Agnosticism and Quantum Mechanics

What do we really know?

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Outline

- History of the agnostic principle and common misconceptions
- The agnostic principle and its implications on the philosophy of science and religion
- The agnostic principle and quantum mechanics
- Summary

The Word Agnosticism

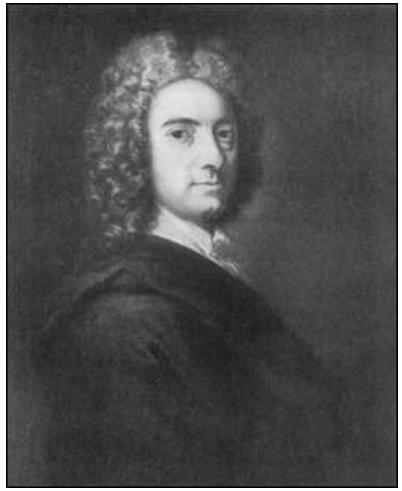
- Invented by T.H. Huxley to describe his scientific and philosophical point of view
- Hails from the greek preposition *a-* (α-, not-) and word *gnosis* ($\gamma\nu\acute{\omega}\sigma\eta\varsigma$, knowing)

Misconceptions

- Agnosticism is sort of a religion
- Agnosticism claims we cannot know anything about God
- All agnostics are atheists that wants God to exist
- All agnostics are people that cannot make up their minds

George Berkeley

- Born: March 12, 1685
- Dead: January 14, 1753
- Idealist
- Wrote in many areas
- Motto: “esse est percipi”



“It is, I think, a received axiom that an impossibility cannot be conceived. For what created intelligence will pretend to conceive, that which God cannot cause to be? Now it is on all hands agreed, that nothing abstract or general can be made really to exist, whence it should seem to follow, that it cannot have so much as an ideal existence in the understanding.”

Thomas Henry Huxley

- Born 1825, Dead 1895
- Biologist
- Follower of Darwinism
- Nicknamed “Darwin’s bulldog”
- Man and ape similarities
- “Inventor” of agnosticism

“If you go buzzing about between right and wrong, vibrating and fluctuating, you come out nowhere; but if you are absolutely and thoroughly and persistently wrong, you must, some of these days, have the extreme good fortune of knocking your head against a fact, and that sets you all straight again.”

The Agnostic Principle

Huxley's own definition of agnosticism:

"Agnosticism is not a creed but a method, the essence of which lies in the vigorous application of a single principle. Positively, the principle may be expressed as in matters of intellect, follow your reason as far as it can take you without other considerations. And negatively, in matters of the intellect, do not pretend that matters are certain that are not demonstrated or demonstrable."

- It is a method to be used in "matters of intellect"
- No mention of God

Agnosticism and Religion

- Is agnosticism consistent with theism?
  - Theism is a *belief* that there is a god
  - The theist must not be certain and his god must not be demonstrable
- Is agnosticism consistent with atheism?
  - Atheism in the weak sense is a *belief* that there is no god
  - The weak atheist must not be certain that god does not exist
  - Atheism in the strong sense is the conviction that god cannot exist
- As long as nothing non-demonstrable is taken for *certain*, there is no conflict with agnosticism

Agnosticism and Reality

- Can we really be certain of reality?
- What is “reality”?

The agnostic’s answer depends on what is meant:

- Reality as some ideal composition of perfect objects
- Reality as what we can describe

Agnosticism allows to make a description of reality.

Explaining and Describing

Explaining:

- “To make plain or comprehensible”
- In terms of what?

Describing:

- “To give an account of in speech or writing”
- For example how one can predict certain measurements

Citations from The American Heritage Dictionary of the English Language

Explaining and Describing

Explanation is always in terms of something else. Is this something really comprehensible or in some way real? A description makes no claim to have made something comprehensible, only to describe the characteristics of something.

The view of the agnostic:

- Describing can be done
- Explaining is more uncertain
  - What do we really assume when explaining?
  - Do we take our assumptions for certain?
  - Have we really explained something?

Agnosticism and Science

Given a hypothesis, how many different points of view?

- The hypothesis is true
- The hypothesis is false
- The hypothesis is indeterminable

The agnostic response:
“Is the validity of the hypothesis a better description of what we can observe than the non-validity of the hypothesis?”

