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Vagueness

Vagueness is an attribute of some concepts and, hence, of some propositions containing them.

A concept is *vague* if its sense is imprecise, and hence its extension is imprecise too. To quantify the imprecision of the extension requieres a theory of truth. But we can quantify the imprecision of meaning before.

Sorites paradox

means "heap") is a paradox that arises from vague predicates.



The sorites paradox (/souraitize/; sometimes translated as the paradox of the heap because in Ancient Greek: σωρίτης sōritēs





Let us define the nuclear n vagueness of meaning.

If *p* is a proposition shared be theories, then

 $R_{\text{nucl}}(p) = \bigcap_{T \in t} R_T(p)$ $S_{\text{nucl}}(p) = \bigcap_{T \in t} S_T(p)$

 $A \triangle B = (A \cup B) - (A \cap B)$

Let us define the nuclear meaning, in order to quantify the

If p is a proposition shared by all members T of a family t of

$\operatorname{Vag}_{T} M(p) = \langle \Delta_{T} R(p), \ \Delta_{T} R(p) \rangle$ $\Delta_{T} R(p) = R_{T}(p) \Delta R_{\operatorname{nucl}}(p)$ $\Delta_{T} S(p) = S_{T}(p) \Delta S_{\operatorname{nucl}}(p)$



If T is not a well-formed theory, vagueness itself is vague.

When $M(p) \to M_{nucl}$, $Vag M(p) \to \langle \emptyset, \rangle$ and p is **exact** (exempt of vagueness).

The ideal of science is to produce only exact propositions about the world

The vagueness of a predicate is propagated to its extension. The extension of *P* is: $E(P) = \{x : x \in D \land V(Px) = 1\}$

where D is some domain of individuals and V designates the truth value of the predicate evaluated for x.

If p is vague, the E(P) will not be well-defined. This vagueness results in the sorites paradox. It can be removed through the exactification of p

Suggested topic for discussion

Are there vague objects? What would mean for an objects to be vague? Are quantum objects vague? And fields? And molecular clouds? Galaxies? People?



Theory of truth



What is TRUTH?

Ontological truth and **semantic truth**

<u>Ontological truth</u> is the adequacy of thought to reality. It's a relation between processes in the brain of a knowing subject and processes in the world (either the environment of the subject or his body, even the brain itself).

Ontological truth is a fact-to-fact relation, and hence it should be investigated by science (specifically neurosciences).

'Truth' is a polysemic word. I will differentiate at least two meanings:



<u>Semantic truth</u> is the adequacy of a conceptual object such as a proposition to reality. A proposition asserting the occurrence of an event *e* is said to be *true* if *e* occurs.

Notice that in order to understand what the proposition asserts, the proposition must be meaningful. Hence, meaning precedes truth, and not the other way around.

Since propositions are either formal or factual, semantic truth are divided into formal and factual truth.





Semantic



Formal (e.g. mathematics)



Factual (e.g. physics)



Semantic truth is attributed to some proposition according some theory of truth. Truth is not a property of the proposition: there is no analysis of the proposition alone that might reveal whether it is true or not.

The elucidation of the concept and the formulation of a truth theory that is in accord with scientific practice is primary the task of philosophical semantics.

A theory of truth has been defined as a theory that can answer the following problem:

statement in some metalanguage L₂ such that

Then to provide a theory of truth is to specify the nature of the truth bearer X in L_1 , and to determine the necessary and sufficient conditions in L₂ to call 'X' true.

This is more or less Tarski's approach to the problem.

If X belongs to some language L_1 and P_{TL2} is an open

P_{TL2}: 'X' is true iff Y

Alfred Tarski





Some traditional answers to the problem of truth

Theories of truth

Traditional theories of truth: Coherence theory of truth

'Recent' theories of truth: Consensus theory of truth Pragmatic theory of truth Deflationary theory of truth Video.edhole.com

- Correspondence theory of truth

Correspondence Theory

- The dominant theory, especially popular with empiricists
- Correspondence Theory proposes that a proposition is true if it corresponds to the facts
 - Example: "The apple is sitting on the table" can be true only if the apple is in fact sitting on the table.
- Often traced back to Thomas Aquinas' version: "A judgment is said to be true when it conforms to the external reality" (Summa Theologiae, Q. 16)
 - Also leaves room for the idea that "true" may be applied to people (a "true friend") as well as to thoughts
- Two main versions of Correspondence Theory: objectbased, and fact-based (currently prominent)

Correspondence Theory

Strengths:

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- 1. Simplicity
- 2. Appeal to common sense

Weaknesses

- 1. Difficulties pertaining to linguistics
- 2. Falls prey to circular reasoning
- 3. Awkwardness in application to mathematics
- 4. Leads to skepticism about the external world

Coherence Theory "Truth is that which is maximally coherent."

