Theory & Phenomena

Lecture 8

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Contextual Prerequisites for Understanding: Some Investigations of Comprehension and Recall[1]

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The present paper presents a series of studies showing that relevant contextual knowledge is a prerequisite for comprehending prose passages. Four studies are reported, each demonstrating increased comprehension ratings and recall scores when *S*s were supplied with appropriate information before they heard test passages. Supplying *S*s with the same information subsequent to the passages produced much lower comprehension ratings and recall scores. Various explanations of the results are considered, and the role of topics in activating cognitive contexts is discussed.

Questions

- Big Question: How do we understand and remember things?
- Specific question: How do background ideas and knowledge about a situation influence how we understand, comprehend, and remember new information?

Task: Subjects read an ambiguous paragraph
Then, answered questions to measure their memory and comprehension

If the balloons popped, the sound wouldn't be able to carry since everything would be too far away from the correct floor. A closed window would also prevent the sound from carrying, since most buildings tend to be well insulated. Since the whole operation depends on a steady flow of electricity, a break in the middle of the wire would also cause problems. Of course, the fellow could shout, but the human voice is not loud enough to carry that far. An additional problem is that a string could break on the instrument. Then there could be no accompaniment to the message. It is clear that the best situation would involve less distance. Then there would be fewer potential problems. With face to face contact, the least number of things could go wrong.

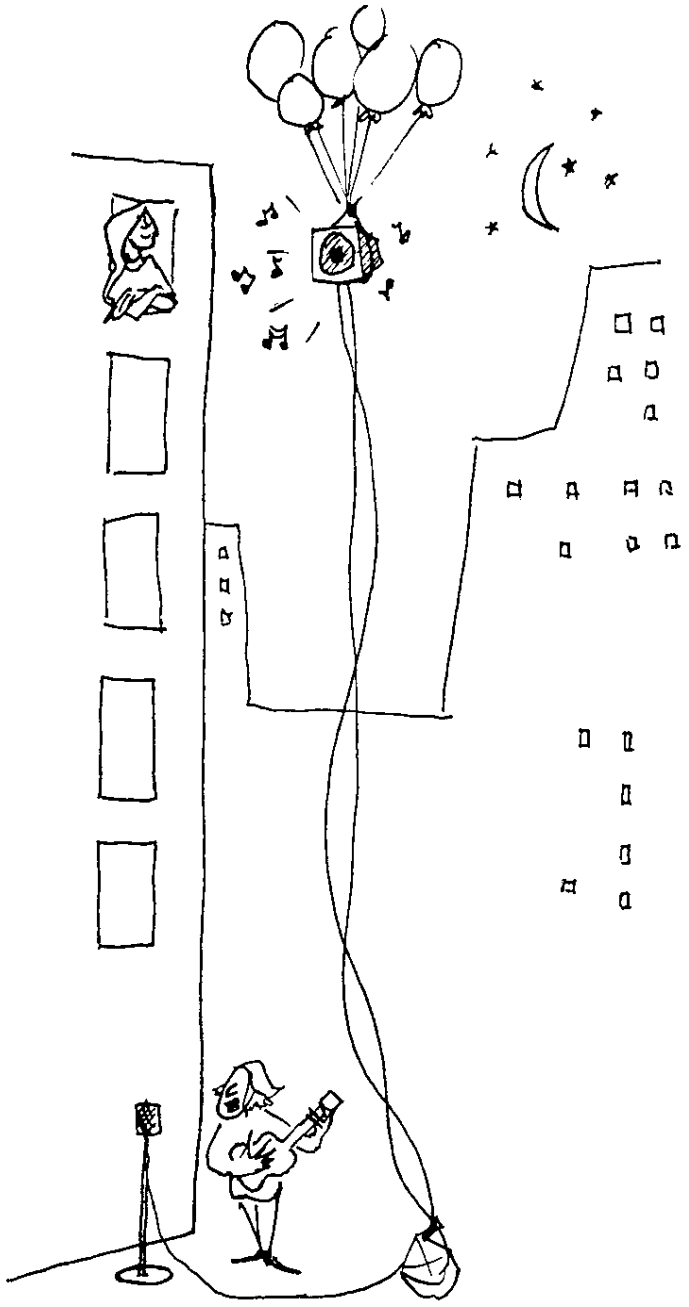

FIG. 1. Appropriate context picture for Experiment I.

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Context Conditions

Full

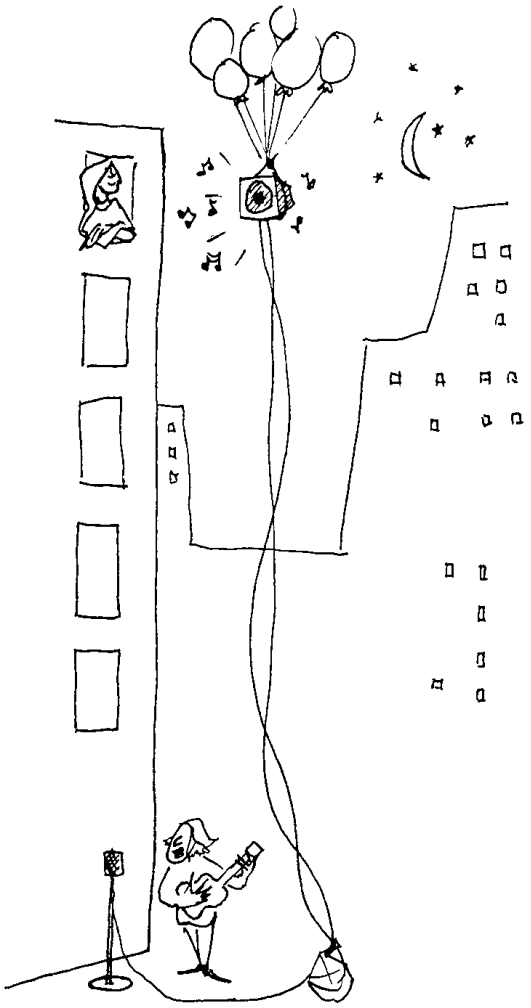


FIG. 1. Appropriate context picture for Experiment I.

Partial

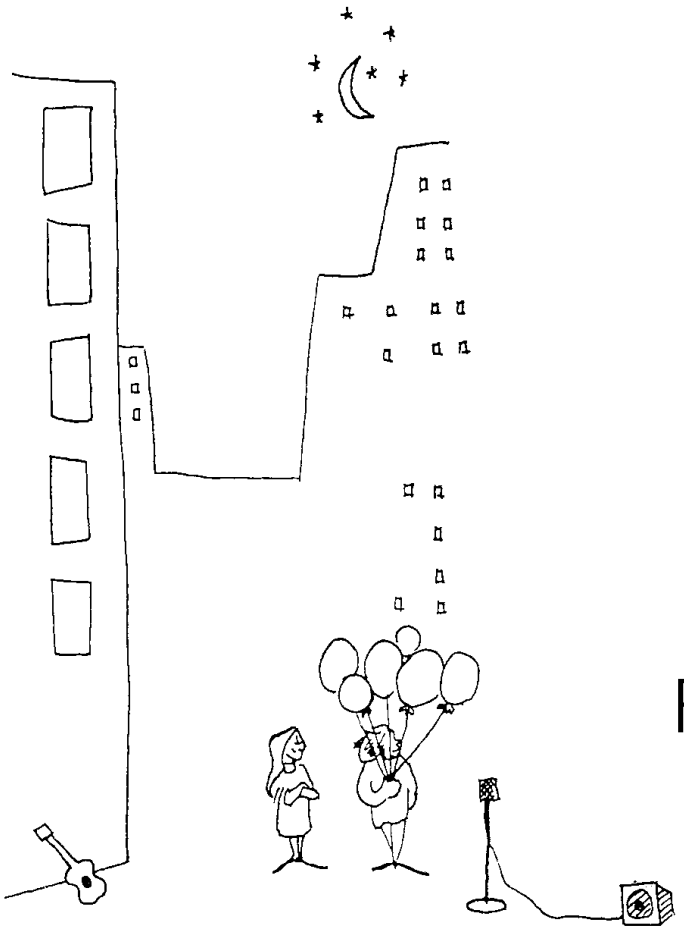


FIG. 2. Partial context picture for Experiment I.

No Context (1)

No Context (2)

Full Context (After)

Partial Context

Full Context (Before)

Results

TABLE 1

MEAN COMPREHENSION RATINGS AND MEAN NUMBER OF IDEAS RECALLED, EXPERIMENT I

	No context (1)	No context (2)	Context after	Partial context	Context before	Maximum score
Comprehension	2.30 (.30)[a]	3.60 (.27)	3.30 (.45)	3.70 (.56)	6.10 (.38)	7
Recall	3.60 (.64)	3.80 (.79)	3.60 (.75)	4.00 (.60)	8.00 (.65)	14

[a] Standard error in parentheses.

Implication

- Appropriate background knowledge about a situation was a strong determinant of comprehension and recall

Phenomena

- A general result, or finding, that has been established by systematic empirical research

Theory

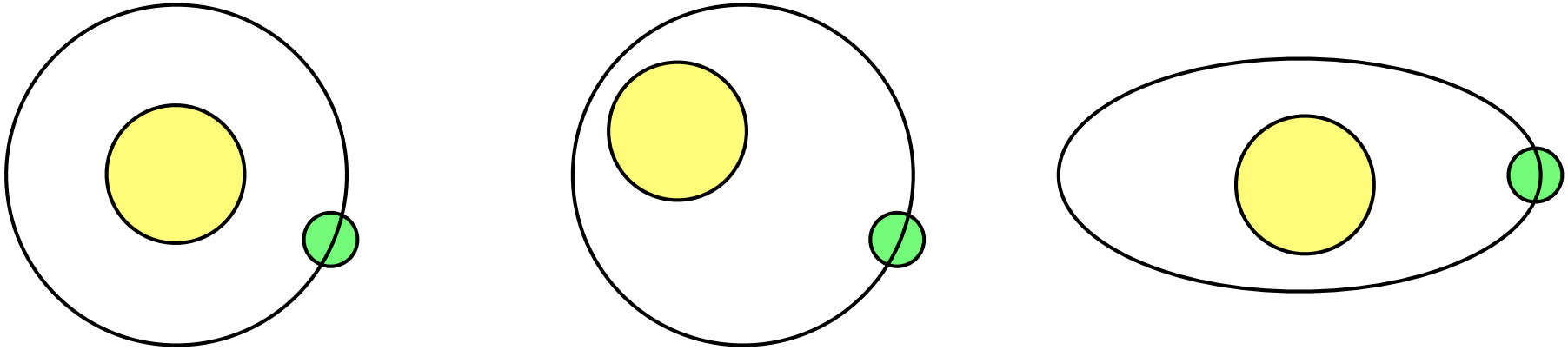
- A coherent explanation or interpretation of a phenomena

Pen & Paper

- Draw a picture of the earth orbiting around the sun
- Now, briefly explain why it is colder in the winter than in the summer

The earth and the sun

Theories

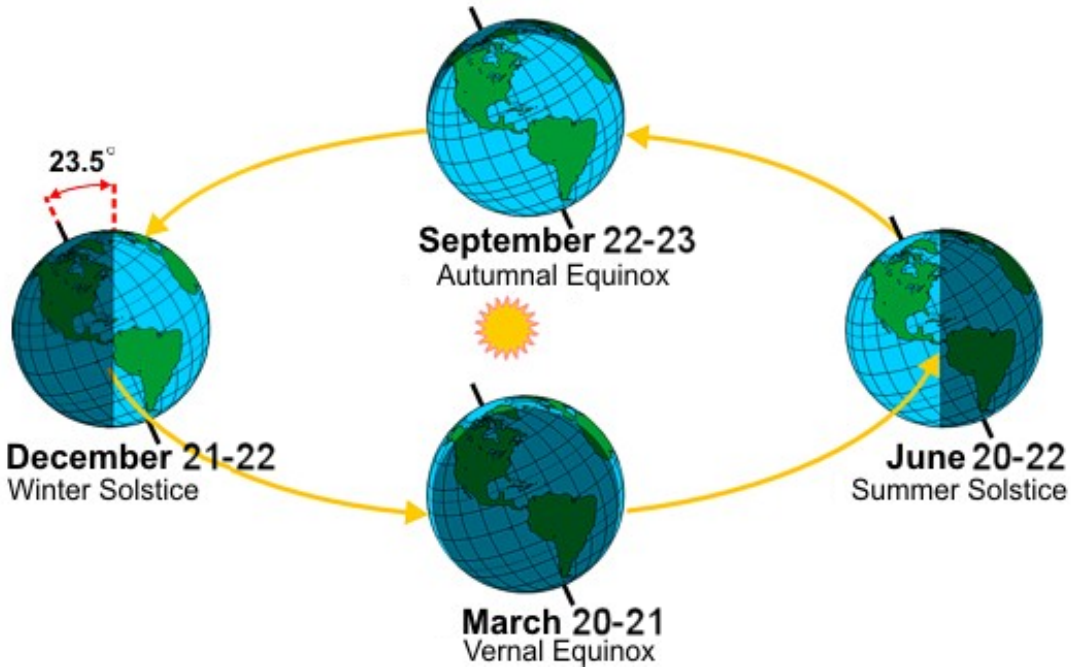


Data

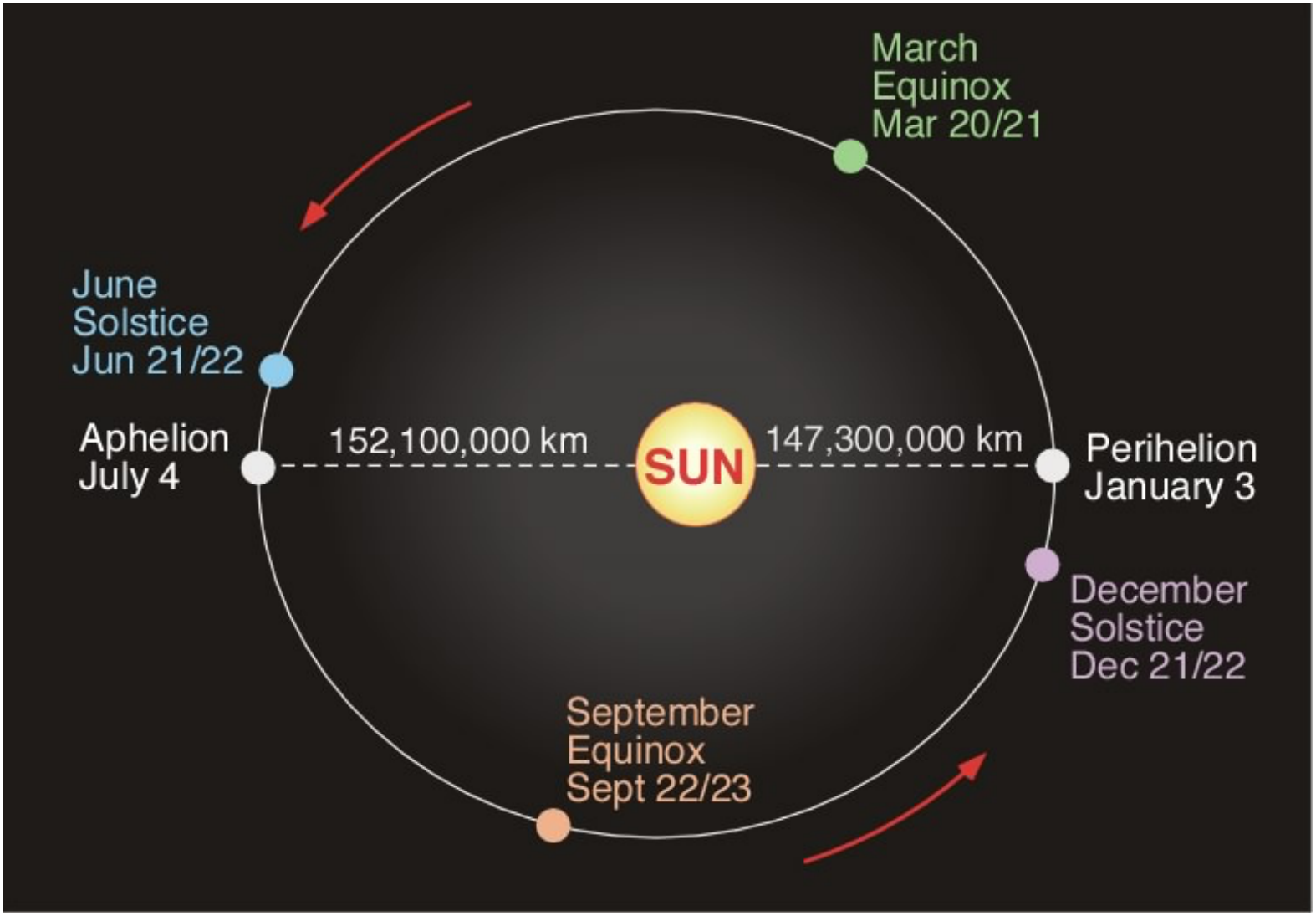
- Hot in summer, cold in winter
- 1 year is once around the sun
- Winter in northern hemisphere, summer in south

