

## Occam's Razor

### Parent of the KIS Principle

**One should not increase, beyond what is necessary, the number of entities required to explain anything.**

**Background:** Occam's razor ("Occam" is a Latinised variant) is a logical principle proposed by the English philosopher and Franciscan monk, William of Ockham (1284-1347). "*Pluralitas non est ponenda sine neccesitate*" or "plurality should not be posited without necessity." Roughly translated it says that one should not make more assumptions than the minimum needed. At it's core the Razor assumes that simpler explanations are inherently "better" than complicated ones.

Like many Franciscans, William was a minimalist in this life, idealizing a life of poverty, and like St. Francis himself, battling with the Pope over the issue. William was excommunicated by Pope John XXII. He responded by writing a treatise demonstrating that Pope John was a heretic.

What is known as Occam's razor was a common principle in medieval philosophy and was not originated by William, but because of his frequent usage of the principle, his name has become indelibly attached to it.

The scientific method of hypothesis generation and testing relies heavily on this powerful tool. The principle, often called the principle of parsimony, underlies all scientific

modeling and theory building. It admonishes us to choose from a set of otherwise equivalent models of a given phenomenon the simplest one. In any given model, Occam's razor helps us to "shave off" those concepts, variables or constructs that are not really needed to explain the phenomenon. By doing that, developing the model will become much easier, and there is less chance of introducing inconsistencies, ambiguities and redundancies.

Though the principle may seem rather trivial, it is essential for model building because of what is known as the "under determination of theories by data". For a given set of observations or data, there is always an infinite number of possible models explaining those same data. This is because a model normally represents an infinite number of possible cases, of which the observed cases are only a finite subset. The non-observed cases are inferred by postulating general rules covering both actual and potential observations.

For example, through two data points in a diagram you can always draw a straight line, and induce that all further observations will lie on that line. However, you could also draw an infinite variety of the most complicated curves passing through those same two points, and these curves would fit the empirical data just as well. Only Occam's razor would in this case

## 2005 MAFN Facilitator's Workshop Series

guide you in choosing the "straight" (i.e. linear) relation as best candidate model. A similar reasoning can be made for  $n$  data points lying in any kind of distribution.

It is unlikely that William would appreciate what some of us have done in his name. For example, atheists often apply Occam's Razor in arguing against the existence of God on the grounds that God is an unnecessary hypothesis. We can explain everything without assuming the extra metaphysical baggage of a Divine Being.

Occam's razor is especially important for universal models such as the ones developed in General Systems Theory, mathematics or philosophy, because there the subject domain is of an unlimited complexity. If one starts with too complicated foundations for a theory that potentially encompasses the universe, the chances of getting any manageable model are very slim indeed. Moreover, the principle is sometimes the only remaining guideline when entering domains of such a high level of abstraction that no concrete tests or observations can decide between rival models. In mathematical modeling of systems, the principle can be made more concrete in the form of the principle of uncertainty maximization: from your data, induce that model which minimizes the number of additional assumptions.

Other interpretations include:

- One should always choose the simplest explanation of a phenomenon, the one that requires the fewest leaps of logic.

- Don't make unnecessarily complicated assumptions.
- Make things as simple as possible - but no simpler.- Albert Einstein
- KISS - Keep It Simple Stupid!

Occam's Razor arguments were used prominently in the Jodie Foster movie "Contact" in 1997.

A related rule, which can be used to slice open conspiracy theories, is Hanlon's Razor: "Never attribute to malice that which can be adequately explained by stupidity". This definition comes from "The Jargon File" (edited by Eric Raymond).

Resources:

<http://pespmc1.vub.ac.be/OCCAMRAZ.html>

<http://www.medinfo.ufl.edu/year1/bcs96/interv/occam.html>

[http://home.xnet.com/~blatura/skep\\_1.html](http://home.xnet.com/~blatura/skep_1.html)

<http://cgm.cs.mcgill.ca/~soss/cs644/projects/jacob/interpretations.html>

W.M. Thorburn, "The Myth of Occam's Razor," *Mind* 27:345-353 (1918) for a detailed study of Ockham