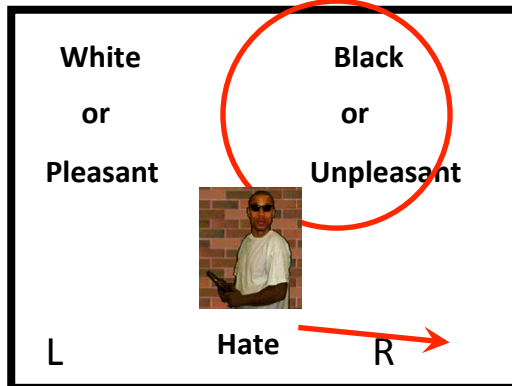
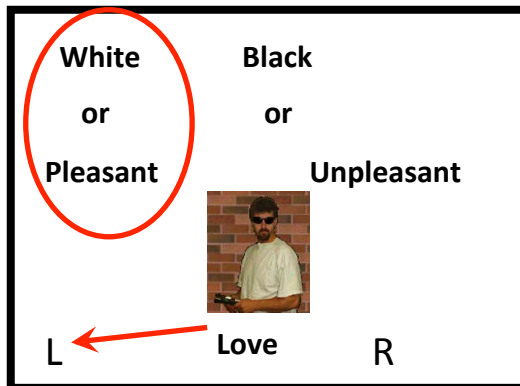


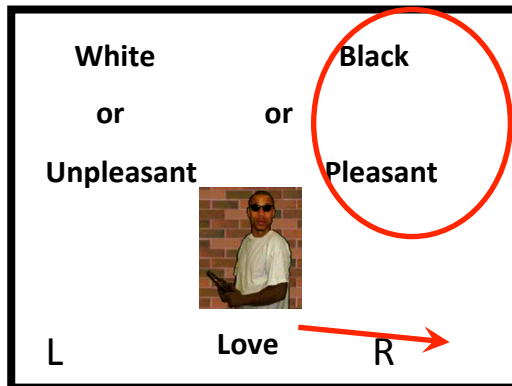
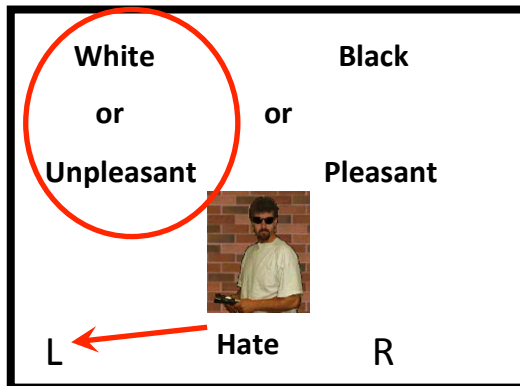
Figure 1. Within subject analysis for Aladdin. Multiple baseline across levels of Complexity includes data series for each deictic relational frame. The lower panel represents Theory of Mind probe percentages.

# Implicit Association Test

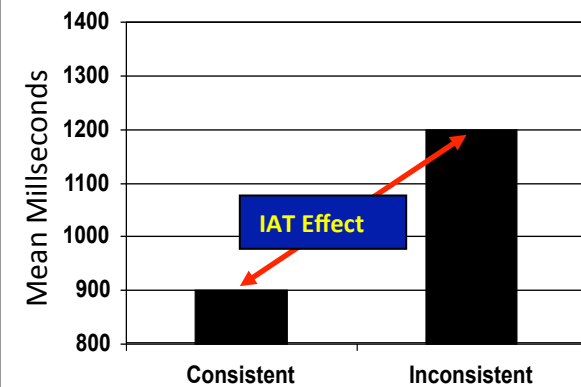
Consistent Tasks (Pro-White/Anti-Black Bias)



Inconsistent Tasks (Pro-Black/Anti-White Bias)