Pictures of orbital path often incorrectly show extreme ellipse

Seasonal variation in temperature is determined by Earth's tilt



More accurate picture of orbital path (97% circular)



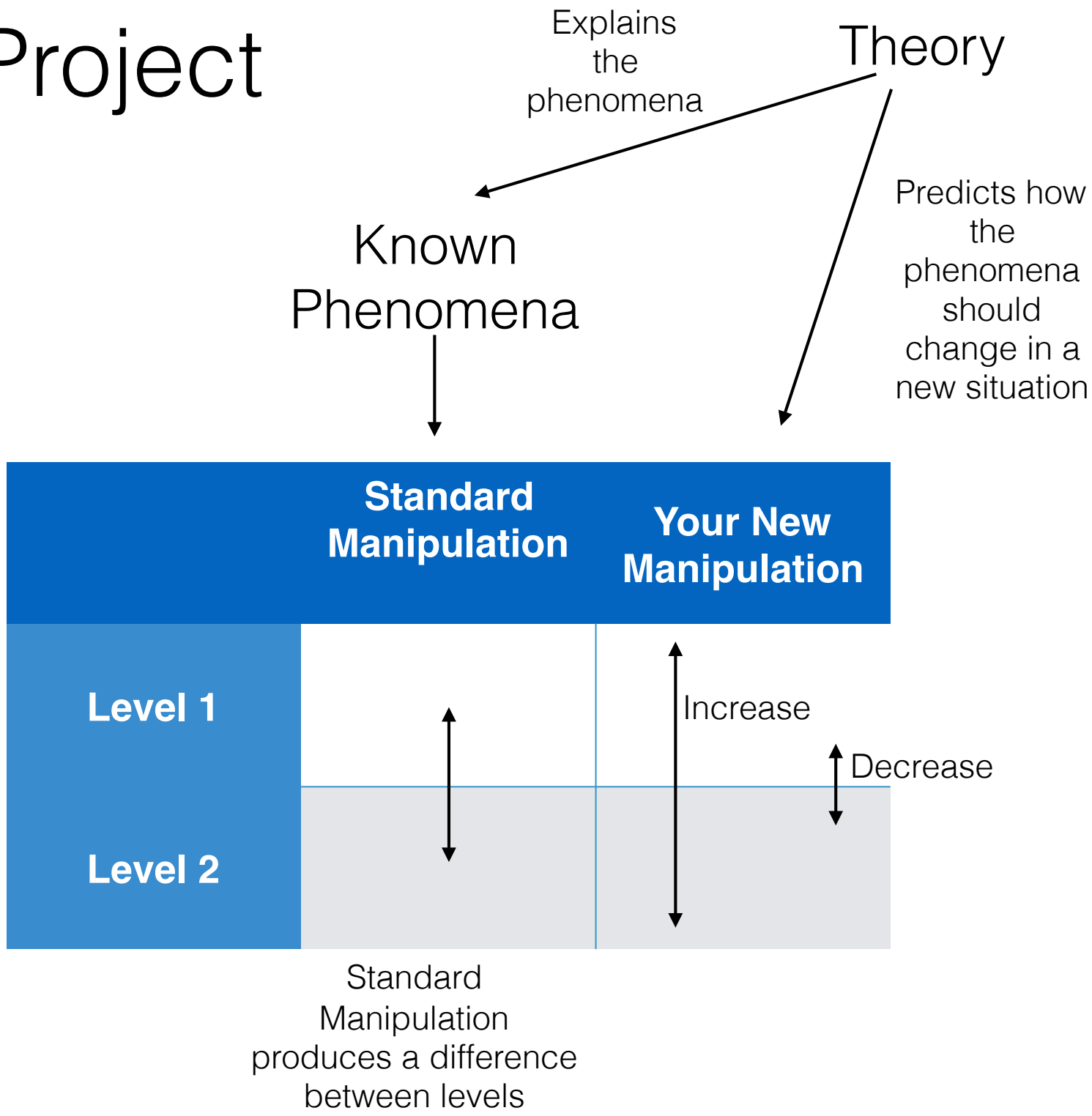
Phenomena

- A general result, or finding, that has been established by systematic empirical research

Theory

- A coherent explanation or interpretation of a phenomena

Final Project



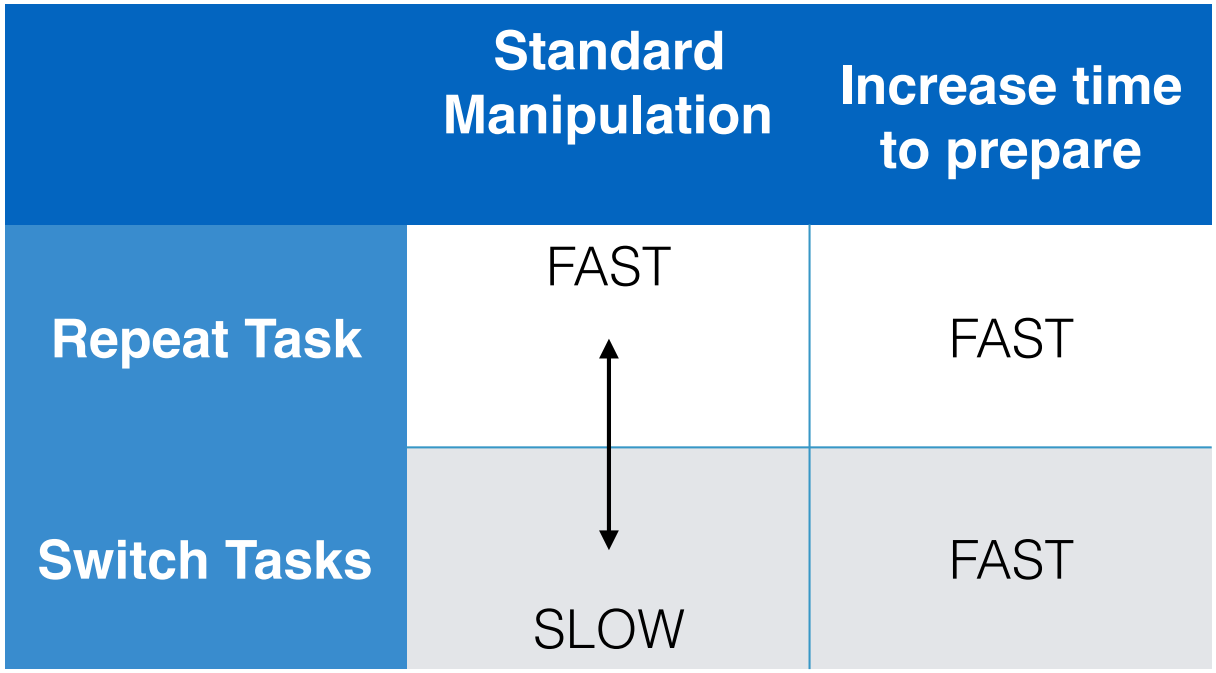
Example

Switching is slow because of time to load new task set

Task sets take time to load

Giving people more time to prepare and load new task set should reduce/ eliminate switch costs

Switching Cost



Difference eliminated

Standard Manipulation produces a difference between levels

Phenomena

- A general result, or finding, that has been established by systematic empirical research

Fluency misattribution	Survival Memory	Switching Costs	Stroop
Face-inversion	Age Priming	Flag Priming	Stereotype Threat
Context-dependent memory	Clothing-priming	Self-Location	

What do we learn from phenomena?

- We learn that these phenomena exist (especially, when they are widely replicated
- We learn that the manipulation (IV) causes a change in our measurement

What do we **not** learn from phenomena?

- We do **not** learn **why** the phenomena occurs
- We do **not** learn **how** some process produces the phenomena
- We only learn **that** something produces the phenomena. **Theories** are used to explain what the something is, and how it works to produce the phenomena.

Theory

- A coherent explanation or interpretation of a phenomena
- Theories can take a variety of forms
- All, go beyond the phenomena they explain by including variables, structures, processes, functions, or organizing principles that have not been observed directly.

Popular misconceptions about theories

Popular Beliefs about Theories	Misconception
“It’s just a theory”	Theories are untested ideas/opinions that we shouldn’t take seriously
Theories are a guess or a hunch	Strong theories are complex working models of a phenomena
Theories become fact when they are proven with research	Scientific knowledge is always tentative, and subject to revision when new evidence is obtained
Hypotheses are theories	Hypotheses are logical implications derived from theories. Without a theory they are unjustified statements

Scientific Use of Theory

- A coherent explanation or interpretation of a phenomena
- Can be untested, extensively tested and well-supported; and, extensively tested and rejected as a bad explanation

What are theories for?

- Explanation
- Organization
- Prediction
- Generate new research

Some Kinds of Theories

High Level Perspective	Broad view identifying general principles and factors
Verbal Theory	Statements about how general principles and factors explain phenomena
Stage Theory	Identification of different parts of a process (not how they work)
Statistical model	Describes patterns between measurements
Biological substrate theories	Identification of Bio/Neuro systems, and how they work to produce a phenomena
Formal mechanistic (math) model	Complete description of how a process works

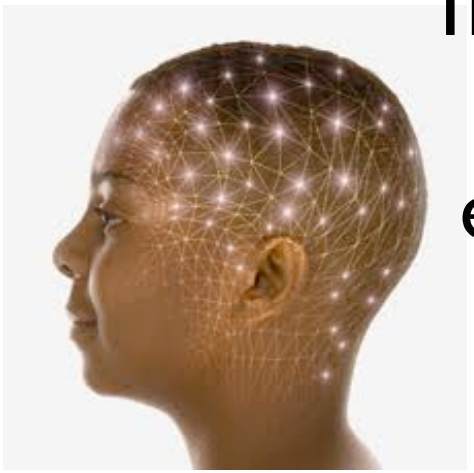
The assembly line metaphor

"Cognition" refers to all processes by which the sensory input is *transformed, reduced, elaborated, stored, recovered, and used.*

-Ulric Neisser

The assembly line metaphor

Information from the world



Information is:

