Research Designs

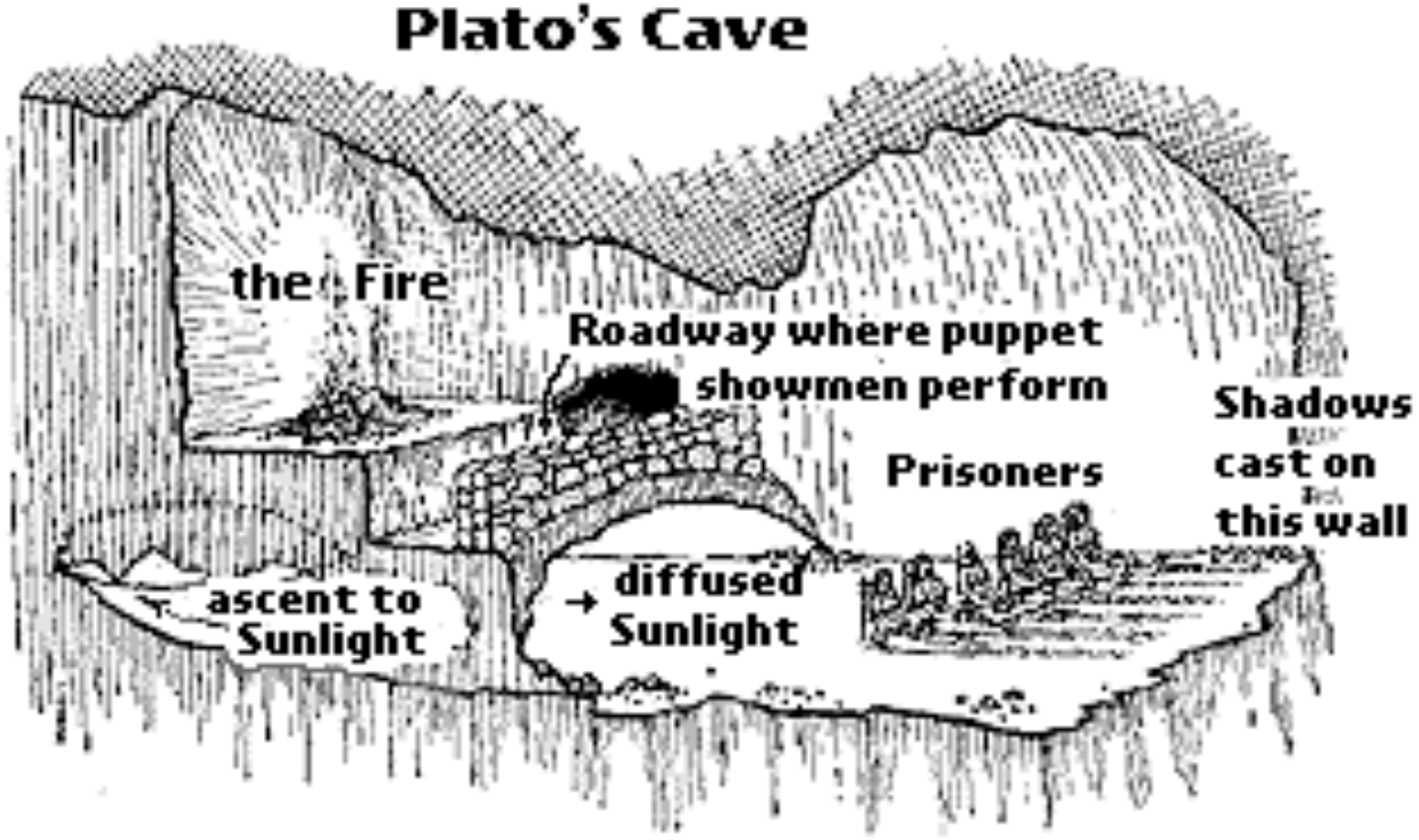
Overview

- Some one tells you they love you. What does that mean? How do you know?
- You think someone is intelligent. What does that mean? What do you use to make that inference?
- Absence makes the heart grow fonder but proximity leads to propinquity. How can both of these be correct?

Theory development and testing

- Theories as organizations of observable variables
- Constructs, latent variables and observable variables
  - Observable variables
    - Multiple levels of description and abstraction
    - Multiple levels of inference about observable variables
  - Latent Variables
    - Latent variables as the common theme of a set of observations
    - 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



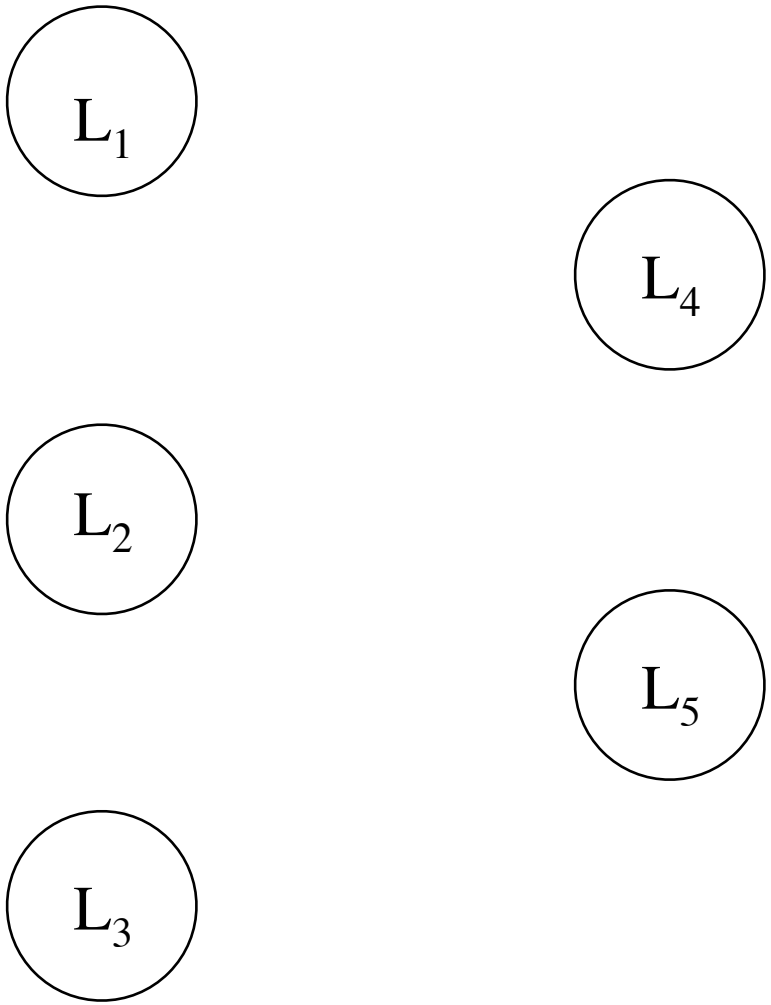
http://faculty.washington.edu/smcohen/320/cave.htm

