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Jocax's razor

Summary

We will make a critical analysis of Ocam's razor[1] and, then, we will propose an alternative razor.

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Introduction

Philosophy, as a Science, always searches for true knowledge. These two fields of knowledge are so dynamic that new theories and hypothesis always arise. Several new theories or hypothesis broach the same problem, and they may conflict against each other. In our daily life, we come across with piece of information/assumptions; some of them are contradictory and

they need, in some way, to be evaluated so that we can take a decision about them. (In this text, suppose that words "hypothesis" and "theory" are synonyms, because they are assertion or statements regarding some aspect of reality.).

So, regarding several theories that come up wanting our acceptance, the following question that arises naturally is:

What is the best way to choose?

Logic

The first criterion is Logic.

If you have to choose one hypothesis among two or many others as valid and true information, those that are against logic are always rejected. But what if theories do not go against logic? How to choose the best ones?

In this case, we still have the knowledge base...

The knowledge base

The second criterion of choice would be the conformity of the hypotheses we are evaluating with the base of scientific knowledge - considered by the scientific community as the most valid one we have so far - would be the Physics laws [e.g.: quantum mechanics, relativity theory] , Biology laws [Genetics, Evolution] etc.

Simple hypothesis

If the theory we are evaluating do not challenge the laws of the knowledge base itself - and this is important - then, we can use it to evaluate the competing hypotheses. In the vast majority of cases, whether in our daily lives, in courts, or even in Science, the hypotheses, or conflicting theories, refer to statements which do not challenge the premises of our knowledge base.

Our scientific knowledge base has been tested successfully for a long time and, in many cases, is fairly reliable. If a hypothesis conflicts with this basis, it is more reasonable that this hypothesis is wrong than some theory of this basis. So, until the knowledge base is proven to be 'false', the best we can do is to take it as a true, and a hypothesis contrary to this basis is more likely to be false, and it should be rejected.

In terms of illustration, which of the theories below would you consider more correct?

a) The "Flat Earth" theory is true. b) The Earth is not flat, but almost spherical. c) Earth rests on four huge turtles in space.

And these?:

a) Holy water never boils. b) Holy water, like all water, boils at 212ºF.

In these examples, we have no doubts; we run to the knowledge base and choose the options (b) in the two examples.

New Theories fighting for a place in the Base

In case where the hypothesis to be analyzed challenge some of the theories of the knowledge base itself, we cannot - a priori - refute it simply by claiming that it goes against some theory of our base. If that were the case, today, we would still think that the Earth would be the center of the Universe! Generally, new ideas face a lot of resistance to be established,[2] that's why Galileo[3] almost burned on bonfire for denying the ancient Geocentrism in favor of Heliocentrism.[4] However, on the other side, and unfortunately, Giordano Bruno didn't have the same luck, and he was burned on bonfire by the Inquisition for disagreeing with some dogmas of that time.[2]

A new theory, which intends to replace the oldest one, should rather, and above all, explain every set of problems and/or experiments that the previous theory explained. In addition, if the new theory can explain facts that the previous one could not, it should be considered better, and replace the previous one. For that reason the Newtonian Mechanics was replaced by the theory of General Relativity.[5] Particularly in the Physics field, there are observations in which our current theories (2018) do not explain some cosmological observations.

For example, it has been observed that galaxies are moving away at fasted speed. The theory of general relativity itself did not explain this phenomenon, so the "Dark Energy" hypothesis was proposed,[6] which it would be a new cosmic entity that would create a repulsive force and, then, this separation would occur. Another example is "Dark matter",[7] which it is also an 'ad-Hoc' added hypothesis,[8] to

explain the accelerated rotation of the galaxies in which current theory itself could not.

These relatively new "Dark Elements (matter + energy)" have not been fully confirmed yet, nor even detected by other independent experiments - besides the observation of the movement of the galaxies - so they provided a 'very fertile soup' for emergence of dozens of other rival theories - some of them seeking to the golden throne left by Einstein.[9–11] Other theories keep the legacy of Theory of General Relativity, but they are reinterpreted.[12–13]

Today, at the beginning of XXI century, we have not yet ended this "War of Theories". It is too early to know whom will win the battle which will explain the movements of the galaxies and its stars without resorting to the "Dark Elements" but we can already predict that the new theory must also explain the phenomena already explained by the old theory of General Relativity and, if it can exclude the need for these "Dark Elements", it will succeed even faster.

