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## Some considerations on the estimation of the value associated to a clinical act

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### Abstract

The assignment of a *value* to any economic system, especially in healthcare management, is the topic of this article. The assignment of a *value* to a clinical act is a very complex process, as it joins the complexity of estimating *value* in an economic system with the estimation of the *value* of well-being. An interdisciplinary approach joining disciplines such as Philosophy, Business, Psychology and Physics is used to analyse the assignment of a *value*; and it is obtained that it is necessary the integrated use of three concepts; viz., *Truth*, *Good*, and *Beauty*. It is also obtained that the concept of *Beauty* has the biggest difficulty in being computationally represented, and that to achieve such representation it is necessary the use of *Statistical Philosophy*, a here-proposed branch of the *Philosophy of Information*. Moreover, it is obtained that *value* is made of three types of *value*; viz., *Truth-value*, *Good-value*, and *Beauty-value*. Finally, it is made an assessment of the difficulty in choosing the appropriate necessary projection of the 3-vector *value* into a *worthiness*-scalar, a projection that is necessary because the choice of a best option, e.g. a best clinical act, always requires that the option is quantified by a scalar.

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## 1. Introduction

The increasing costs for trained personnel (e.g. nurses), the cumulative availability of useful devices (e.g. magnetic resonance imaging), the mounting complexity of what constitutes a sufficiently healthy person plus the competing demands on the salary of the personnel in comparison to "device costs vs. patient improvement" can, in the approach proposed here, be best interpreted by using what is known in Philosophy as Plato's *Transcendentals* (a.k.a. Platonic Triad):

- The Truth (in healthcare meaning that the devices provide objective information)
- The Good (in healthcare meaning that the patient's health is improved)
- The Beauty (in healthcare meaning that the employees are well paid)

Indeed, fields like Neuroscience, Psychology, Psychiatry have clarified the relationship between the Actual Reality (i.e., the physical universe) and our mental perception of a Perceived Reality (i.e., the human mind). On the other hand, the role that computation can play in these areas may increase the need and / or capacity for the existence of computing tools that are able to deal with issues that have been associated with Philosophy and its main branches, together with its main question, viz.,

- Epistemology → What is Truth?
- Ethics → What is Good?
- Aesthetics → What is Beauty?
- Logic → Which axioms and conclusions are valid?
- Metaphysics → What is one's origin and end?

Although branches such as Logic and Metaphysics seem to be a very natural adaptation to contemporary computer tools, the other branches are not normally included in such devices; but in areas like healthcare, the relationship between Actual Reality and Perceived Reality is inherently unclear, namely in the relation between Actual Health (the lack of physical harm) and Perceived Health (the lack of a feeling of discomfort). Therefore, when computer tools are used for health care, their applicability can be improved by including some taxonomies from the field of Philosophy. Specifically, the often used, Plato's *Transcendentals*; meaning; *Truth*, *Good* and *Beauty*. Undeniably, the two branches of Logic and Metaphysics fit well with the usual methods of today's computer tools once they implement a kind of axiomatic system that is in direct correspondence to, respectively, Newtonian Axiomatic Systems (NAS) and Darwinian Axiomatic Systems (DAS), with a match into the system's area of, respectively, Deterministic Physics and Darwinian Biology [1] [2] [3].

The Philosophy branches of Epistemology, Ethics and Aesthetics look at different areas of human knowledge and depend, undoubtedly, on how these words are interpreted. For example, *Truth* may symbolize experimental, economic, and / or personal truth. Depending on what the words *Truth*, *Good* and *Beauty* are thought to mean; the relationship to actual computer implementations may diverge. The approach developed here proposes that the word *Truth* should only refer to the experimental values allocated to an observation-strategy; and that *Good* should only relate to what improves patient health, while *Beauty* denotes the economic values corresponding to the staff's salary. This last relationship between *Beauty* and *value* is possible, mostly, because *Beauty* and economic *value* are both physiologically [4] and culturally [5] linked.