- Yes: Include the hypothesis in a description of the world
- No: Include the anti thesis of the hypothesis
- Cannot tell them apart: Assume nothing about the validity of the hypothesis

An Example

Hypothesis:
“The universe consists of many space-times which are totally disconnected.”

The agnostic: “If the hypothesis is true, there is no way of observing another space-time. If the hypothesis is false, there is still no way of observing another space-time.”

- The truth- or falseness of the hypothesis are not demonstrable
- According to the agnostic, neither should be assumed in a description of our universe

(However, for all practical purposes, we may clearly use only properties of the space-time in which we live for our description regardless of if the hypothesis is true or false.)

Further examples

Not all examples are as clear as the previous one.

- “There is maximal mixing in the leptonic sector of the SM”
- “String theory is a gives a better description of Nature than the SM”
- “God exists and performs miracles every day”

In general

- The hypothesis may be indeterminable by definition as in our example
- Even if the hypothesis is, in principle, determinable. We may not be able to do so at the present time
- The hypothesis may be vaguely formulated

Views on Quantum Mechanics

The great quantum mechanical debate:
“What happens between measurements?”

The three points of view are:

- The Realist
- The Orthodox
- The Agnostic

The Realist

The realist position includes the following ideas:

- Quantum mechanics is not complete
- The intermediate states are given and always exist
- Hidden variables needed for complete description

According to the realist, a system always has a definite state, regardless if it is measured or not. It should be noted that the realist does not believe quantum mechanics to be wrong, just incomplete.

The Orthodox

The orthodox position includes the following ideas:

- The indeterminability is a natural part of the system
- A measurement causes a system to choose its state using the quantum mechanical probability density function
- The measurement is important and forces a system to be in a specific state

The orthodox position gives much importance to the observer of a system. There are no hidden variables which determines the exact state at all times.

- Gave rise to paradoxes like Schrödinger's cat

The Agnostic

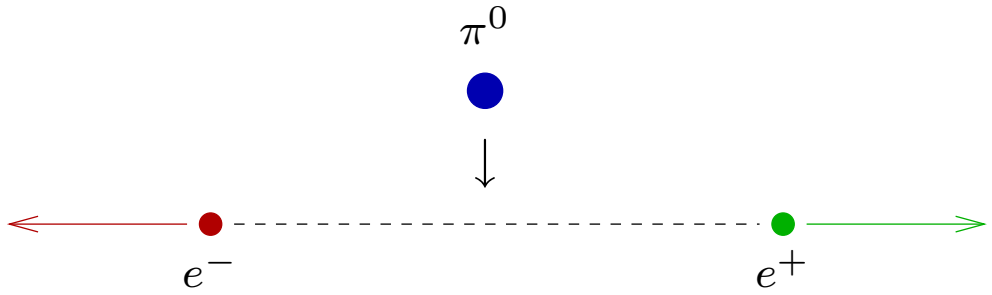
The agnostic position includes the following ideas:

- The intermediacy problem is indeterminable
- No explanation is needed

The agnostic dodges the problem. Since you must make a measurement to know the state of a system, you cannot know the state of a system between measurements.

The EPR paradox

Formulated by three devoted realists: Einstein, Podolsky and Rosen



- Pion has spin zero
- Electron and positron must have equal and opposite spin
- According to the orthodox view, information will travel faster than the speed of light when a measurement is made on the electron or positron

John Stewart Bell

- Born: July 28, 1928
- Dead: October 1, 1990
- Theoretical Particle Physicist
- Bell's inequality
- Disproves hidden variables

Views on Quantum Mechanics, revisited

After Bell's inequality, we have two remaining views:

- Bell's inequalities disproves the realist position
- The orthodox and agnostic positions remain

We should note that:

- The orthodox position contradicts the agnostic principle
- The agnostic position is often taken as a "retreat" position
- The agnostic position is not necessarily a "retreat" position

Summary

- Word “agnostic” invented by T.H. Huxley
- Scientific and philosophical method, not a religious statement
- Implications on the philosophy of science
- The three points of view on quantum mechanics (realist, orthodox, agnostic)
- The EPR paradox and Bell’s inequalities

References and Further Reading

- The Internet Encyclopedia of Philosophy, http://www.iep.utm.edu/
- Physics Web, http://physicsweb.org/
- The Atheism Web, http://www.infidels.org/news/atheism/
- “Introduction to Quantum Mechanics”, Griffiths, ISBN 0131244051