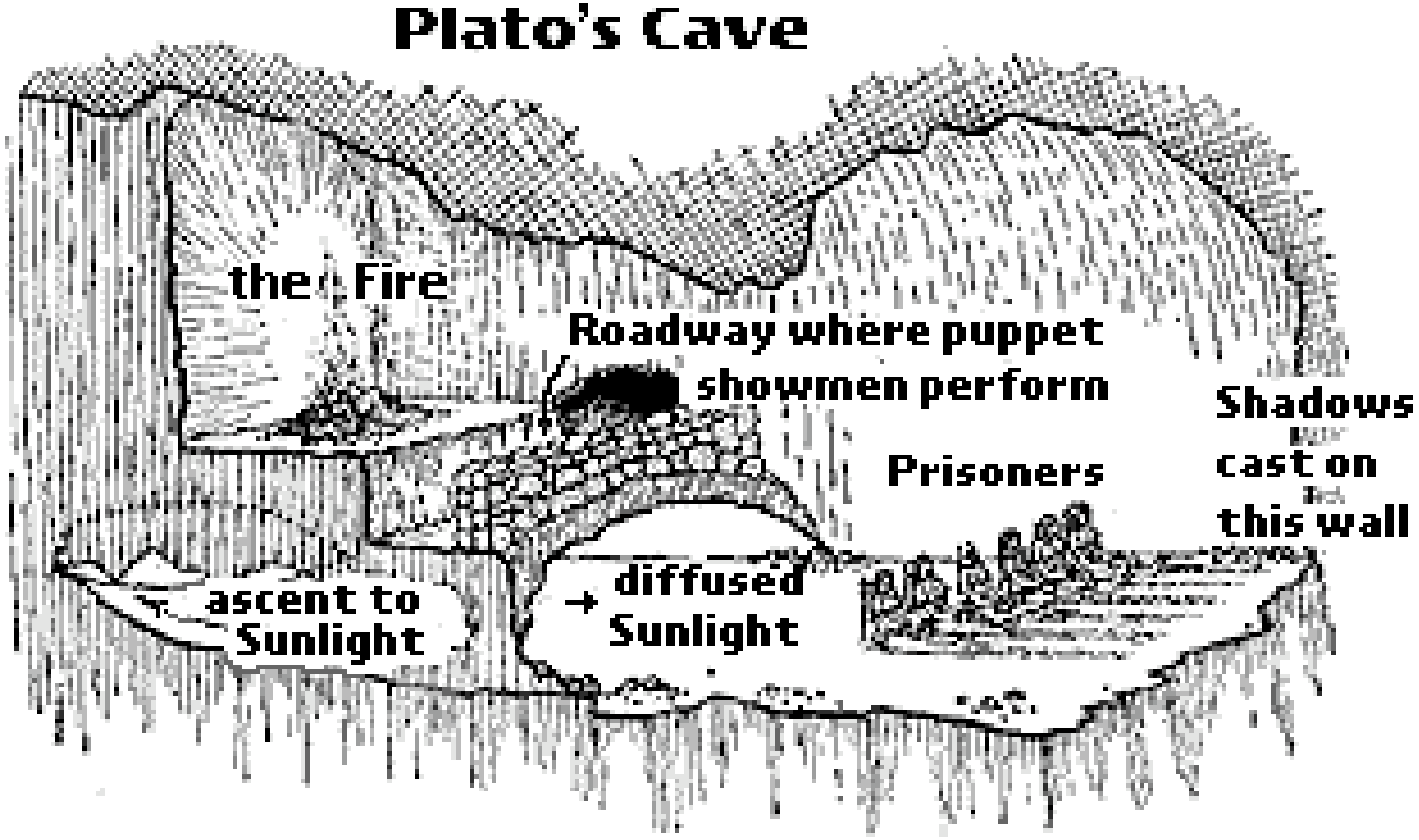
Research Designs

Overview

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

Latent and Observed Variables
The allegory of Plato's Cave



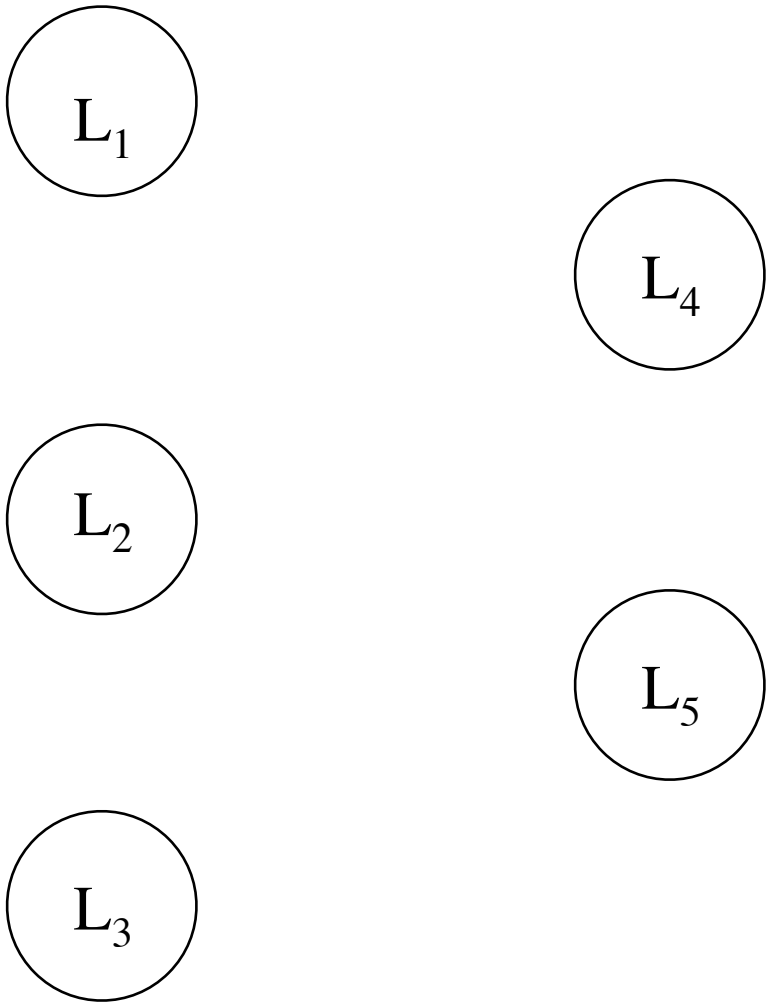
