Has the symbol grounding problem been solved or not?

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Today's Goals

To consider how we can and should assess an approach to the symbol grounding problem

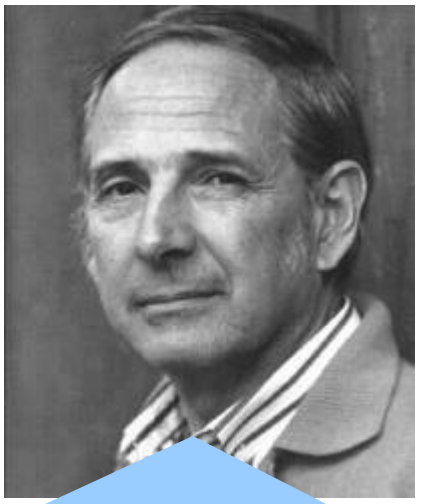
To show what kind of approaches are the best against the background of the teleosemantic theory of meaning

Background: Turing vs Searle

If one cannot sufficiently distinguish a machine from humans by its external linguistic behaviour, then the machine qualifies as truly intelligent.

``Computing Machinery and Intelligence'' (1950)

A. Turing



J. Searle

If a machine do not understand the meaning of the words it manipulates, then the machine cannot be intelligent.

``Minds, Brains, and Programs'' (1980)

Background: Harnad's question

How can symbols manipulated by an AI
be associated with things in the real world?

``The Symbol Grounding Problem'' (1990)

S. Harnad

The Symbol Grounding Problem

Various solutions have been proposed so far.

Solutions to the SGP

It is not sufficient to give a machine a certan semantics so that a symbol can refer the machine to the object.

It is essential that the machine should generate its own semantics as it operates in the real world

Taddeo and Floridi's criterion for evaluating various approaches to the SGP

M. Taddeo

L. Floridi

The Zero Semantical Commitment Condition (Z-condition)

Any solution to the SGP should provide semantics that is neither

(1) pre-installed into the system, nor
(2) external to it,

but the system should autonomously elaborate its own semantics from the scratch.

``Solving the Symbol Grounding Problem: a Critical Review of Fifteen Years of Research'' (2005)

Taddeo and Floridi's classification of approaches to the SGP

- Representationalist
  - A hybrid model (Harnad 1990)
  - A functional model (Mayo 2003)
  - An intentional model (Sun 2000)
- Semi-representationalist
  - An epistemological model (Davidsson 1995)
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- Non-representationalist
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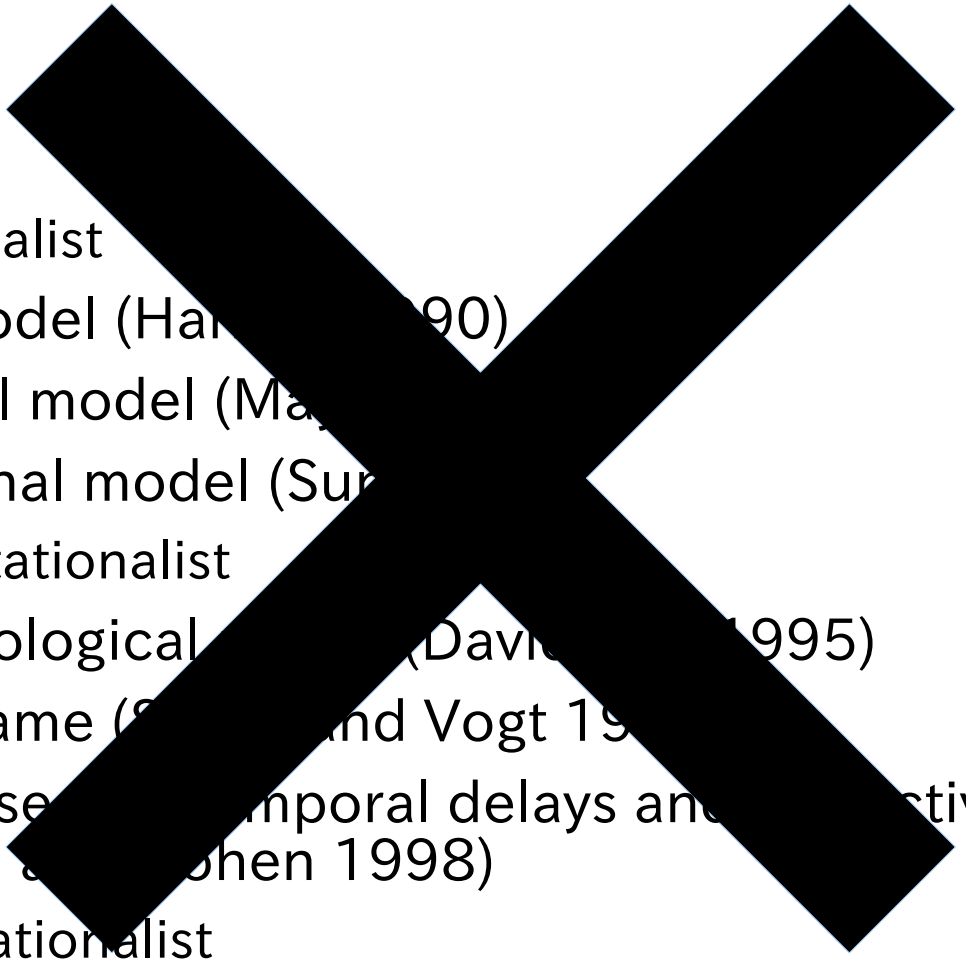
And their diagnosis thereof



