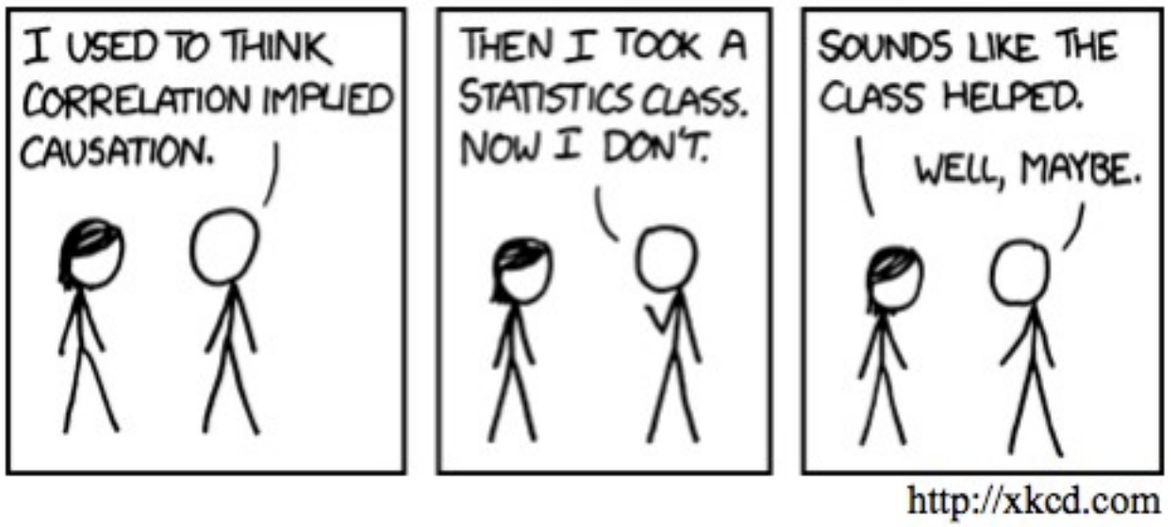
Psychology as science

Schools of Thought

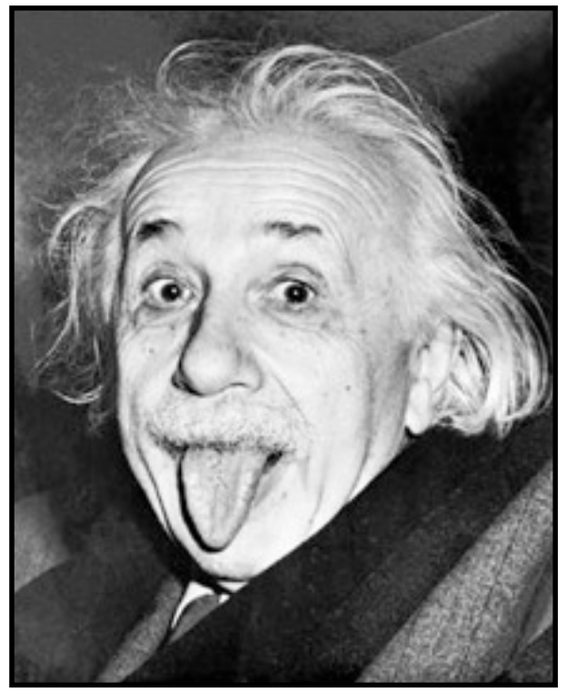
What makes a science?

science:
intellectual, systematic, rigid methodologies, agreed upon procedures

natural / empirical / observable (starting point)
*correlations and causations



"No amount of experimentation can ever prove me right; a single experiment can prove me wrong"



makes falsifiable predictions

as the universe is lawful, we assume **determinism**, or everything that happens is a consequence of existing preconditions. We **search for these laws**: particularly laws of **causation**

the philosophy of Karl Popper

science starts with a **problem**. The nature of the problem determines the **methods** of solving it.

principle of falsifiability: something that can be everything has no explanatory value.

major critique of Freud (postdiction)

ideally, the science makes **risky predictions** (those that are likely to turn out false). In fact, these are more valuable.

non-scientific methods are valuable is well (everything starts this way).