http://faculty.washington.edu/smcohen/320/cave.htm

Plato's Cave

Saenredam after Cornelis Cornelisz, *The Cave of Plato*, Engraving, 1604, (London, B

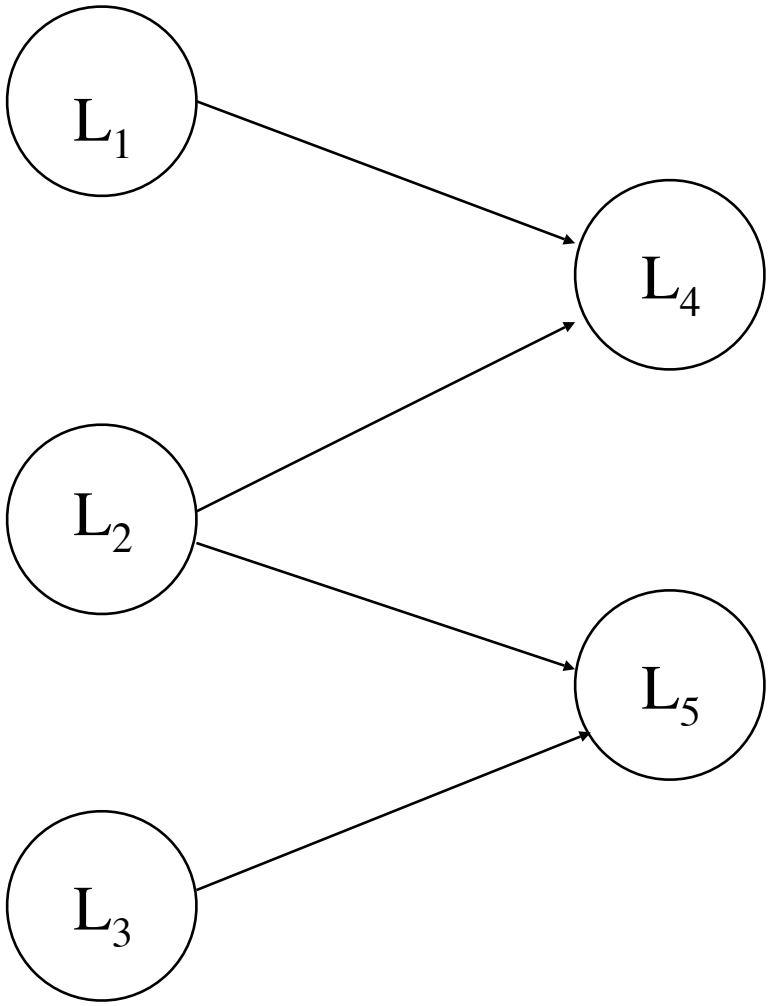
http://www.newcastle.edu.au/disciplne/fine-art/theory/analysis/plato.htm

