

Lecture/Workshop Wednesday April 1, 2009

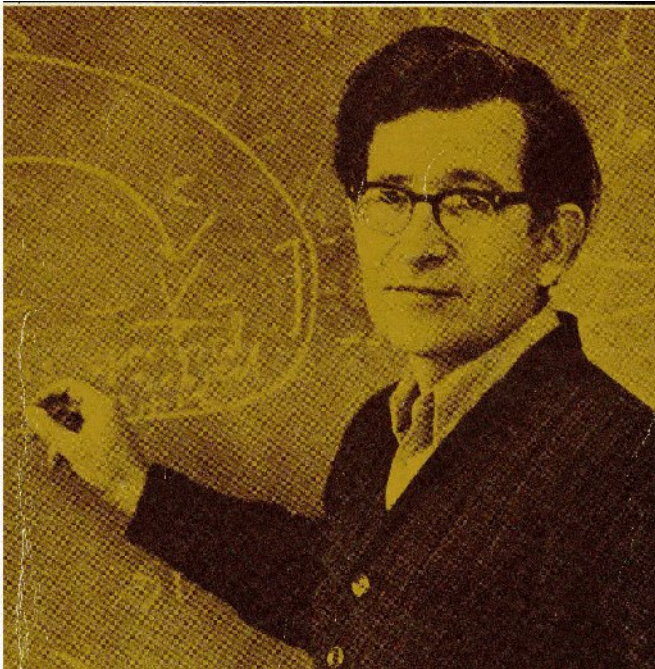
9-10:30 A bit of history: Introduction to Noam Chomsky
on Language and Mind

Break

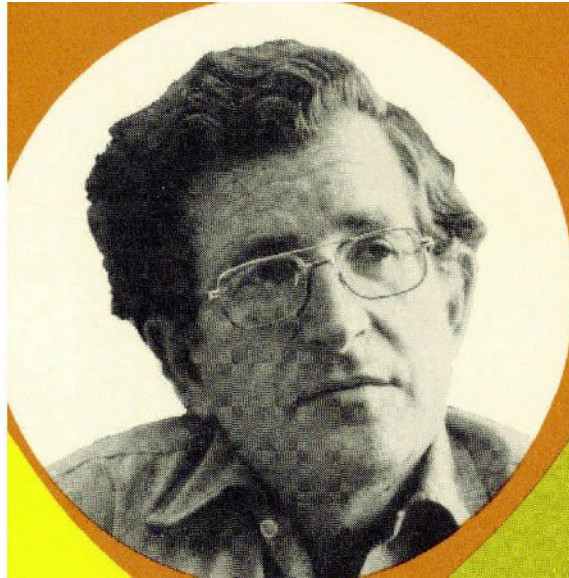
11:00-12:30 Situating Chomskyan Linguistics

Noam Chomsky (b.1928)

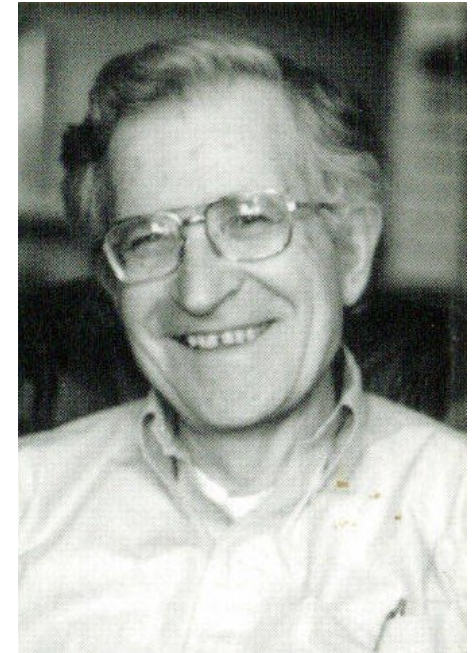
Transformational figure in 20th century Linguistics



1950s “linguistic
revolutionary”



1970s “establishment
leader”



2000 “éminence
grise”

Sequence of Topics on Context and History

Chomsky as a revolutionary in both the study of cognition (mind) and in linguistics.