theory in science

Scientific activity begins with a **problem** or **question** that guides observation, not unguided observation

problems → theories → solutions

theory = proposed solution "vehicle to truth"

theory **guides the direction of science** (where do we go find the info we are seeking); it does not need to be correct to be useful... **but it must be testable**

Gordon Allport

"A theory is a well coordinated conceptual system. It attempts to give rational coherence to a body of known empirical relations; and from it can be deduced theorems whose predictive validity can be tested, thereby appraising, in part, the validity of the theory. At the very least such conceptual systems, if not too tenaciously adhered to, have a value in stimulating research. At their best they serve not only in this capacity, but as the openers of wider horizons."

classification of theories

Physical theories use a mechanism to account for observations.

the mechanism does not need to be available to the senses (logical positivism)

* see Ch. 5 "Positivism", Ch. 13 "Logical Positivism"

examples: Atomic theory (John Dalton), Mendelian genetics, viral theory of disease

1. All matter is composed of extremely small particles called atoms.
2. ***All atoms of a given element are identical, having the same size, mass, and chemical properties. Atoms of a specific element are different from those of any other element.***
3. ***Atoms cannot be created, divided into smaller particles, or destroyed.***
4. Different atoms combine in simple whole-number ratios to form compounds.
5. In a chemical reaction, atoms are separated, combined, or rearranged

Had Dalton ever seen an atom when he proposed his theory?

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1. 1865: alternative versions of genes account for variations in inherited characters.
2. For each character, an organism inherits two genes, one from each parent.
3. If the two alleles differ, then one, the dominant allele, is fully expressed in the organism's appearance; the other, the recessive allele, has no noticeable effect on the organism's appearance.
4. The two genes for each character segregate during gamete production.

Had Mendel ever seen DNA? No sample taken until 1869. Even then, it was not accepted until statistic support from R.A. Fischer in 1918

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- 1890 Ivanovsky was commissioned to study a disease that was destroying tobacco plants in the Crimea
- Widely believed the cause was bacterial
- Ivanovsky ruled out a bacterial source using a porcelain filtering method and bacteria too big to fit through filter trap
- concluded that source of infection was small parasitic microorganism that was invisible even under great magnification

Scientists accepted viral theory because it explained bacteria-like infections that did not have a bacterial source

Mathematical-abstractive theories use precise descriptions of relationships to account for observations.

often the relationships are **formalized (expressed in mathematical statements)**

examples: Theory of relativity, Darwinian evolution

- (E)nergy = (M)ass × c^2, c = speed of light

- States that when a body has mass, it has a certain amount of energy
- Energy remains even if it is at rest and does not have any form of potential energy, chemical energy, etc.

- 1 kg of mass converts into a quantity of energy equal to 21.48076431 megatons of TNT

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examples: Theory of relativity, Darwinian evolution

- Proposed that species evolve to take advantage of unfilled ecological niches
- Natural selection determines the “fitness” of any species
- Fitness = living long enough to successfully produce offspring

classification of theories

Metaphorical theories: an event is explained simply by ascribing it to forces that are themselves at least as mysterious and complicated as the event itself

ex. early man and the power of the gods

ex. early fossil explanations: Failures of a creative force within the earth; a "stone-making force"; coincidence; "tumultuous movement of terrestrial exhalations"; "fatty matter set into fermentation by heat"; "lapidific juice"

None of these statements actually tells us anything about fossil formation.
Examples in psychology??

classification of theories

Analogical theory: A process that is already understood is taken as a model for the process that is to be explained

Analogical theories can be accepted in science

Analogy may make understanding and explaining the system easier during early theorizing, but is only useful so far.

The only analogical model that can fully represent a phenomenon in every detail is identical to the phenomenon itself

Psychology is extremely guilty of this one...

and psychology?

Hullian Learning Theory (Hull, 1943)

- Proposed that all organisms have four basic needs (air, water, food, sex)
- When needs are not met, an internal "drive force" builds in the organism that compels it to actions to attain the substances that satisfy the need
- **Behavior is a function of drive needs**
  - Learning is a function of drive satisfaction
  - Learn S-R associations that reduce drive
  - Behaviors that do not reduce drive are eliminated

Effective excitatory potential — **incentive value of reward** — **inhibition** — **conditioned** — **reactive**

$$sEr = D \times K \times sHr - sIr - Ir$$

drive — **habit strength**

does psychology need a theory?

