

DECISION THEORY AND SUSTAINABILITY IN THE ECONOMIC CHOICE – IMPACT OF EVOLUTIONISM

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Abstract:

The paper aims to question the required decision theory concept, structure, and mechanism under the current challenges of optimality model of rationality crepuscule, sustainability model of rationality emergence, and evolutionism extending from the biological species to the symbolic ones (as decision theory is). To this end, the three symbolic species are logically described based on their sufficiency predicates, then the three sets of sufficiency predicates are put together in order to find the compatibility among them, as either binomial or trinomial compatibility. So, three complete compatibilities are found based on which some concluding remarks are provided.

Keywords: *Sufficiency Predicates, Logical Compatibility, Symbolic Species*

JEL classification: *A14, B41, Z10*

1. Introduction

1.1. Briefly on the economic choice

The concept of economic choice is related to the problem of the hierarchical ordering of at least two alternatives, usually of an actional/praxiological nature, but also in the political or scientific fields. The history of economic sciences (especially positive Economics) has privileged substantial utility as a measure of economic choice, so as hierarchy criterion of the alternatives in case but, of course, any other criteria of interest for individuals or groups can ground the choice. No matter if the alternatives are associated or not with probabilities or risks, which modify the expected utility, finally the economic choice means to build up the mentioned hierarchy and decide according to the first-ranked alternative. By now, we can conclude that the economic choice is simply a technique, more or less sophisticated¹, to establish, based on a given criterion, a hierarchy of alternatives. However, in the background of the discussion, an imponderable matter lurks – it is about the quantifying the substantial² utility itself.

The economic choice is, generally, grounded on the hypothesis of a rational choice³. The rational choice means that the choice is done on rational bases. But which are those rational bases?

First, it must be said that rationality is of two kinds: (i) theoretical rationality; (ii) practical rationality. Both rationalities provide adequacy

Theoretic rationality requires that the (economic) choice be made according to the (economic) preference. The economic preference is one of the most imponderable issues in the economic theory and it has many vulnerabilities, both conceptual and methodological (which will be ignored from the perspective of the present intervention). The preference, in turn, is an objectifying of an even more imponderable issue, namely the belief (or, in David Lewis's terminology, credence). The belief/credence formation is vague enough, both from logical and psychological views, and even from the phenomenological perspective (Düppe, 2009), so it is considered as given when reasoning is made on the economic choice (Nota bene, of course, the preference must be considered, instead, as at least adaptive, as the recent literature proposes – Dinga et al., 2022). In such context, theoretical rationality is considered that rationality able to find a justification for the choice, i.e., to find a ground in the preference or, deeper, in the belief.

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Practical rationality requires that the economic means chosen to be the most appropriate to get the purpose established by the economic choice (Hooker; Streumer, 2004). Although we have to do here with rather praxiological rationality, the denomination of practical rationality is adequate since the allocation of the means to get the purposes is used not only in the economic field but also in any other field of human activity: politics, science, art.

To conclude, we can say that both kinds of rationalities provide just the adequacy: theoretical rationality provides the adequacy of the choice with the preference/belief, while practical rationality provides adequacy of the mean to the purpose. Logically and psychologically, the two rationalities come as follows: firstly, operates the theoretical rationality, and secondly, operates the practical rationality.

1.2. Decision theory and its avatars

The decision theory has as its object to find the principles, models, methodologies, and instruments to get the best alternative in a set of commensurable alternatives. Consequently, the decision theory can acquire very high degrees of abstraction, so very high of generality and, so, it was, historically, very permeable for mathematical modelling. Since it is to find the best solution inside a set of constraints, the decision theory provides a way of optimizing, i.e., a theory of establishing the conditional extreme value in the economic choice. In the conditions of the imponderability of economic preference (and all the more, of the individual's belief), the decision theory cannot more than assume all kinds of constants – the most prominent of them being exactly the preference or the set of preference (*Nota bene*: the impossibility of a hierarchy of the preferences – the Arrow's theorem of impossibility – has, also, been hidden under various technical subterfuges). This mechanism has been quickly observed and some new directions in decision theory development have arisen, the most prominent (and productive) being the game theory. Game theory is, conceptually, a contextual decision theory, i.e., the decision is not anymore taken by an isolated (insular) individual but in the context of interaction between two individuals. Game theory is not a qualitative jump in the decision theory but a quantitative one – each individual in the process of interaction has his/her model of rationality, that is, his/her reaction-function to the other individual's decision (a duopoly). Game theory has developed in three (significant) directions: (a) competitive game theory; (b) cooperative game theory; (c) evolutionary game theory (*Nota bene*: the last category can also be named as self-learning game theory). In the trinomial, which will be discussed further, economic choice – decision theory – sustainability, the evolutionary game theory will be, especially, considered. As far as the issue of artificial intelligence, again, we think it is talking about a scale not a quality in the learning process development (including the evolutionary perspective), so it will be not taken into account as a novelty.