Some Basic elements and ideas in his early work

Impact of Chomsky on the prevailing psychological paradigm: Behaviorism

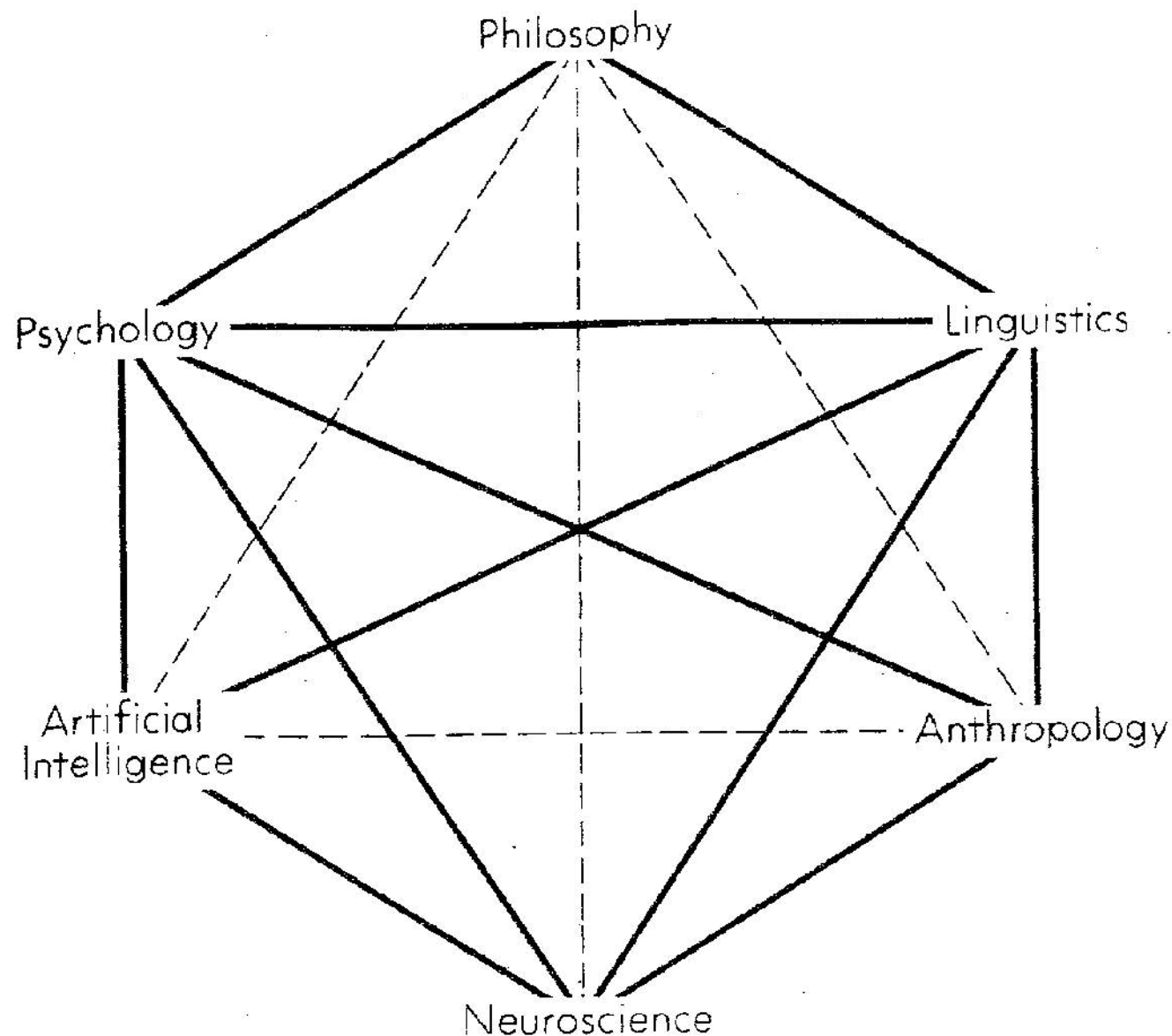
Chomsky and Descartes: the “Second Cognitive Revolution

Howard Gardner’s characterization of “The Mind’s New Science”

Cognitive Science: interdisciplinary work linking
Psychology (Cognitive Psychology)
Linguistics (Formal Linguistics)
Philosophy (Philosophy of Mind)
Computer Science (Artificial Intelligence Research)

(more distantly, neuroscience and anthropology)

September 11, 1956



Connections among the Cognitive Sciences

KEY: Unbroken lines = strong interdisciplinary ties
 Broken lines = weak interdisciplinary ties

From Howard Gardner, *The Mind's New Science*, 1985

Cognitive Revolutions

First

Cartesian
Notion of Mind
17 century

Second

Re-emergence
of Mentalism
in the 1950's

Chomsky explicitly saw himself as part of a tradition;

He wrote a book, *Cartesian Linguistics: A chapter in the history of rationalist thought*, 1966, in which he explicitly traced his relationship to Descartes

See Handout item A Chomsky's *Language and Mind*, 1968, p 4-5

The Cartesians tried to show that when the theory of corporeal body is sharpened and clarified and extended to its limits, it is still incapable of accounting for facts that are obvious to introspection and that are also confirmed by our observation of the actions of other humans. In particular, it cannot account for the normal use of human language, just as it cannot explain the basic properties of thought. Consequently, it becomes necessary to invoke an entirely new principle—in Cartesian terms, to postulate a second substance whose essence is thought, alongside of body, with its essential properties of extension and motion. This new principle has a “creative aspect” which is evidenced most clearly in what we may refer to as “the creative aspect of language use,” the distinctively human ability to express new thoughts and to understand entirely new expressions of thought, within the framework of an “instituted language,” a language that is a cultural product subject to laws and principles partially unique to it and partially reflections of general principles of mind.