## 2. Assessing Value

In Kant's perspective there could be no objective definition, in principle, for *Beauty*, since the aesthetic experience of *Beauty* relates only to the subjective pleasure of the subject and not to a property of the object [6]. In Schiller's viewpoint, *Beauty* can be defined objectively [6]. The perspectives of Kant vs. Schiller thus constituting opposing views about the possible objectivity of *Beauty*. In Schiller's work it is used the term *Beauty* and not *value*, but in the approach proposed here, they are inter-linked, and therefore the *Beauty-value* notation is used. The reason for

keeping the *Beauty-value* notation is that it is possible to argue that the basis of all *Beauty* feelings is the market *value* of neurotransmitters in the brain [4], and that the basis of market *value* is the *Beauty* appreciation that people assign to the objects [5], i.e., *Beauty* is the basis for *value* and vice versa. Therefore, and in accordance with Kant and Schiller, no finite *Beauty-value* can be assigned to a person, since each person is an archetypal of their freedom and is, consequently, a matter of their own [6]. Thus, only countless *Beauty-value* can be assigned to people as people are both capable and entitled to freedom. As a result, Schiller ascribes the utmost *Beauty-value* to the objects that present the uppermost freedom, i.e., the objects that have the least usefulness and are therefore closer to a thing that exists for itself. While this definition of *Beauty* seems to be in direct contradiction with the definition of *value* in contemporary economy, which assigns *value* to knowledge, meaning "useful information" [5], and is designated here as *Truth*. Therefore, contemporary economics seems to place more value on *Truth* than *Beauty*, and people are prepared to spend large amounts of their wealth to improve their health, suggesting that *Good* is also worthwhile. In fact, there are three types of *value*, viz.

- *Truth-value*
- *Good-value*
- *Beauty-value*

The infinite *value* that Kant and Schiller ascribe to a person relates only to *Beauty*, and it is an ascription that characterizes Kant and Schiller's philosophical period, the romantic, which is a pre-Darwinian one. The development of Darwinism as a *Biological* [7], *Mathematical* [8], *Economic* [5] and *Physical* [9] concept raises new questions that may be assessed with the help of computing tools. In order to be able to judge these three types of *value*, it must be possible to work with an "axiom-driven *value* calculation" for the *Truth-value*, e.g. a NAS; and with an "environmentally-driven *value* calculation" for the *Good-value*, e.g. a DAS; whereas a new form of calculation is required for the *Beauty-value*. This new form of calculation, which is suitable for estimating the *Beauty-value* of an object, is the partial information-driven calculation given in ref. [10], and further developed in ref. [3] which presents the 3 axes of *Psychology*, viz.,

- Thanatos
- Eros
- Tyche

The relationship between the 3 axes of ref. [3] (see Fig. 1), the three factors of ref. [10], and *Plato's Transcendentals* of Philosophy are shown in Table 1.

Table 1. The relation between *value* and *Beauty* is described [6][3][10].

<b>Plato</b>	<b>Neves</b>	<b>Lori</b>
Truth	Initiative	Hunting/Power/Now-Then/Thanatos
Good	Empathy	Eating/Pleasure/In-Out/Eros
Beauty	Self-Discipline	Choosing/Meaning/Tone-Word/Tyche

The information concept used here is that of *Shannon Information*, i.e., the logarithm of the inverse of the probability of occurrence of a symbol in an alphabet; which is thus based on probability theory. This new form of calculation, the partial information calculation, is a probabilistic one, without necessarily assuming that these probabilities are the result of a lack of discipline of the observer, but that the information available is not sufficient to provide more than the probabilities. A key question for this new form of partial information-driven calculation named *Statistical Philosophy*, a here-proposed branch of the *Philosophy of Information*, is the importance of the role causality plays in the observed system. This is a central issue for *Statistical Philosophy*, since causality plays a direct role in the appropriate control of variables, which enables an appropriate statistical estimation of the probability of

events. The correct way to use variable control depends on whether the variable acts as a *mediator*, *confounder* or *collider*. The role of the variable is defined by whether that variable has causality that will: [11]

- *go through*;  $\rightarrow \bullet \rightarrow$ ; indicating a *mediator*
- *diverge*;  $\leftarrow \bullet \rightarrow$ ; indicating a *confounder*
- *converge*;  $\rightarrow \bullet \leftarrow$ ; indicating a *collider*