The Evidences

The word "Evidence": From Dictionary:[14]

Proof: Character of what is evident, manifest, and leaves no doubt. Clue; which demonstrates the existence of something: the evidence of murder.

From Wikipedia:[15] Evidence (lat. evidentia, ae: visibility, clarity, transparency) is the attribute of everything that leaves no room for doubt. It can also mean what indicates, with probability, the existence of something.

In Philosophy: In ancient philosophy, evidence is the characteristic of knowledge in its highest degree, that is, the knowledge reached by the intuitive intellect (nous, in the Aristotelian terms):

In Science: Scientific evidence is the set of elements used to support or refute a scientific theory or hypothesis.

These definitions leave a lot to be desired in face of such an important concept. The concept of "certainty" or "no doubt" is something scientifically and philosophically very controversial. To understand this reason, we need to look at the "*Principle of Philosophical Uncertainty*" (PPU)[16] which states we can be sure of almost nothing:

"It is impossible to know whether any observation, measure, or perception actually match to the reality."

Therefore, a good definition of "Evidence" would be:

"Evidence is an observation, measurement, or verification that, for it to be refuted or denied, it would need more unlikely hypotheses than to be accepted."

Then, we can say that a hypothesis that goes against the evidences should be deferred to those which do not contradict them. Because a hypothesis that goes against evidence shows a clear sign that it is false (although it may not be!).[16]

For example, consider the following theories concerning a box of shoes on street:

a) The box is empty.

b) There is a necklace inside the box.

Neither of two hypotheses presents logical inconsistency nor transgressed any scientific law.

However, if we have the following evidence: -A picture that the boy just took from the open box shows a necklace inside of it.

Before this evidence, the best theory would be (b), because it would be quite difficult for a picture to show a necklace when, in fact, there was nothing to be shown.

However, how can we choose when neither of the hypotheses presents logical failings, nor contradict our knowledge base and do not present evidence to resolve them?

In this case, we must use logical-philosophical concepts known as "Razors".

The Razors

Razors are criteria of choice which aim to guide us when choosing the conflicting hypotheses or theories. Especially when the standard criteria of choice (Logic, Knowledge Base and Evidence) are not enough. There are several razors from Wikipedia[17] we have:

Occam's razor: Occam's razor, the best known of the philosophical razor, states the following: "When confronting different hypotheses to explain the same phenomenon, one must select those that involve less actions and entities."

Grice's razor: It is a principle of parsimony. It states that practical implications should be preferred before abstract semantic contexts for linguistic explanations.

Hume's razor: "If the cause attributed to any effect is not enough to fully explain it, we must reject the cause or add to it qualities which give a fair proportion to the effect".

Hitchens's razor: It says that "What can be stated without proof can be rejected without proof."

Alter's razor: Also known as "Newton's Razor" or "Newton's Flaming Laser Sword", it consists of the statement that if something cannot be tested nor observed, it is not worthy of debate.

Popper's razor: Also known as the "Principle of falsifiability [of Popper]", it consists in the statement that for a theory to be considered scientific, it must be falsifiable.

Rand's razor: It is closely linked to Occam's razor, since it states that "concepts should not be multiplied beyond necessity."

Among the known razors, the most important and by far the most famous is the "Occam's Razor", we will analyze below:

Occam's Razor (O.R.)

The "Ocam's Razor" ("Occam's Razor" or "Ockham's Razor") is a logical-philosophical principle that establishes we should choose the hypotheses with the fewest assumptions possible.[1] An equivalent form says that it should not add unnecessary hypothesis(es) to a theory, or in another way: in its original in Latin:

'pluralitas non est ponenda sine neccesitate'.[1] ("pluralities should not be put without necessity").

Or yet:

'Entia non sunt multiplicanda praeter necessitatem'[1] ("Entities should not be multiplied beyond necessity").