Transformed

reduced

elaborated

stored

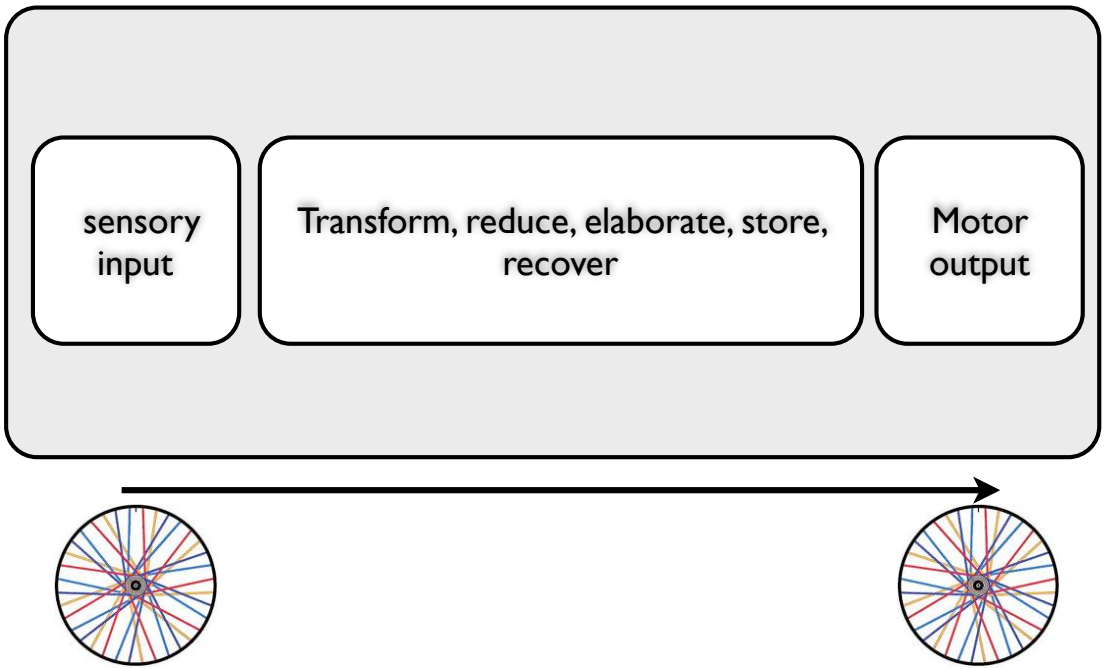
recovered

used

The assembly line metaphor

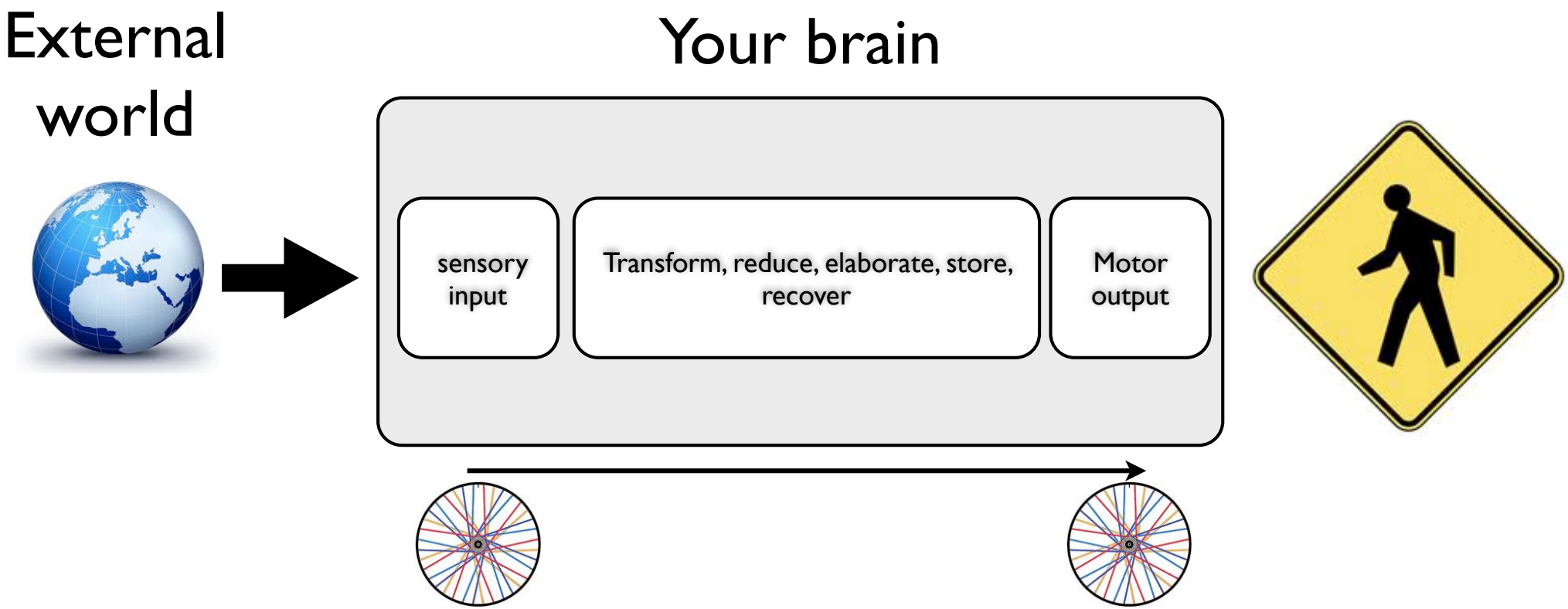
External world

Your brain



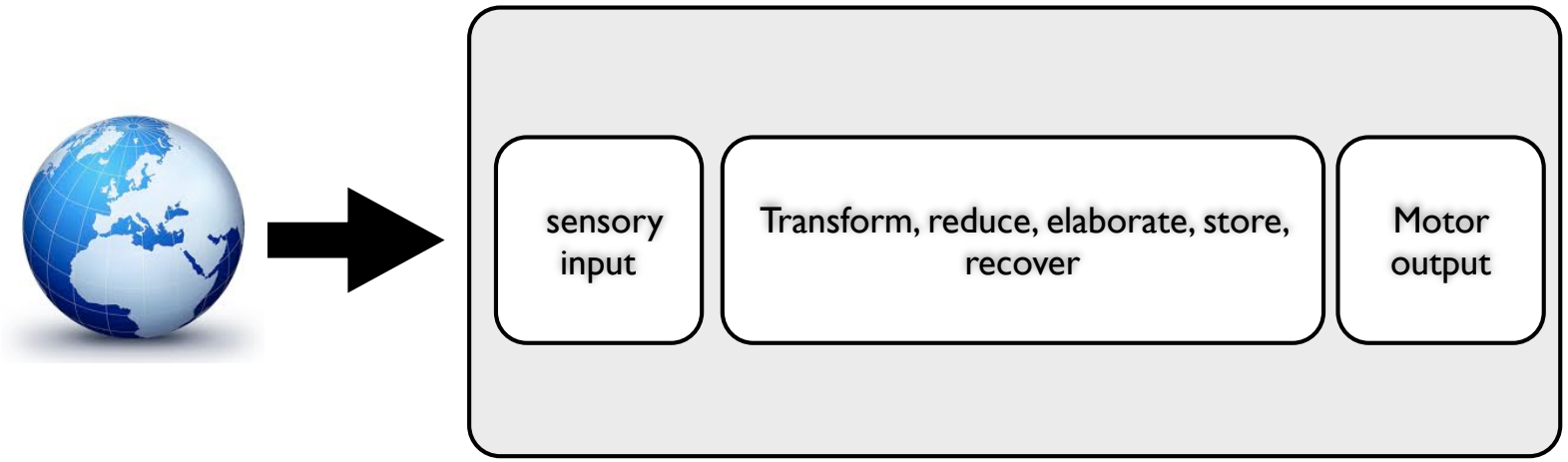
The assembly line metaphor

1. separate stages of processing
2. Stages take time



Reaction Time - Donders

Potentially measure how long different stages take to complete processing



Simple reaction time

The time it takes for you to respond to any external stimulus

Time

Recognition reaction time

The time it takes for you to respond to a specific external stimulus, and not to others

Go (when light is blue)

Don't respond

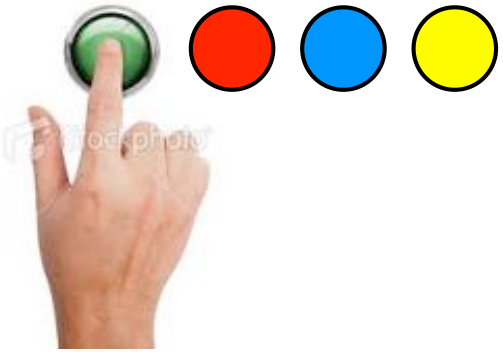
(when light is red)

Time

Choice reaction time

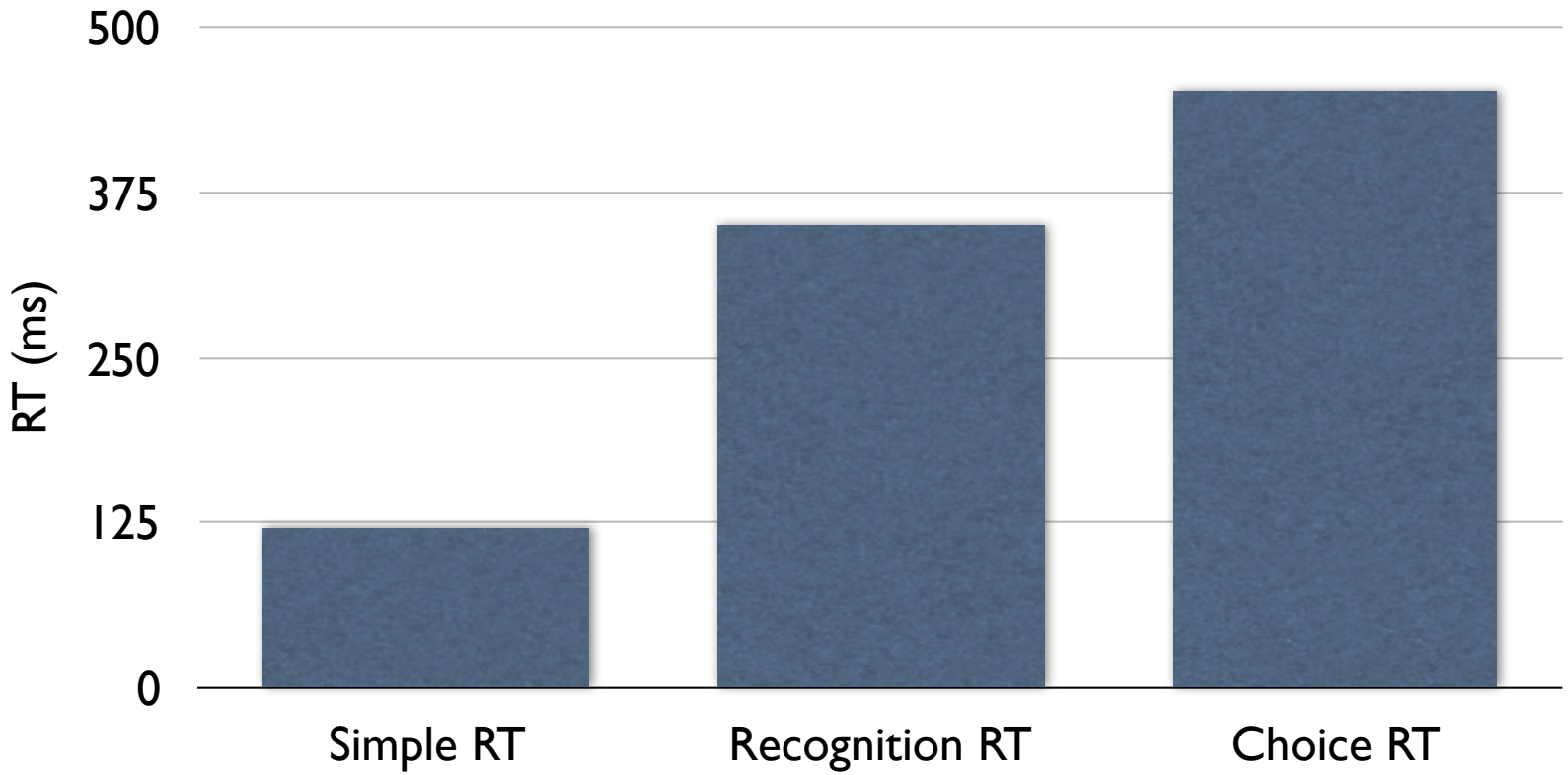
The time it takes for you to identify one of many possible stimuli

Identify color by pressing appropriate button



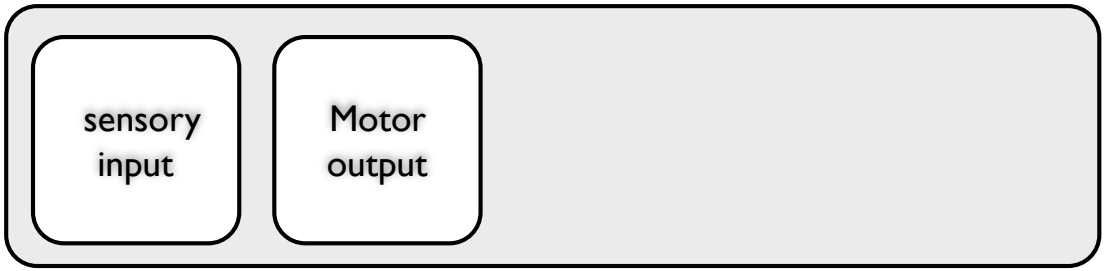
Time

RTs depend on task complexity

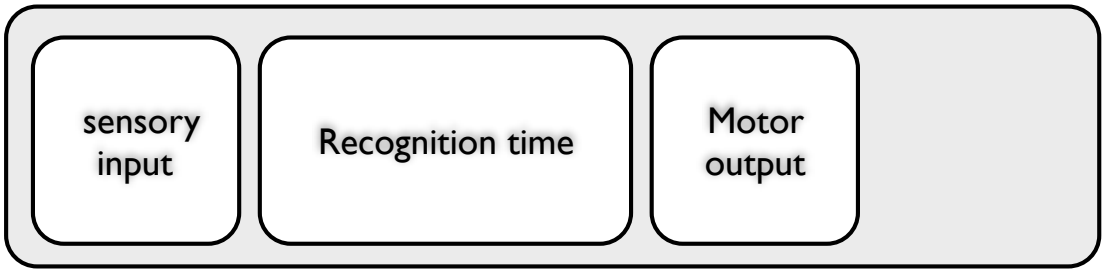


Donders subtractive logic

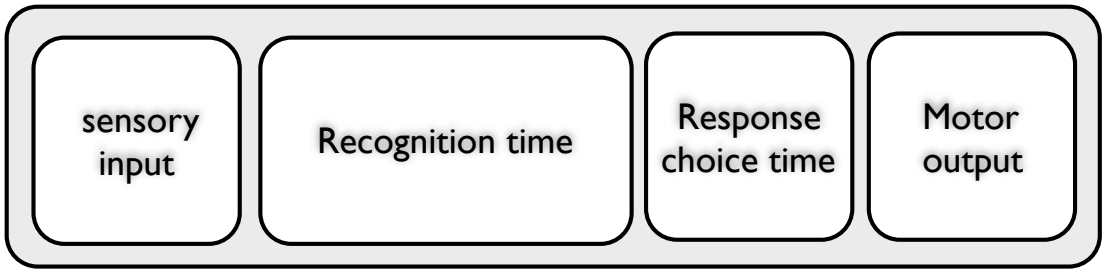
Simple RT



Recognition RT



Choice RT



Donders subtractive logic

1. RTs increase with task complexity

2. Subtracting one RT from another (e.g., choice RT- recognition RT) gives the processing time (e.g., response choice time) to complete the more complex task.

Donders subtractive logic

Problems:

1. RTs are additive

2. Can't explain situations when RTs are faster for more complex tasks than less complex tasks

e.g., word superiority effect

Formality

- Theories range in their formality (specificity)
- Informal theories are usually verbal, and include limited, often general and sometimes vague statements about how things work
- Formal theories are usually mathematical, and include highly specific, and numerous statements about how things work

Scope

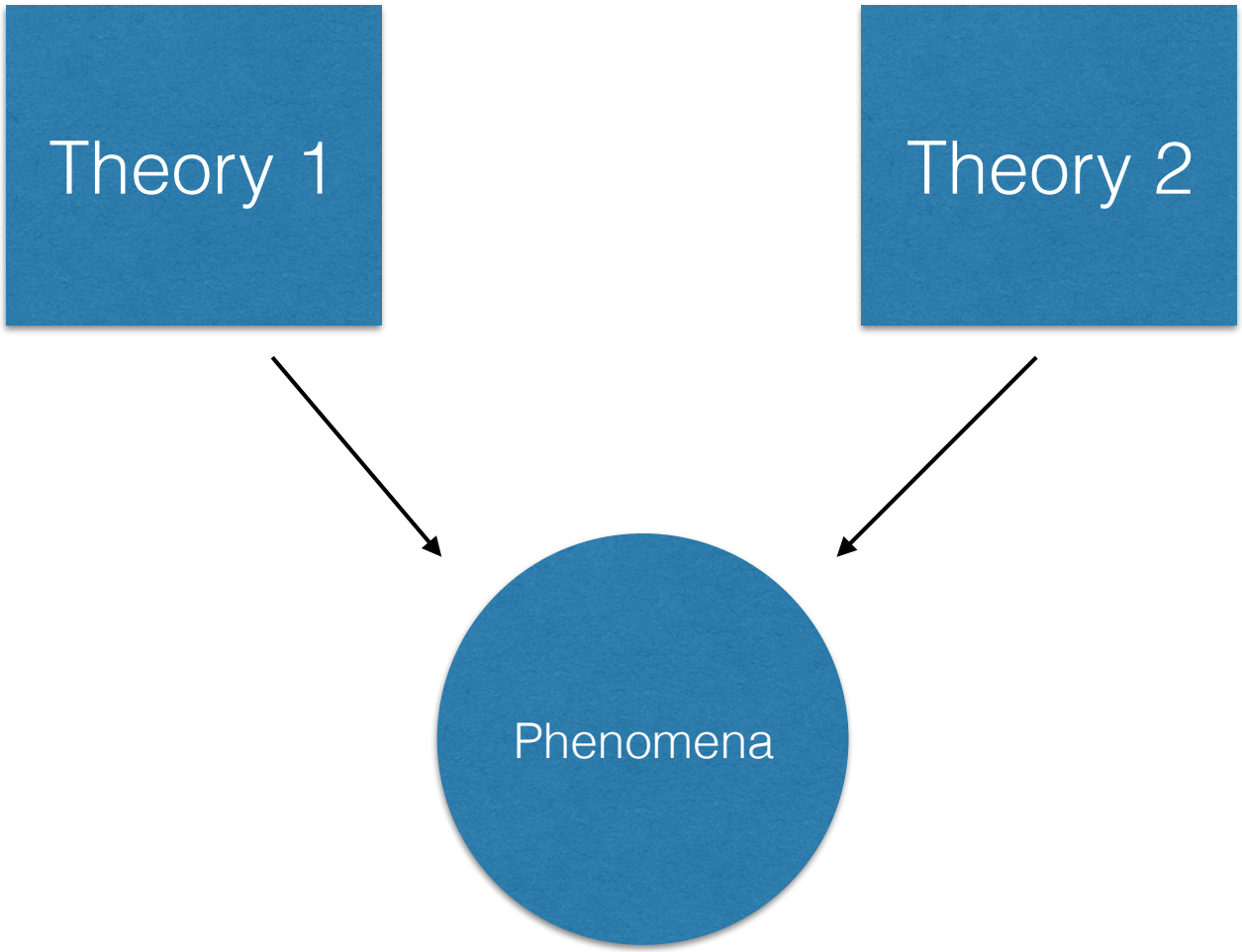
- Theories range in their scope (what they appy to)
- Theories can be limited in scope, and only apply to the explanation of one or a few phenomena
- Theories can be broad in scope, attempting to explain many or all phenomena (e.g., a grand unified theory of everything).