Latent Variables



Theory as network of constructs

Theory=Organization of Latent Variables

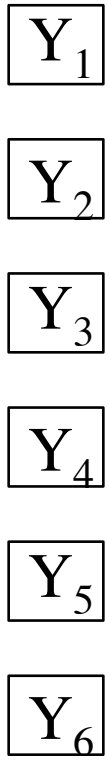


Theory as network of constructs

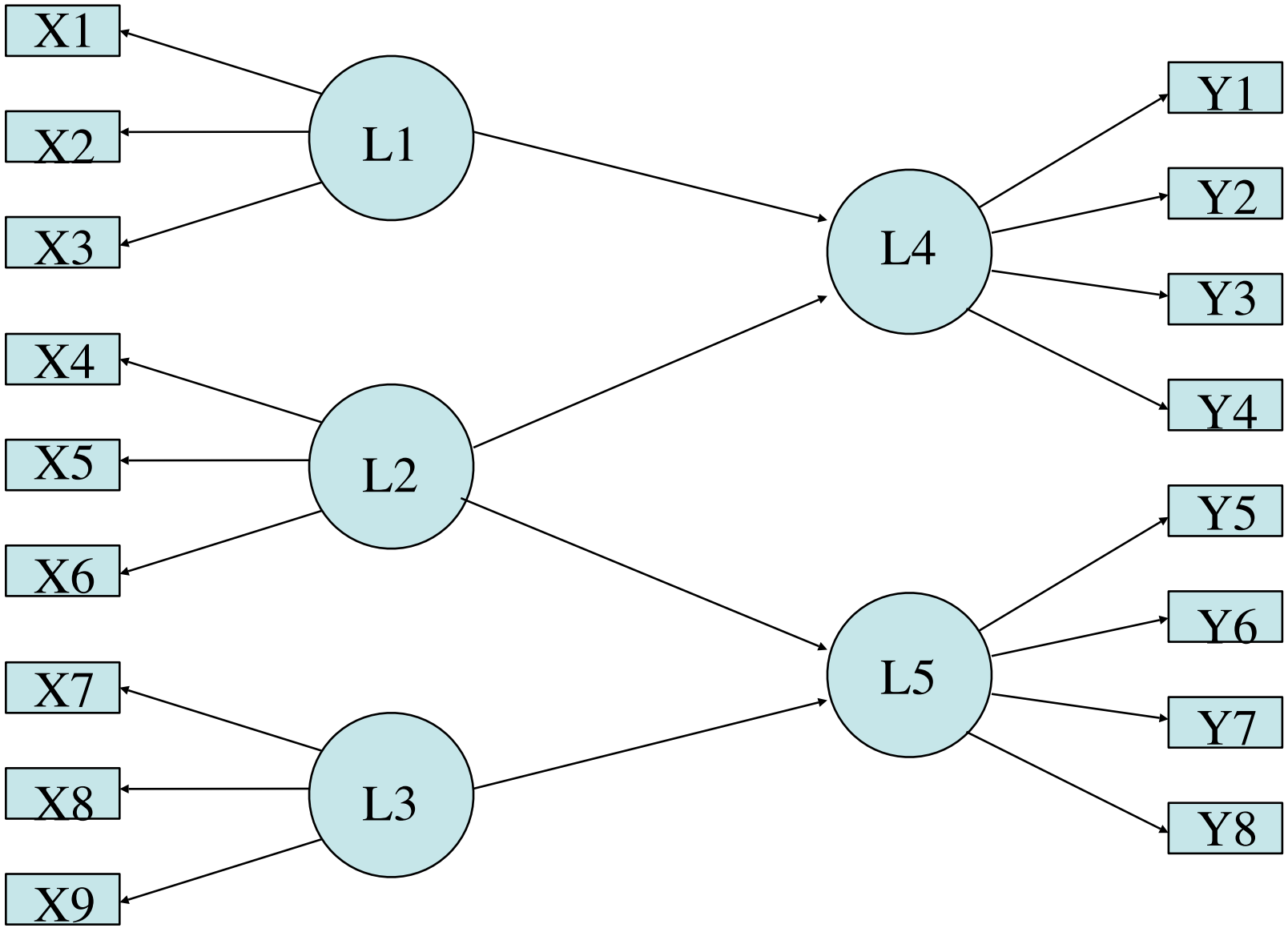
Examples of psychological constructs: how to operationalize them as observables