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They all presupposes certain semantics and thus fail to meet the Z-condition according to Taddeo and Floridi

Is the Z-condition a reasonable requirement?

The Z-condition precludes, for example, the use of a neural network or genetic algorithm because such system involve commitment to the programmers' semantics.

Moreover, it also precludes learning through communication with agent who is already competent at a existing language.

But doesn't this render even symbols used by human agents ungrounded?

Is the Z-condition a reasonable requirement?

Taddeo and Floridi, in ``A praxical solution of the symbol grounding problem'' (2008), wrote that the language game described in Wittgenstein's *Investigation* ``clearly do not satisfy the Z-condition.''

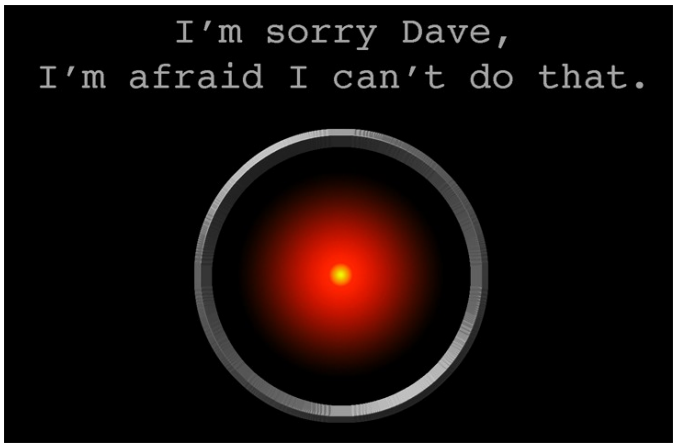
The Z-condition is too demanding!

Requirements for requirements for approaches to the SGP

At least humans (and other organisms) should meet the requirement.

Simple symbol manipulation machines should not meet the requirement.