Usefulness

- Theories can be useful and useless for different reasons
- Incorrect, and untrue theories, can be useful for generating new research ideas, or generating research that disproves those theories
- Theories that can accurately explain a phenomena, may nevertheless be useless because they are limited in scope to explain other phenomena.

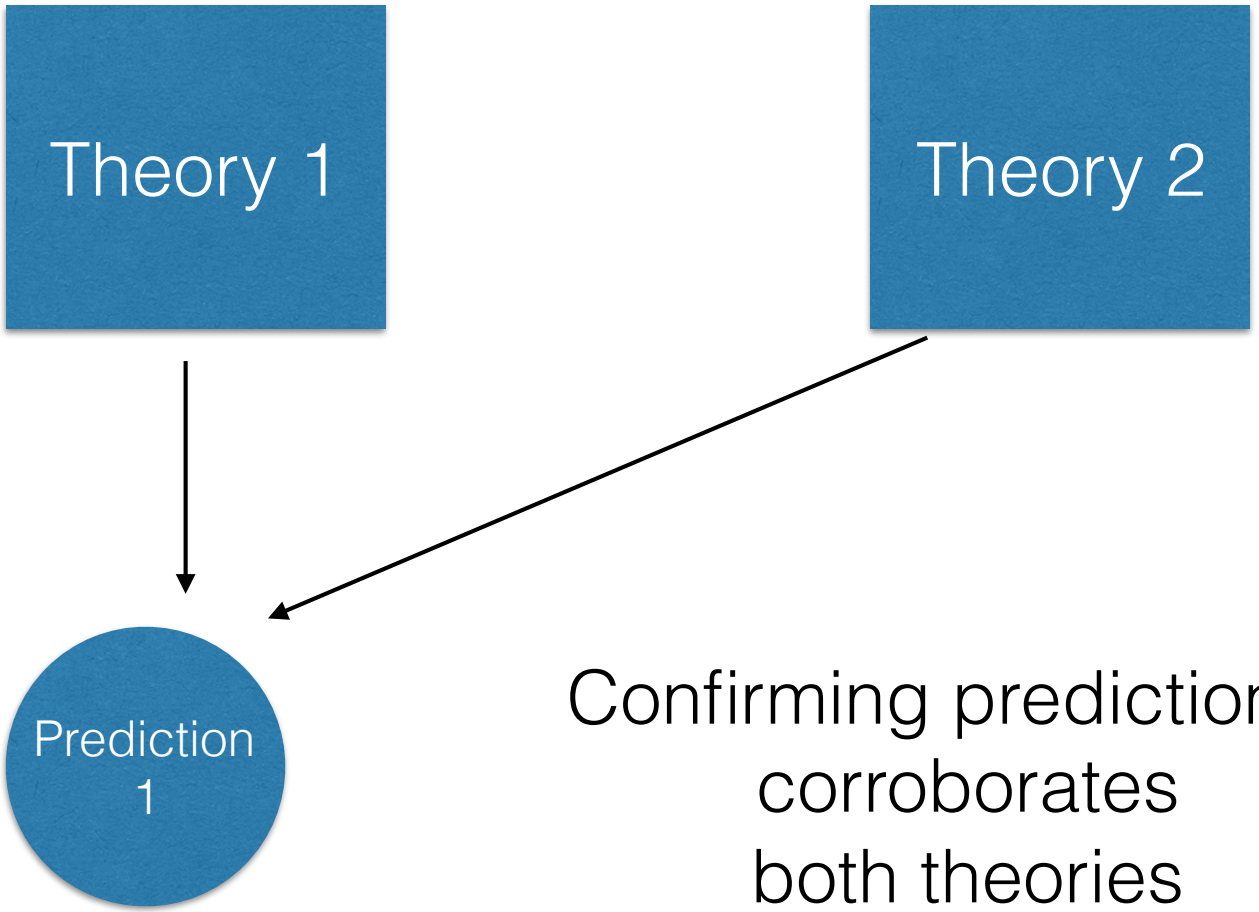
Multiple Theories

Complex phenomena are often consistent with more than one theory



Testing Theories

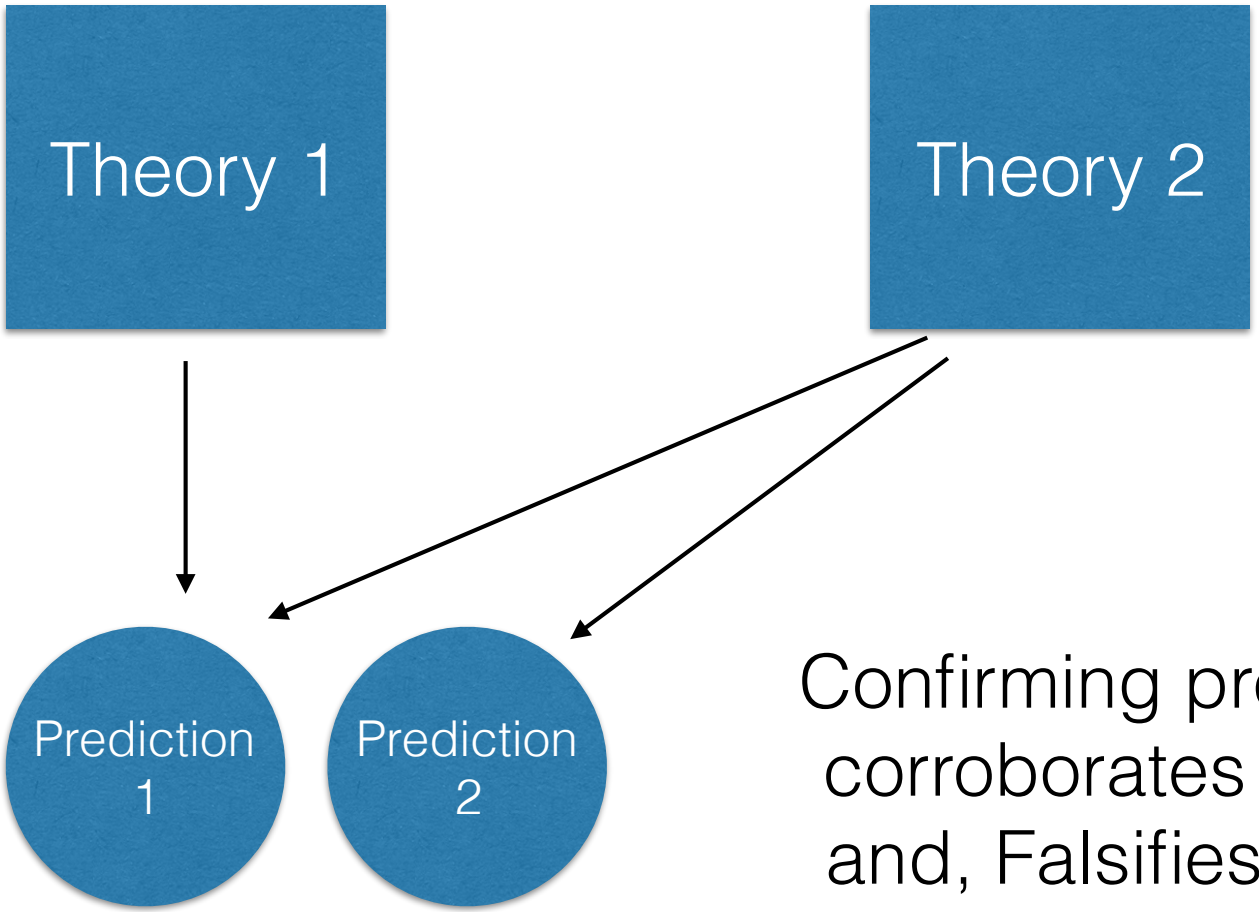
Different theories can make the same predictions



Confirming prediction 1, corroborates both theories

Testing Theories

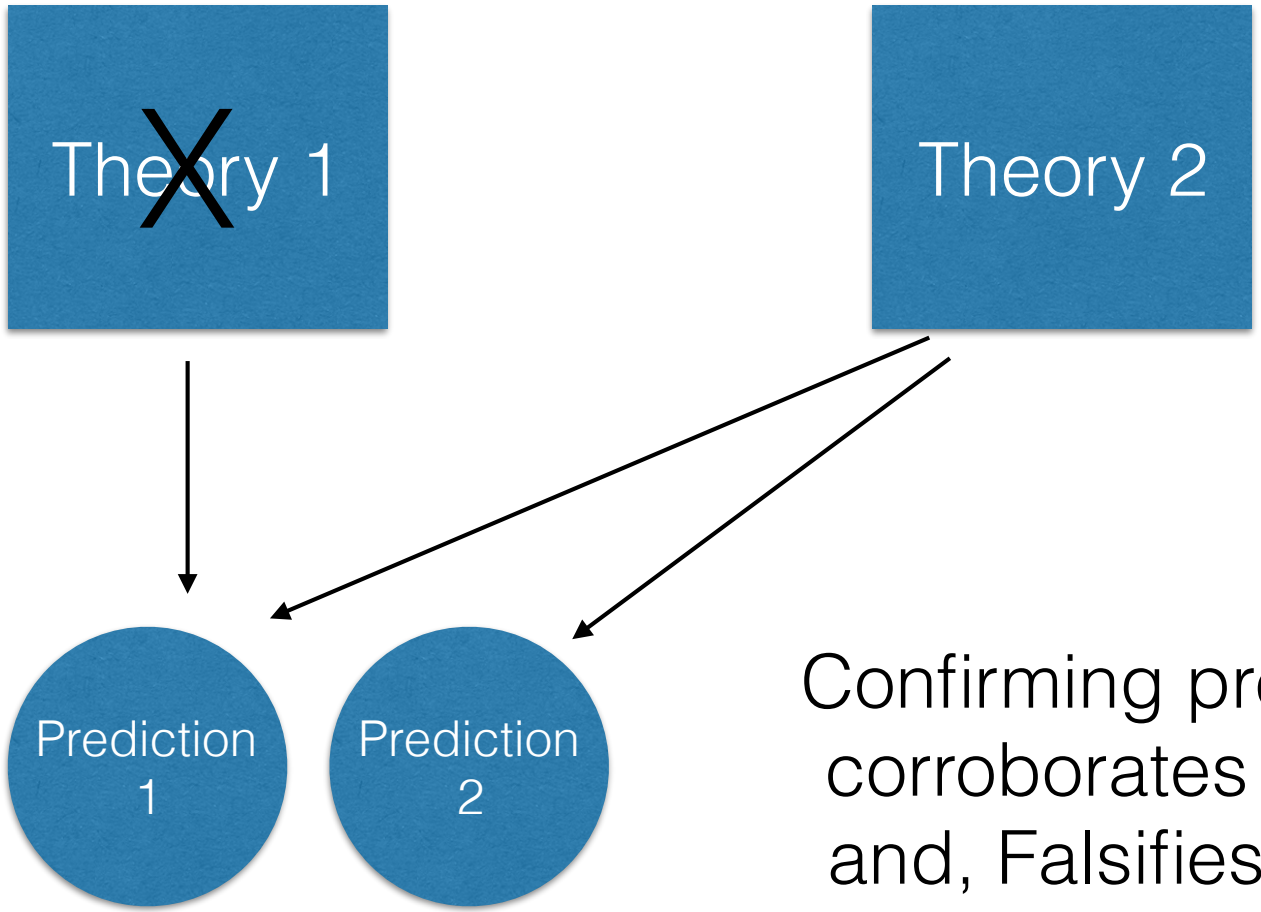
Different theories can make the different predictions



Confirming prediction 2, corroborates Theory 2, and, Falsifies Theory 1

Falsification

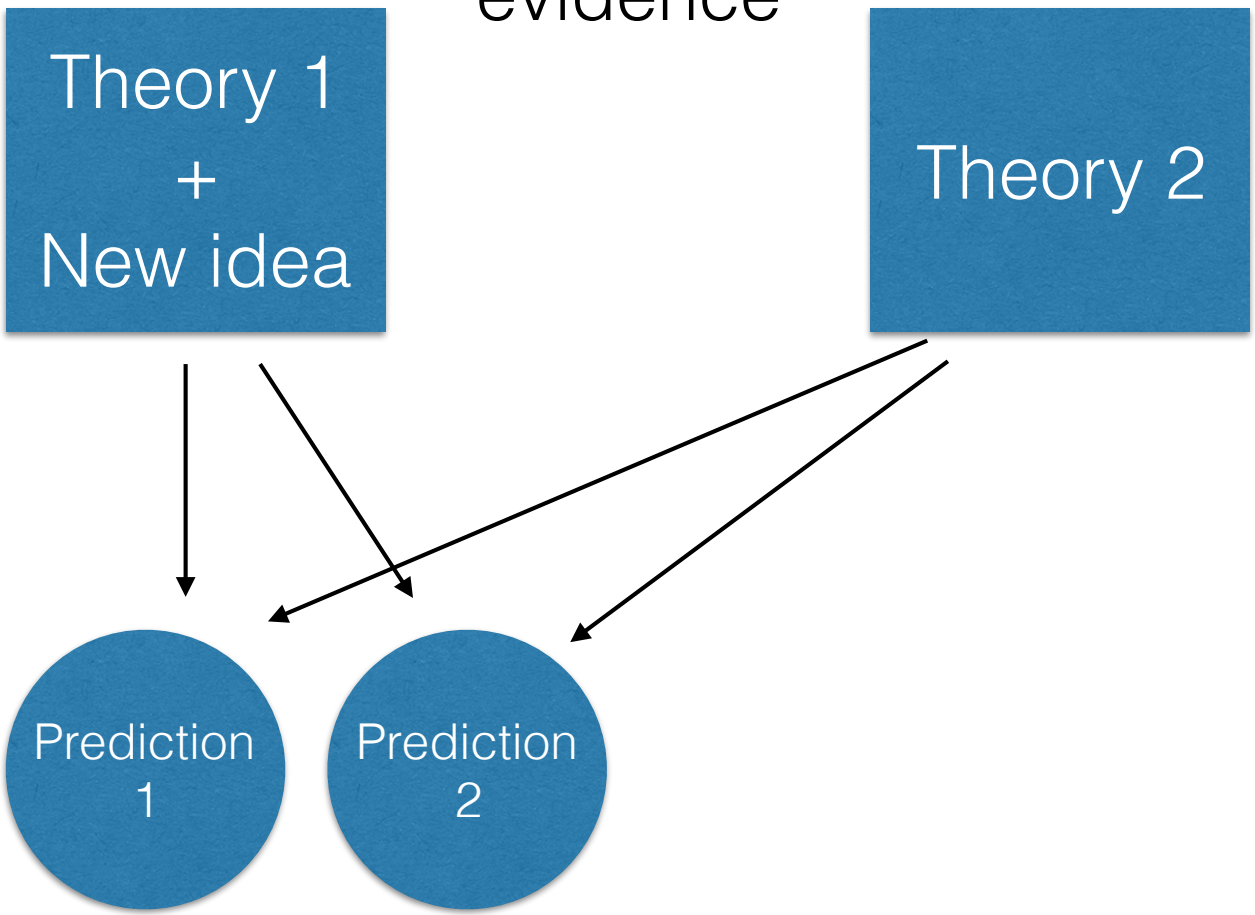
We can eliminate wrong theories, by obtaining evidence inconsistent with predictions of the theory