See Handout Item B

Descartes argued that the only sure indication that another body possesses a human mind, that it is not mere automation, is its ability to use language... There is nothing at all absurd in the conclusion. It seems to me quite possible that at that time in the development of Western thought there was the possibility for the birth of a psychology of a sort that still does not exist, a psychology that begins with the problem of characterizing various systems of human knowledge and belief, the concepts in terms of which they are organized and the principles that underlie them, and that only then turns to the study of how these systems might have developed through some combination of innate structure and organism environment interaction Chomsky, *Language and Mind*, p. 6

Cartesian Linguistics

See Handout Item C

The human mind is run according to distinctly human principles (structures) that account for the “creative aspect” of thought and language

RATIONALIST TRADITION

Descartes 1596-1650
Leibniz 1646-1716

Noam Chomsky?
1950s →

Immanuel Kant
1724-1804

EMPIRICIST TRADITION

John Locke 1632-1704
Geo. Berkeley 1685-1753
David Hume 1711-1776
J.S. Mill 1806-1873

B.F. Skinner
Logical Positivists
1930s →

Check Link to Stanford Encyclopedia of Philosophy on our program web site

Chomsky and the “old guard”

Chomsky—Syntactic Structures (1957)

Obscure press, version of his dissertation

Linguistic splash: 1958 Third Texas Conference on Problems of Linguistics in English

Chomsky against Behaviorism: Review of Skinner's Verbal Behavior (1959) in *Language* (central journal)

See Handout Item D1

Third Texas Conference on Problems of Linguistic Analysis in English 1958

“[The] traditional approaches to understanding language were doomed to fail.... a complete inventory of elements in language [structuralism] could never give rise to a characterization of all possible sentences.... inductive discovery procedures could never work.” Gardner p., 194

... [Chomsky] “went on to argue: ‘I think that the failure to offer a precise account of the notion 'grammar' is not just a superficial defect in linguistic theory that can be remedied by adding one more definition. It seems to me that until this notion is clarified, no part of linguistic theory can achieve anything like a satisfactory development...I have been discussing a grammar of a particular language here as analogous to a particular scientific theory, dealing with its subject matter (the set of sentences of this language) much as embryology or physics deals with its subject matter.”

Chomsky grammar = theory of sentences

Howard Gardner *Minds New Science* p. 194

See Handout Item D3

“Following his presentation Chomsky engaged in debate from the floor with leading structuralists of the past generation, whose views he was opposing. While some of them had hoped to defeat the young upstart once and for all, there was a very different outcome...[In the transcripts] we can see linguistic history documented as nowhere else—Chomsky, the *enfant terrible*, taking on some of the giants of the field and making them look rather like confused students in a beginning linguistics course.” Gardner, p. 194-5

B.F. Skinner and Behaviorism (about Language)

Behaviorism was the dominant approach to psychology when Chomsky mounted his challenge

Classical Stimulus-Response behaviorism.

Traced to Ivan Pavlov (1849-1936) and John Watson (1879-1958)

a natural connection between an (unconditioned) stimulus e.g. food and salivation for a dog, is manipulated so that a new (conditioned) stimulus (a flashing light) is able to produce the same behavior.

Features of Chomsky's (early) position

Syntax (grammar) is at the heart of the study of language

Autonomy of syntax ('syntactocentric' Jackendoff p. 35)