Plato's Cave

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

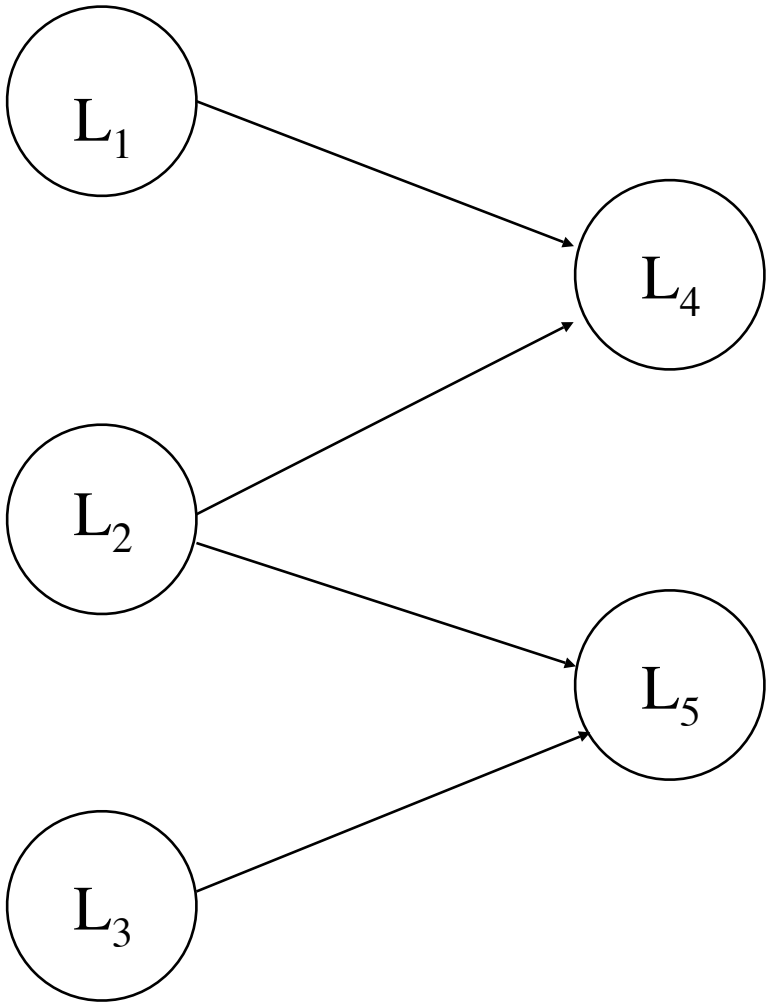
http://www.newcastle.edu.au/disciplne/fine-art/theory/analysis/plato.htm