Confirming prediction 2, corroborates Theory 2, and, Falsifies Theory 1

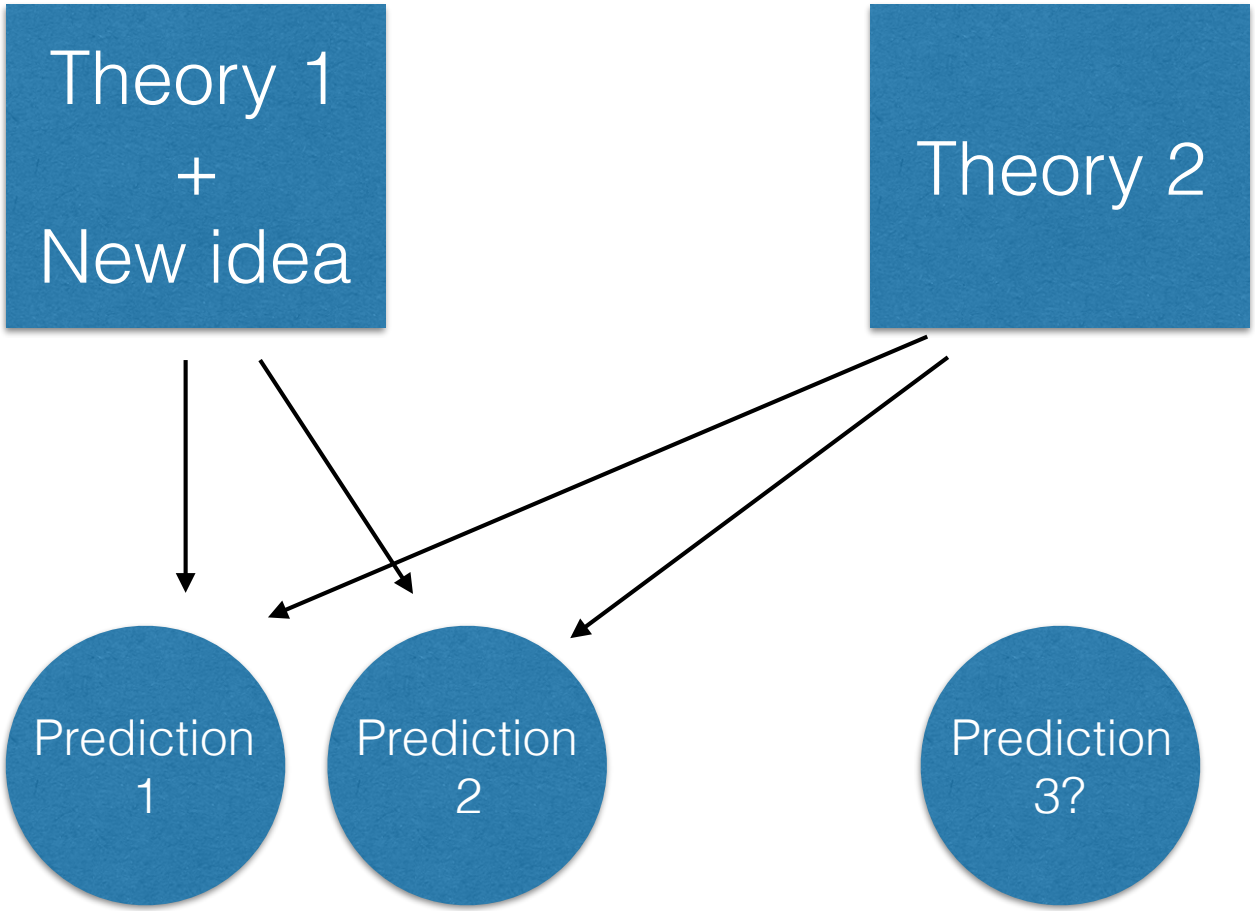
Revision

We can update wrong theories, with new assumptions, so they accurately predict new evidence



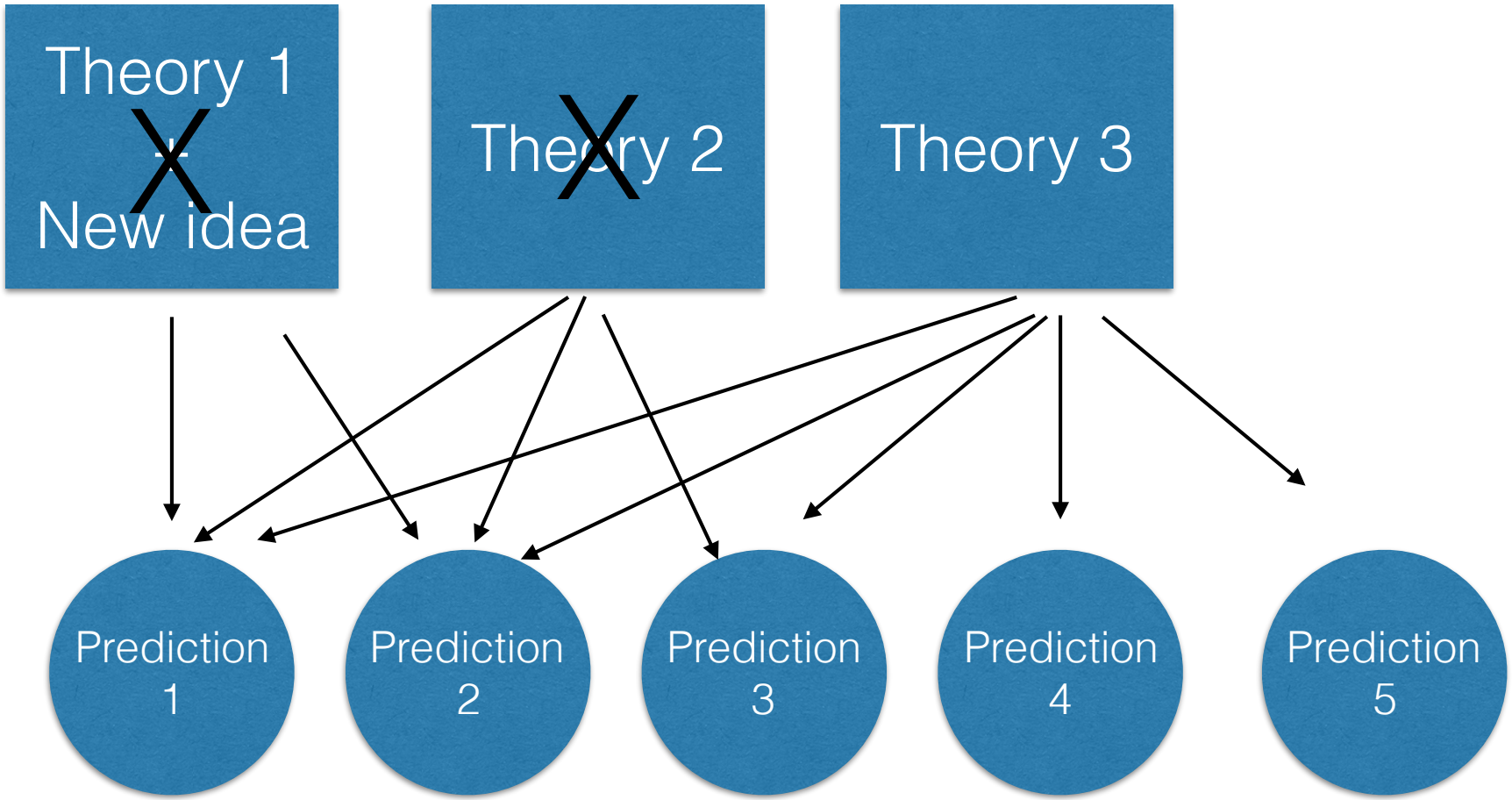
Newer tests

We look for differences in the assumptions between theories, to find new predictions than can be tested



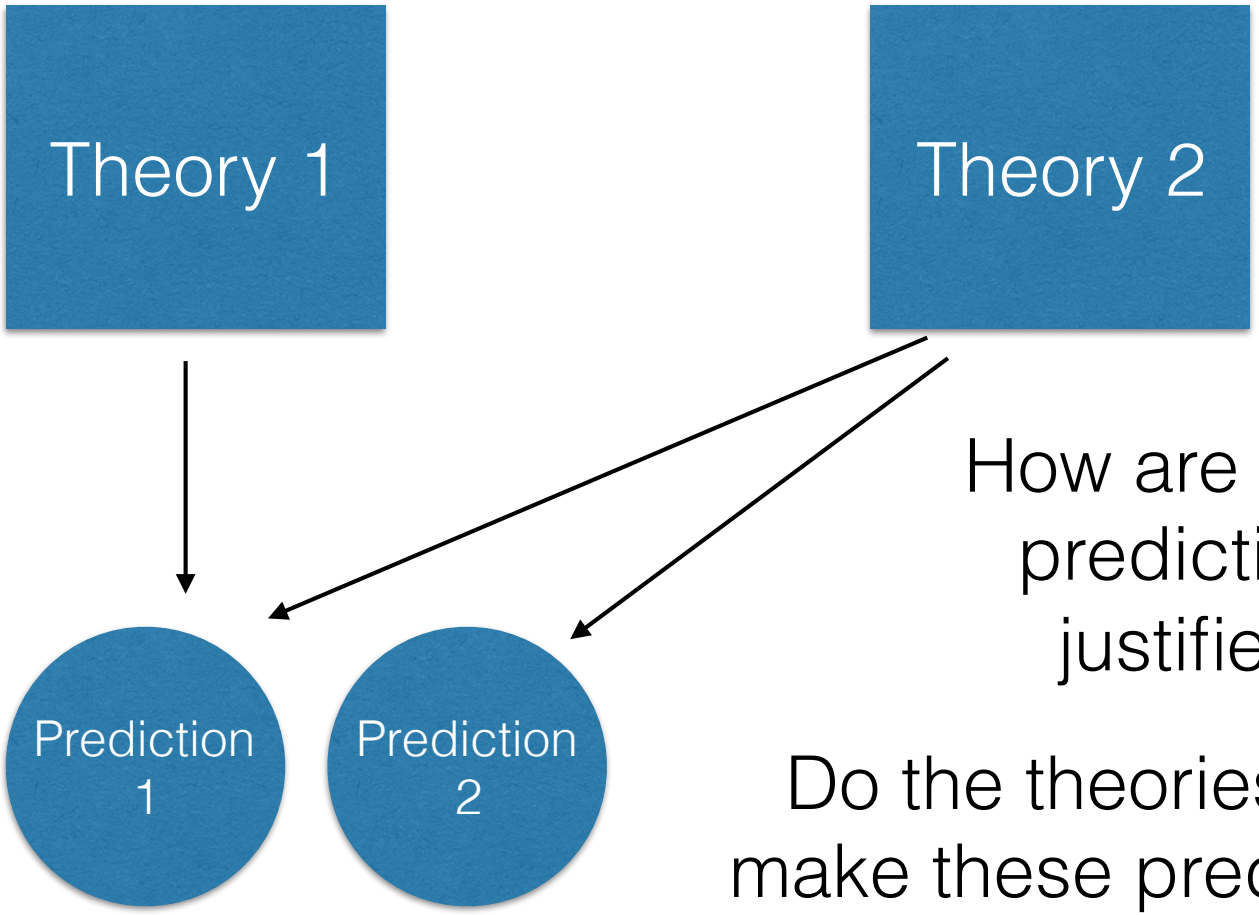
Survival of the fittest Theory

We look for differences in the assumptions between theories, to find new predictions than can be tested



Testability

Do the theories actually make, or fail to make, specific predictions

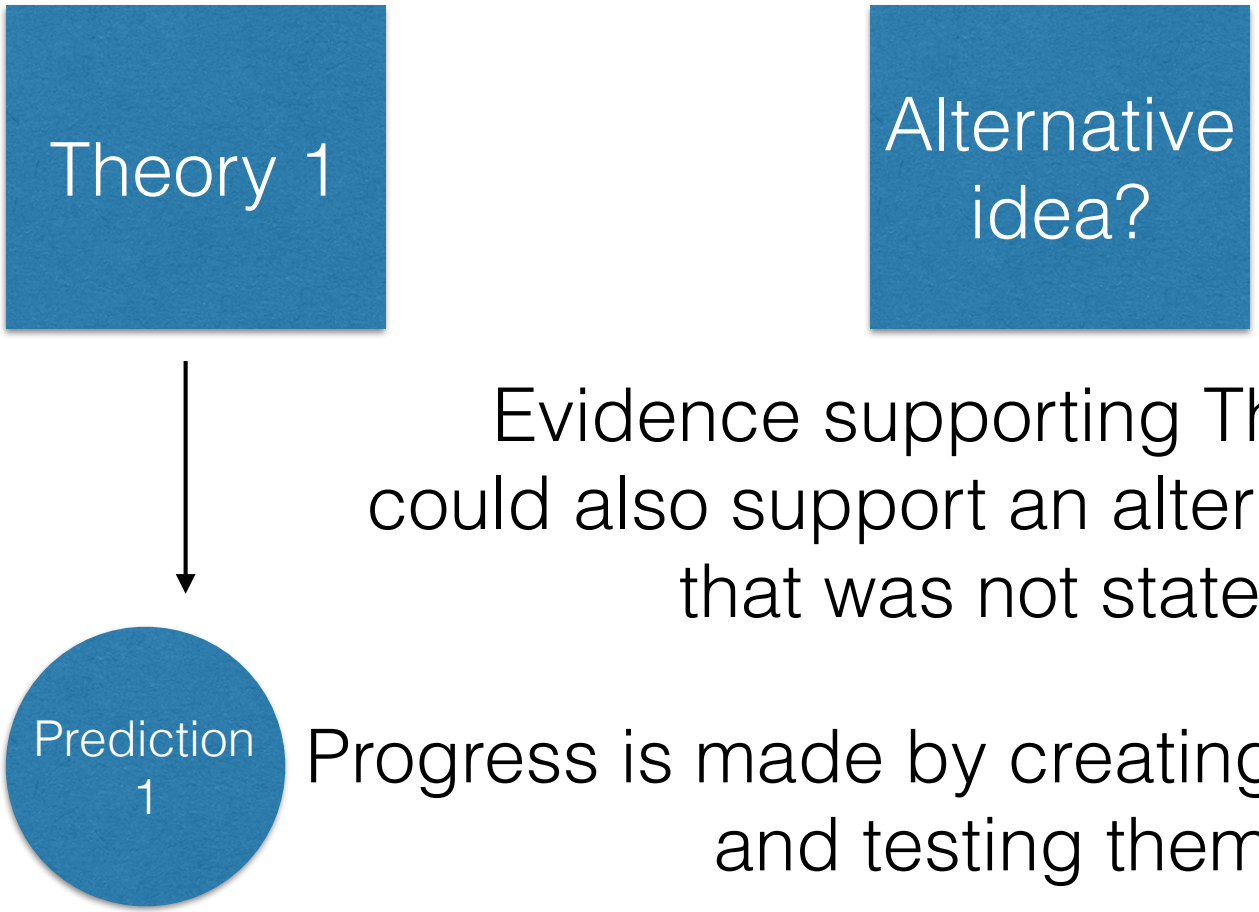


How are these predictions justified?