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

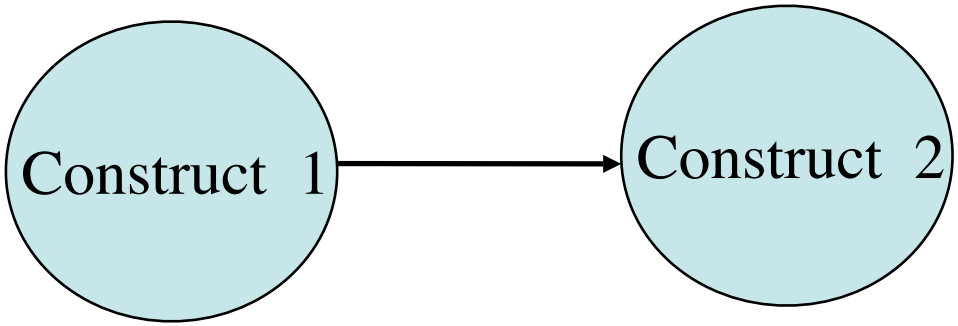
Observed Variables



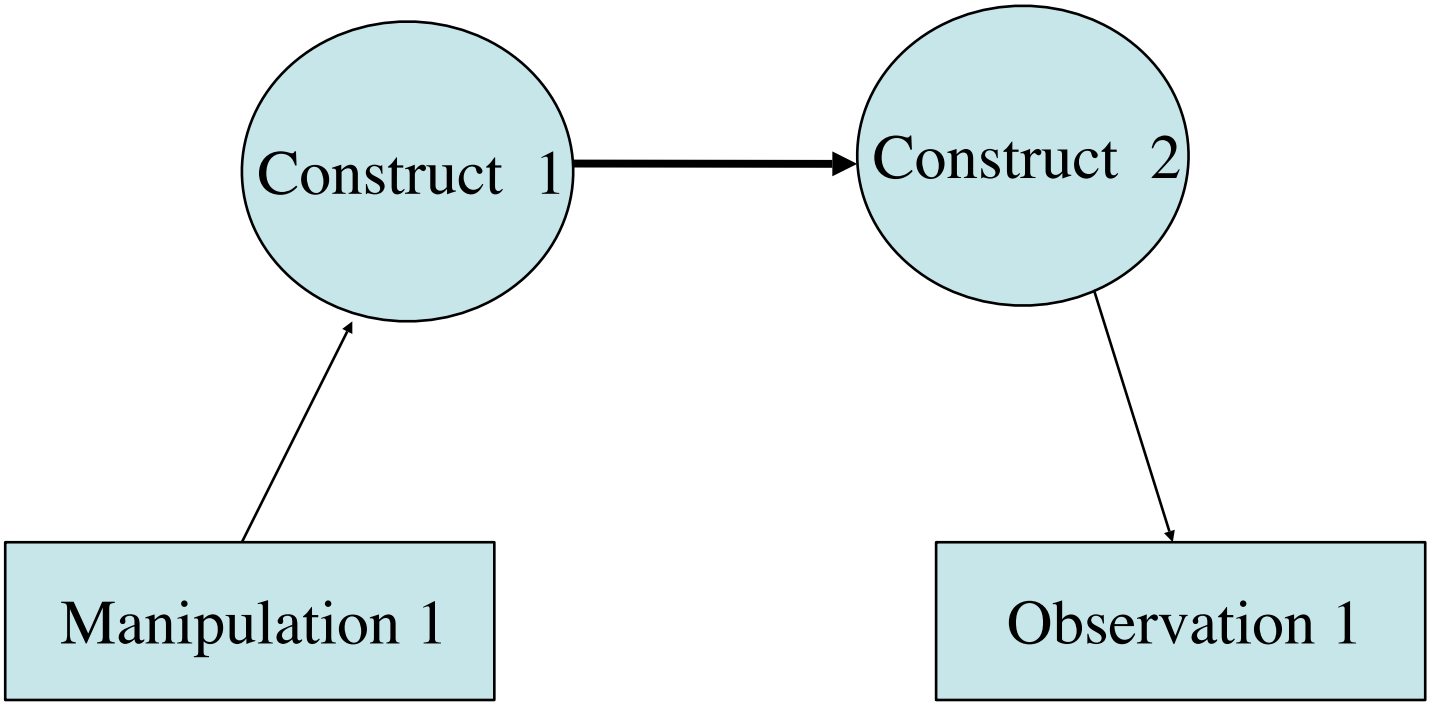
Theory + Data



