

An argument for the impossibility of Human-Robotic Communication

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Turing's intention

"I propose to consider the question,
"Can machines think?" This should begin with
definitions of the meaning of the terms
"machine" and "think."
(Turing 1950).

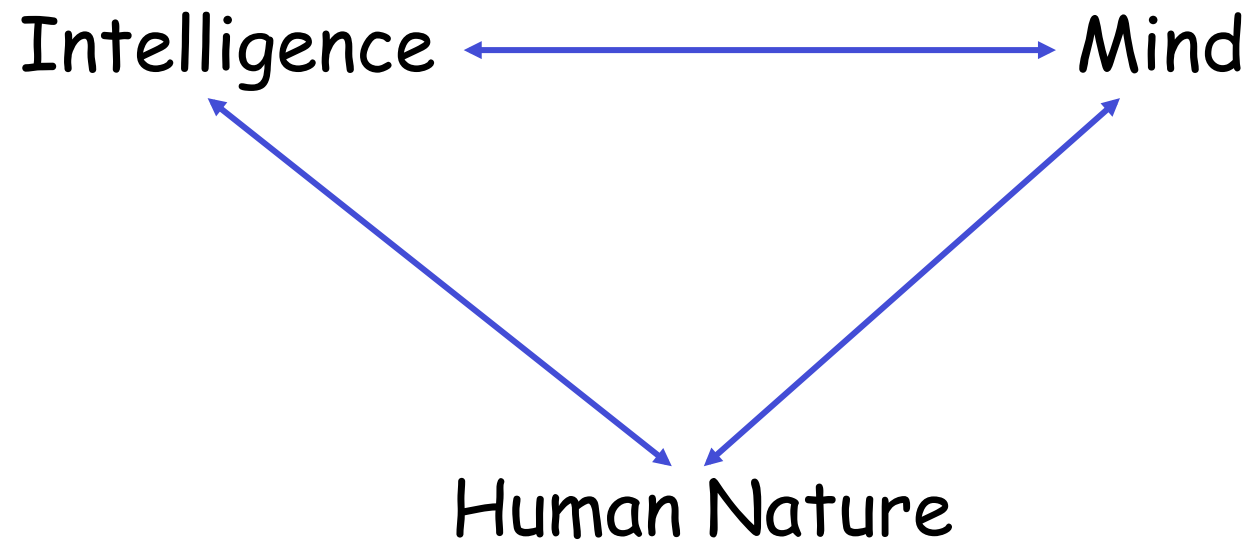
The key notions we have to define are:

'Human'

'Robot' and

'Communication'.