Do the theories really make these predictions?

What's the alternative

What other plausible ideas can explain the phenomena at hand?



Evidence supporting Theory 1 could also support an alternative idea that was not stated

Progress is made by creating alternatives and testing them

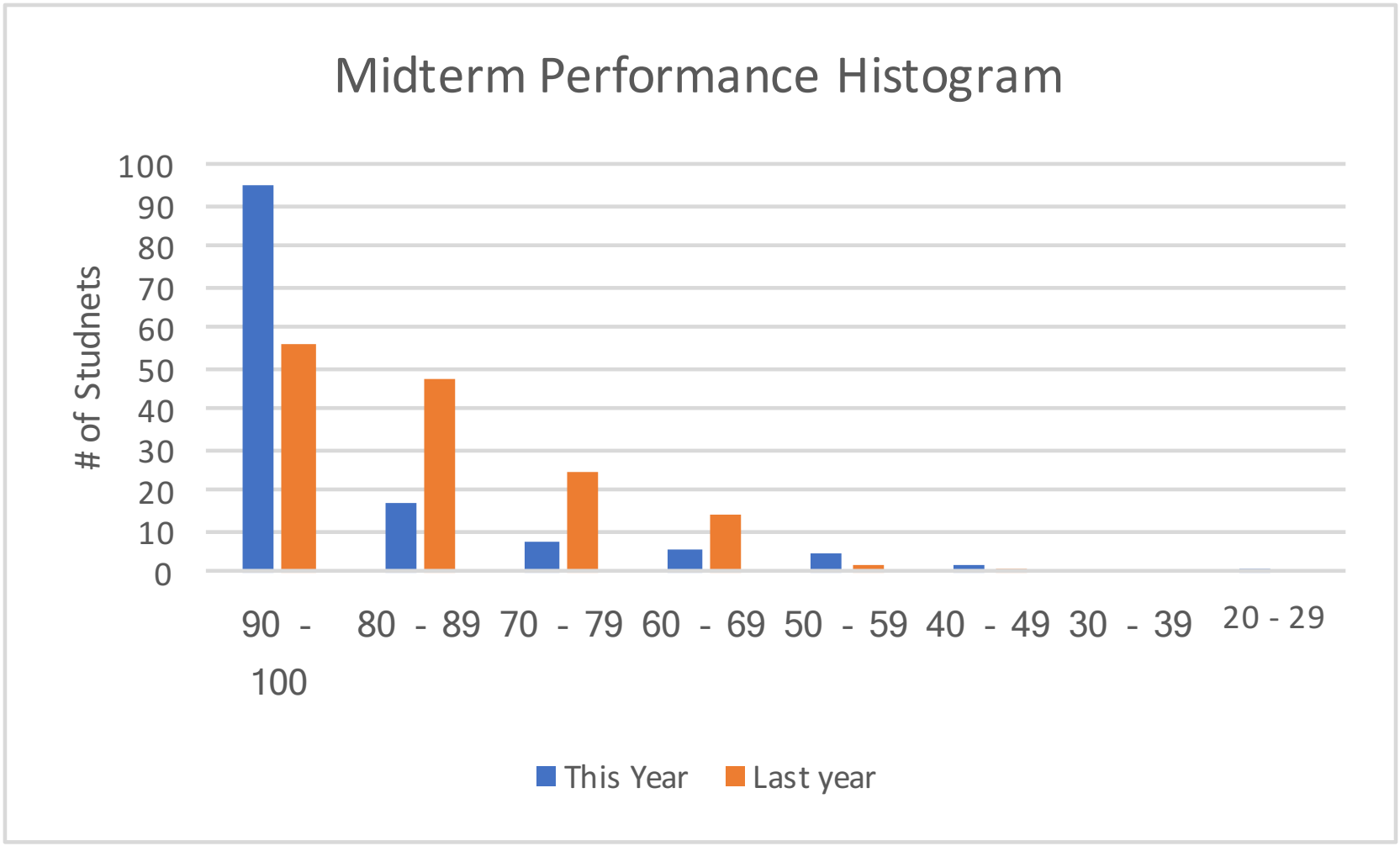
Examples

- Coming up with ideas that explain a pattern of data

Midterm Performance

- We have data on test scores for our recent midterm
- Let's look at this phenomena, and discuss alternative ideas that could explain the outcomes

Midterm Performance



Examples

- Coming up with ideas that explain a pattern of data, **AND** make a new testable prediction about what would happen in a new situation

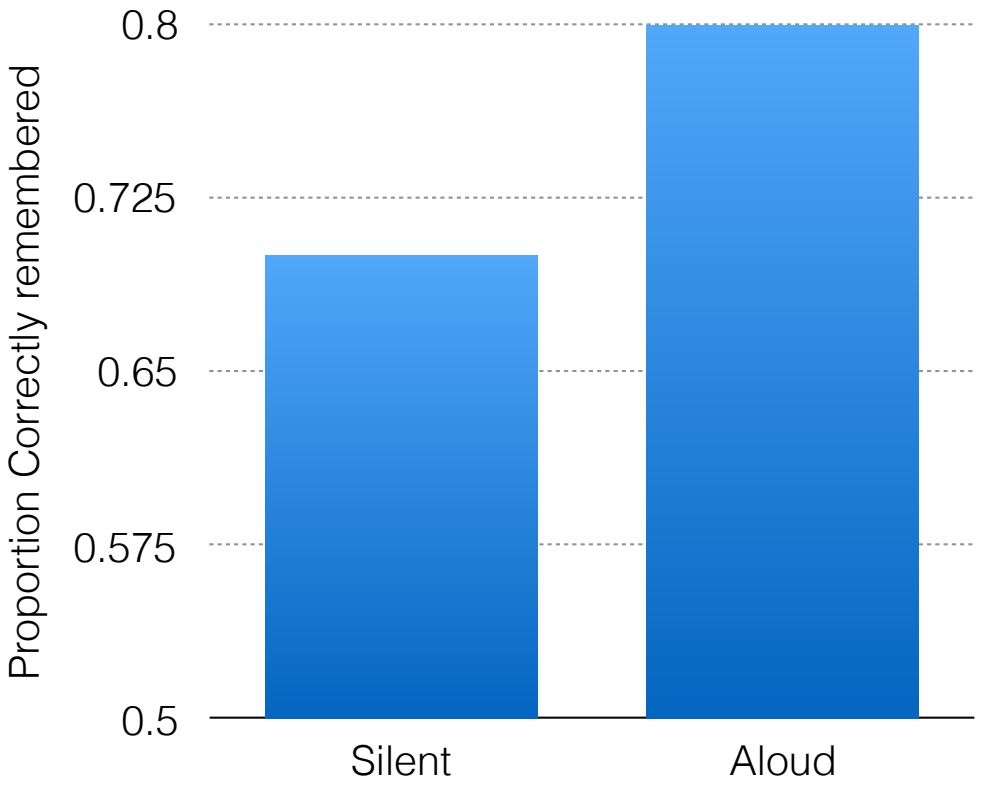
Production Effect

Read Silently

Read a list of words silently for a later memory test

Read Aloud

Read a list of words **out loud** for a later memory test



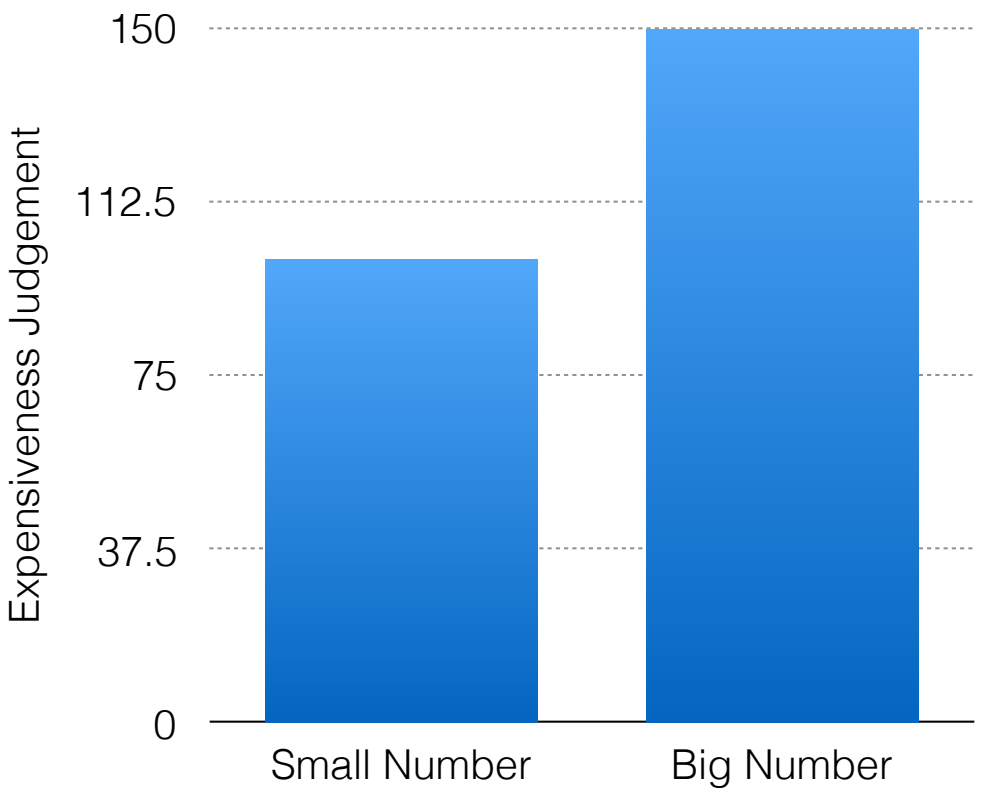
Anchoring Effect

See small Number

Judge how expensive a product is

See large Number

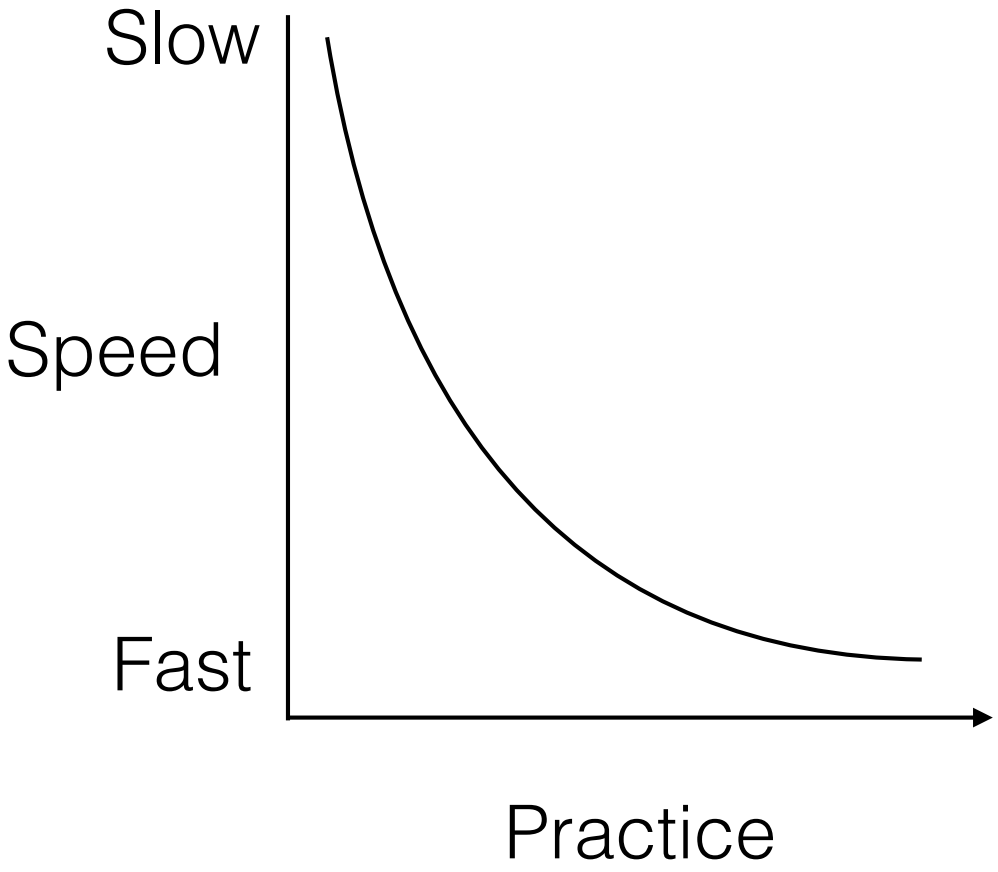
Judge how expensive a product is



Examples

- Generating a testable implication from a formal theory

Instance memory and automatization (Logan, 1988)