Latent Variables



Theory as network of constructs

Theory=Organization of Latent Variables

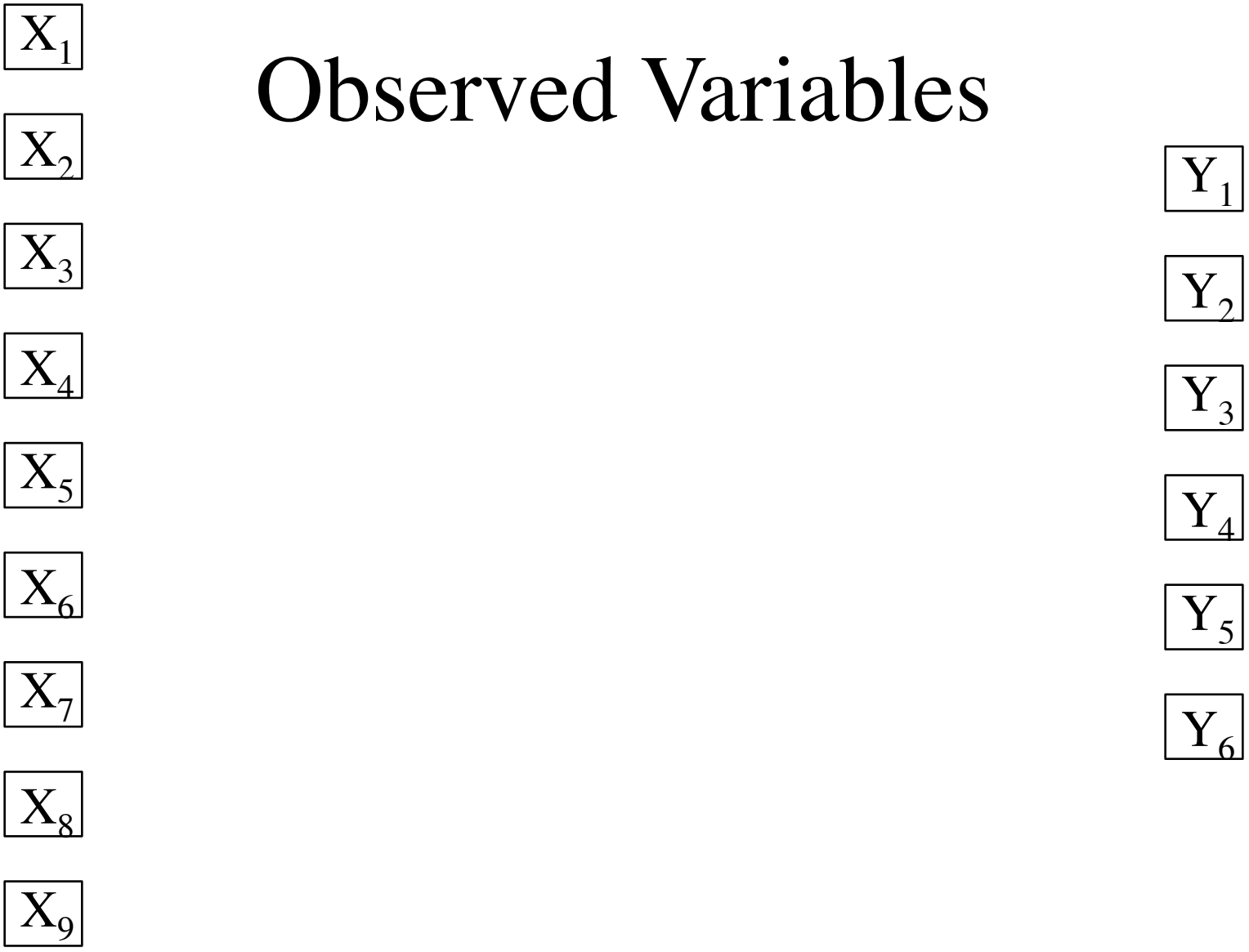


Theory as network of constructs

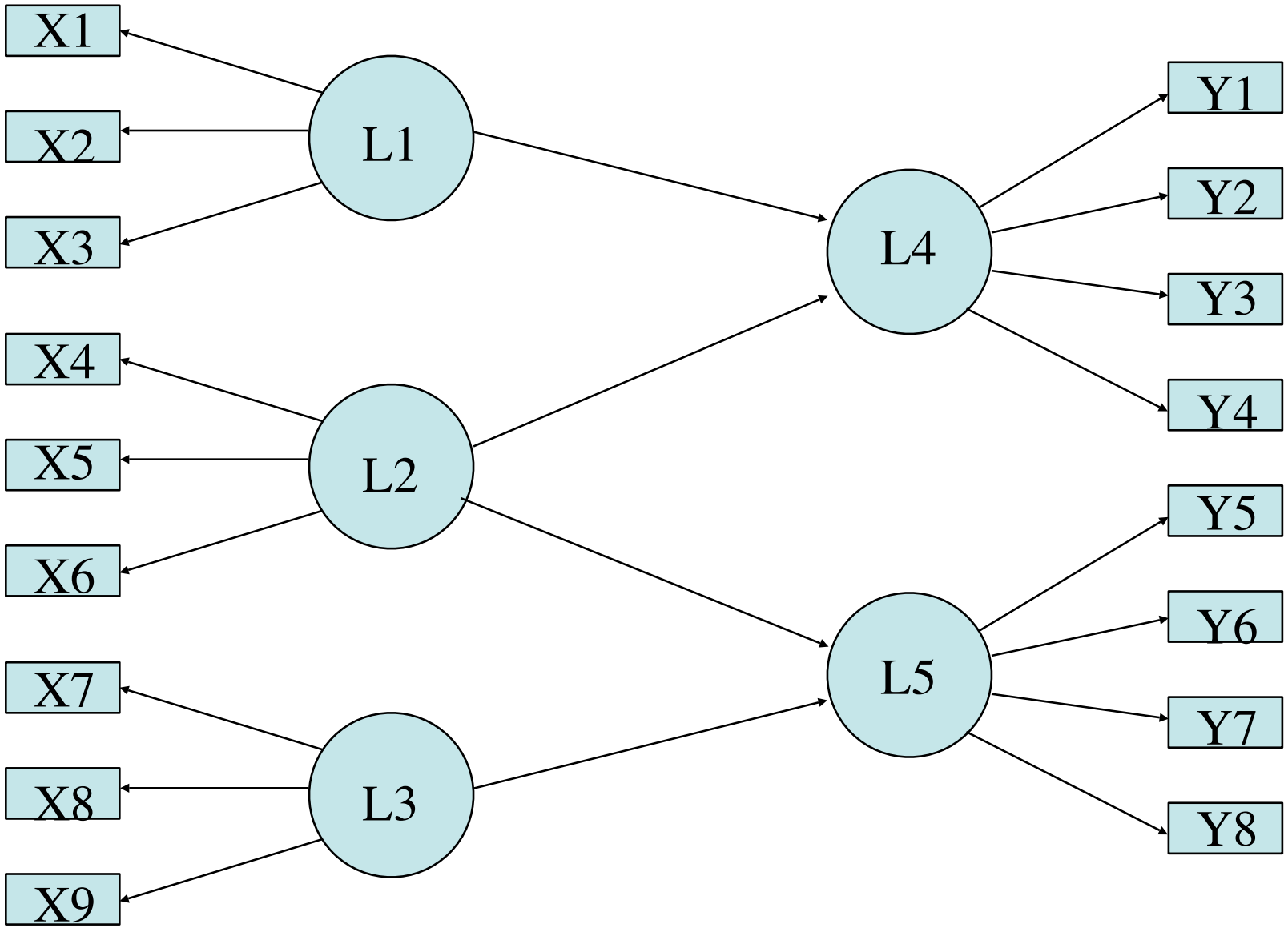
Examples of psychological constructs: how to operationalize them as observations