1.3. Sufficiency predicates of theory of decision

No matter its contemporary avatars, the decision theory, as symbolic species, must verify a minimal number of sufficiency predicates which qualify it as such, namely as a theory of decision. I think the following such sufficiency predicates must be retained:

- (CD) holds a *criterion of decision*: since a theory of decision must choose an alternative from a set of alternatives (generally unequal among them, as significance), it requires operationalizing a criterion of choice or, equivalently, a criterion of stopping the reasoning;
- (AS) holds an *algorithmic structure*: a theory of decision must have such a kinematic functioning that is able to develop an automatic unfolding of the implied reasoning aimed at achieving the expected solution. This automatism is required by the very stability of the concerned theory of decision;
- (CO) provides the *certitude of its outcome*: a theory of decision must be able to get an outcome, i.e., a solution to the problem for which it is concerned;
- (NAO): provides the *non-ambiguity of its outcome*: the outcome (solution) provided by a theory of decision must be clear, i.e., without any ambiguity. For example, in a falsifiability

process regarding a hypothesis, the solution must indicate either corroboration or refutation of that solution, the third/middle being excluded.

1.4. What sustainability means?

Sustainability must be viewed as a name for a praxiological paradigm, namely a paradigm that is causally generated by the current (still) dominant praxiological paradigm: the optimality paradigm. Despite it is used, by both experts and, especially, non-experts, in all domains and all meanings, the concept of sustainability has, or should have, very rigorous sufficiency predicates to define it. We will briefly identify the minimum set of sufficiency predicates based on which a system/process of any kind is or can be declared as sustainable:

- (i) (*SRS*) *self-replication of the structure*: the system/process must hold internal principles and „forces” to replicate its structure, which automatically will replicate the functions, i.e., the functionality and the behaviour⁴;
- (ii) (*SRCI*) *self-recovering of the consumed inputs*: the system/process must recover the consumed inputs through the intermediation of its own outputs, either directly (in the current cycle of functioning of the given system/process) or indirectly (in a longer chain of concatenation of cycles of functioning or of systems/processes);
- (iii) (*VTV*) *verifying the teleological values*: sustainability (like any other artifacts) is designed and operated by human beings, who have an axiological matrix (values) regarding the finality of the economic/social process engaged in. If those values are violated, the system/process in case is no longer practiced, i.e., it becomes unsustainable. So, it must be retained that sustainability has a *technical* component (*SRS* and *SRCI*), as well as an *axiological* component (*VTV*). Usually, the axiological component of the sustainability is proxied by ethics (for example, by the social justice commandments).

There are some crucial differences between the two praxiological paradigms: of optimality and of sustainability, respectively, as follows:

- optimality means extremizing a function-objective subjected to a set of constraints, while sustainability means purely survival, without any degree of such survival;
- optimality exhausts the continuity of inputs due to the need to extremize the output, while sustainability does not this, since the output is selected exactly by the basin of inputs;
- optimality is a purely technical determination, based on calculus, while sustainability has, together with a technical determination, an axiological (i.e., social, moral) one, based on values.

2. Relationships Between Decision Theory And Sustainability

2.1. General framework

For decision theory to work from the sustainability perspective, it should acquire predicates that bind it to the sufficiency predicates of sustainability. As seen before, sustainability is subjected to two basic commandments: (i) survival (predicates *SRS* and *SRCI*); (ii) ethics (predicate *VTV*). Decision theory should, therefore, gain one (or more) predicates that can confer to it a mechanism able to get conclusions compatible (or convergent) with the two categories of sustainability's predicates. Fortunately, the very development of the decision theory provides such a possibility, namely the evolutionary game theory. Consequently, I think the decision theory based on the evolutionary game theory (EGT) could constitute a good starting point for a new decisional paradigm in the current context of replacing the optimality behaviour (and thinking) with the sustainability on. In the following the EGT will be used to describe and examine the relationships between decision theory and sustainability.