Clarifications

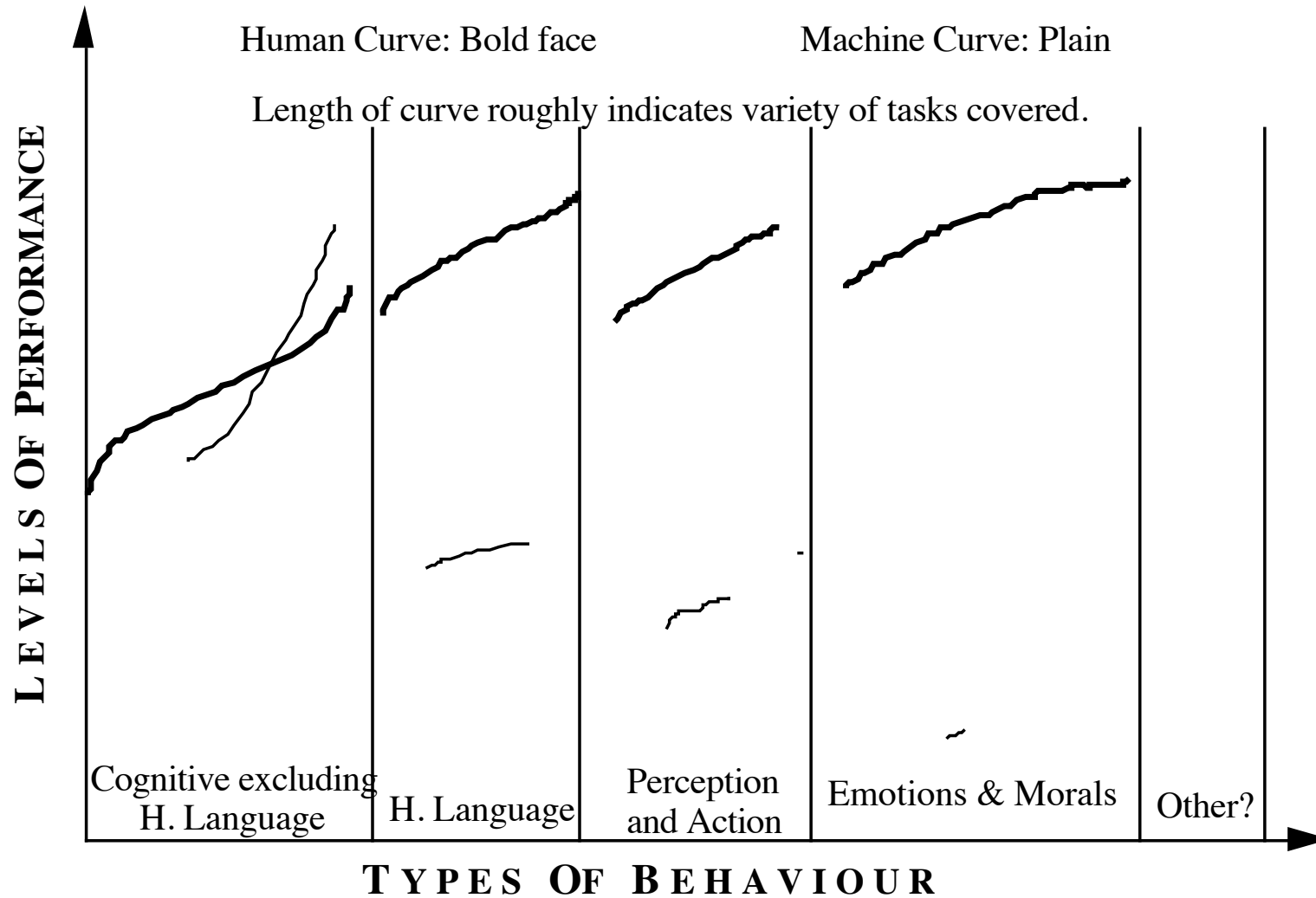


**Intelligence is used in two
very different senses:**

- a) as a performance measure.**
- b) as co-extensive with mind.**

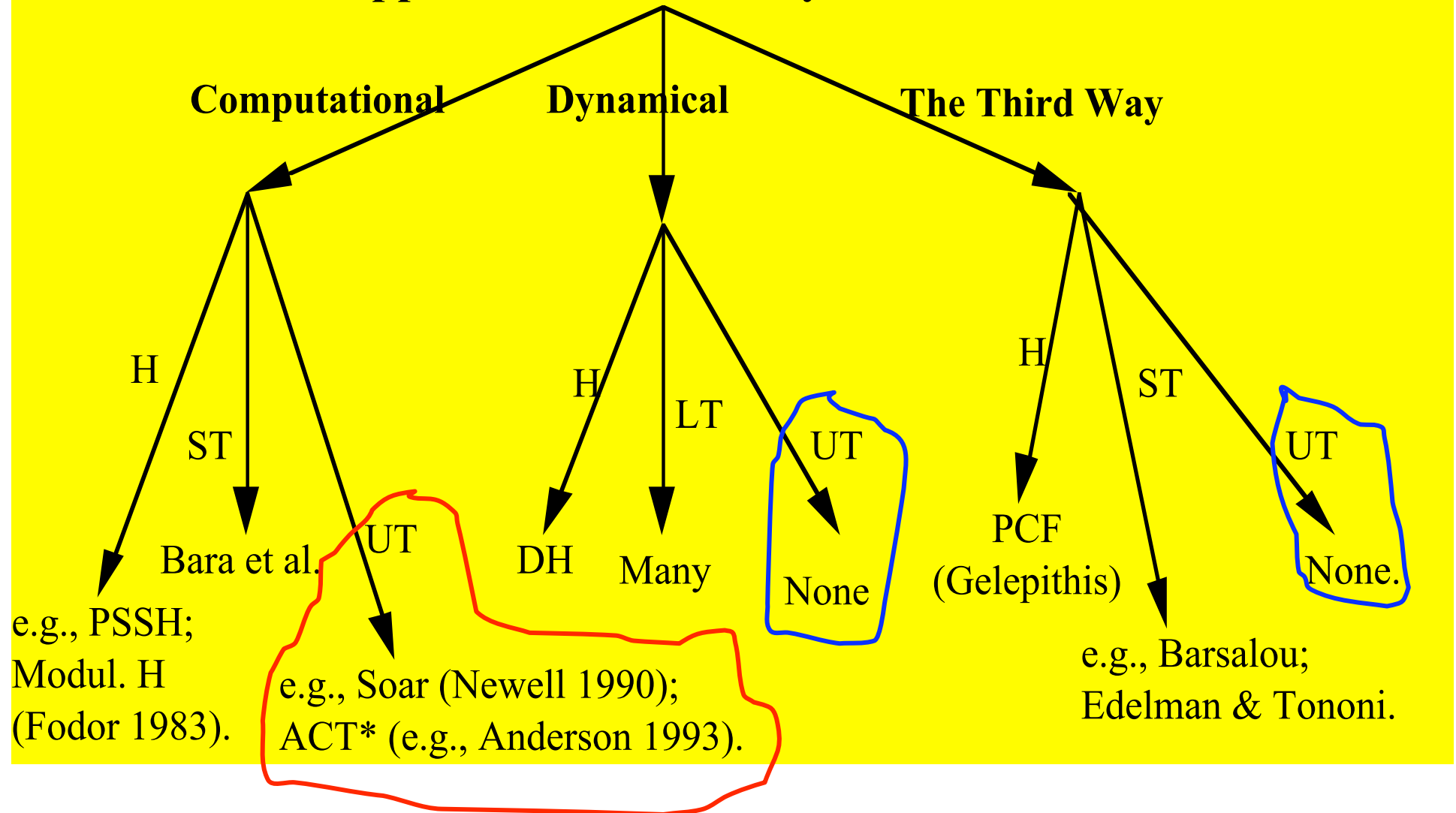
Comparison of H. and Machine Intelligence in the Year 2000

Gelepithis 1999, 2001.



Approaches to the Study of Mind

(After Gelepithis 2002)



ST= Subject Theory
LT= Local Theory
UT= Unified Theory

H = Hypothesis
DH = Dynamical Hypothesis
PCF = Preliminary Conceptual Framework

Foundational notions of Cognitive Science

<i>According to Newell (1990)</i>	<i>According to Gelepithis (1999, 2003)</i>
1. Behaving systems,	1. Perception,
2. Knowledge,	2. Action,
3. Representation ,	3. Growth (e.g., self-organisation),
4. Machine* (e.g., computation),	4. Meaning,
5. Symbol,	5. Thinking (e.g., computation),
6. Architecture,	6. Understanding,
7. Intelligence ,	7. Communication,
8. Search,	8. Representation ,
9. Preparation vs. deliberation*.	9. Intelligent system ,
	10. Purpose,
	11. Emotion,
	12. Human language,
	13. Consciousness,
	14. Beauty.

Derived notions:
Knowledge,
Symbol.