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

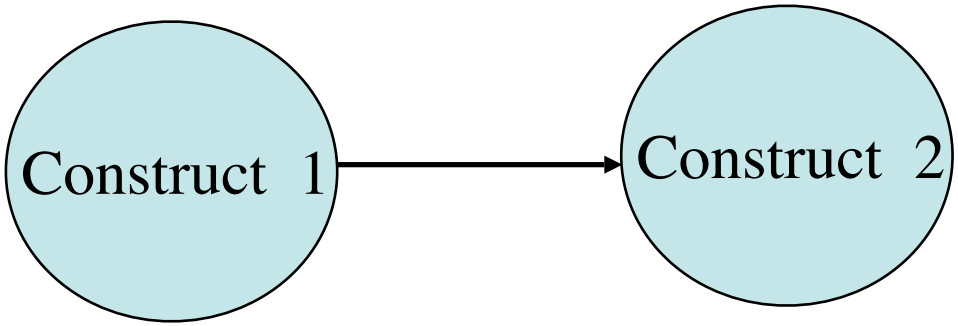
Observed Variables



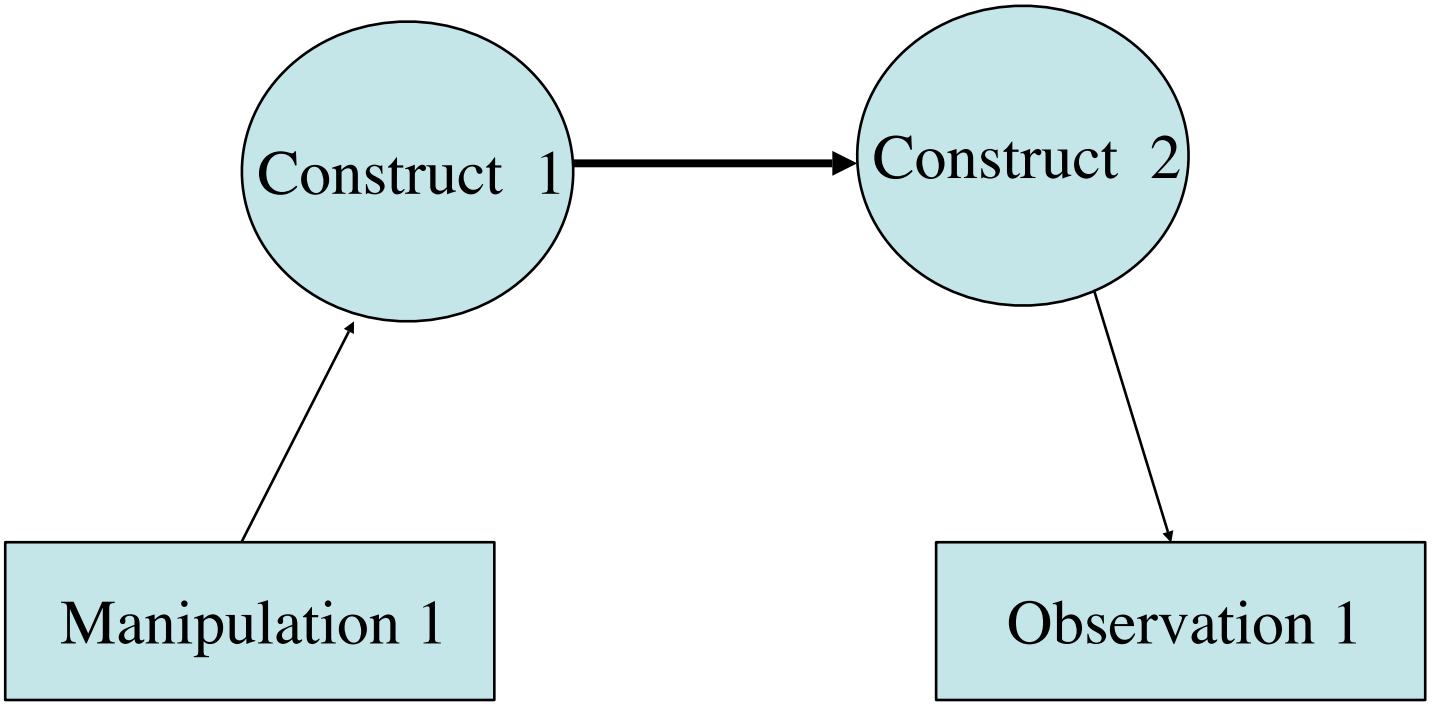
Theory + Data



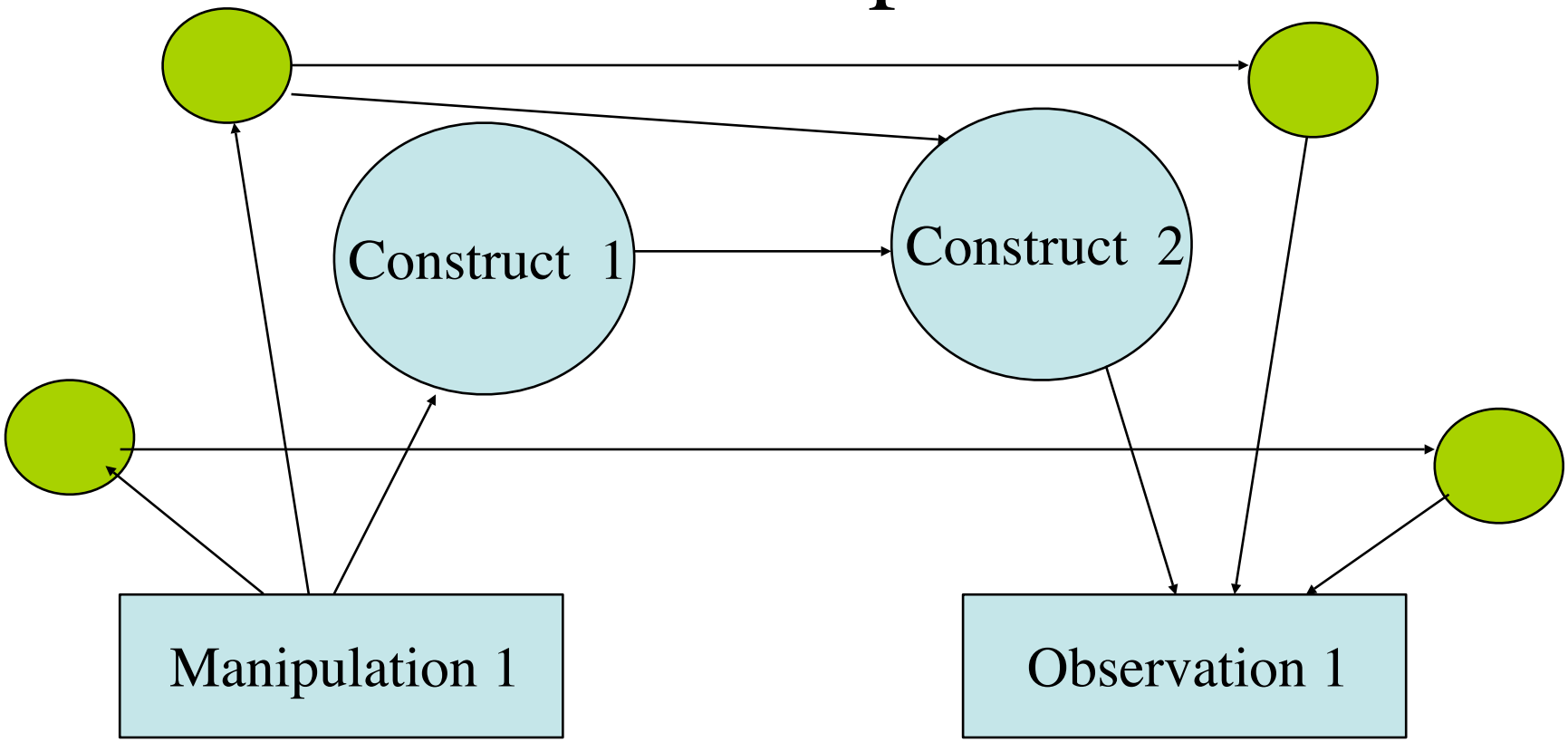
Theory and Theory Testing I: Theory



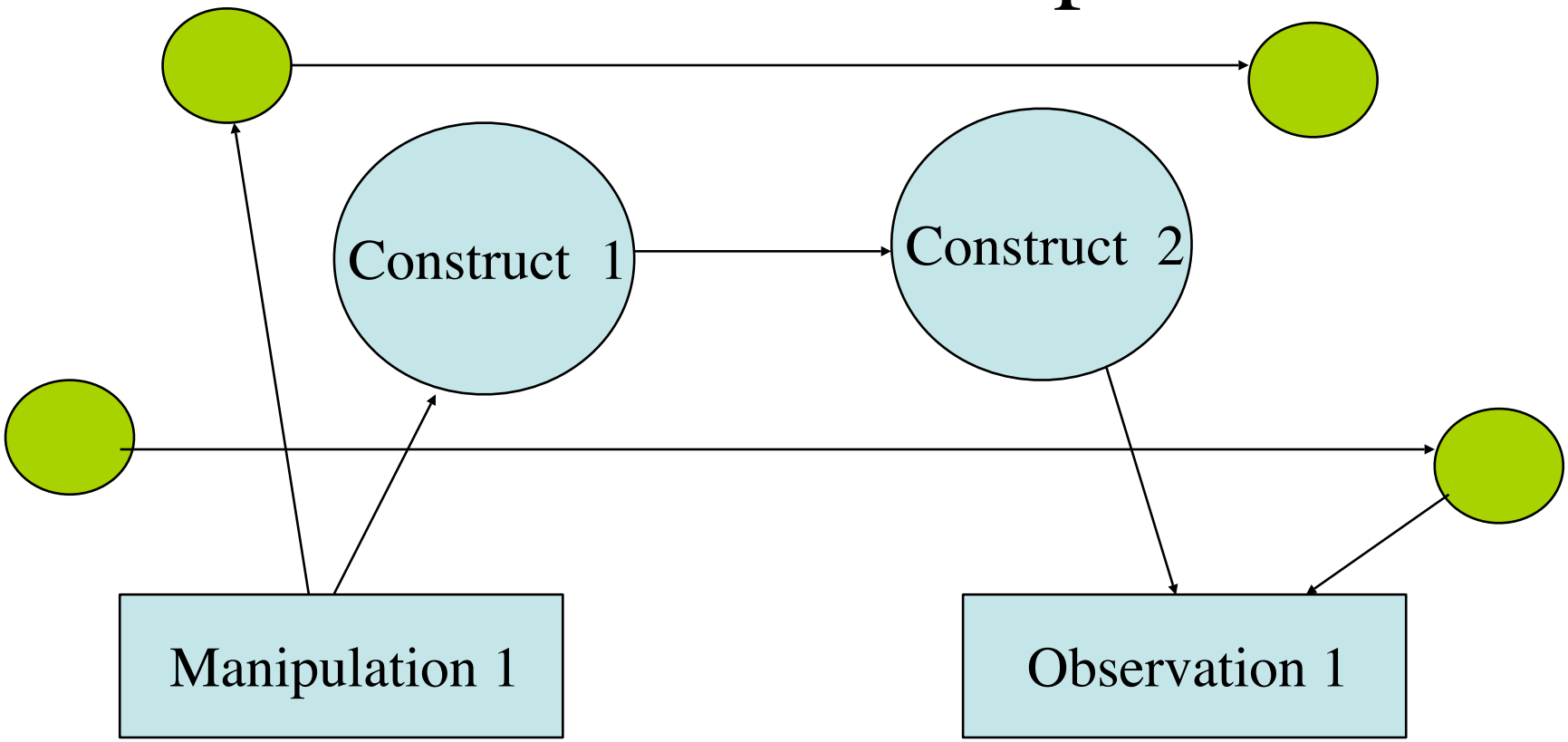
Theory and Theory Testing II: Experimental manipulation



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

Reasoning in research

- The example of Madsen and McGaugh (1961)
- The pitting of two theoretical explanations for the same phenomena
- Meta question:
  - What is memory and how is it stored
  - Historical studies on memory consolidation had shown temporal effects of Electroconvulsive Shock on memory

Madsen and McGaugh

- Prior work on ECS and memory consolidation (Carl Duncan)
  - retrograde amnesia -- loss of memory for an event immediately prior to a trauma.
  - Avoidance learning followed by ECS
    - Box with two compartments
      - brightly lit but safe compartment
      - unlit compartment with gridded and electrified floor
    - Animals learn to avoid the gridded side
  - ECS applied various times after learning trials

Duncan, 1949

TABLE 1

Mean numbers of anticipatory responses, all groups

Data based on animals that completed the experiment

GROUP	n	N	MEAN	σM
20 sec.....	12	11	2.54	.85
40 sec.....	12	7	5.85	1.02
60 sec.....	12	9	8.00	.77
4 min.....	12	9	9.11	1.66
15 min.....	12	10	10.20	.79
1 hr.....	6	6	12.33	.68
4 hr.....	6	6	12.16	1.36
14 hr.....	18	15	12.66	.68
Control.....	18	18	12.00	.53

n — number of animals at the beginning of the experiment.
N — number of animals that completed the experiment.