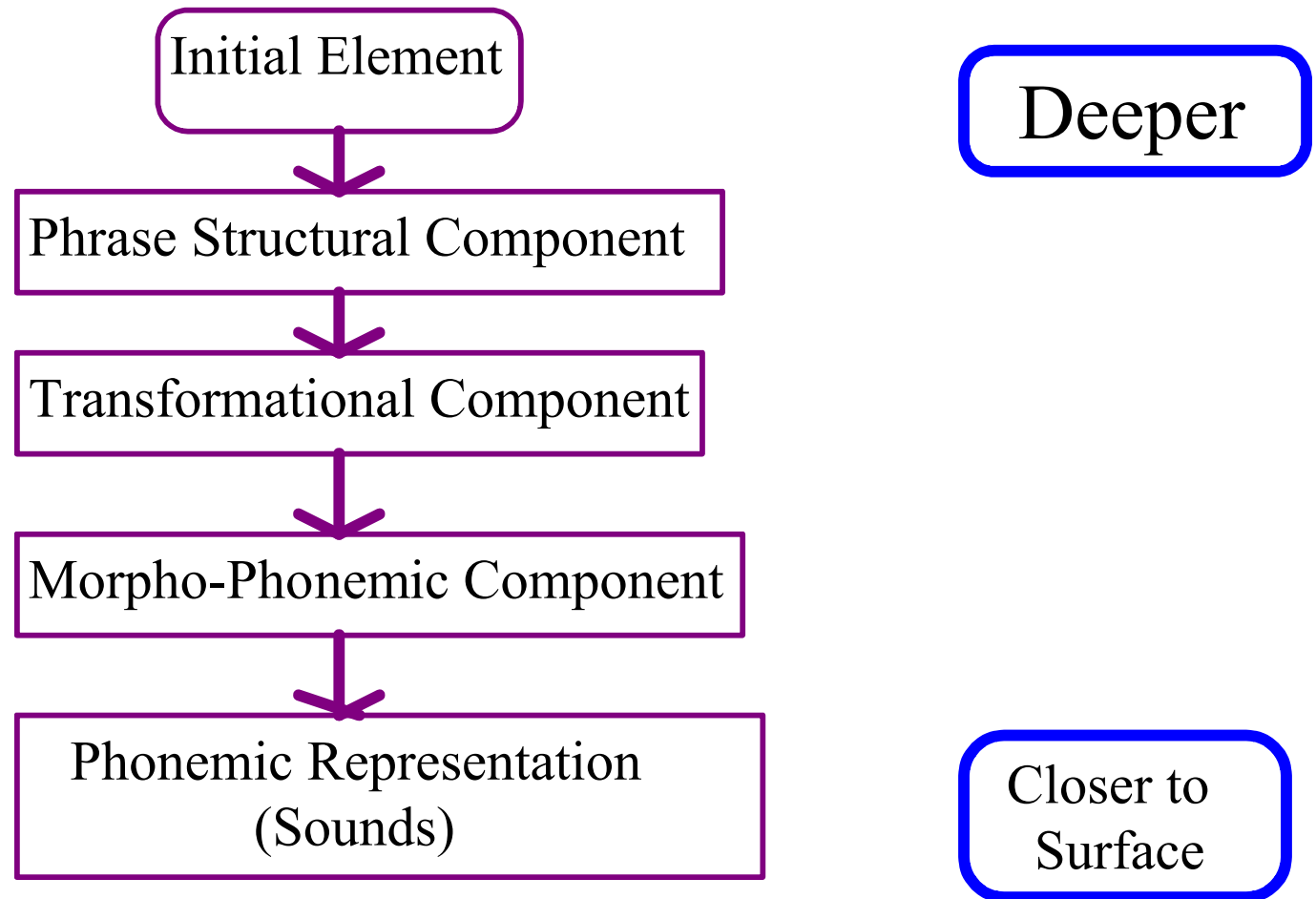
2. There is more to language than meets the ear!!

Surface Structure vs. Deep Structure

3. Language makes "infinite use of finite means" Language is creative, has "boundless expressive power (Pinker, p. 1

An adequate theory of language provides a generative grammar

Model of “generative Grammar in Early Chomsky



A sample Phrase-Structural Grammar and derivation (generation) for a Fragment of English

Chomskyan *Syntactic Structures* (1957) style rules

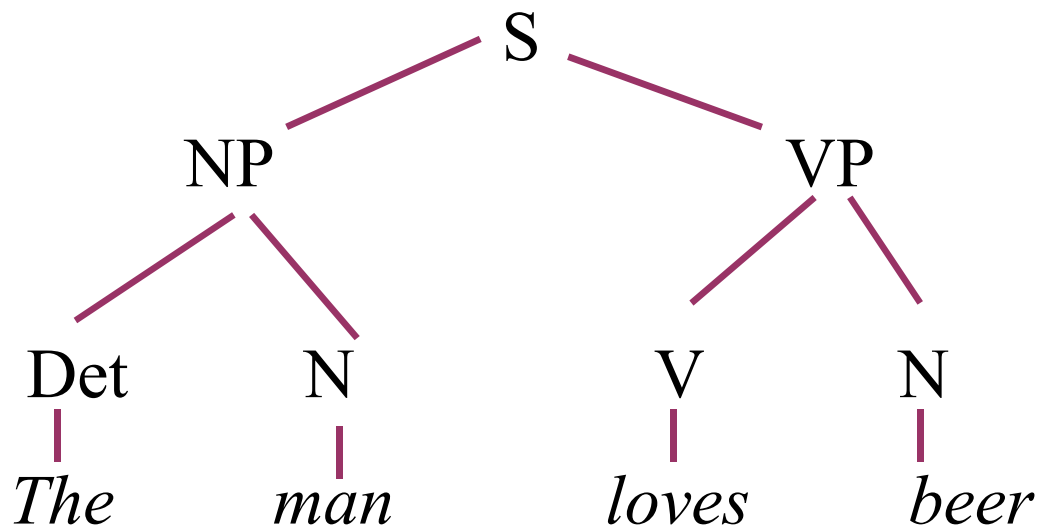
- a) $S \rightarrow NP \ VP$
- b) $VP \rightarrow V \ (NP)^*$
- c) $NP \rightarrow (Det)^* \ N \ (that \ S)^*$
- d) $N \rightarrow \{man, \ God, \ father, \ woman, \ beer..\}$
 $V \rightarrow \{loves..\}$
 $Det \rightarrow \{the, ..\}$ *optional

| | |
|---------------------------|-----------------|
| S | initial element |
| NP VP | (rule a) |
| Det NP VP | (rule c) |
| Det N VP | (rule c) |
| Det N V NP | (rule b) |
| Det N V N | (rule c) |
| <i>The man loves beer</i> | (rule d) |

| | |
|---------------------------|-----------------|
| S | initial element |
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| Det N VP | (rule c) |
| Det N V NP | (rule b) |
| Det N V N | (rule c) |
| <i>The man loves beer</i> | (rule d) |

See Handout Item E2

Parse Tree for the sentence



Labelled Bracketing Version

[_S [_{NP} [_{Det} the] [_N man]] [_{VP} [_V loves][_N beer]]]

A simple Transformational Grammar

- a) Phrase-Structural Component
- b) Transformational Component

NP1 + Verb + NP2 → NP2 + is + verb + ed + by NP1

The man loves beer. → Beer is loved by the man.