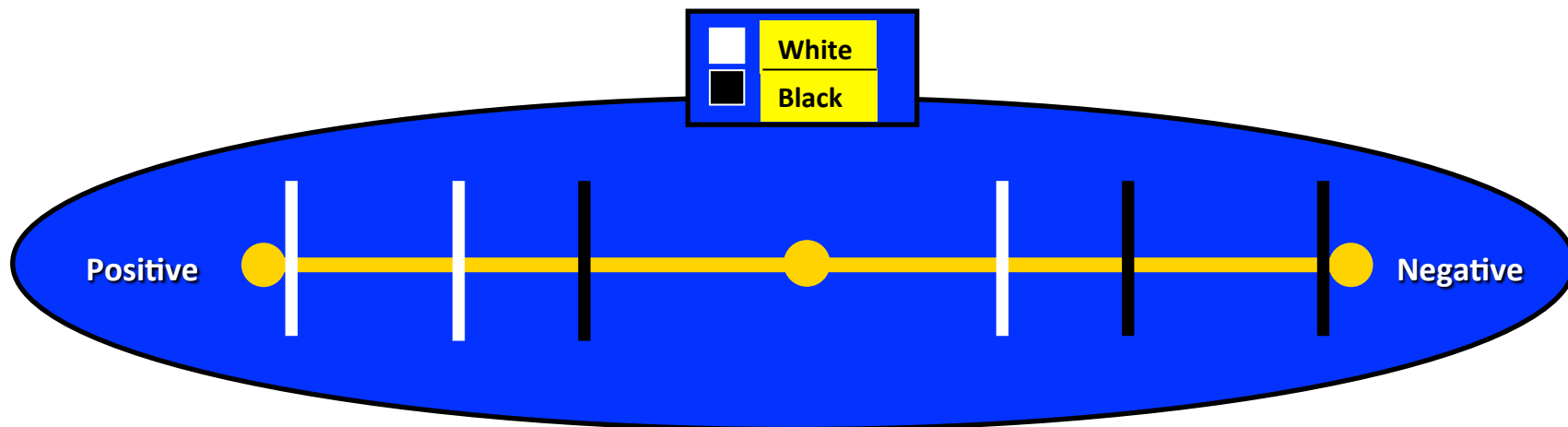
Numerous studies have shown that white participants tend to produce a pro-white/anti-black IAT effect:





# The IAT Limitation

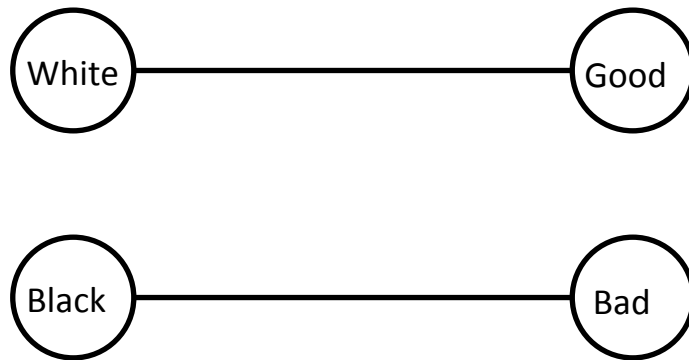
- One widely recognised limitation to the IAT is that it provides a measure of relative associative strength, which can mask the exact nature of the attitudes under study





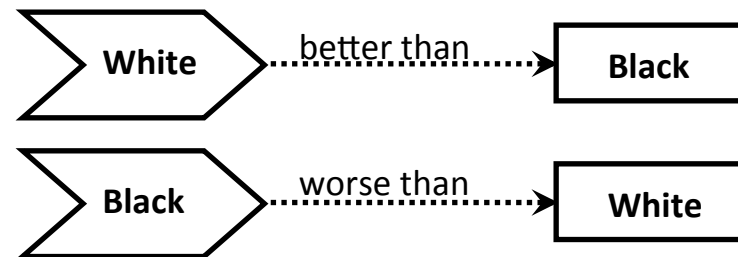
# Targeting associations rather than attitudes