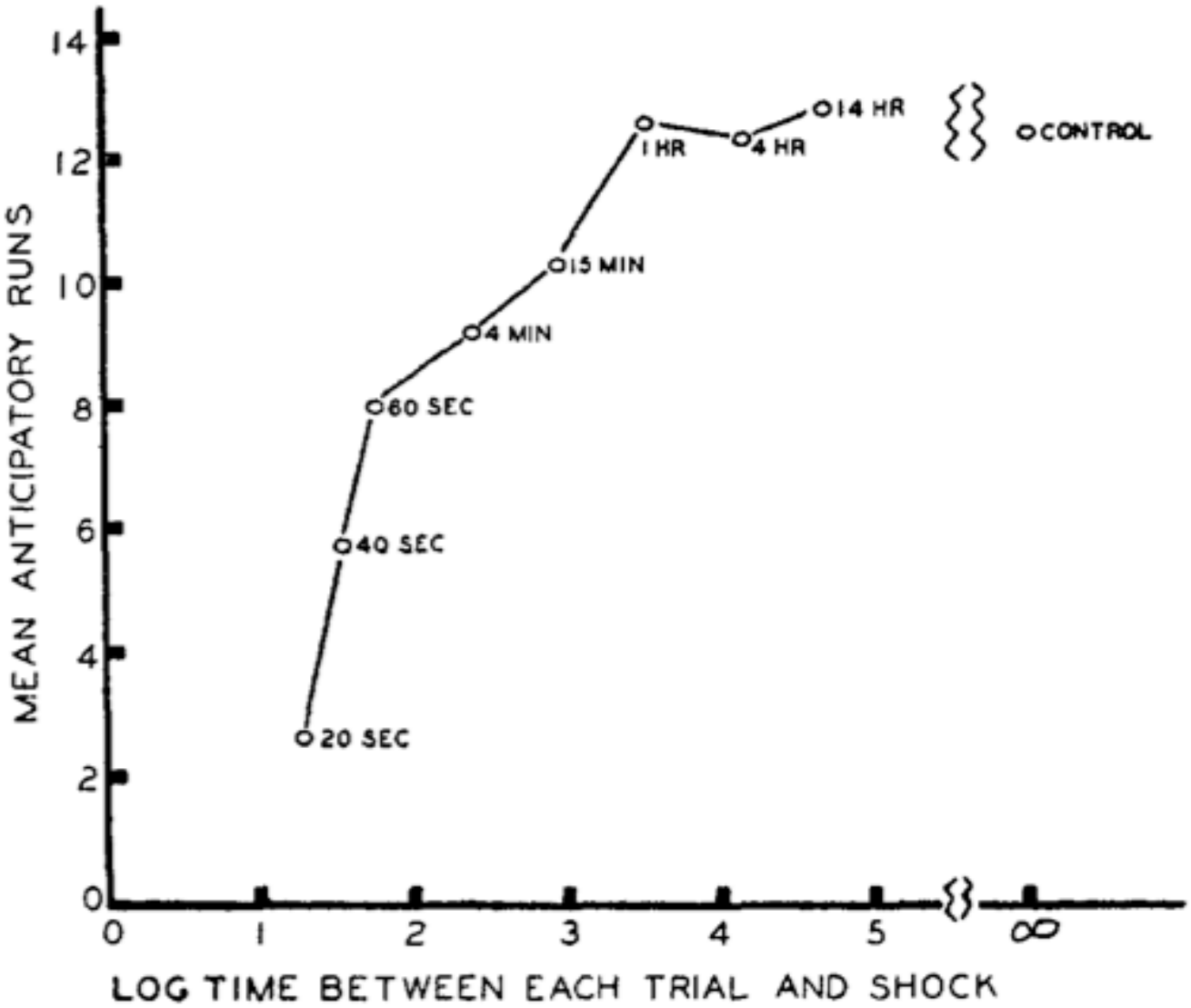


FIGURE 1. MEAN ANTICIPATORY RUNS FOR ALL 18 TRIALS AS A FUNCTION OF THE TRIAL-ELECTROSHOCK INTERVAL EXPRESSED IN LOGS

Different points on the curve represent different groups