2.2. Conceptual relationships

Compared to standard/classic game theory, EGT uses the findings of evolutionism as applied (or applicable) to the social domain, that is, on the symbolic species, as the sustainability paradigm is, besides. This confers to EGT some interesting features as follows:

- the reaction-functions of players, namely, their „laws of movement” are no longer invariant, as in the classical game theory (CGT) but they are, in turn, under the change pressure of their own very working;
- this means that the reaction-norms of every player in the game (*Nota bene*: in the most simple and intuitive models, there are two players, so a duopoly) are under mutual adaptation to every other player’s reaction-norms⁵;
- in this context, two kinds of learning occur: (a) an intra-paradigmatical learning – the reaction-norms (as outputs of reaction-function) change inside the same reaction-function („law of movement”); (b) an inter-paradigmatical learning – the reaction-function itself changes, as result of the reaction-norms changing;
- *Nota bene*: of course (see note 5) it can be thought on an indifference curve or pattern in which the reaction-function changes just to conserve the reaction-norm, but the paper will not develop such a suggestion;
- the intra-paradigmatical learning is the apanage of the CGT, while the inter-paradigmatical learning is the apanage of the EGT. It is to be observed that optimality is grounded on intra-paradigmatical learning, while sustainability is grounded on inter-paradigmatical learning.

To conclude, sustainability can be compatibly, convergently, and synergically connected or associated with the EGT, basically on the inter-paradigmatic learning side of the last.

2.3. Methodological relationships

The methodological relationships between decision theory and sustainability paradigm must be viewed from two perspectives: (a) the decision taken within the decision process (i.e., based on decision theory); (b) the implementation of decision within the sustainability paradigm.

- (a) this perspective focuses on how decision theory is actualized (amended, modified, adjusted) under the pressure of the sustainability paradigm. The primary impact of sustainability is objectified on the social determination exerted by sustainability, namely on the axiological driving/guiding. Any economic decision (as strategic decision) is implemented by individuals (or by groups of individuals sharing the same set of values or the same morals), so the axiology is apt and able to adjust the final decision taken according to the values expected to be objectified (*Nota bene*: do not forget that any economic process is, in last instance, an artifact, based on teleology, despite the claim of libertarians regarding the invisible hand – the invisible hand acts among the individuals’ teleologies); it is to be mentioned that this perspective obeys theoretical rationality;
- (b) this perspective focuses on how the taken decision (according to point (a)) is actually implemented by intermediation of the individuals’ behaviour. This time, the behaviour of individuals (or groups, as the case can be) obeys practical rationality – practical rationality allows emotions in making the operational decisions, aimed at technicalizing the strategic decision (for example, the essence of economic sustainability is the inter-generational empathy).

So, methodologically, sustainability introduces two categories of factors to adjust the standard EGT: the axiological vector in choosing the strategic decision (what to do), and the emotional vector in choosing the operational decisions (how to do what must be done).

3. Sustainability And Evolutionism

3.1. About evolutionism

The evolutionism is, essentially, a theory of becoming, (logically) of the same family of other theories of movement – for example, the mechanical theory, chemical theory, and psychological theory. However, evolutionism holds some features that make it, probably, the most important theory for becoming⁶:

- similarities with other theories of movement
 - evolutionism still remains a regional theory; it is applicable to living entities, understood as both biologically living entities and logically living entities (Dinga, 2020) – for example, sustainability is such a logically living entity, since it is an artifact – but it seems to be inapplicable to non-living entities;
 - evolutionism is completely (factually) testable although, many times, the time horizons required by such testability are very large – geological durations;
 - evolutionism holds the property of effects additivity, meaning that the new changes, regularly, do not neutralize the previous ones but add to them;
 - evolutionism could work as a *sui generis* predictor, which confers to it the required scientificity.
- differences from other theories of movement
 - as mentioned, evolutionism is applicable to living entities only, either as biologically or logically living, while the other theories of movement are applicable to non-living entities;
 - overwhelmingly, evolutionism is (factually) testable by natural experiments, not by artificial ones, the last being much more accessible to the other theories of movement;
 - evolutionism is an inextricable mix of necessity and contingency, either as intra-necessity contingency or as intra-contingency necessity, at a much higher level than the other theories of movement.

3.2. Sufficiency predicates of evolutionism

It is of (scientific) interest to identify the list of sufficiency predicates of evolutionism.

3.2.1 Preamble

As I have proceeded in the cases of decision theory and of sustainability, it is of interest to examine, now, the sufficiency predicates for the concept of evolutionism. The question will be viewed from both perspectives of biologically living entities and of logically living entities (the last case addresses the concept of symbolic species, i.e., of artifacts). If sustainability is rather a property of systems or processes⁷, both decision theory and evolutionism are, properly, theories.

3.2.2 List of sufficiency predicates

For a given theory to be qualified as evolutionism or theory of evolutionism, it must concomitantly verify the following sufficiency predicates:

- (DC) *non-stationary character*: an evolutionary system or process must develop, that is, it must change its structure (*Nota bene*: a structural change will, of course, change the functions, i.e., functionality and behaviour of that system/process, which means non-stationarity). For example, an evolutionary system/process cannot be circular;
- (PN) *populational nature*: an evolutionary system/process must have a kind of statistical property, that is, must be composed of individuals whose aggregation generates a species;
- (IR) *individual replicability*: an evolutionary system/process must imply the replication of contained individuals (the replication bears exactly the – random or deliberative, after the case – required possibility of structural changes);
- (DF) *directed finality*: the structural changes are cumulative and directed to a finality (*Nota bene*: where the individuals, respectively, species concerned are conscious, the finality becomes purpose, since it is representational and teleological). Generally, the criterion of

directing to a finality is called fitness – of course, the fitness has different meanings as it refers to biological species or to symbolic species.