Occam's Razor is also known as "Principle of Economics" or "Principle of Parsimony", which states that "entities should not be multiplied beyond necessity, the nature itself is economical and it does not multiply in vain." It is believed that William of Ockham, a XIV century Franciscan friar, has been the creator of this principle. William was born in the village of Oakham in England in 1285, and he was a controversial theologian and one of the most influential philosophers of XIV century. Willian of Ockham died in Munich in 1349, a victim of the black death which, at that time, devastated Europe.[18]

Simplicity

"Occam Razor" is also known as the "Principle of Simplicity" and states that more "simple" theories are preferable than the more "complex" ones. But the way "Occam's Razor" is known can be dangerous, unless one defines the meaning of the word "simplicity", it can be a serious mistake to consider the more "simple" theory as the one that is easier to understand. Simplicity, on Ocam's Razor, is not necessarily the easiest to understand. For example, for some, it may seem simpler to think that the "rain god" provokes rain than to understand a complicated physical process of evaporation of water by the Sun and subsequent condensation of water in the clouds. Therefore, it is always risky to associate "Occam's Razor" with the "Principle of Simplicity" if it is not clear which concept of simplicity is correct.

In terms of illustration, consider the following theories:

a) There's a chicken egg in that shoebox.

b) In that shoebox there is a colored rectangular stone encrusted with 20 small diamonds.

We can see that neither of these two theories violates the logic or some law of our knowledge base. Moreover, since we have no evidence of any of them, we should use some razor to choose the best hypothesis. Using the O.R. we should select the theory (a), the one with the least hypotheses.

It is very important to be clear that:

This choice does not imply that the hypothesis chosen is true, or that the rejected hypothesis is false.

Eventually, in the box, it could have the colored stone encrusted with diamonds!

Criticism of Occam's Razor

Although "O.R." is very good razor for a rational choice of theories, however, when we do not have alternatives, it does present some flaws we will point out below:

-The oldest definitions of O.R. are:

"Pluralities should not be posited without **necessity**" ('pluralitas non est ponenda sine neccesitate') and "Entities should not be multiplied **beyond necessity**" ('Entia non sunt multiplicanda praeter necessitatem')

The affirmations are analogous. The problem is that they are, practically, a logical-semantic tautology, that is, an absolute truth that, in fact, does not bring any information. The terms 'without necessity' and 'beyond necessity' already imply that such unnecessary entities are not necessary, and if they are not necessary, then they should not even be in theory. Obvious? Yes! If the hypothesis is not necessary, there is no reason to put it in theory. The problem lies precisely in knowing what is necessary or not in theory. And in this case, these O.R.'s affirmations cannot help us. That is, we need to have a degree of prior knowledge to evaluate the theory - to know what is necessary or not -, which does not always happen.

However, even the "tautological" version of the O.R. can be useful when someone * knows * some of the hypotheses that are not necessary, even if those who formulated these hypotheses seem essential to them. Consider, for example:

a) To ride a car, it is necessary to have fuel and the driver; before turning it on, pray the 'The Our-Father'.

b) To ride a car, it is necessary to have fuel and tires.

We know that the hypothesis of prayer (in item "a") is unnecessary, even if, for those who formulated it, this may seem to be indispensable.

Let us now consider the other, more objective, O.R.'s definition:

"We must choose the hypothesis with as few assumptions as possible"

Although it may be good in many cases, it may fail in several others just because the premises of the theory may not have the same probability.

Consider the two theories:

a) In that hole there is a stone, two ants, three chicken eggs and a marble.

b) In that hole there is a pink diamond.

If we are going to use O.R. to choose between the two hypotheses, and using the least amount of hypotheses, we would have to choose the hypothesis "b" where we know that it is much less likely to be true than the hypothesis "a".

Another example:

We know that in a closed box there are 2 dice and 4 coins. Which one of the following two theories should we choose?

a) In the box, the dice 1 shows the face 6 facing upwards. Also in dice 2.

b) In the box, coin 1 gave "Heads", coin 2 gave "Heads", coin 3 gave "Heads", and coin 4 also gave "Heads".

In the first theory we have 2 hypotheses about the data. In the second theory we have four hypotheses. For O.R., the theory with fewer premises is the theory "a", because it presents only two hypotheses about the data, as the theory "b" presents 4 premises. However, the premises are not equiprovable in the two theories: The theory "a" has a probability of 1/36 to be true, while "b" theory has a probability of 1/16. Therefore, in this example, the theory "b" is actually twice as likely to be true as the theory "a", although O.R. says that we should choose theory "a" (which presents least hypotheses). In last examples we have seen that, contrary to O.R., our 'common sense' says that we should choose the most probable theory, not the

least number of hypotheses. And this gives us the clue to the new razor: "The Jocax' Razor".