Learning curves Duncan, 1949

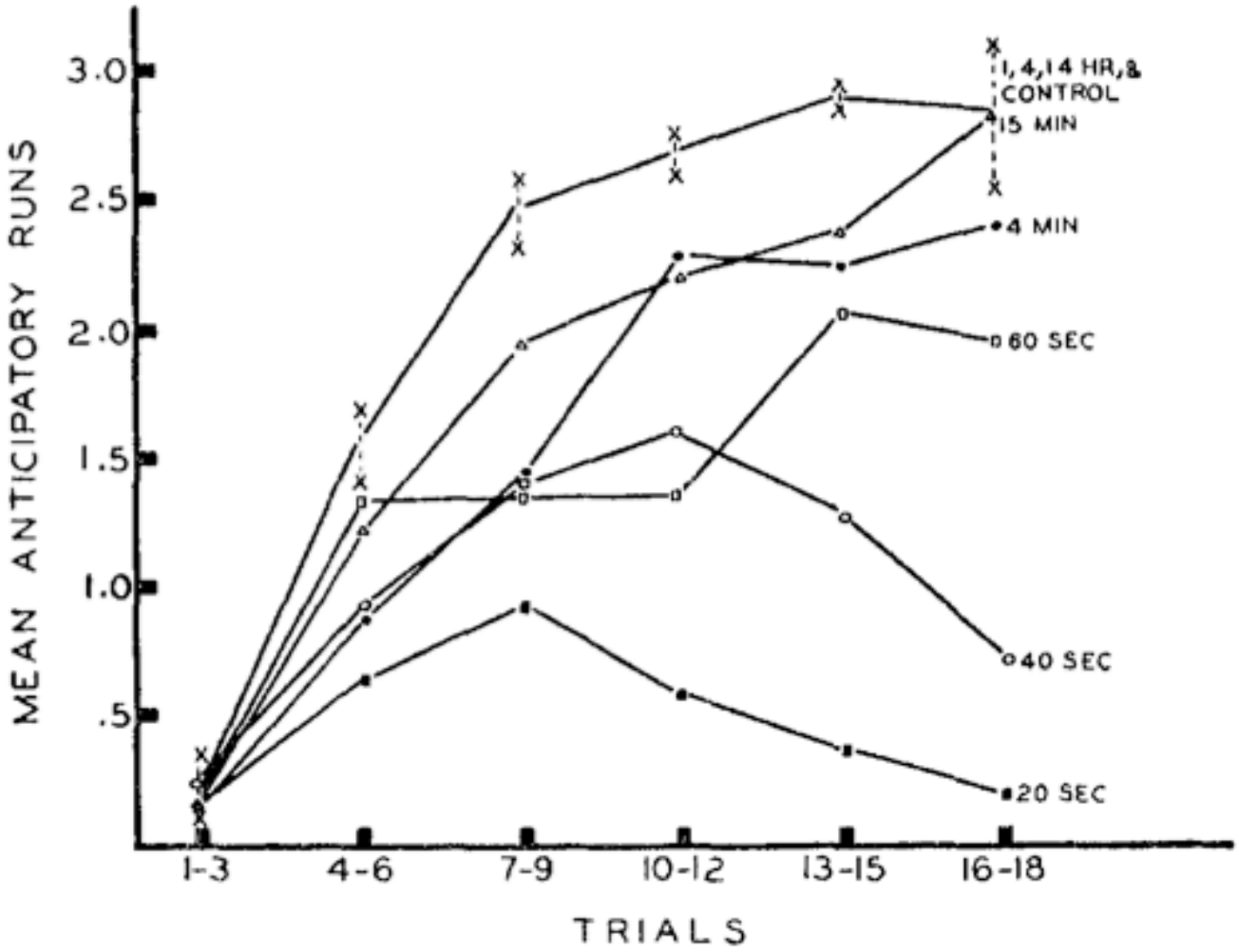


FIGURE 2. LEARNING CURVES FOR ALL 9 GROUPS

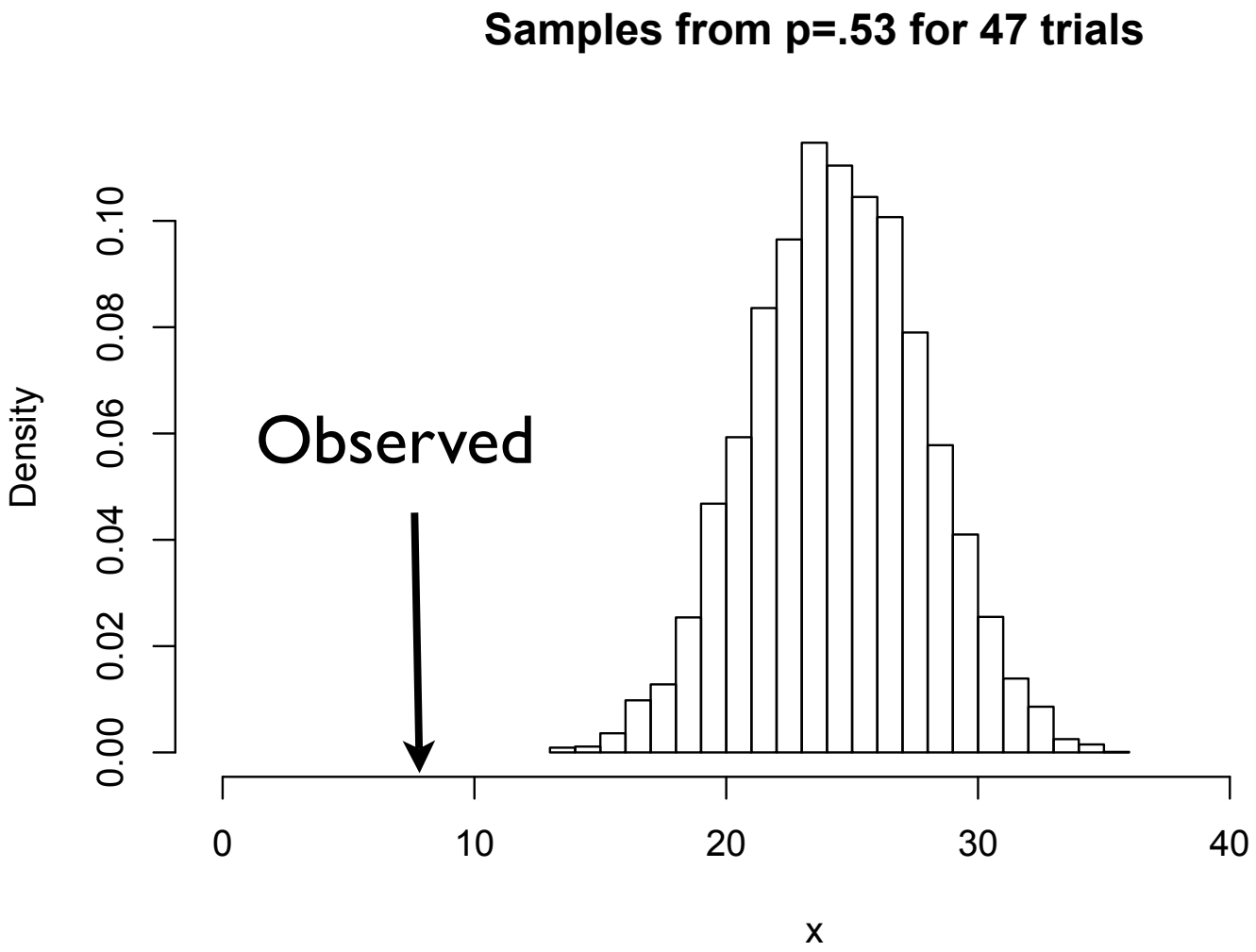
But is this effect fear or retrograde amnesia