Culture,
Ethical principles

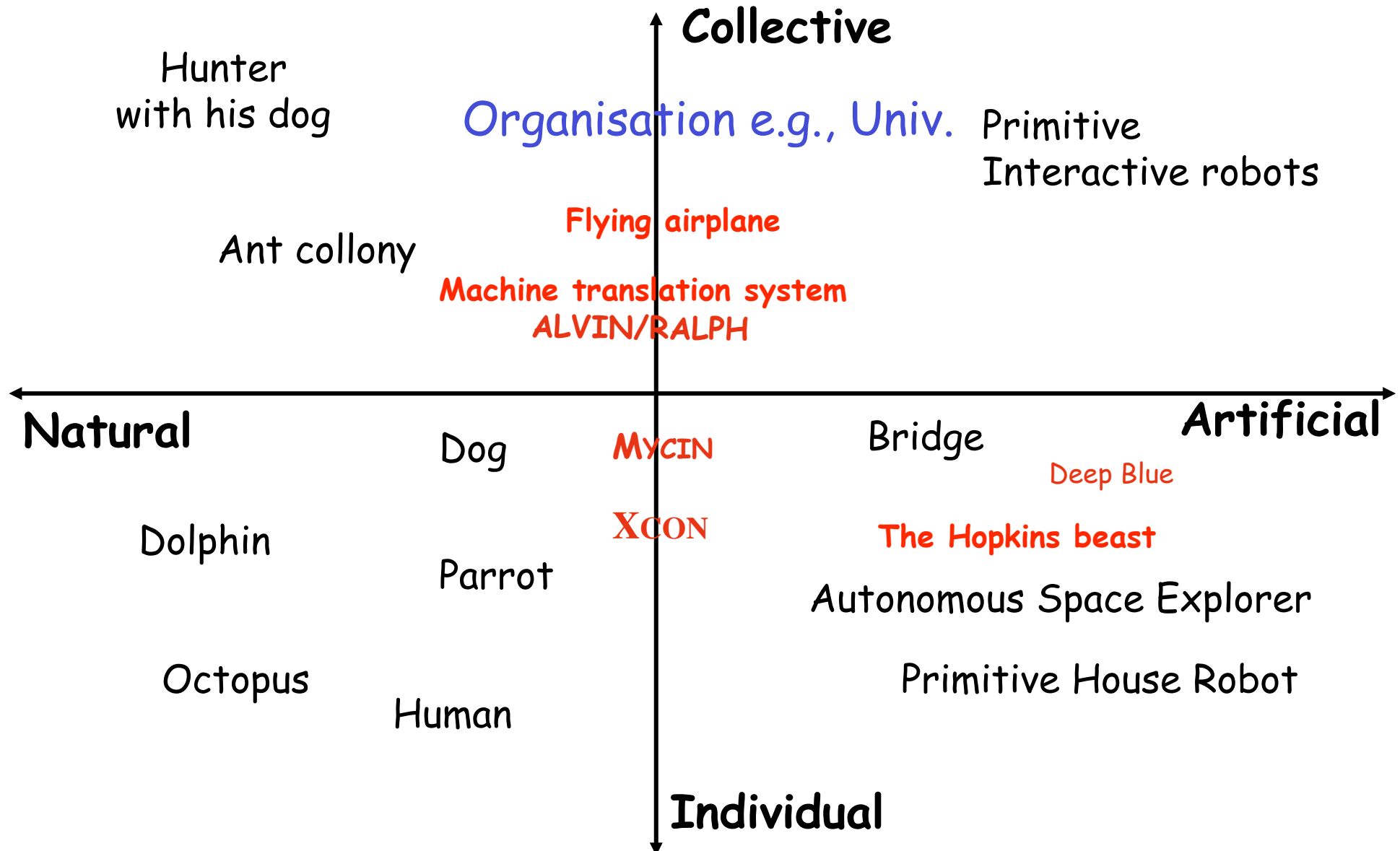
Minimum requirements for an appropriate definition of 'robotic intelligence'

It should be independent of any human characteristics or features which might limit its functions or development over time.