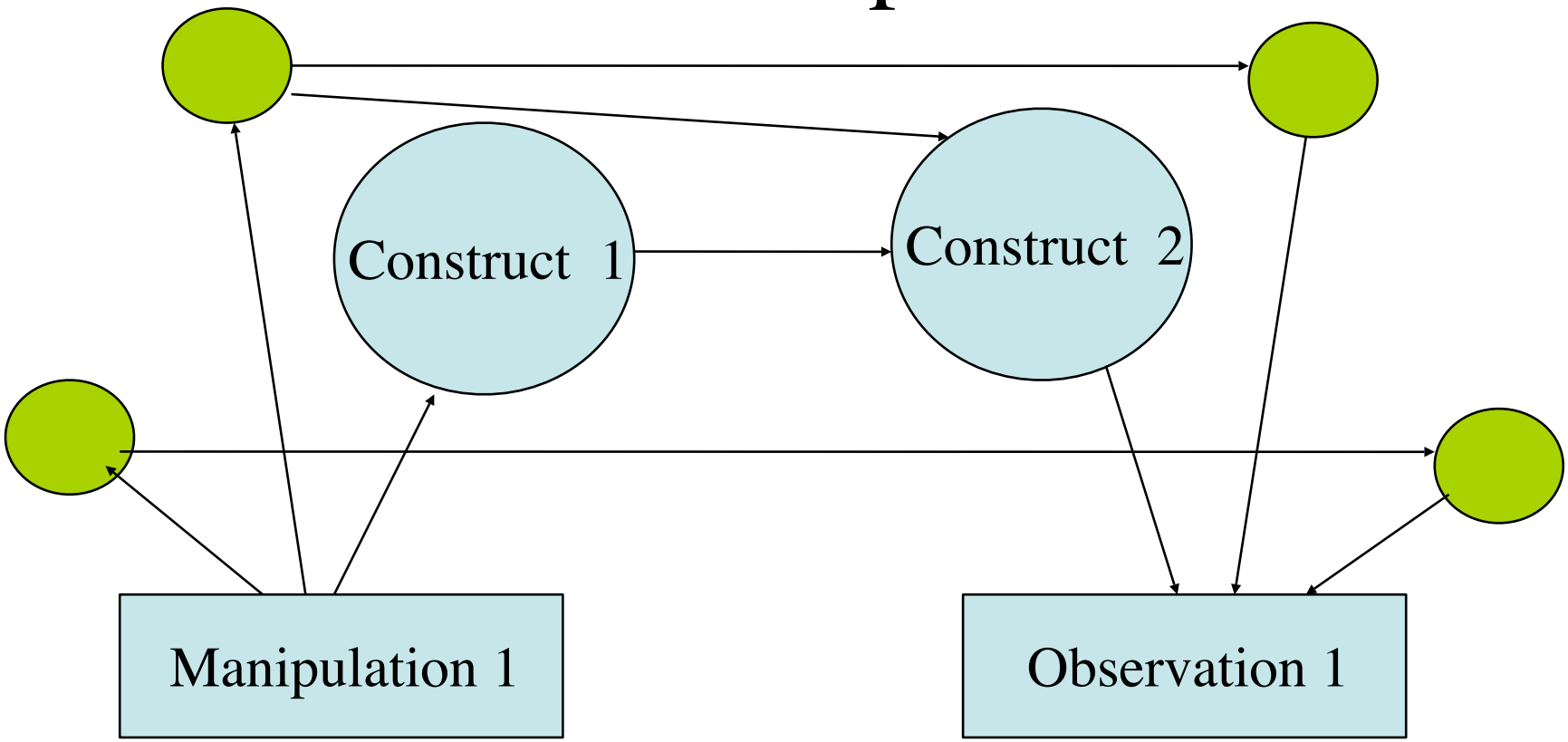
Theory and Theory Testing I: Theory



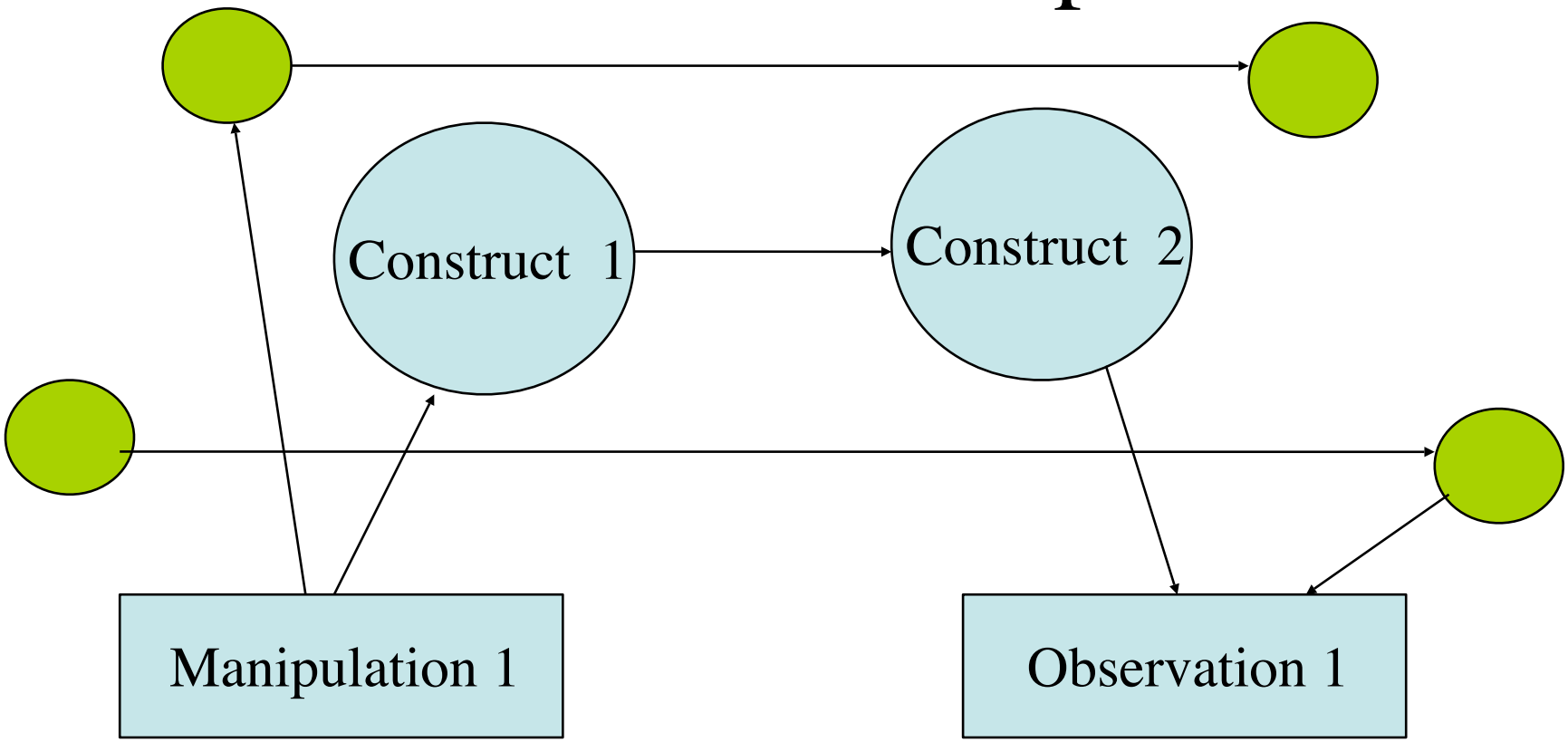
Theory and Theory Testing II: Experimental manipulation