Associations are Bi-directional Activations



Indirect Evidence for the Belief that White is Better than Black

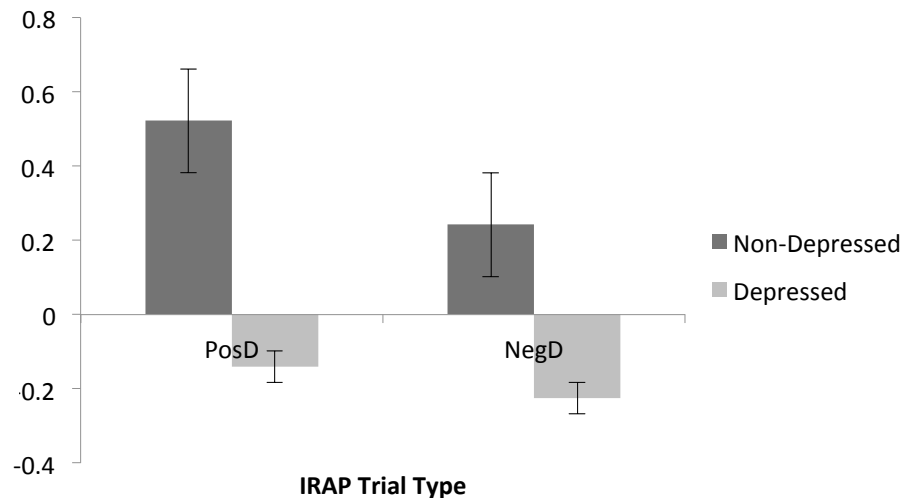
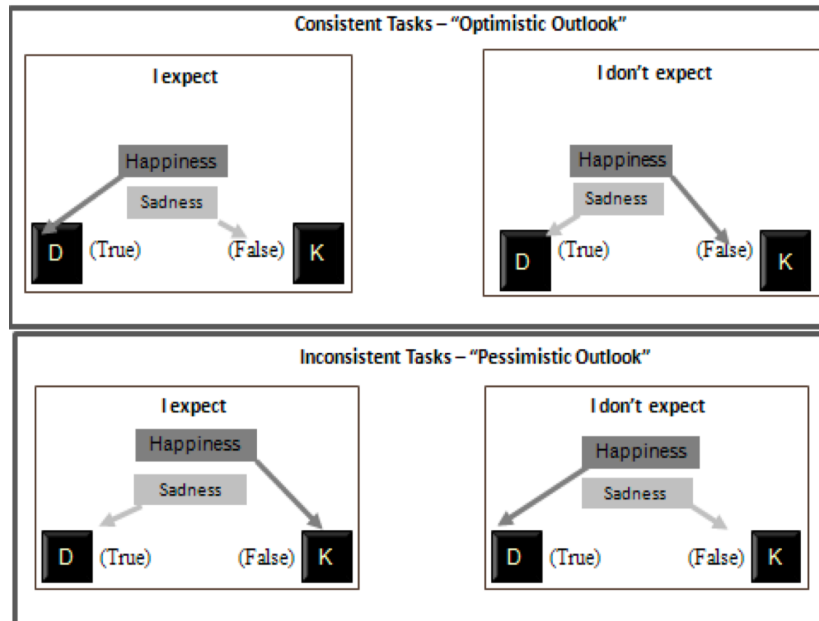
Attitudes and Beliefs Involve Relations/Propositions



Or Several Relations/Propositions



# IRAP predicts sub clinical depression based on future expectancies



# Wallace

- Intelligence is an adaptation to a knowledge-using, socially interdependent lifestyle, the “cognitive niche.”

BUT WHAT IS INTELLIGENCE?

DRR - OPERANT

# Pinker

Hominids evolved to specialize in the cognitive niche, which is defined by:

- 1. Reasoning about the causal structure of the world  
Multiple stimulus relations
- 2. Cooperating with other individuals  
Initial non verbal level  
Deictics
- 3. Sharing that knowledge and negotiating those agreements via language

# Symbolic Inheritance and Derived Relational Responding