B.F. Skinner

"...it is possible that the most rapid progress toward an understanding of [Psychology] may be made by research that is not designed to test theories. An adequate impetus is supplied by the inclination to obtain data showing orderly changes characteristic of [psychological processes]. An acceptable scientific program is to collect data of this sort and to relate them to manipulable variables, selected for study through a common sense exploration of the field."

why might Skinner be wrong?

to get a complete account of the phenomena (for Skinner, **S-R** relationships), all possible aspects must be observed.

this is an impossible task, theory helps guide our decisions about which to focus on an the degree to which they should generalize

to say nothing about observation v. understanding

Having fun with science...

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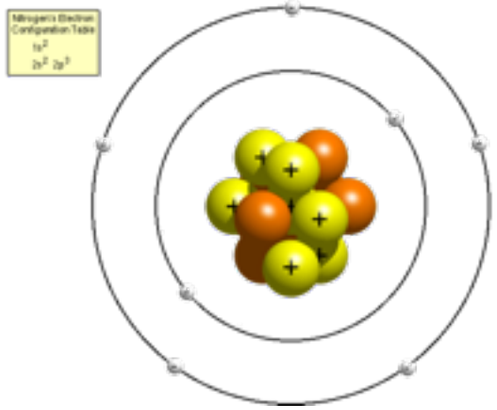

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http://htwins.net/scale2/

general v. single domain

general theories try to explain everything in a domain

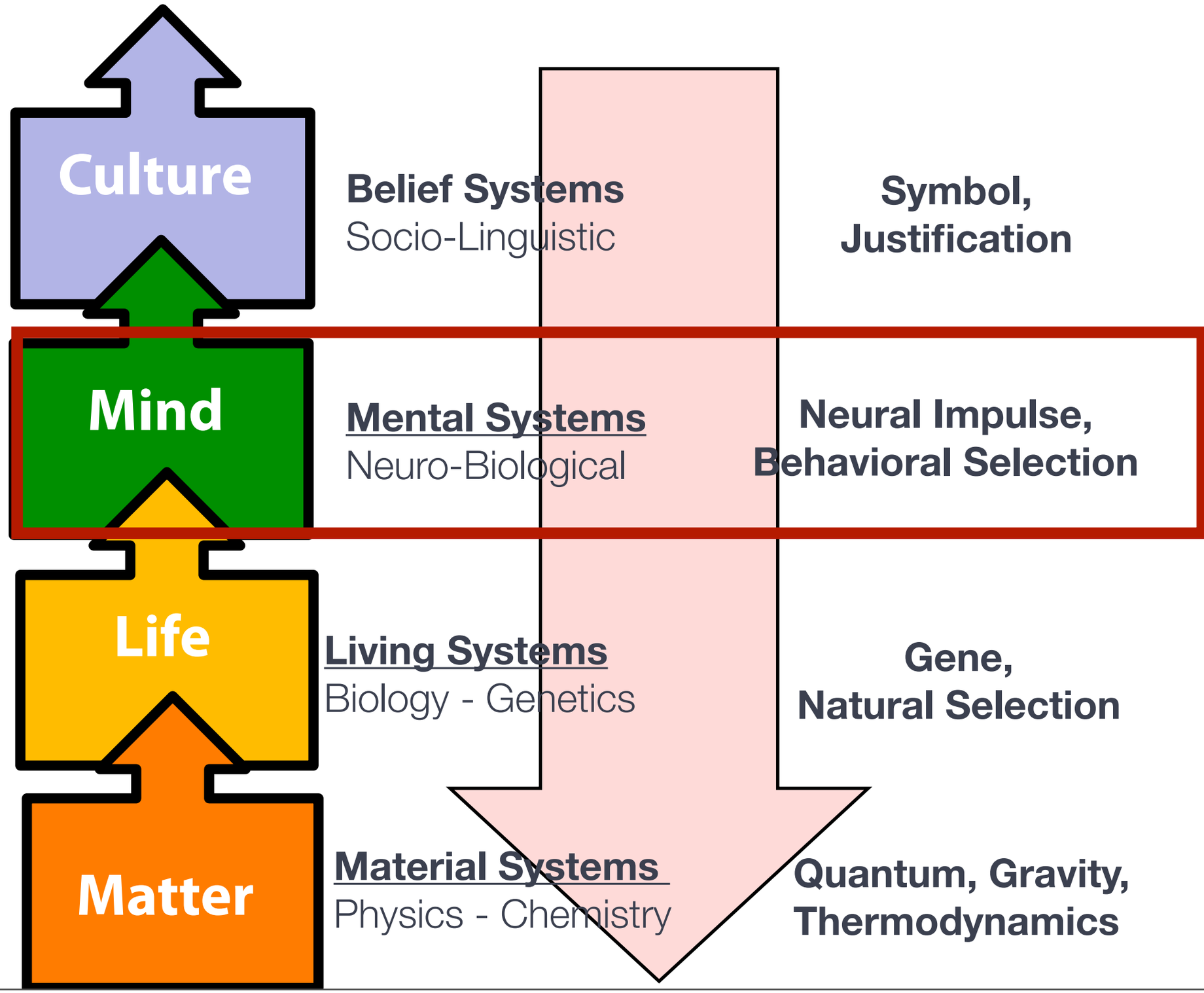
- **Newtonian physics** tried to explain all of physics
  - Newtonian physics displaced by Einsteinian physics
  - String theories now trying to unite Newtonian and Einsteinian physics
- **Freudian psychodynamic** model tried to explain all elements of personality and psychological pathology
- **Hullian drive theory** tried to explain all learning