Theory and Theory Testing III: Alternative Explanations



Theory and Theory Testing IV: Eliminate Alternative Explanations



Multiple ways of asking theoretical questions

- Observational-correlational
  - Correlations across people
  - Correlations across time
- Experimental
  - Within Subjects
  - Between Subjects
  - Mixed
- Quasi-experimental and field studies

Two Disciplines of Psychological Research

(Cronbach, 1957, 1975; Eysenck, 1966, 1997)

B=f(Personality)	B=f(P*E)	B=f(Environment)
	Darwin	
Galton		Weber, Fechner
Binet, Terman		Watson, Thorndike
Allport, Burt	Lewin	Hull, Tolman
Cattell	Atkinson, Eysenck	Spence, Skinner
Epstein		Mischel

Two Disciplines of Psychological Research

	B=f(Person)	B=f(Environment)
Method/ Model	Correlational Observational Biological/field	Experimental Causal Physical/lab
Statistics	Variance Dispersion Correlation/ Covariance	Mean Central Tendency t-test, F test
Effects	Individuals Individual Differences	Situations General Laws
	B=f(P,E) Effect of individual in an environment Multivariate Experimental Psychology	

Types of designs and types of theorists

- Correlational
- Importance of individual
- Variance and covariance
- r
- Observation
- Analogous to biological sciences (but consider oceanography, geology)

- Experimental
- Importance of situation
- Mean
- F and t test
- Manipulation
- Analogous to Physical sciences (but consider microbiology)

True Experiments

- Direct manipulations thought to affect underlying causal constructs
- Direct measurements thought to reflect underlying constructs
- Need to eliminate alternative explanations

Types of experimental designs

- Within subject designs
  - controls for subject variability
  - two or more conditions -- repeated many, many times
  - confounds practice/order effects with manipulation
- Between subject designs
  - Subject variables as an alternative explanation of results -- threats to validity
  - Randomization as a control
- Mixed -- Within/Between
  - Some variables studied between subjects
  - Some variables studied within subjects

Questions for evaluating research

- What are the basic constructs being studied?
- What are the particular operationalizations (observations) associated with the constructs?
- How much of the variability in a construct is due to the (experimental manipulation) independent variable?
- What are possible alternative sources of variation?

Examples of logical design

- Madsen and McGaugh
  - Electroconvulsive shock in rats
- Roediger and McDermott
  - False learnings in humans

Madsen and McGaugh: The effect of ECS on one-trial avoidance learning

Meta-Theoretical Question

(1) the process of memory consolidation

(2) a desire to study the timing and effects of memory consolidation

(3) work has continued with biochemical markers for memory consolidation as well as an examination of neural structures involved in consolidation

Prior work

ECS disrupts memory consolidation

Alternative explanations

ECS induces fear which inhibits action, rather than disrupts memory

Theoretical statement

(1) if ECS interferes with memory, then ECS should inhibit step-down avoidance

- (2) if ECS induces fear, then ECS should facilitate step-down avoidance

Madsen and McGaugh Method

subjects

maze bright and maze dull rats

apparatus

step down avoidance plate

procedure

(a) one trial step down

(b) shock/no-shock

(c) retest 24 hours late

Madsen and McGaugh-Results

Shock/no shock	Control	ECS
Avoid/not avoid		
i) Avoid	26	8
ii) Not avoid	23	39

X^2 test of association = 11.67

(hypothesis of no association is rejected)