Consequence: Words like human intelligence, robotic intelligence and intelligence are related but quite distinct.

Space of 'intelligent' Systems in the Y2004

(adapted from Gelepithis 2001, p. 20)



Necessary and sufficient conditions for the mental

A system, S , is **noemonon** if and only if:

- a) It possesses sensors.
- b) It is able to act on its environment.
- c) It possesses its *own* representational system R_s , i.e., R_s is independent of the language of another kind of system S^* .
- d) It is able to connect sensory, representational, and motor information.
- e) It is able to communicate with other systems within its *own* class.

Noemonon:=has developed a mind.

Definitions of Human and Robot

- They follow from previous slide.
- Discuss, (if needed).

The Nature of Communication

"The book [*On Human Communication*] was first written as an attempt to make a case for the study of human communication as an academic subject. That case still stands, though the nature of such a study is still far from crystal clear." (Colin Cherry, 1978*1980).

Literature on Communication

- Varied and extremely multidisciplinary (*not interdisciplinary*).
- Nevertheless, the *nature* of 'communication' was never pinned down in a convincing and generally accepted way and is primarily used as an *orienting term* rather than as an *explanatory theoretical tool*.

Aims

1. We illustrate the ambiguity with which 'communication' is being used in a number of disciplines.
2. We briefly counter a potential argument concerning the presumed lack of objective characteristics of communication.
3. We present a conception of communication that clarifies its nature, it is applicable across the range of animals and machines, and is rich enough to be used as an explanatory theoretical construct in disciplines like **Cybernetics**, **Cognitive Science**, **Sociology** and **Political Science**.

Conceptions of Communication (1)

- *Commonsense, e.g.,*
 - Benowitz et al. (1984*1985).
 - Sass (1984*1985) on communication patterns as revealing factors in the etiology of schizophrenia.
 - Scott (1996) on the institutional practices that may lead to a special case of communication failure ("inadvertent pathologies").
 - Murray (1998) on the connections between literacy and cybernetics.

Conceptions of Communication (2)

- “a relationship between two or more active persons, entered into [it] with the aid of shared signs” (Schramm, 1973).

Remark: Too complex.

Conceptions of Communication (3,4,5)

- “The social mediation of information” (Roberts 1973).
- ‘Communication’ identified with interaction (Katz and Danet, 1973).
- ‘Communication’ as “any exchange of messages between human beings”
(Runcan 1985).

Conceptions of Communication (6)

- “When I intend to communicate, I intend to produce understanding. But understanding will consist in the grasp of my meaning.” (Searle 1999*2000, p. 145).

Conceptions of Communication (7)

- “*Communication* can be understood as the practice of producing meanings, and the ways in which systems of meaning are negotiated by participants in a culture. *Culture* can be understood as the totality of communication practices and systems of meaning.” (Schirato and Yell, 2000, p. 1).

Conceptions of Communication (8)

- "communication refers to the process of human beings responding to the symbolic behavior of other persons." (Adler and Rodman, 2000, p. 2).

Orienting device or Theoretical construct

- Are there any characteristics of 'communication' that cut across all of its different nuances of meaning and can they be combined in a way that captures the nature of communication?

Potential objection

- 'Communication', as opposed to gravity, is a socially constructed notion rather than an objective reality and, therefore, any attempt to provide an objective account of it is doomed to failure.

Counter comment

- Both 'gravity' and 'communication' are humanly constructed concepts and both refer to some external phenomena. Their only difference is that 'gravity' has a generally accepted meaning within the Earth-based physicists, whereas 'communication' does not have one within the community of scientists using this notion.

The Objective-Subjective issue

- Durkheim vs Weber (in Sociology)
- The *systems* vs the *interpretive* perspective (in communication studies).

The way forward

- Based on the general agreement in the literature that 'communication' involves a kind of an exchange, relationship, symbolic response, sharing, (system of) meanings, or even 'understanding', I have developed the following **axiomatic** definition of communication.