Evidence

a) Different SURFACE , same DEEP Structure

The man loves beer.

Beer is loved by the man.

b) Same SURFACE, different DEEP Structure

John is eager to please.

John is easy to please

c) Structurally AMBIGUOUS sentences

I like him cooking.

Flying airplanes can be dangerous.

The shooting of the hunters awakened me.

d) Judgments of UNGRAMMATICALITY

*Mary appeared to John's friends to hate one another.

John's friends appeared to Mary to hate one another.

e) Judgements of GRAMMATICALITY even when
meaningless

Colorless green ideas sleep furiously.

Two More Features

4) "Galilean Linguistics"

Performance vs Competence Distinction

5) Language Acquisition Device

Universal Grammar

Galilean Linguistics

"Linguistic theory is concerned primarily with an ideal speaker-listener, in a completely homogeneous speech-community in which there is no variation of style or dialect, who knows its language perfectly and is unaffected by memory limitations and distractions"

This theory of the ideal is a **theory of linguistic competence**.

A theory concerned with actual production would be a **theory of performance** and is not the concern of the linguist as such.

The LAD (Language Acquisition Device), a mental organ

Argument from the Poverty of Stimulus

(1) If the environment in which a process occurs is impoverished and unstructured

AND (2) the process leads uniformly to highly specific and intricate structures

IT IS LIKELY THAT the process is innate

Examples: Plato on geometry, Puberty, Mammalian Visual Systems, Human Language Competence

What has Chomsky wrought?

- Autonomy of Syntax Thesis –
see “Syntactocentrism” of Jackendoff
- Deep structure vs Surface structure
- Generative Grammar
- Galilean Science of Mind/
Competence vs Performance
- The Language Acquisition Device (LAD)/
Idea of a Universal Grammar

Behaviorist vs Cartesian Linguistics

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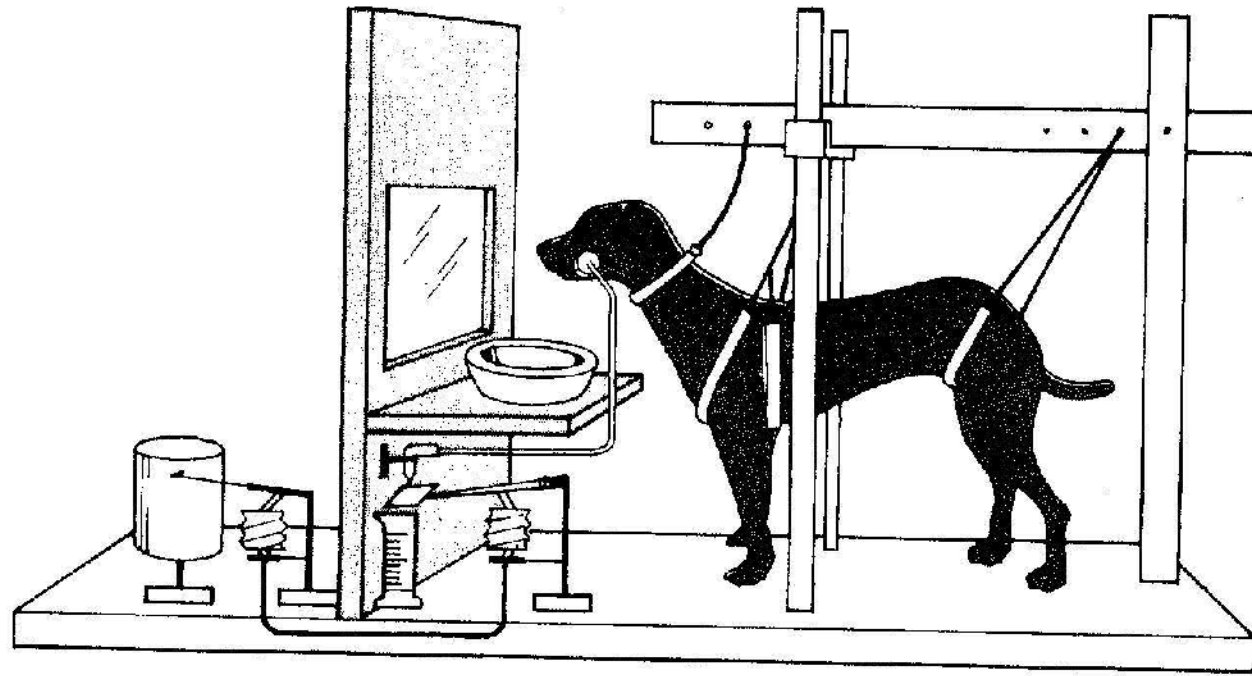


Fig. 7-1 Pavlov's dog. The dog, held in a harness, is presented with a bell as the CS and meat powder as the US. The conditioned response, salivation, is measured by a tube connected to an opening in the salivary gland. Rate of salivation is measured on the revolving drum. (Reproduced from *Psychology* by Henry Gleitman, by permission of W. W. Norton & Company, Inc. Copyright © 1981 by W. W. Norton & Company, Inc.)