Grounded



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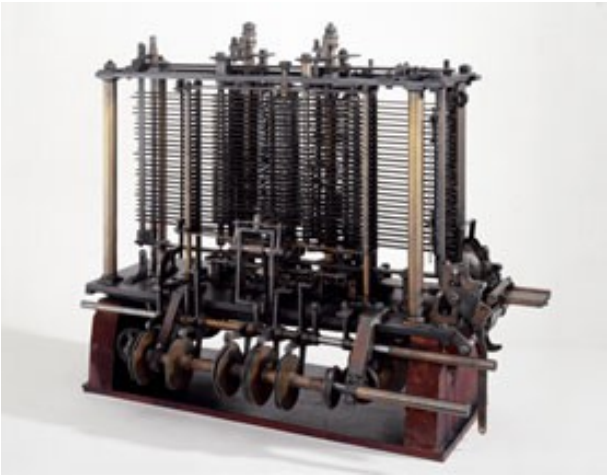

Ungrounded

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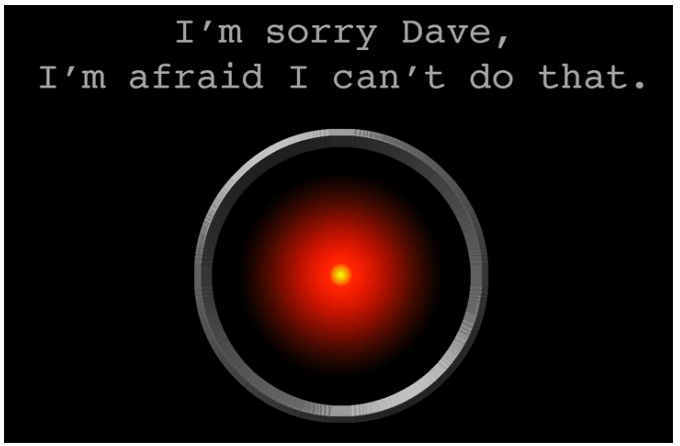
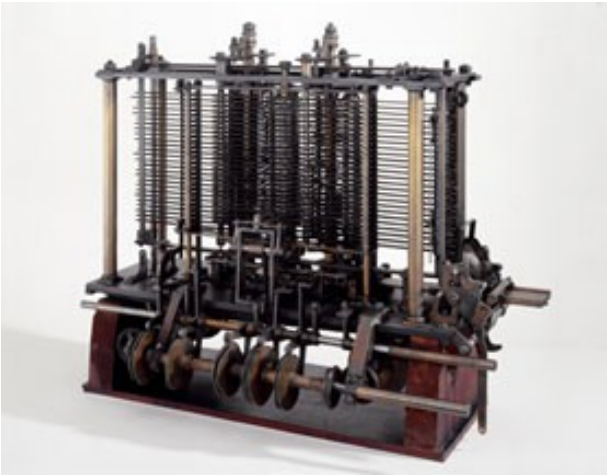
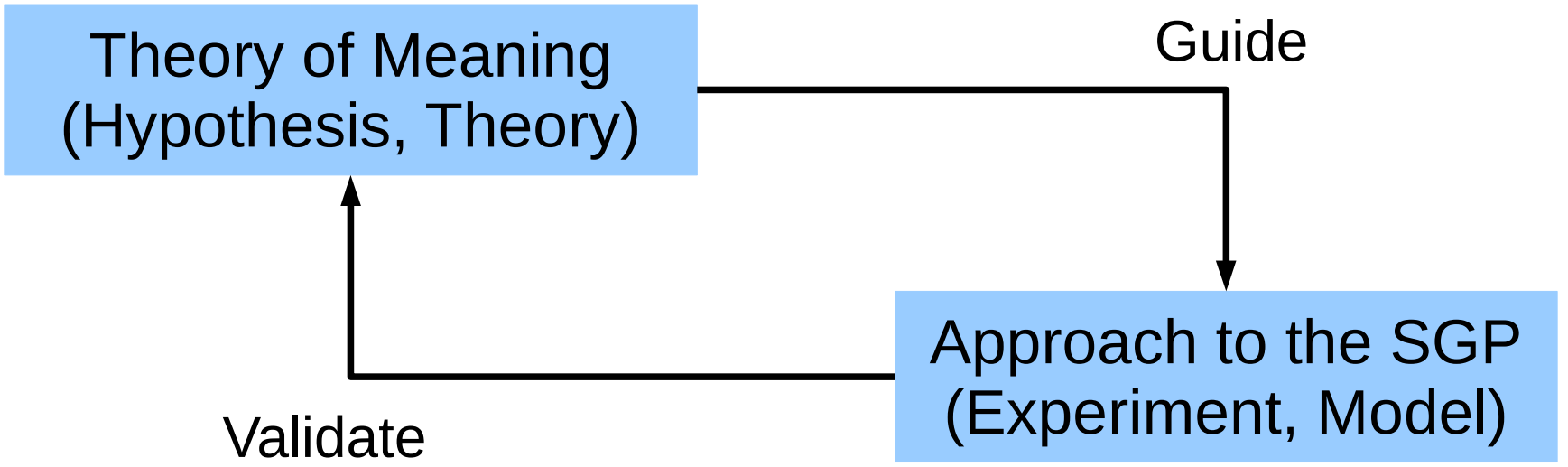