single domain theories try to carve up segments of a body of knowledge to explain parts of the findings

- Universe is incredibly complex, which makes it difficult to formulate one unifying theory that explains everything in a domain
- Single domain theories may be more successful in allowing us to understand and predict
- Eventually, however, someone may invent a theory that reunifies all of science!

reductionism

Tries to explain observations in terms of the actions of entities or processes that are themselves simpler than the observed phenomena



Philosophy of science

Thomas Kuhn proposed that science does evolve gradually toward truth, but instead undergoes periodic revolutions.

Paradigm: dominant viewpoint or framework that guides activity: questions asked and the methods used. **This is good and bad.**

evolution: pre-paradigmatic → paradigm → revolution

within a paradigm, most people are doing **normal science (WWPS?)**

Science is not static all theories will be replaced as the science advances through criticism and confirmations of previously unconfirmed hypotheses

best you can hope for: ***not yet disconfirmed (K. Popper)***

what influences the paradigm?

Explanatory value of theory is linked to temporal context

What constitutes a good theory is constrained by its believability in a particular temporal context

Zeitgeist: "time ghost"; the intellectual and cultural climate of an era

Changes with time as people become disaffected with it

Because science is a social enterprise, Zeitgeist has implications for science, too.

Opinions that deviate from the ruling zeitgeist always aggravate the crowd.
- Anne Louise Germaine de Staël

"Don't take any shit from the zeitgeist." - George Carlin

paradigm shift

As a paradigm is explored to the limits of its scope, **anomalies** (failures to account for empirical observations) accumulate

Anomalies may cause some scientists to break with paradigm and engage in "**revolutionary science**"

Explore alternatives to assumptions of current paradigm

A period follows in which there are adherents to both paradigms

With time, if solidification and unification of challenging paradigm is achieved, new paradigm will replace the old (paradigm shift)

Paradigm shift isn't just a change in theory, Kuhn argued that a paradigm shift causes broad sweeping changes in science. Changes in intellectual circumstances and possibilities that have huge implications for areas that need to be researched, useful kinds of constructs, OK ways to conduct research, appropriate statistics, etc.

Psychology as science?

- John Stuart Mill

Psychology as the science of the elementary laws of the mind

makes falsifiable predictions?

e.g., psychoanalysis: ad hoc explanations

empirical observation?