- Preferred by many idealists
 - coherence theory particularly attractive
- then it is true.
 - beliefs; truth comes in degrees

• For idealists, reality is like a collection of beliefs, which makes the

 The coherence theory of truth states that if a proposition coheres with all the other propositions taken to be true,

The truth of a belief can only consist in its coherence with other

 Coherence theorists hold that truth consists in coherence with a set of beliefs or with a set of propositions held to be true, not just an arbitrary collection of propositions

Coherence Theory

Strengths:

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- 1. Makes sense out of the idea of mathematical truths
 - Ex: (5+2=7) is true because: 7=7; 1+6=7; 21/3=(2x3)+1; are all true

Weaknesses

- Like the Correspondence theory, the Coherence theory falls prey to circular reasoning
 - Ex: Proposition A is true because propositions B and C are true. But how do you know B is true? Because proposition A and C are true. But what external evidence is there to support the truth of any of these propositions?

Pragmatism

 "Ideas (which themselves are but parts of our experience) become true just insofar as they help us to get into satisfactory relations with other parts of our experience,...truth in our ideas means their power to 'work' " – William James, Pragmatism (49)

- idea "working"
 - It is "true."

The key thing for James and pragmatism is that of an

 If believing that there is a gaping hole in the middle of the cafeteria prevents you from falling and breaking a leg, or making a fool of yourself in front of that cute boy from chapel, then that belief works.

Pragmatism weaknesses

- What is true for one person can be false to another
- Relativism •
- Lies can do it very well.

• At odds with science: not all truths help to maximise "our power".

Consensus Theory

- In the past, we have been all wrong
- We rarely agree: different religions, ideologies, etc.
- Subjectivism: truth depends on what human beings believe
- At odds with science: old, wrong theories had consensus once.

Something is true if all agree that its true

Deflationist theory

Truth is a superfluous concept. It adds nothing. To state that X is true is the same as to state X

- Avoids the answer, but not the problem
- Relativism: contradictory things can be stated
- representation of nature.

• At odds with science: we search for a true representation, not just a

A fictionalist theory of semantic truth

Truth is an *attribute* we assign to some propositions. Propositions do not have truth value unless we ascribe it to them. To do the assignment of value we need a *truth criterion* to specify a truth valuation function that maps propositions into truth values. This function is a partial function since not all propositions have truth value. If we do not ascribe a truth value to a proposition, the proposition in itself remains neither true nor false.

In short: <u>truth and falsity are not intrinsic properties</u> of propositions but <u>attributes assigned to them on the basis of some evidence</u>. Truth is as fictional as a proposition or a mathematical function.

Since there are formal and factual propositions, it is reasonable to have different truth criteria for them, in accordance to scientific practice.

Truth criterion

Formal propositions: coherence

Factual propositions: correspondence

Formal truth

Let L be some formal system and p a proposition of L. We say that the truth value $V_L(p)$ in L is 1 iff p is a theorem in L: $L \vdash p$

An abstract formula $\phi(x)$ in L has truth value 1 in L iff there is a model of $\phi(x)$

If a proposition or formula in L has truth value 1, we say that they are true in L. If they are not true, we say that they are false in L. We assign a truth value 0 to falsity.



Formal truth

Examples.

false in arithmetics of matrices.

assigns values of 0 or 1 to the The function $V_L(p): \mathfrak{P} \to \{0, 1\}$ $\mathfrak{P} \subset L$ of decidable propositions of L. Undecidable set propositions do not have truth value in L, but they might have it in a different system L'.

Summing up:

formal truth equals either satisfiability or theoremhood.

- The proposition (3+2=5) is true in arithmetics of real numbers.
- The formula 'AB-BA=0' is true in arithmetics of real numbers but

Factual truth

Factual truth is an attribute of propositions concerning facts. We assign a truth value to a proposition *p* on the strength of empirical tests such as a run of observations.

The assignment is done through a new proposition in the metalanguage: '*p* has a truth value $V_E(p)$ with respect to evidence E'.

Truth values can change if the evidence change.

Formal factual: evidence

The evidence *E* is formed by a set of propositions that express empirical determinations of some property *M* whose value according to a proposition *p* is μ . Then

 $EM=e \pm B$

where e is the measured value of M and β is the corresponding error. Then, p is true with evidence E if

If we have two pieces of evidence E and E' the truth value has a strength corresponding to the evidence of smaller error.

| µ - e |< ß.

We rarely are completely sure of a factual truth. Hence, we introduce a valuation faction of partial truth:

 $V: P \rightarrow [0, 1]$

The function V is determined by a set of postulates

Factual truth valuation function

Axioms for partial truth

- relative error β , then $V(p)=1-\beta$.
- A₂ If $p \neq \neg q$, V($\neg p$) = 0 iff V(p) = 1 and V($\neg p$) = 1 iff V(p) < 1 If $p = \neg q$, $V(\neg p) = V(q)$
- A₃ For any two propositions p and q, if $p \leftrightarrow q$, then V(p)=V(q)
- A₅ For any two propositions p and q, such as $p \neq \neg$ q: $V(p \lor q) = \max\{V(\neg p), V(q)\}$

• A_1 - If p is a quantitative proposition that has been found to be true with

• A₄ - If $p \neq \neg q$, then $V(p \land q) = \frac{V(p) + V(q)}{2}$, and if $p = \neg q$, $V(p \land q) = 0$

Otherwise: $V(p \lor q) = V(q \lor \neg q) = 1$

particular A₄ can be easily generalised.