Grounded ? Ungrounded

Thus we need to articulate the way symbols used by living organisms are grounded in the first place.

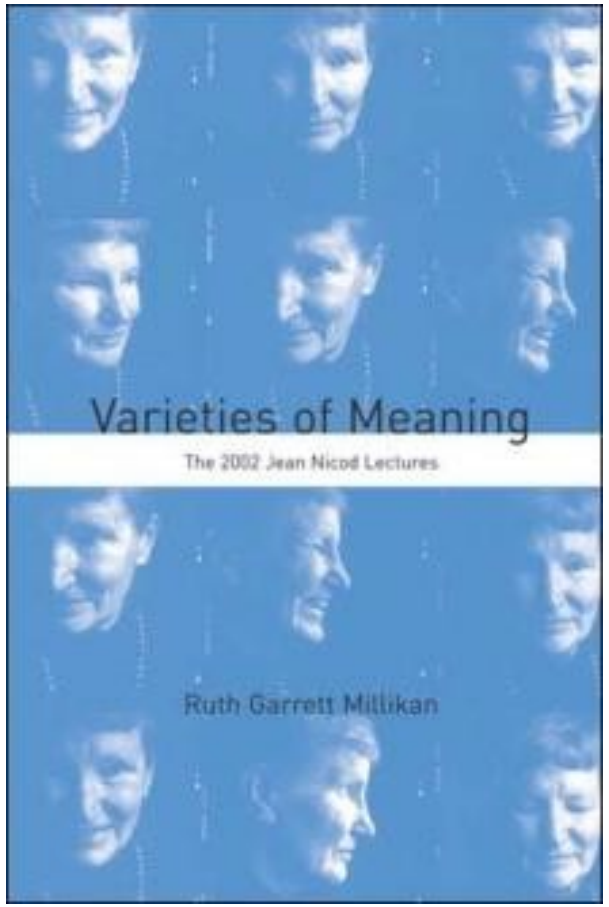
Theory and Model



Here is a great chance of philosophers of language and roboticists interacting with each other in a meaningful way.

Good example of applied philosophy

Teleosemantic theory of meaning



Proposed by R. G. Millikan, teleosemantic theory of meaning explains how signs used by living organisms has obtained meaning through the process of evolution.

According to the theory, if some mechanism associate a type of events with another, the former has a semantic mapping relation to the latter, and becomes a sign for it.

Teleosemantic theory of meaning

According to teleosemantic theory of meaning, an intentional sign has a meaning if

1. there are a producer and consumer of the sign,
2. the production and consumption are carried out following the normal mechanisms,
3. there is a task to be done by using the sign, and the performance of the task has some survival value, and
4. the sign's having a certain relation to an objects is involved in the mechanism of performing the task.