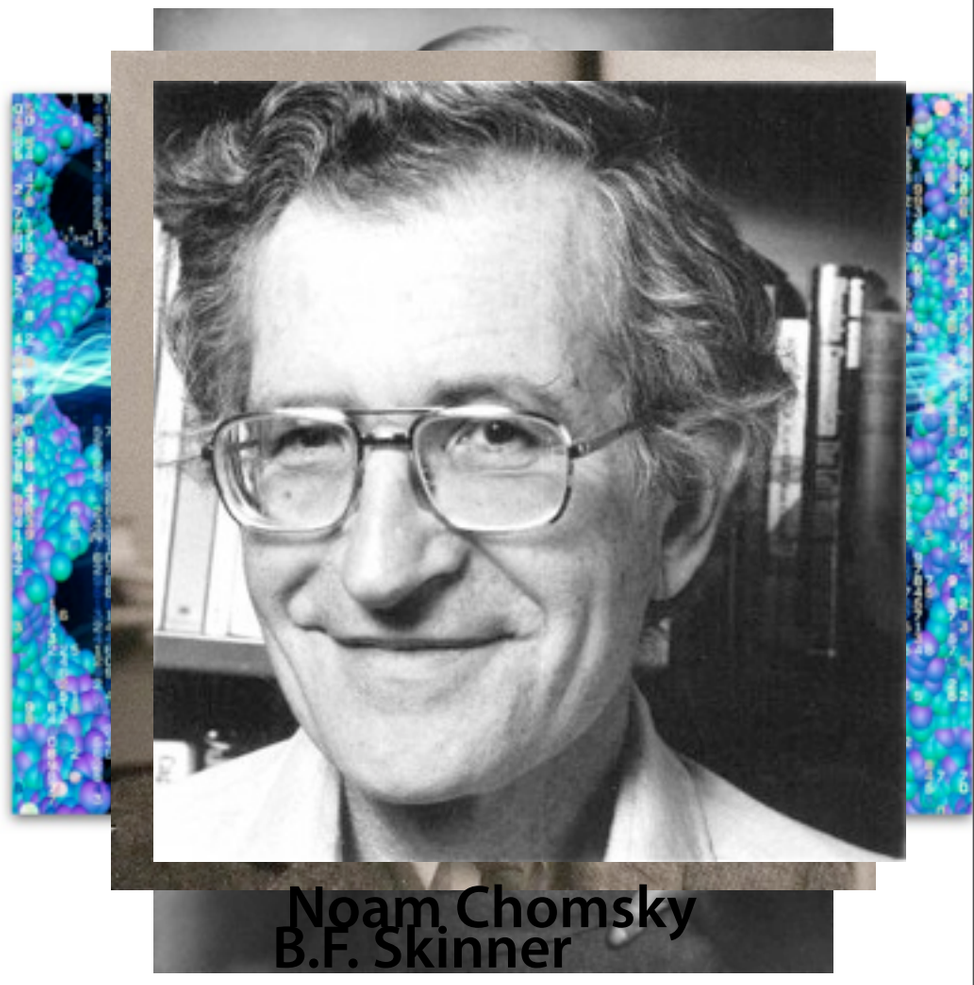
measuring the mind?

unifying theory?

relativity, thermodynamics, evolution ???

determinism

physical v. psychial determinism?



Sigmund Freud

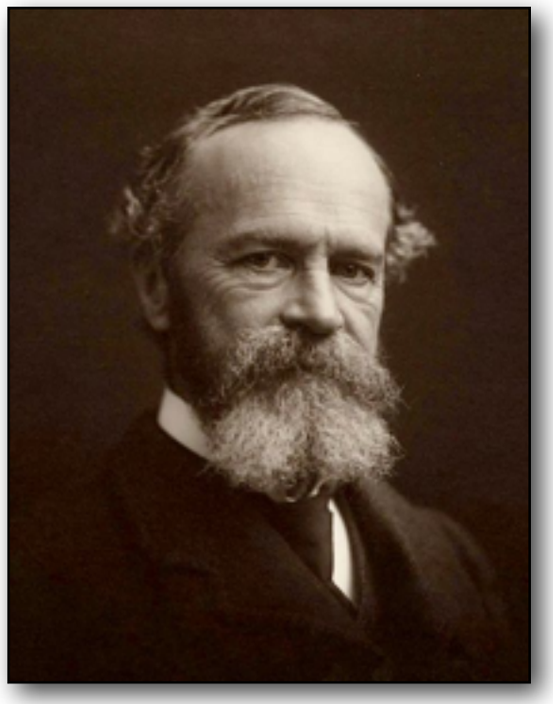
Voluntarism

- **Wilhelm Wundt** founds the first psychological lab in Leipzig, Germany in **1879**
- focus on the nature & composition of mental states
- creativity and will
- *introspective method*