In order to use causality correctly in statistical analysis, it is necessary to carry out causal interventions in probabilistic inference using the MAKE operator, which is an operator defined as symbolizing the forcing of a causal effect. The use of the MAKE operator enables the creation of a counterfactual statistical analysis, which enables the creation of the two upper levels of the causal inference above the *correlative causality* level, i.e., the *interventive causality* and *counterfactual causality* levels. The *correlative causality* resembles an act of *seeing*, meaning it identifies the likelihood of the simultaneous occurrence of events; the *interventive causality* an act of *doing*, meaning it identifies the likelihood that an effect resulted from a certain cause; and the *counterfactual causality* an act of *imagining*, meaning it identifies the likelihood that an effect that did not occur resulted from a certain cause not occurring. This new form of calculation enables a *Statistical Philosophy* based on computational tools. The counterfactual definition of causality was already available in the biblical dialogues of Abraham but was not used by Aristotle, and it was not used by Hume in his work from 1739, but only appeared in Hume's work from 1748. [11]

It was Hume's analysis of ethics and causality that prompted Kant to develop his own approach to ethics and causality, in a direct contradiction to Hume's approach [12]. This is relevant to the approach proposed here, as this approach is directly related to the distinction between Hume and Kant morals [13]; moreover, Kant's ethics are based on duty (therefore associated with language), and Hume's are based in emotion (hence associated with tone of sound) (see Fig. 1). This approach is also related to the difference between Kant's view that *Beauty* is not objective and Schiller's view that *Beauty* can be objective [6]. The Kantian preference for a NAS approach implied that the causality rules can be axiomatically accepted but not empirically proven. Hume's 1739 approach opted for empirically based correlation-driven DAS validation of the causality rules, although such approach cannot resolve the induction problem [14]. It is Bayes' causal probability that apparently enables the causality to be directly derived from experimental data; but Bayes' causal probability can only infer *correlative causality*, the first level of causal reasoning, not the *counterfactual causality* of Hume's 1748 approach [11]. However, the counterfactual algorithms currently implemented in today's computers use Bayesian networks [11]. In fact, the selection of the best possible *counterfactual causality* rules is already carried out in some contemporary big data analyses [15].

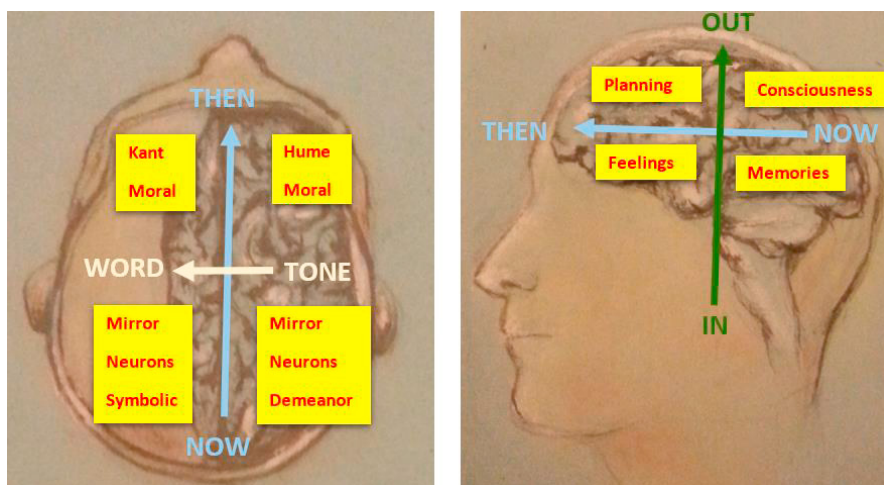


Figure 1. Simplified relation between brain 3-axes approach and brain function. On the left is a view from above (© Sandra Lori), and on the right a view from the left side (© Sandra Lori).