Definition of **Communication**

An entity E_1 has communicated with E_2 on a topic S if, and only if:

E_1 has understood S -symbol: $U(E_1, S)$.

E_2 has understood S -symbol: $U(E_2, S)$.

$U(E_1, S)$ is presentable to and understood by E_2 .

$U(E_2, S)$ is presentable to and understood by E_1 .

Definition of (the-end-result-of) Understanding

An entity E has understood something, S ,
if and only if,
 E can present S in terms of a system of *own* primitives.

Definitional characteristics of Human Understanding

1. Human understanding always involves the grasp of human meaning.
2. Human understanding is a **process** that takes place in human brains.
3. Human understanding is required to be terminated.
4. At the end of the process a presentation in terms of a human's own primitives must be possible.

Justification of Definition:

It meets pinpointed inadequacies:

- provides necessary conditions for U.
- says what U is.
- it is in accordance with established linguistic conditions.

It satisfies the positive contributions of the propositional approach, because:

- Context, motivation, and principles are part of a system of primitives.
- The essence of the semasiosyntactic approach is accounted for as our definition implies the existence of a sequence of steps.

It satisfies our feeling for HU as a fundamental mental process.

It does not violate the common sense of U as described by most dictionaries and encyclopaedias.

It does not contradict major philosophical positions on HU.

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Conceptions of Human Understanding

Nature (Schools and Individuals)	Main advantage	Main disadvantage
<p><i>Semasiosyntactic:</i></p> <p>To understand a sentence in a language it is adequate to understand the meanings of the words comprising the sentence and know the grammatical rules of that language.</p>	<p>Formalistic nature (applicability).</p>	<p>Inadequate requirements. Silent on the nature of understanding.</p>
<p>P R O P O S I T I O N A L</p> <p><i>Contextual:</i></p> <p>Semasiosyntactic requirements plus the context in which a sentence occurs.</p>	<p>Showed inadequacy of the semasiosyntactic approach.</p>	<p>As above</p>
<p><i>Motivational:</i></p> <p>Contextual requirements plus knowledge of the motivation behind the utterance of of a sentence.</p>	<p>Showed inadequacy of the contextual approach.</p>	<p>As above (eg intention is lacking).</p>
<p>Pask's work/view.</p>	<p>Powerful conceptual analysis.</p>	<p>Set of conditions given for understanding incomplete.</p>
<p>Ziff's work/view.</p>	<p>Cleared several misconceptions in the study of understanding.</p>	<p>Too general to be useful.</p>
<p>H E R M E N E</p> <p><i>Majority of cases:</i></p> <p>Understanding is seen as a primitive notion or, possibly, as a methodological tool (see, Ricoeur, Dilthey).</p>	<p>Ascribes to understanding its much needed significance.</p>	<p>Unnecessarily imprecise.</p>
<p>U T I C</p> <p><i>Moravcsik:</i></p> <p>Understanding is seen as that state of mind which yields the insight that unites one's knowledge required to arrive at the solution to a problem.</p>	<p>Understanding describable in terms of knowledge. Partly successful criticism of the analytic school.</p>	<p>Against established linguistic conventions. Introduction of terms less clear than understanding itself eg, insight.</p>

Précis of the Argument

Since linguistic primitives are reducible to sense primitives except if they are purely linguistic, one needs human sense primitives to understand human linguistic primitives *and*, at the same time, human linguistic primitives to describe the human sense primitives. Hence, Π_{HL} and Π_{RL} could not be described in terms of each other. In other words, human-robotic communication is impossible.

Development of the Argument

If needed (8 slides).

Discussion Points

DP-1

One should distinguish between computer-enhanced human intelligence and robot intelligence proper.

DP-2

Human Cognition and
the emerging Robotic Cognition are
fundamentally different.

DP-3

Could Robotic Knowledge be developed to
become **incompatible** with Human
Knowledge?