The Jocax's Razor

Surely many have intuited or had the idea that the best choice should be the most likely theory/hypothesis, not the one with the least number of hypotheses. So I will formalize this idea calling as "Jocax' Razor" (JR):

"The best choice must lie in the theory we estimate to be most likely to be true." (Jocax' Razor)

Knowing that we are always looking for the theory that is true (or, at least, the closest to it) we will analyze this new razor from several angles:

This Jocax' Razor (JR) would be as tautological as are some forms of the Occam's Razor (O.R.)?

If we had defined JR as: "... the theory that is most likely to be true." Then, in this case, it would be a tautology, because the true theory is also most likely to be true, and false theories are the least probable. The word "estimate" regarding the probability of a theory is true, in the JR definition, prevents it from being a logical tautology. Of course, two different estimates can lead to different choices, but if someone shows that their estimate is more accurate than the rival estimate, then it should be the preferred estimate.

Estimation of probability depends on context.

Consider again the example of topic (iv.2):

a) In that hole there is a stone, two ants, three chicken eggs and a marble.

b) In that hole there is a pink diamond.

Of course that on planet Earth the option (a) is more likely and, therefore, should be the chosen option, but, what if we are on the planet Neptune? In this case, it is not! It is more likely to find a diamond in a hole in Neptune than three chicken eggs!

Number of hypotheses

When we have no way of estimating the probability of the assumptions that composes the theory, I think we must take them all with the same probability (since there would be no reason to take one hypothesis more likely than another). Thus, in this case, estimating that all hypotheses or assumptions of the theory have an equivalent probability, then the Jocax' Razor becomes equivalent to Occam's Razor because, the greater the number of statements made in theory, the smaller the likelihood of all being true at the same time. In this case, therefore, theories with fewer hypotheses would be more likely to be true and, therefore, should be preferable in our choice.

The role of evidence

Unlike Occam's Razor, which says nothing about evidence in relation to theory, in JR, the role of evidence naturally appears in the estimation of probabilities. We know that Conditional Probability Theory[19] sates that: "The probability of occurring "X" given that event "Y" is equal to the probability of ("X" and "Y") divided by the probability of event "Y". In mathematical notation we will have:

$$P(X/Y) = P(X \text{ and } Y) / P(Y)$$

Where P (X and Y) = Probability of occurring "X" and "Y" (= Probability of Intersection). In our case, "X" represents the Theory we are evaluating and "Y" is observed evidence.[20] Then, the probability of the theory "X" being true since it was observed (happened) the evidence "Y" will be ZERO if the evidence "Y" is incompatible with the "X" theory: If

$$P(X \text{ and } Y) = 0 \rightarrow P(X/Y) = 0$$

If the evidence is incompatible with the theory, it suggests that the theory must be false. That is, it is reasonable to reject the theories that go against the observed evidence.[21] For example, consider the theory:

X = "All eggs are white and cubic"; Consider the evidence: Y = "An oval egg was observed"

As the evidence "Y" occurred $P(Y)>0$, , but $P(X/Y) = P(X \text{ and } Y)/P(Y)$, but P (X and Y) = 0 since there can be no cubic and oval egg at the same time!

$$P(X/Y) = 0/P(Y) = 0\%$$

So, the probability of the theory "X" being right in front of this evidence is null.

We can also observe that the greater the 'weight' of the evidence 'Y' on the 'X' theory, the more likely the theory is. In extreme case, if "Y" is an evidence that it is the theory itself, i.e., 'X' = 'Y', then the probability of the theory is 100%. For example, the theory says that X = "today is going to rain", and the evidence says that Y = "it rains now", so the theory is correct. In more formal terms, we will have:

$$\text{"}X\text{"} = \text{"}Y\text{"} \rightarrow P(X/Y) = P(X \text{ and } Y)/P(Y) = P(Y)/P(Y) = 100\%$$

This formalism is another advantage over Occam's razor, which lacks a way of handling evidence.

Conclusion

The Jocax' Razor is a logical philosophical principle that probably was not just "named" before because it was extremely intuitive and simple. However, comparing it with the "Ocam's Razor", the latter is superior, since O.R. makes no reference to the probabilities of the hypotheses which, as we have seen, can lead to wrong choices. O.R. also does not treat the evidence, so important in scientific research. A critique to J.R. would be when we have no way of estimating the probabilities of the hypotheses that compose the theory but, as we have seen, in this case we should all consider them with the same probability value and, thus, the J.R. would be equivalent to O.R.

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Conflict of interest

The author declares that there is no conflict of interest.

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