### 3. Trilemma Constraints and the attribution of Value

The goal of maximizing the *Truth-value*, *Good-value*, and the *Beauty-value* seems to be the obvious answer to the health management problem analysed here; but, just like in health management it seems impossible to have equipment costs, patient improvement and staff wages maximized without going bankrupt; it is analysed here that the attempt at maximizing *Truth-Value*, *Good-Value* and *Beauty-Value* often leads to a kind of trilemma restriction that occurs in many forms (e.g. Fries' Trilemma [16][17]). In this work, the focus is in the economics of healthcare management, hence, the focus of this work is in the economic perspective of the *Political Trilemma*, meaning the triplet of "Democracy vs. national sovereignty vs. global economic integration " [18][19], and also the economic perspective of the *Impossible Trinity*, meaning "independent monetary policy vs. fixed exchange rate vs. free movement of capital" which has been confirmed by empirical studies [20][21]. The finding of the balance in healthcare management between "staff wages vs. equipment costs vs. patient improvement" will be proposed here to be identical to finding an appropriate balance in the *Political Trilemma* and the *Impossible Trinity*, hence the approach proposed here is likely to have applicability beyond the healthcare management field.

The relationship between the three aspects of the *Political Trilemma* [18][19], and the *Impossible Trinity* [20][21] is straightforward; however, it is proposed here a form by which computational tools can be used in clarifying the balancing-characteristics of the *Impossible Trinity*. Specifically, the attempt at an "independent monetary policy" is an attempt at establishing a NAS *Truth-value* using locally-defined *Consistent* axioms, whereas a "free capital movement" is an attempt at establishing a DAS *Good-value* using globally-defined *Complete* axioms. Yet, as it is known by the *Gödel Incompleteness* theorems, the axioms with a finite-amount of *Shannon Information* cannot simultaneously be *Complete* and *Consistent* [8], which can have implications in both *Brain Behaviour* [1][3] and *Fundamental Physics* [2].

The time evolution dynamics of *Darwinian* advancement is only partially predictable, not only because it is probabilistic, but also because the form of the aptitude-*Probability Distribution Function (PDF)* is only partially predictable, as the predictable part of the time evolution is only the aptitude of the newest types [7]. The *Darwinian* evolutionary processes of *DAS*, i.e., the "free movement of capital" in the sense of *Good-value*, are fundamentally *Unpredictable* [7]; whereas the Newtonian evolutionary processes of *NAS*, i.e., the "independent monetary policy" in the sense of *Truth-value*, are fundamentally *Predictable* [8]. The balance between the *NAS* and the *DAS*, which represents the "fixed exchange rate" for the *Beauty-value*, is therefore a weak balance between *Predictability* vs. *Unpredictability*, local influence vs. global influence, *Consistent* axioms vs. *Complete* axioms, and/or *NAS* vs. *DAS*. The calculation of this balance takes place in our brain when it is evaluated the *value* of an action [4], and also when the world economy evaluates the *value* of an object [5].

The choice of the clinical action that is more worthy, as it often occurs in health management, inevitably requires the projection of a three-dimensional *value* vector, i.e., [*Truth-value*, *Beauty-value*, *Good-value*], into a one-dimensional *worthiness*-scalar. This projection is necessary, as the concept of best is necessarily one-dimensional. The various forms of projecting the *value* 3-vector to the one-dimensional *worthiness*-scalar form the *political / ethical / religious* decisions that every person and every society make. The *Statistical Philosophy* computational tools are unlikely to provide an unique answer to what is the best political, ethical or religious choice, but the *Statistical Philosophy* computational tools will offer new and more thorough perspectives for the best possible assessment of what is the cause and what are the consequences of the political / ethical / religious decisions that occur.

### 4. Conclusion

The developments in the fields of *Biomedicine*, *Medical-informatics* or *Health Management* pose special requirements, which have led to the development of different approaches for calculating the associated *value*. It is found that the simple use of computing tools makes it difficult to estimate the *value* associated with a clinical act. However, these computational tools are best used if they are integrated with philosophical perceptions, which have become clearer through recent developments in the fields of *Neuroscience*, *Economics*, *Physics* or *Mathematics*. Furthermore, the need to develop new computational tools for calculating the *value*-vector and its projection into a *worthiness*-scalar, will likely create new software industries. Also, a brief description is made of the difficulties associated to that projection process, plus, a proposal is made of how to best handle such difficulties, which, in

short, consists of always taking into account that *value* is made of three components: *Truth-value*, *Good-value*, and *Beauty-value*.

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