From Snodgrass, et. al., *Human Experimental Psychology*

a natural connection between an (unconditioned) stimulus
e.g. food and salivation for a dog, is manipulated so that a
new (conditioned) stimulus (a bell) is able to produce the same
behavior.

Skinner told a more elaborate story

He focused on what he called a reinforcement (stimulus)

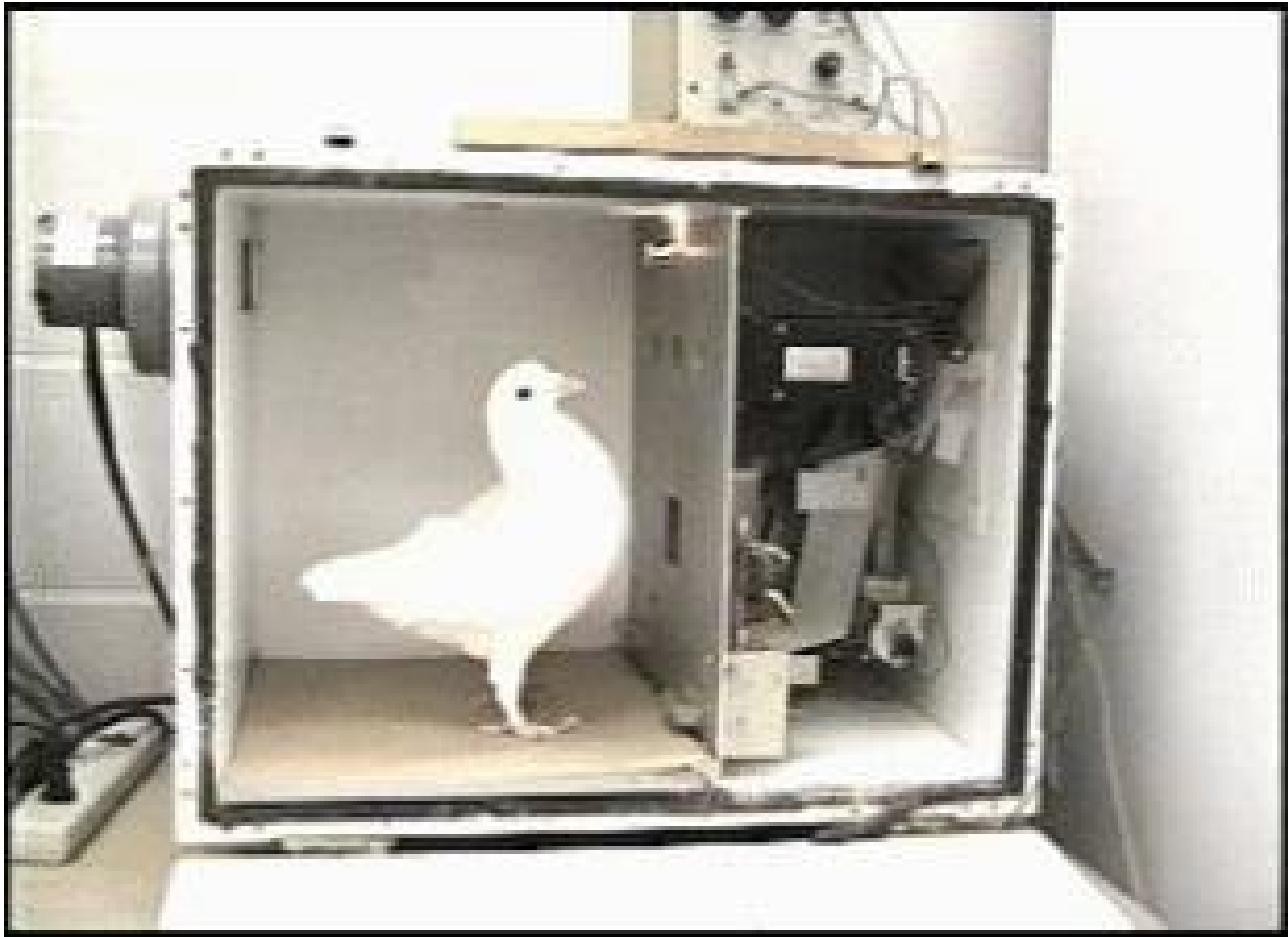
Unlike classical (Respondent) conditioning, the behavioral response comes before the reinforcing stimulus

Classical, Respondent conditioning

Stimulus → Response (S → R)