Roediger and McDermott

Meta-theoretical question

(1) memory as photograph versus memory as reconstruction

(2) “recovered” childhood memories of trauma versus “false” memories

(3) legal testimony of accuracy of memory

Roediger and McDermott-background

Prior work

(1) memory distortions over time -- Bartlett

(2) reconstructive memory -- Loftus

(3) low error rates in recognition memory -- Underwood

(4) intrusions in free recall -- Deese

Roediger and McDermott

Alternative explanations for memory effects

(1) connection strength models of memory

(2) network models of association

Theoretical statement

(1) not testing theory but rather testing phenomenon

(2) need to get a robust measure of false memory in order to study it

Roediger and McDermott Study 1

Materials

(a) 6 lists of 12 words with high associates of 6 target lures

(b) recognition list

i) 12 studied words

ii) 6 target lures

iii) 12 weakly related

iv) 12 unrelated

Procedure

(a) verbal presentation of each list

(b) free recall after each list

(c) recognition 2 minutes after all lists had been presented

Results

(a) recall shows serial position effects

(b) intrusion errors almost as strong as low point of serial position

(c) recognition errors are frequent

Roediger and McDermott Study 2

Materials

(a) 16 lists

procedure

results

Our study

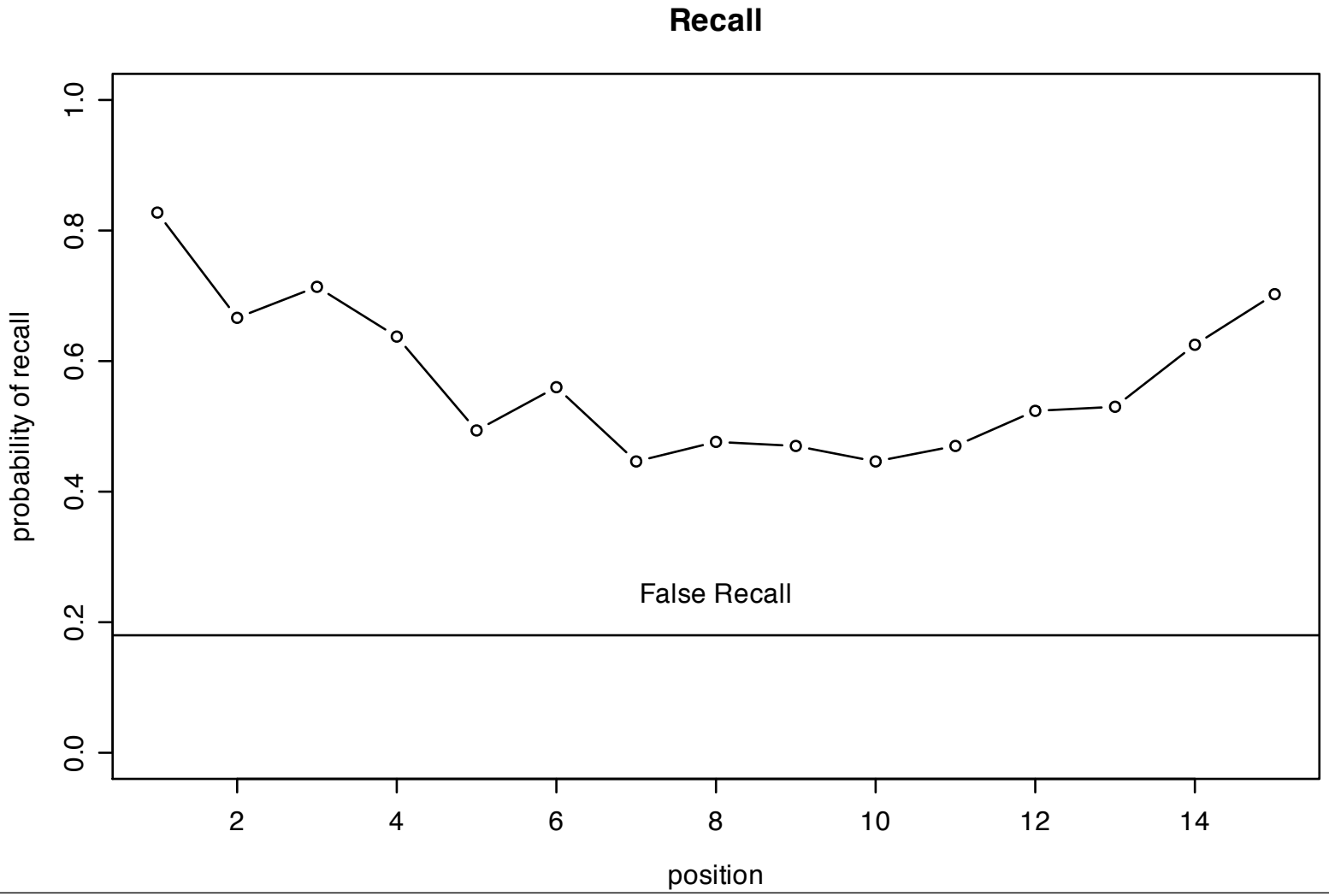
- Replication and extension of Roediger and McDermott
- Based upon prior work in 205, discovered that recall interval had an effect on subsequent false recognition.
- Within subject study
  - Time of study (2 vs. 3 seconds)
  - Time of recall (45 vs. 90 seconds)
  - Recall vs. no recall (math vs. recall)

Class Design- counterbalancing

List	Time	Recall	A/B
1	2	45	Recall
2	3	90	Math
3	3	45	Math
4	2	90	Recall
5	3	90	Recall
6	2	45	Math
7	2	90	Math
8	3	45	Recall
9	3	90	Math
10	2	45	Recall
11	2	90	Recall
12	3	45	Math
13	2	45	Math
14	3	90	Recall
15	3	45	Recall
16	2	90	Math