- Madsen and McGaugh chose a task that fear and amnesia made opposite predictions
- Step down avoidance
  - stand on a plate, shocked if step off the plate
  - experimental rats received ECS 5 seconds after stepping off the plate, controls did not
- Learning would lead to not stepping off plate
- Fear would lead to not stepping off plate
- Amnesia would inhibit learning

Madsen and McGaugh

Strain	Control		Experimental	
	Avoid	Not Avoid	Avoid	Not Avoid
S1	11	17	1	22
S2	15	6	7	17
Total	26	23	8	39
p	0.53	0.47	0.17	0.83

Statistical analysis by the binomial distribution



Madsen and McGaugh

- ECS impairs memory, not by inducing fear
- Subsequent work by McGaugh has been tracking the storage process of memory.
- What circuits and neuro-transmitters facilitate and hinder the storage of memory.

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

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

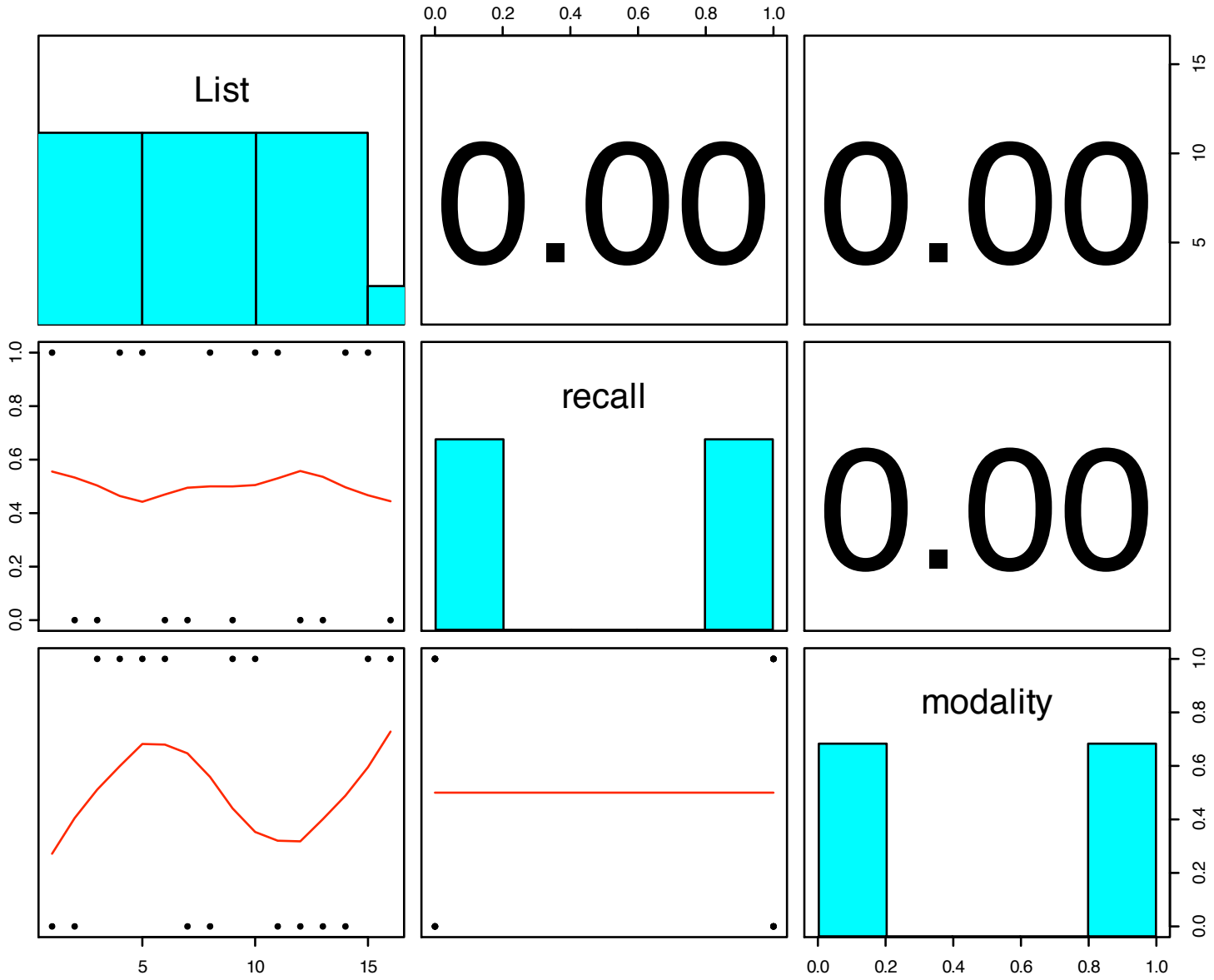
Class Design- counterbalancing

List	Modality (within)	A/B (between)
1	Visual	Recall
2	Visual	Math
3	Aural	Math
4	Aural	Recall
5	Aural	Recall
6	Aural	Math
7	Visual	Math
8	Visual	Recall
9	Aural	Math
10	Aural	Recall
11	Visual	Recall
12	Visual	Math
13	Visual	Math
14	Visual	Recall
15	Aural	Recall
16	Aural	Math

Purpose of counterbalancing

- Conditions are independent of order and of each other
- This allows us to determine effect of each variable independently of the other variables.
- If conditions are related to order or to each other, we are unable to determine which variable is having an effect

Design matrix shows no correlations



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, observed lower rates of subsequent false recognition than R & M. Was this due to modality of presentation?
- Within subject study
  - Modality of presentation (visual vs. oral)
  - Recall vs. no recall (math vs. recall)

Preliminary Analysis of class study

- Do we find basic serial position effects of list learning?
  - Recall thought to reflect a combination of rehearsal, long term activation, and some short term store.
  - Instructions were to dump the last few words. This should enhance recall of last few.