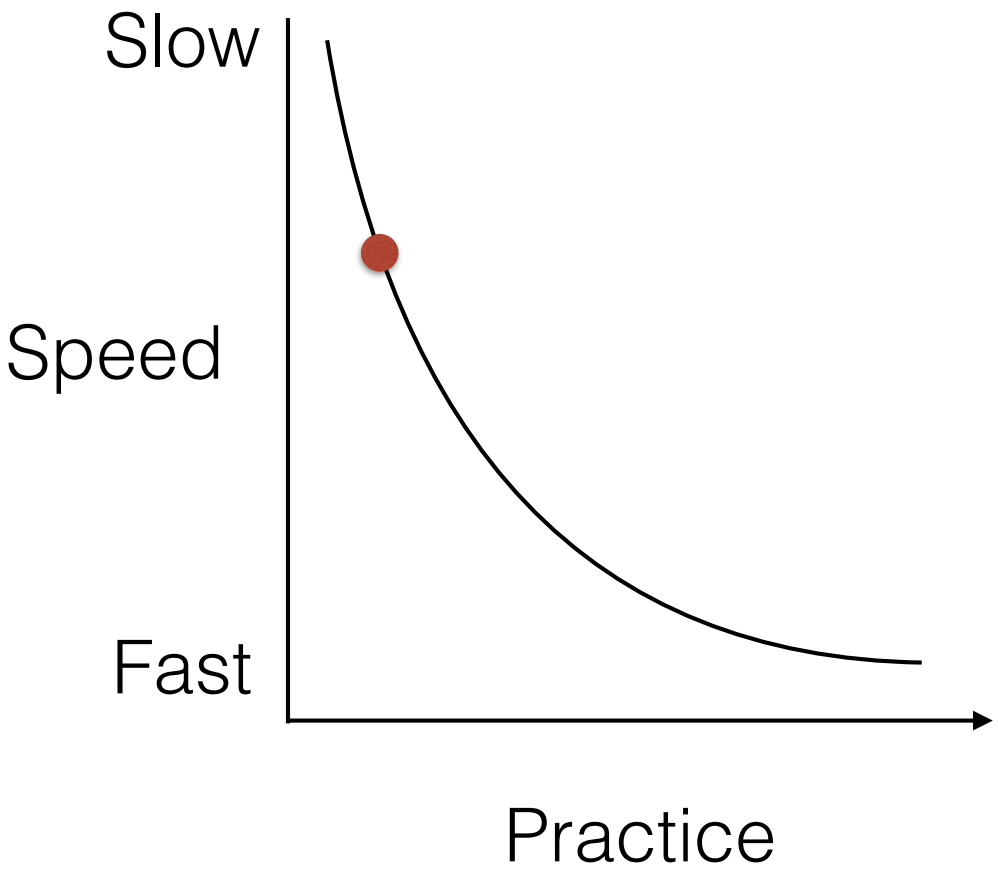


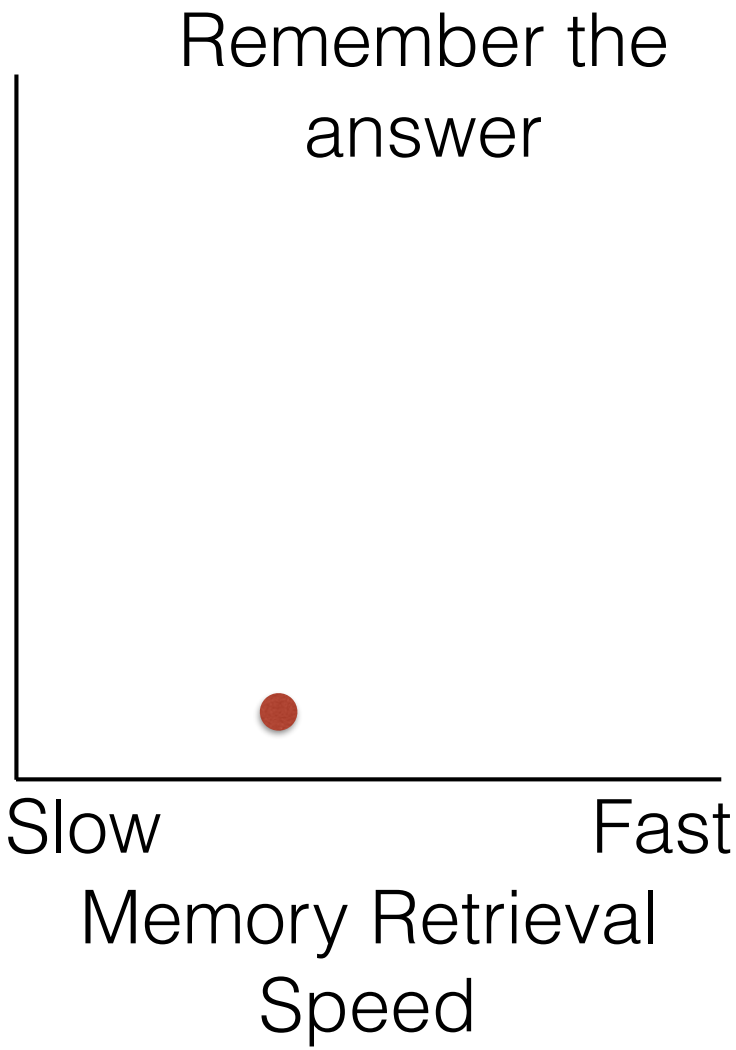
Speed = Time to figure out answer

or

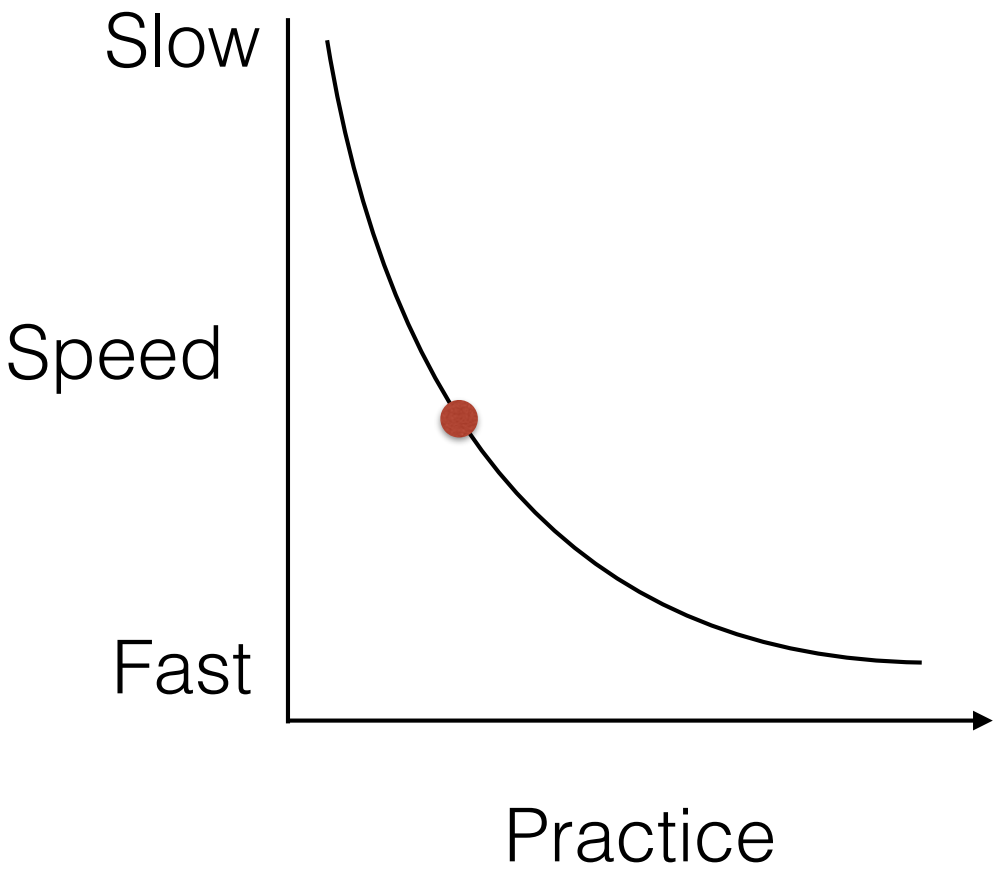
Speed = Time to remember the answer

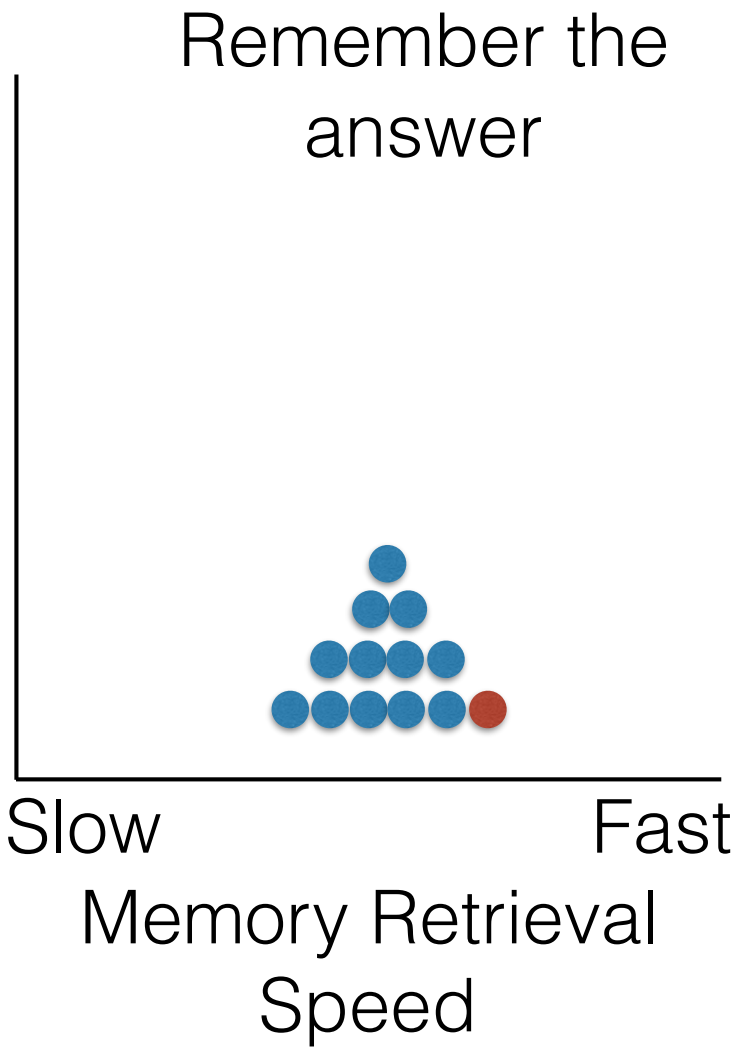
Instance memory and automatization (Logan, 1988)



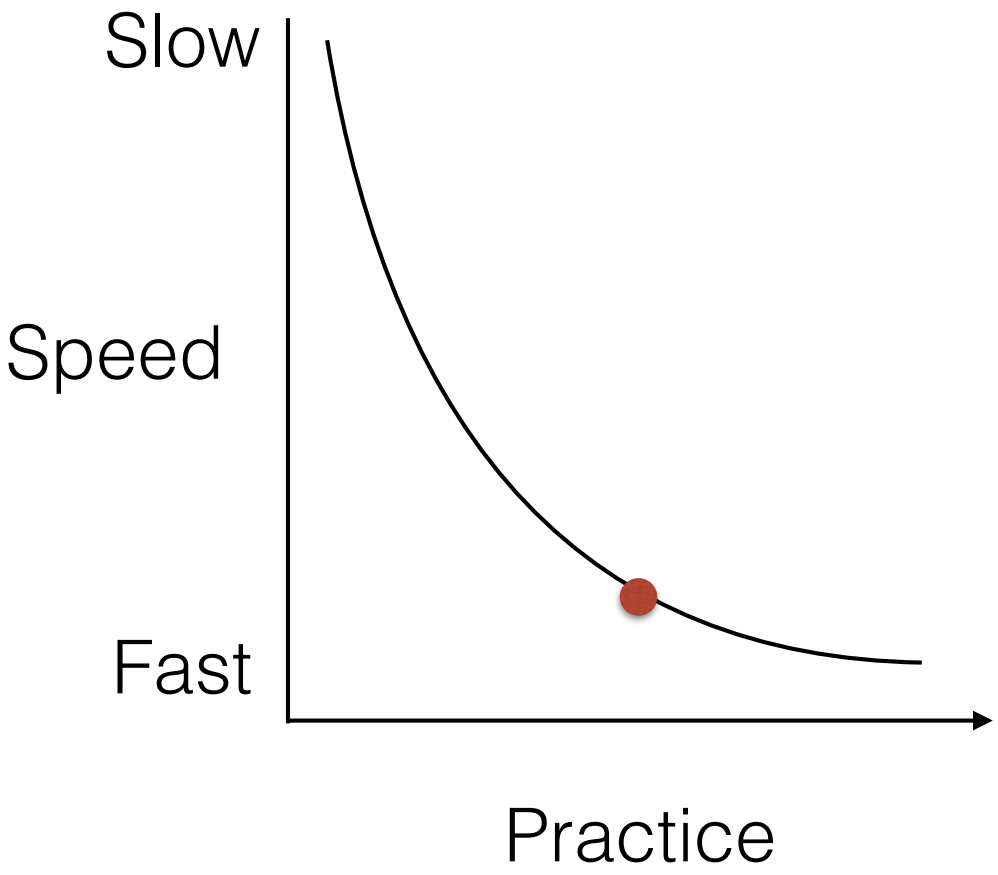


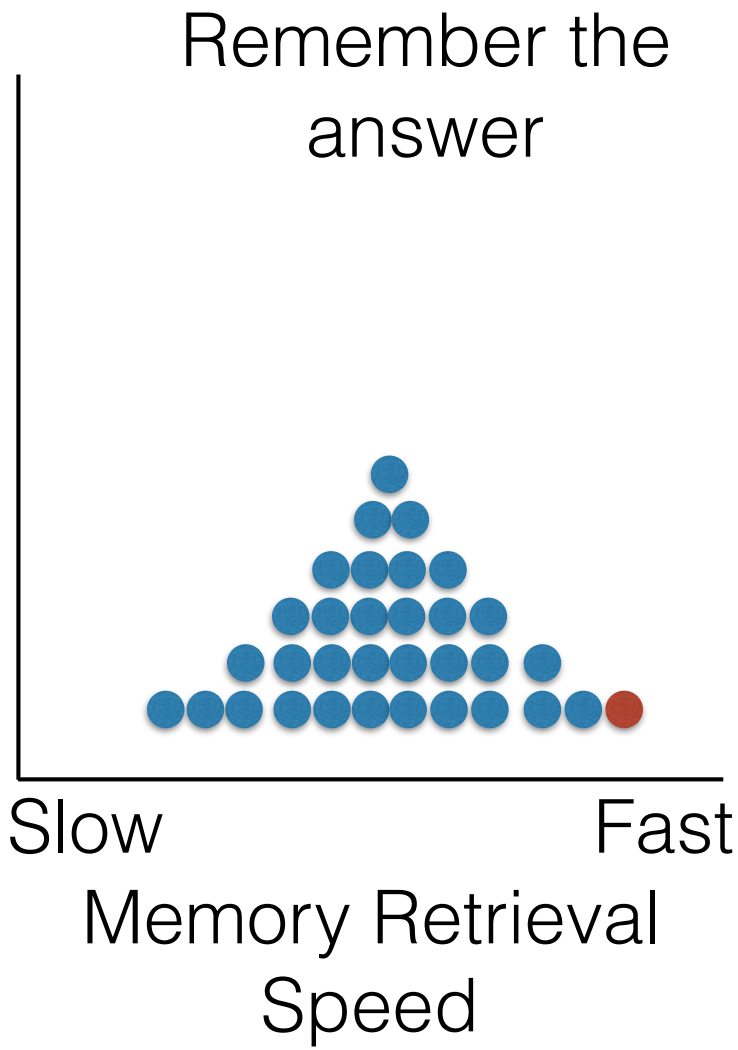
Instance memory and automatization (Logan, 1988)