Structuralism

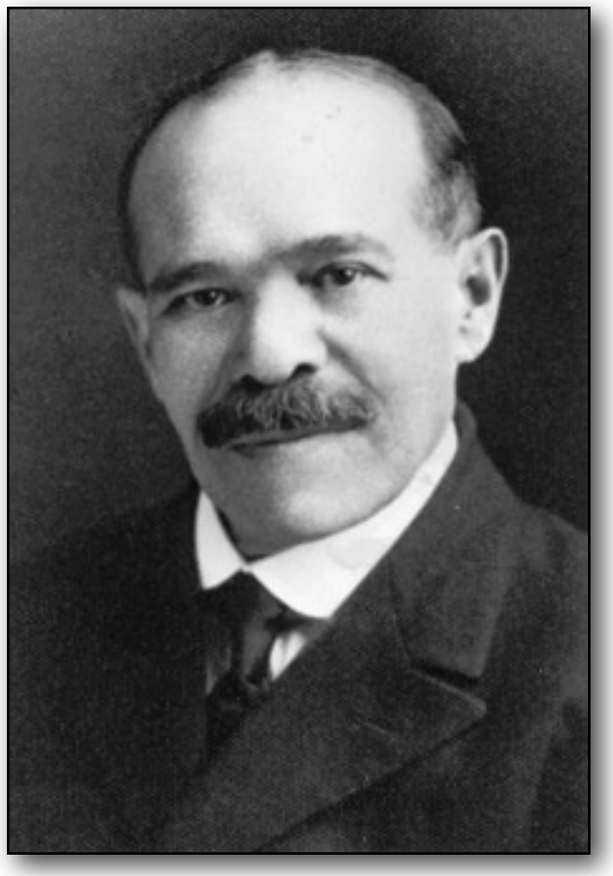
- **Edward Titchener** was a student of Wundt (as were many early psychologists), with a focus on sensory experience
- a descriptive analysis of conscious mental states allows one to understand the structure of mind
- separate each experience into primary elements

Functionalism



- **William James** (also influenced by Wundt) took a radically difference perspective:
  "The mind cannot be understood in terms of elements anymore than a house could be understood by studying each individual brick"
- mental capacities, like physical traits, evolved for an adaptive purpose and served important functions in human (and animal) life
- American school