Skinnerian Operant Conditioning

Response → Reinforcement Stimulus



Example, “superstition” in pigeons

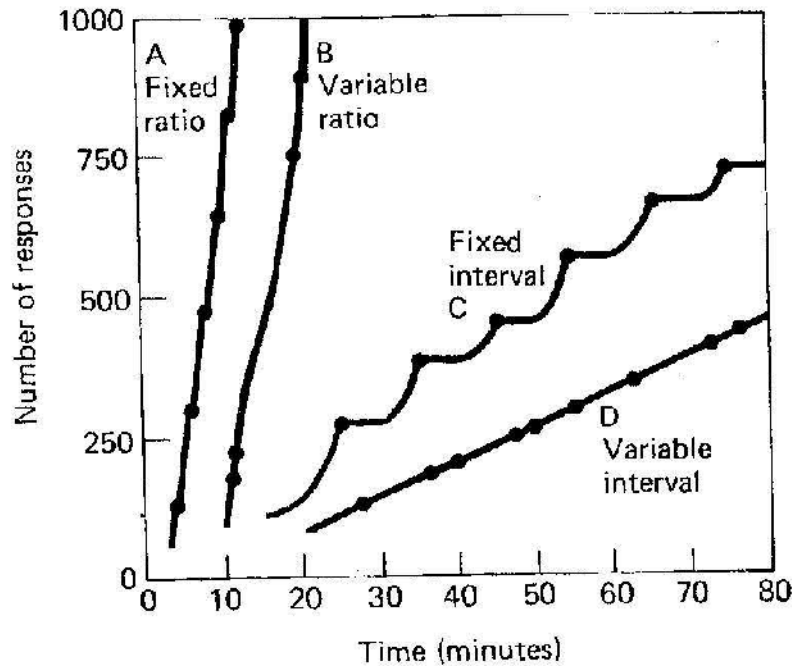


Fig. 7-3 Typical patterns of responding under four schedules of reinforcement. The functions are cumulative response counts, so increasing rates of response produce steeper slopes, and a horizontal line indicates no responding. The solid circles show delivery of a reinforcement. Ratio schedules produce much higher response rates than interval schedules. The scallop shape is typical of a fixed interval schedule, and shows that the pigeon increases its response rate toward the end of a fixed interval, as reinforcement becomes more and more certain. (From "Teaching Machines," by B. F. Skinner. In *Scientific American*, 1961, 205, 90-102. Copyright© 1961 by W. H. Freeman and Company. All rights reserved. Reprinted by permission.)

Pattern of Responding=
operant behavior

Explanation: Assumes deprivation ("motivation") that is, pigeon is deprived of food, 75% of usual body weight ("hungry")

Pigeon has been reinforced (with a fixed interval) for the operant,

Hence, operant behavior is more likely to occur=
operant is associated with the behavior

A few additional considerations

Discriminative stimulus— we can include a colored light and arrange a reinforcement schedule so that only when the colored light is on the behavior is reinforced. In this case the presence of the discriminative stimulus elicits the behavior (makes it more likely to occur)

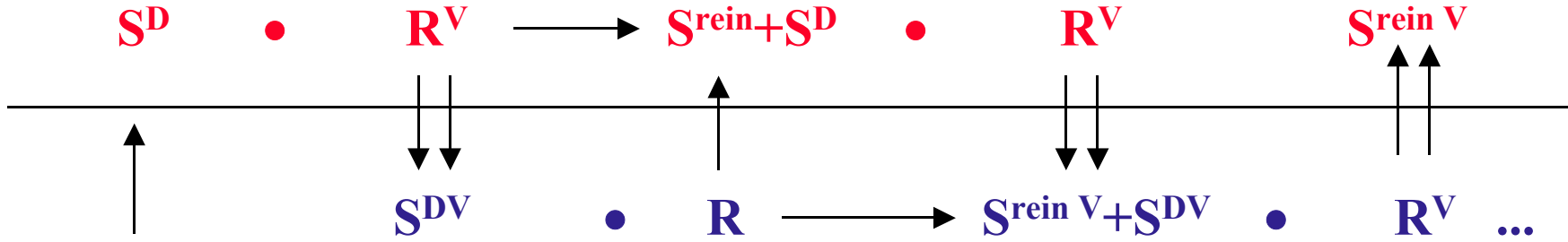
Stimulus Generalization: If a behavior is conditioned on a discriminative stimulus, say a red light, then it can be generalized to “similar” stimuli, say orange or yellow, but may not be generalized to blue.