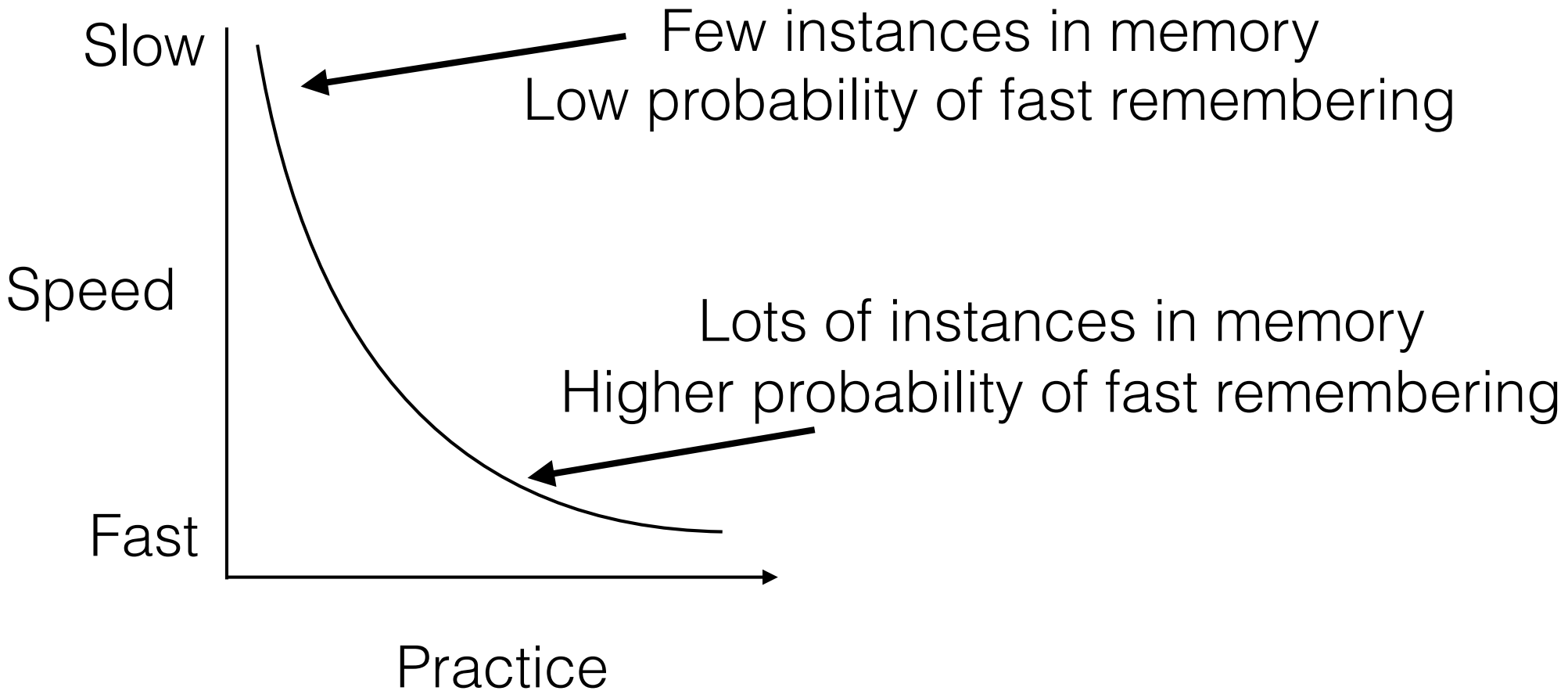


Instance memory and automatization (Logan, 1988)



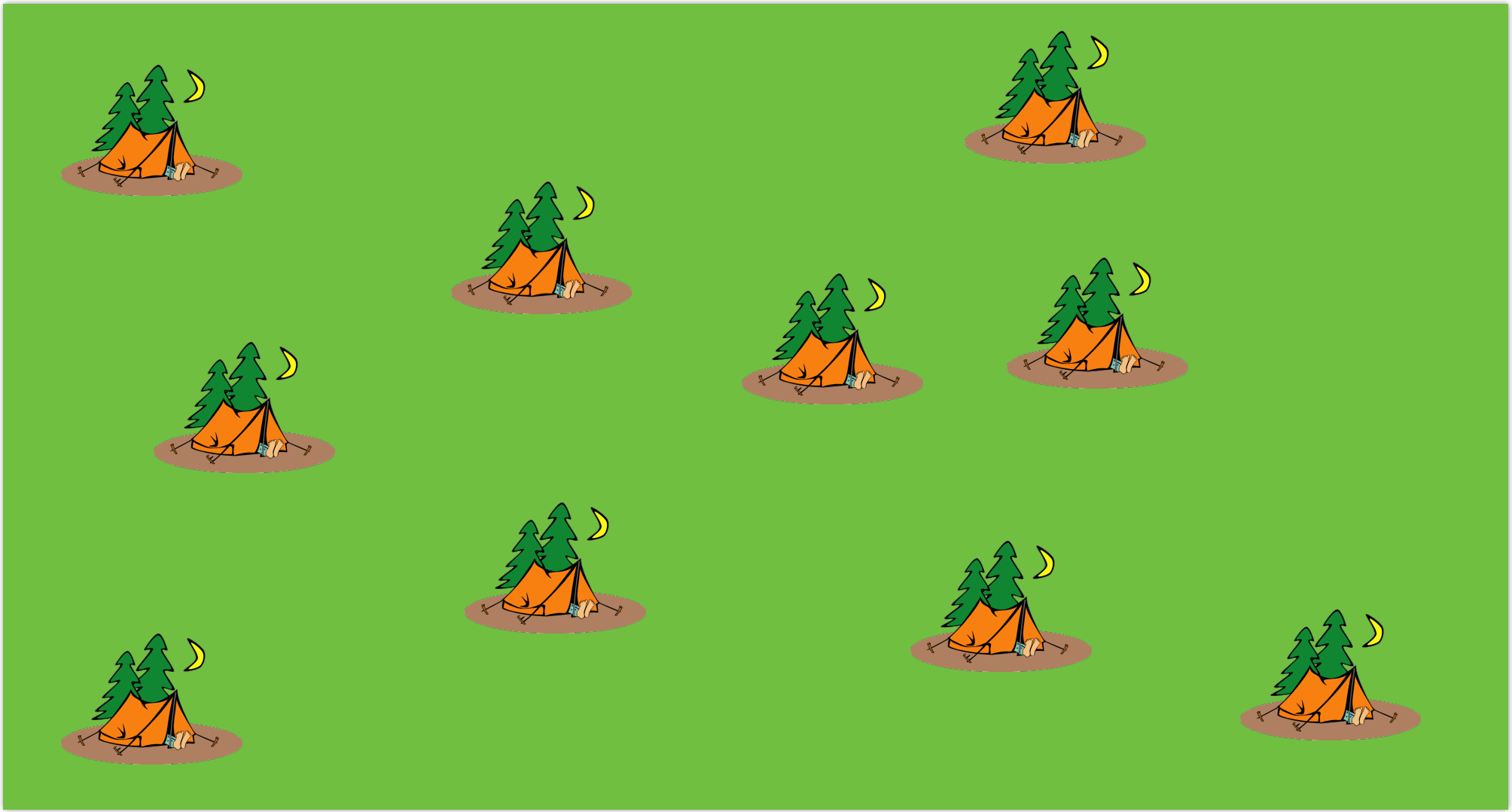


Instance memory and automatization (Logan, 1988)

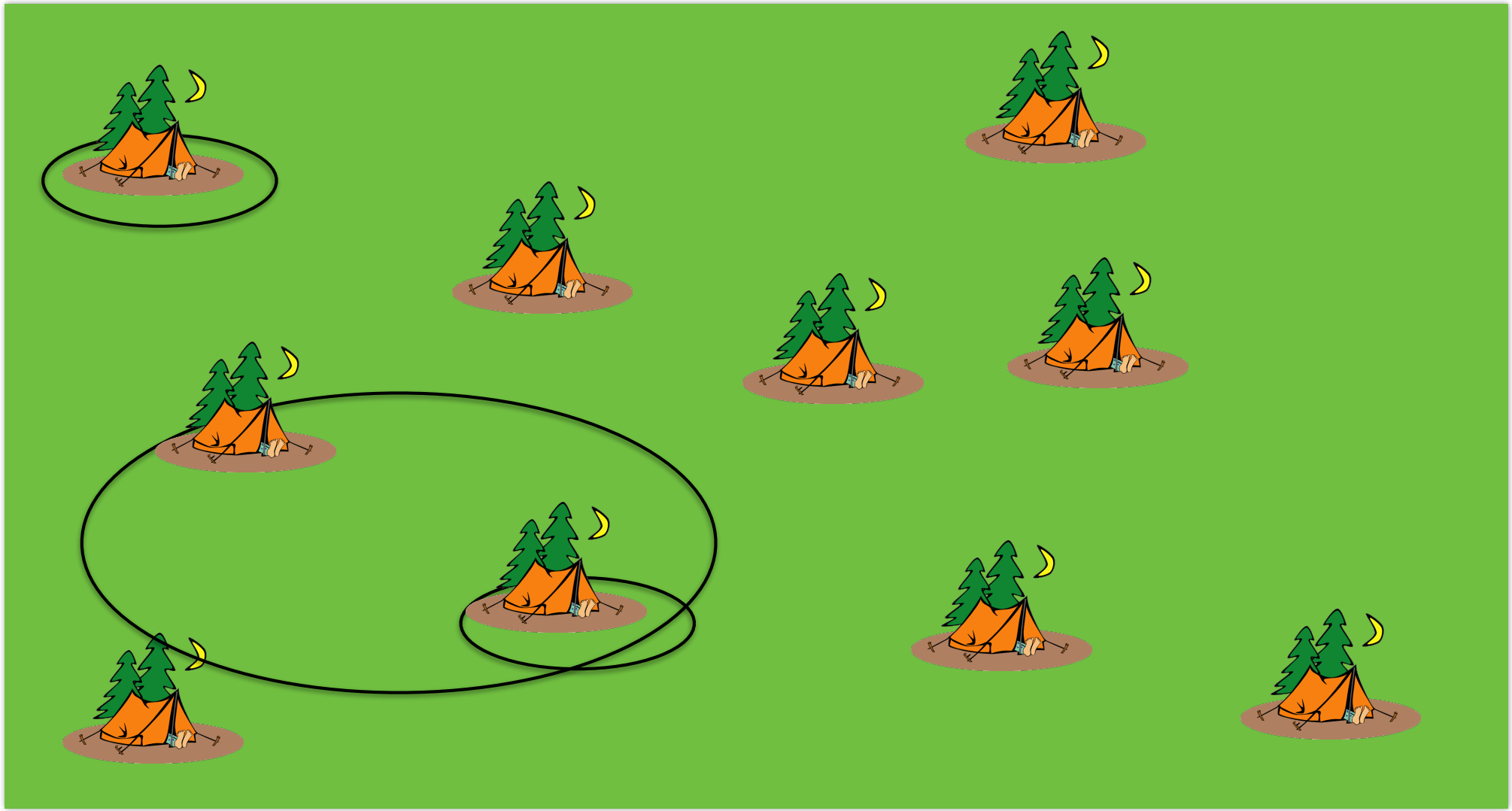


Broader perspective on Theory and Phenomena in Psychology

There are many “camps” with ideas about how to explains parts of the landscape of Psychological Phenomena



Each “camp’s” ideas have different scopes, they explain small or large amounts of different phenomena

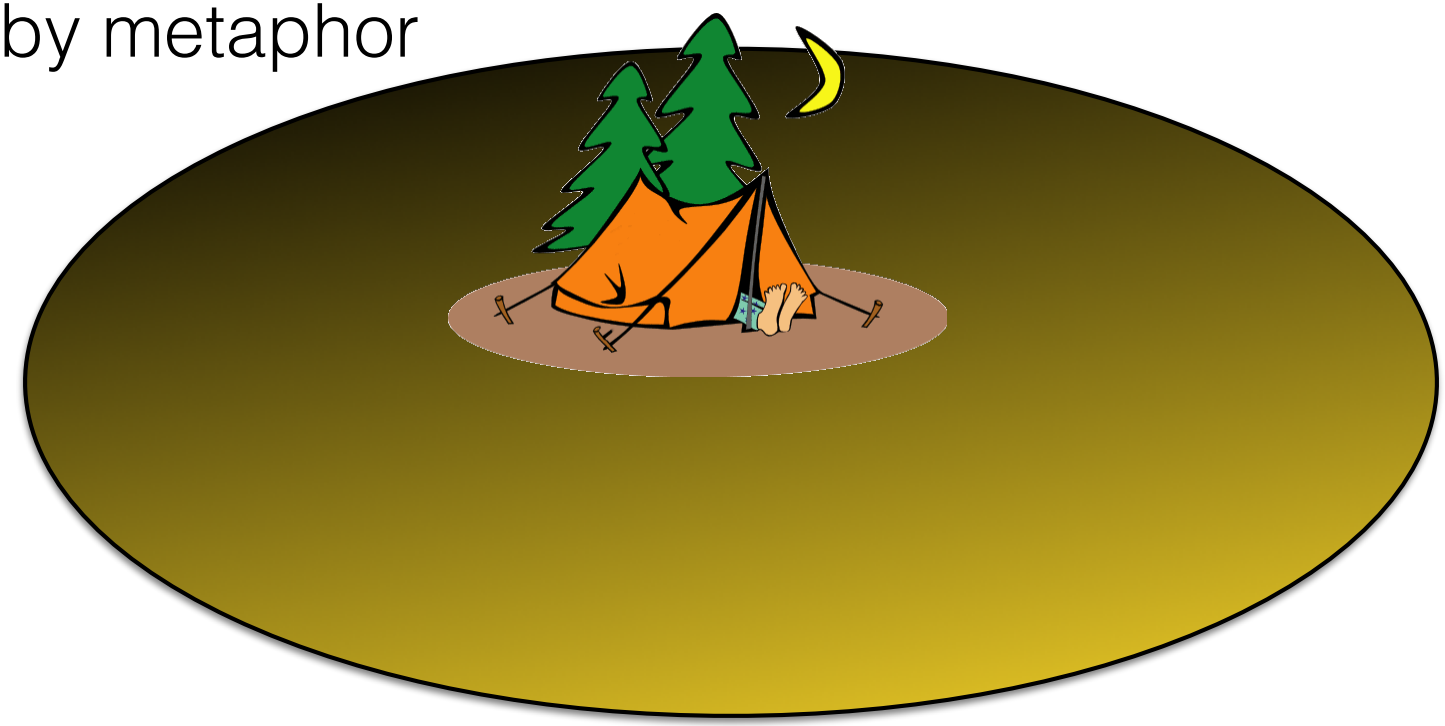


Theories and Metaphors

- Theories about how things work often rely on metaphors.
- e.g., the way X works, is like the way that Y works
- Y becomes a metaphor for X

Metaphors shine and shade

hidden by metaphor



illuminated by metaphor

What is a debate?

War Metaphor for debate

- Debator's are opponents, trying to win a battle
- "I shot down your argument"
- Debator 1 killed Debator 2's arguments

Dance Metaphor for debate

- Debator's are partners, showing an audience how ideas about a topic move around
- "Nice move", "interesting argument"

Implications

- How the debate unfolds could depend on the metaphors that debators have for debates
- How researchers ask questions can depend on the metaphors behind their theories.

Attention Research

Attention is a spotlight

Attention is a filter

Attention is a limited resource

Weekly assignment

- Write a multiple choice question that tests a concept from this lecture and/or the chapter on Theory and Phenomena
- Include four possible choices
- Make the question difficult enough so that (in your estimation) 75% of the class would get the correct answer.