 $V\left(\bigwedge_{i=1}^{n} p_i\right) = \frac{1}{n} \sum_{i=1}^{n} V(p_i)$

In the proposed system meaning precedes test since only if we understand a proposition we can test it. In turn, the result of a test leads to an assignation of truth value. Hence, truth depends on meaning and not the other way around.

Several theorems can be obtain from this basis. In

The partial theory of semantic truth is not free of problems

Let us consider the following problem: what is the age of x? Let us assume that the correct answer is 10 yr old. And let us consider the following statements:

q: 'x is 1 yr old'

 p_n : 'x is younger than the solar system +1/n seconds'

 p_1 : 'x is younger than the solar system +1 second' p_2 : 'x is younger than the solar system +1/2 second'



With a relevant false statement and a large number of irrelevant true statements we can construct a true statement. All statements have the same reference: x

V(q)=0.1 and $V(p_i)=1$, i=1, 2,...

$$\lim_{n \to \infty} \sum_{i=1}^{n} \frac{V(p_i)}{n+1} = 0 + \lim_{n \to \infty} \frac{n}{n+1} = 1$$

Relevancy

We can introduce a bi-valued relevancy function Rel: $P \rightarrow \{0, 1\}$

according to:

If p express a sharp value μ , then Rel p=1 Ι. ii. If Rel $p \neq 1$ then Rel p = 0

With this, we reformulate A₄:

So now V_F is 0 in our example

- Given a problem F, and a statement p with the same reference, the relevancy function assigns a value 1 (relevant) or 0 (irrelevant) to p

$$F_F\left(\bigwedge_{i=1}^n p_i\right) = \frac{1}{n} \sum_{i=1}^n \operatorname{Rel} p_i \cdot V(p_i)$$

In principle we can propose a generalised relevancy function

This is a function that assigns to each statement a relevancy between 0 and 1 respect to a problem F. Its explicit form is not general but depends on the specific problematic and the sense of the various statements.

$\operatorname{Rel}_{F} P \longrightarrow [0, 1]$

Truth bearers

To which objects can we attribute truth values? According to our theory, ontological truth is attributed to **thoughts and brain processes,** and semantic truth to **statements and propositions**.

A *statement* is an assertive sentence, either an inscription or an illocutionary act. It is then a physical object created by human beings.

Propositions are, instead, conceptual objects obtained by abstraction. If we consider statements as primary, then we can define propositions as follows.

Propositions

$$p = \{x$$

$$s \operatorname{Syn} s' \leftrightarrow \langle R(s), S(s) \rangle = \langle R(s'), S(s') \rangle$$

A proposition is an equivalence class of statements.

- Let s be some concrete statement. Then we define a proposition p as
 - $: x \operatorname{Syn} s$

Syn is the operation that assigns to s a synonymous statement s':

Propositions

We can now attribute truth value to a statement and then the value will be inherited by the corresponding propositions, since statements with the same meaning have the same truth value.

$$V(s) = V(p)$$

A **belief** is a psychological attachment to some proposition. As such, beliefs should be studied by psychology and not by philosophical semantics.

$$= \{x : x \operatorname{Syn} s\}$$

Theories are hypothetic-deductive systems of statements. Any finite set of axioms yields an infinite number of statements. Since truth is attributed to statements, it cannot be inherited by theories, because it is impossible to assign infinite truth values on the basis of finite experience and tests.

Hence, *theories cannot be true*. But they can be false. Moreover, a theory can be truer than another, if it contains a larger number of true statements about the same referents.



Analytic/Synthetic distinction of propositions

Df. 1. An expression is *analytic* in S if and only if it is justifiable by means of an examination of its component signs, with the sole help of other expressions of S and/or the logic L presupposed by S.

Df. 2. An expression is *synthetic* in S if and only if it is not analytic in S.

Here, S is some formal language.

Kinds of analyticity

- 1. *Tautologies*: propositions true in S by virtue of their form and independently of their meaning.
- 2. *Contradictions*: propositions false in S by virtue of their form and independently of their meaning.
- 3. *Tautonymies*: propositions true in S by virtue of the meanings of the terms occurring in them.
- 4. *Heteronymies*: propositions false in S by virtue of the meanings of the terms entering in them.
- 5. *Axioms true by convention*: propositions both basic and true in S by virtue of stipulations.

If analyticity is <u>contextual</u> (dependent on S and its logic), then the analytic/synthetic dichotomy is contextual as well.

The analytic/synthetic dichotomy becomes relative but not foolish: <u>it is perfectly valid in each context</u> and must be kept if we do not wish to confuse empirical with linguistic problems and procedures.

Summing up: only some brain processes and statements can be true, false, or something in between. Propositions are constructs that inherit the truth value of the statements from which they are abstracted.

A truth value cannot be assigned to a theory or to a worldview. A theory, however, can be truer that another. The same holds for worldviews. Science thrives for finding ever truer theories about the world.