See Handout Item F

THE MAND (as in command, demand, countermand)

(SPEAKER)

(Audience) Bread Please bread Thank you You're Welcome



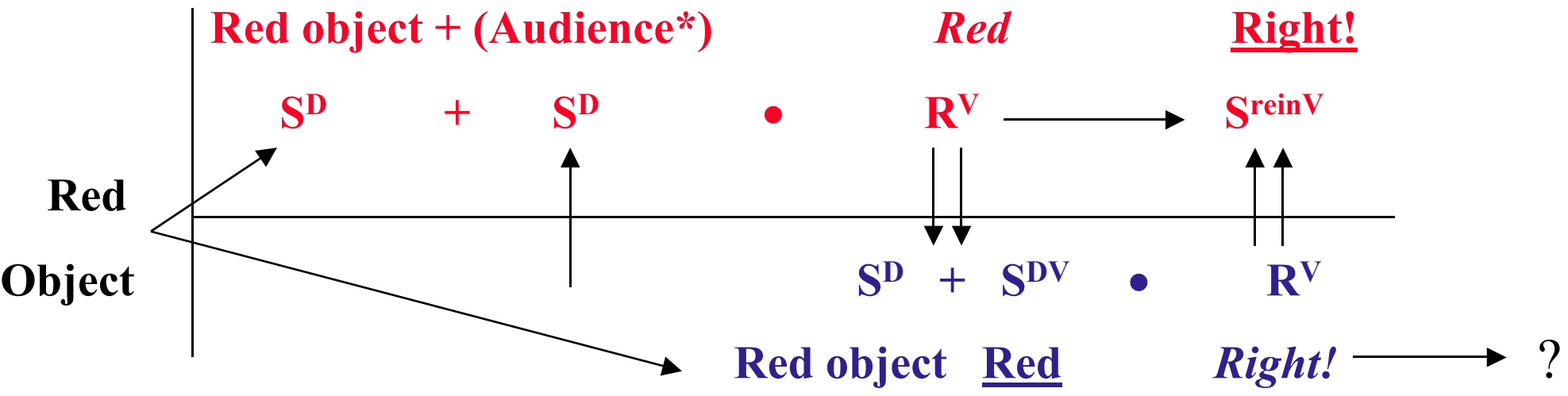
Bread, Please Passes Bread Thank you *You're Welcome*
(LISTENER)

- S^D** Discriminative Stimulus
- S^{SDV}** Discriminative Verbal Stimulus
- S^{rein}** Reinforcing Stimulus
- S^{rein V}** Reinforcing Verbal Stimulus
- R** Response
- R^V** Verbal Response

Vertical arrows=interchange
Horizontal arrows = reinforcement
 • **Discriminative Stimulus Supplies occasion for Response**

THE TACT (as in contact) with an “educational reinforcement

(SPEAKER e.g. child)



(LISTENER, e.g. parent)

- S^D** Discriminative Stimulus
- S^{SDV}** Discriminative Verbal Stimulus
- S^{rein}** Reinforcing Stimulus
- S^{rein V}** Reinforcing Verbal Stimulus
- R** Response
- R^V** Verbal Response

**perhaps also with the Previous Mand from the parent “What color is it?”*

Criticism of Skinner

Chomsky's review of Skinner's *Verbal Behavior* Language 35, 1959

Negative Comments about Skinner's approach

Central concepts are not adequately defined

terms such as stimulus, response, reinforcement
and especially stimulus generalization

Notion of language itself is much too broad

verbal behavior is behavior reinforced through the
mediation of other persons (rat pressing bar?
mechanic repairing a car?)

Specific analysis of language is inadequate

E.g. his account in terms of Mands, Tacts)
and Autoclitics (everything else?)

Suggestion of an alternative--Chomsky's own generative
grammar approach

Pre- 2nd Cognitive Revolution

Answers

- What is knowledge of language? A system of habits, dispositions and abilities
- How is it acquired? By conditioning, training, habit-formation or “general learning” mechanisms such as induction, generalization
- How is language used? Language use is an ability. New forms are used “by analogy” to old ones.

After the 2nd Cognitive Revolution

- What is knowledge of language? Language is computation system, a rule system of some sort. Knowledge of language is knowledge of this rule system.
- How is it acquired? The initial state of the language faculty determines possible rules and interaction. Experience yields an inventory of rules through the language acquisition device.

- How is language used? The use of language is rule-governed behavior. Rules form mental representations, which enter into speaking and understanding.

Comparison of Skinner and Chomsky

| | SKINNER | CHOMSKY |
|--|---|--|
| Philosophy of Science | Empiricist, "Behaviorist" | non-empiricist Rationalist "Galilean Style" of Science |
| Theory of Mind | Behaviorist Epiphenomenalist (?) Uniformitarian | Mentalist Materialist Faculty Psychology "modularity" |
| "Learning" Theory | Environmentalism (with a limited number of learning Mechanisms Associationist | qualified "Nativist" Internalization of Rules |
| Subject Matter of Linguistic Theory | Verbal Behavior (Linguistic Performance) | Linguistic Competence |
| Constraints on Explanation | Operant Condition Model (discriminative stimulus, reinforcement history, deprivation/satiation) | Competence Model 1. Surface vs Deep struct. 2. generative grammar 3. observational, descriptive, explanatory adequacy |

A Poem by John Holland
Coiled Alizarine for Noam
Chomsky

Curiously deep, the slumber of crimson thoughts:
While breathless, in stodgy viridian,
Colorless green ideas sleep furiously

alizarine = a solid appearing reddish-orange as crystals and
brownish yellow as powder--one of the earliest dyes

viridian = a long-lasting, bluish-green pigment consisting
of a hydrated oxide of chromium

That's All Folks