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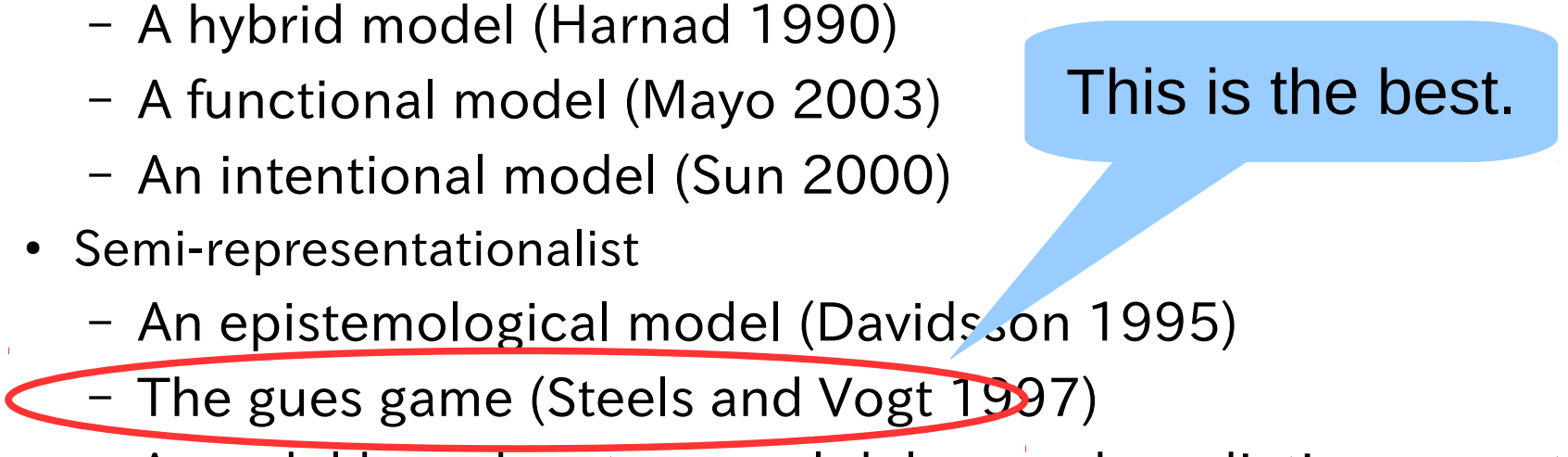

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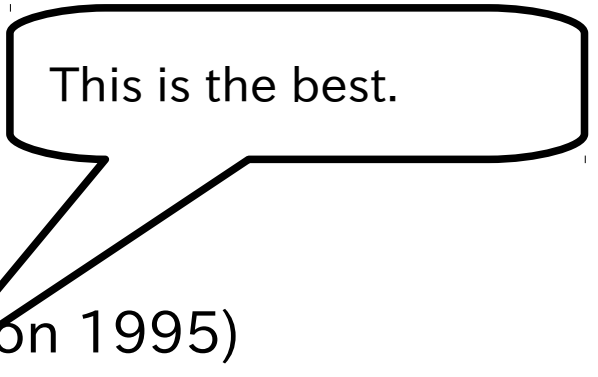

Steels even declared that the SGP has been solved!

Assessment of the guess game approach

According to teleosemantic theory of meaning, an intentional sign has a meaning if

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Doubted

Assessment of the guess game approach

Acc… g, an
inte…

Regarded as violating the Z-condition
by Taddeo and Floridi

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Doubted

The moral here is

- We should, at least tentatively, articulate some kind of theory of meaning when we evaluate approaches to the SGP.
- Adopting the teleosemantic theory of meaning, we can see the guess game is the best, but we do not think that the SGP is completely solved.
- This suggests that the success of every approach to the SGP always comes in degree. Each approach is successful in some degree, or in some aspects.
- It is doubtful that any artificial system would have the same degree of groundedness as human beings or other organisms.
- It is better to view one approach to the SGP as, like any scientific model, abstracting such and such aspects of the phenomenon called meaning.