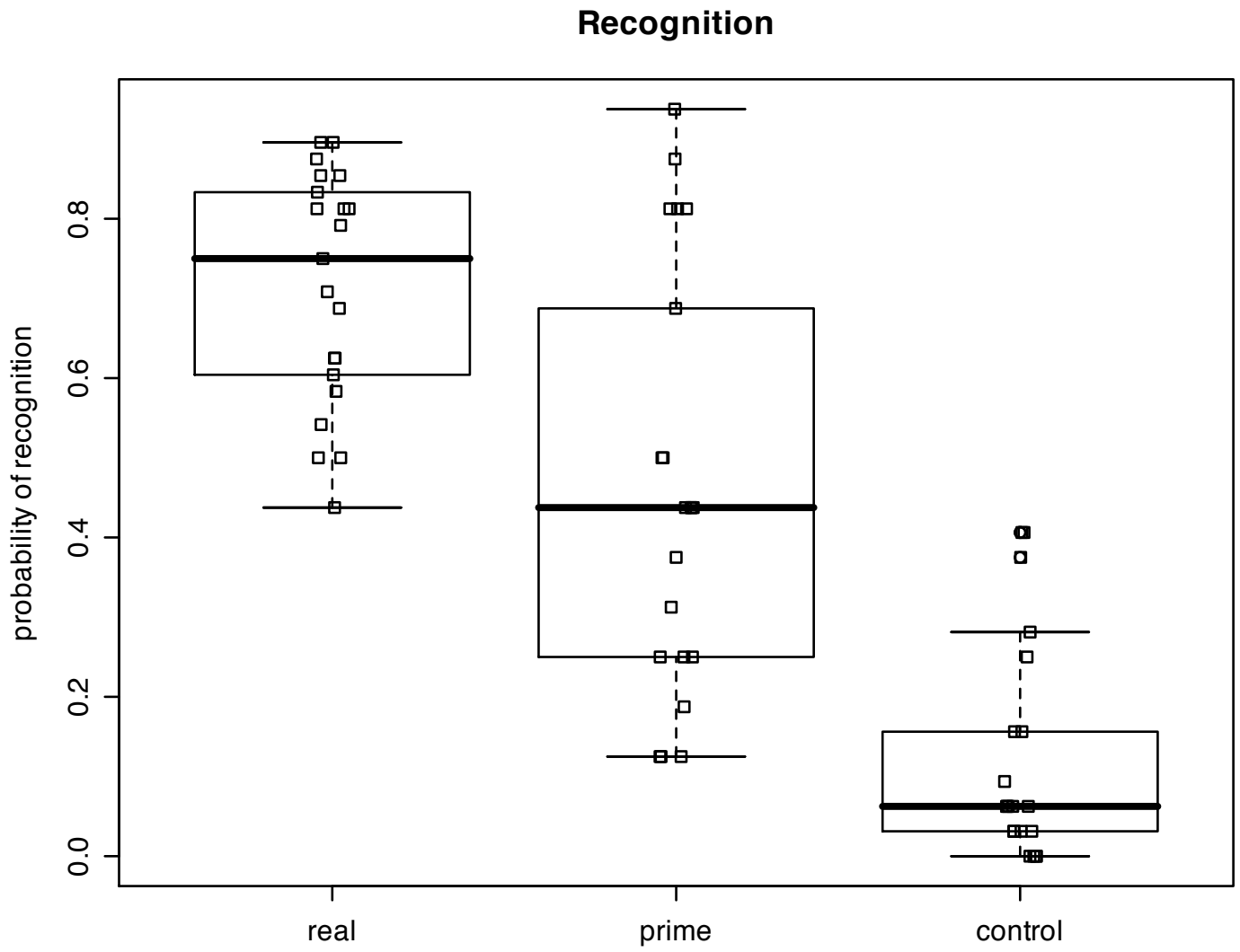
Recall by serial position

```
recall.stats <-   describe(position)
plot(recall.stats$mean/8,ylim=c(0,1),type="b",ylab="probability of recall", xlab="position", main="Recall")
abline(h=.18)
 text(8,.25,"False Recall")
```



Recognition by word type

boxplot(recognition,ylab="probability of recognition",main="Recognition")
stripchart(recognition,method="jitter",jitter=.05,vertical=T,add=T)



Analysis of results

- Descriptive statistics of effects
  - what are the means by conditions
    - mean recognition for words on recall trials
    - recall and later recognition as a function of study interval
    - recall and later recognition as a function of recall interval
    - does recalling a word facilitate later recognition

Calculate Conditional Probabilities

```
attach(memory)
probcrecall <- prr/(prr+prnr)
probcnrecall <-pnrr/(pnrr+pnrnr)
probfrecall <- crr/(crr+crnr)
probfnrecall <- cnrr/(cnrr+cnrnr)
conditional <- data.frame(correctrecall =probcrecall,
correctnotrecall  =  probcnrecall,  falserecall = probfrecall,
falsenotrecall = probfnrecall)
boxplot(conditional,ylab="conditional probability",main="Probability
of Recognition depends upon prior recall" )
stripchart(conditional,method="jitter",jitter=.05,vertical=T,add=T)
```

Preliminary results