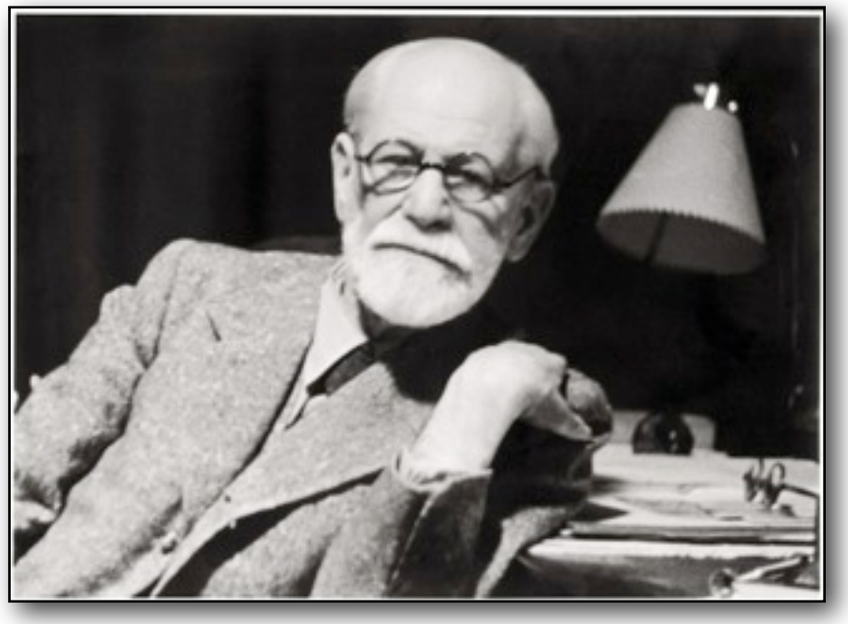
the Gestalt



- **Max Wertheimer** observes pure (objectless) motion; argues that perceptual experience cannot be constructed from individual sensations.
- "the whole is different (greater) than the sum of its parts
- focus on laws (field dynamics)

Freud psychoanalytic

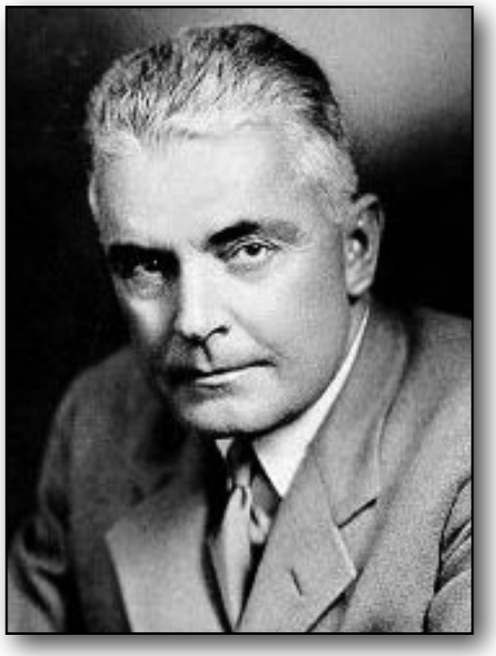
- based on Freud's clinical observations
- interplay of instincts, wishes, drives, and desires cause conflict
- focus on unconscious motives and their implications personality development and mental disease



Clinical approaches

- collection of practices including psychometric approaches to measuring **individual differences**, **intelligence** testing and theorizing about intelligence, **educational psychology**, and **applied psychology** such as **aptitude testing** in the workplace and other contexts
- became popular around WWI

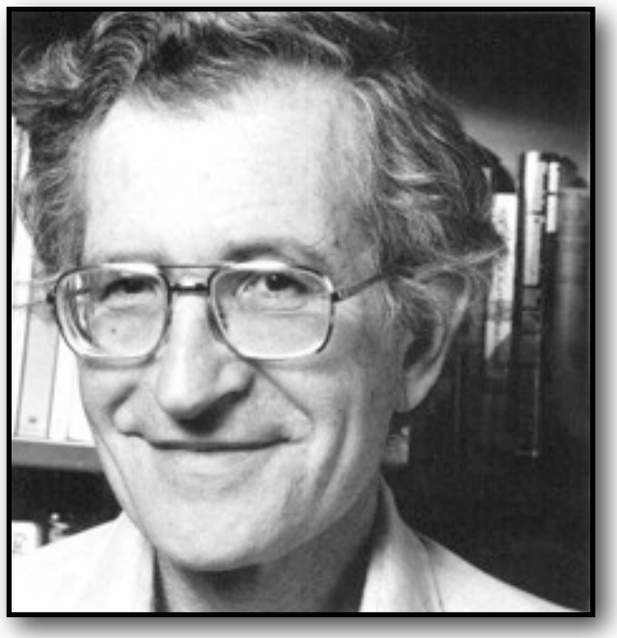
Behaviorism



- **John Watson's goal:** a scientific psychology
- the focus on **observable** organismic responses to environmental stimulus conditions
- ***how can one study what one cannot directly observe?***
- ignored / actively opposed approaches that focused on the study of consciousness or the use of introspection

Cognitive approaches

- early major advocate **Noam Chomsky** argued against behaviorist accounts of **language development**.
- we have a common experience of *internal behavior.*
- major school of the modern era; strongly tied to linguistics, cryptology, information theory, computer technology and metaphors



paradigm shift??