3.3. Peculiarities of symbolic species evolutionism

In the genus of species, the symbolic species are a... species itself, besides the natural (or biological) species (*Nota bene*: the symbolic species can be named logically living species, as well). The evolutionism of symbolic species has some peculiarities as follows:

- it is always an *artifact* – it is an individual of Popper's third world (the objectified reality);
- the mutations are preponderantly *deliberative*, not random;
- the phenotype is a *mean*, not a purpose or a finality;
- the genotype is not held by phenotype but by the *human* individual charged with the functioning of that symbolic species;
- there is no duration from the moment of creation of a symbolic species (or of an individual of a symbolic species) and the moment of the adult age of that symbolic species – the symbolic species is *born directly as adult*, i.e., capable of viable reproduction;
- the fitness and the selection is *not a populational* question;
- the selector agent is always the *human* individual charged with the functioning of that symbolic species;
- the *epigenetic* mutation is preponderantly compared with the genetic mutation.

3.4. About the binomial sustainability – evolutionism

It must be said, from the beginning, that Nature has „invented” evolutionism exactly to provide sustainable principles for living entities (at the species level, not at the individual one). This means that there is a hard core of predicates that are common to the sustainability property and evolutionism process. In this paragraph, I shall try to identify such hardcore. In fact, I think the following sufficiency predicates are members, „with full rights”, of the mentioned hard-core, based on their logical (and functional) compatibility (we note the compatibility between x and y as: $x \bowtie y$). Considering the two symbolic species – sustainability, and evolutionism – the following relationships of compatibility can be retained:

- ($SRS \bowtie IR$): the sufficiency predicate of the sustainability (SRS) property is the main sufficiency predicate of evolutionism too (IR). Indeed, the evolutionism implies that the individuals (phenotypes) to replicate themselves by intermediation of either biological DNA or normative „DNA”;
- ($VTV \bowtie DF$): the teleology of sustainability (VTV), also belongs to evolutionism as directed finality (DF). Although teleology is a... species of finality (namely, that finality which is of conscious type), it is obvious that between the two sufficiency predicates subsists compatibility;
- $\{[SRS \wedge SRCI] \bowtie DC\}$: structural self-replication and self-recovering of the consumed inputs, from the side of sustainability is compatible with the non-stationary character, from the side of evolutionism.

We can conclude that there is a large hardcore, from the sufficiency predicates perspective, so that to accept a (logical) binomial sustainability – evolutionism.

3.5. About the binomial evolutionism – decision theory

Like in the case at point 3.4., it is easy to observe a hardcore of the sufficiency predicates between the sustainability and decision theory. The main compatibility relationships between the two symbolic species are as follows:

- ($IR \bowtie AS$): the individual replicability, from the side of evolutionism, is compatible with the algorithmic structure, from the side of decision theory. Indeed, the individual replicability implies repeatability, which has the same logical meaning as the algorithmic functioning;

- ($DF \bowtie CO$): directed finality, from the side of evolutionism, is compatible with the certitude of outcome, from the side of decision theory. Indeed, to hold the certitude of outcome is, logically, equivalent to hold a direction of movement;
- ($DF \bowtie CD$): directed finality, from the side of evolutionism, is compatible with the existence of a criterion of decision, from the side of decision theory (for example: the above-mentioned concept of fitness).

3.6. About the binomial sustainability – decision theory

By comparing the logical meanings of the sufficiency predicates of the two symbolic species, we can get the following conclusions:

- ($SRS \bowtie AS$): self-replication of the structure, from the side of sustainability, is compatible with the algorithmic structure from the decision theory side. Indeed, both sufficiency predicates in the case hold the property of repeatability or circularity;
- ($SRCI \bowtie CO$): the self-recovering of the consumed inputs, from the side of sustainability, is compatible with the certitude of outcome, from the side of decision theory.

4. Triad: Decision Theory – Sustainability – Evolutionism

4.1. Preamble

To put together decision theory (DT), sustainability (S), and evolutionism (E) is a kind of the three bodies problem in Physics, since the relationships between the three „bodies” are concomitantly and mutually determined⁸. If, in the physical world, the interaction among three bodies is unstable, in the social field such an interaction is (possibly) stable, since the „bodies” are artifacts, i.e., their dynamics is controlled teleologically as well as technically by individuals (for example, by norms).

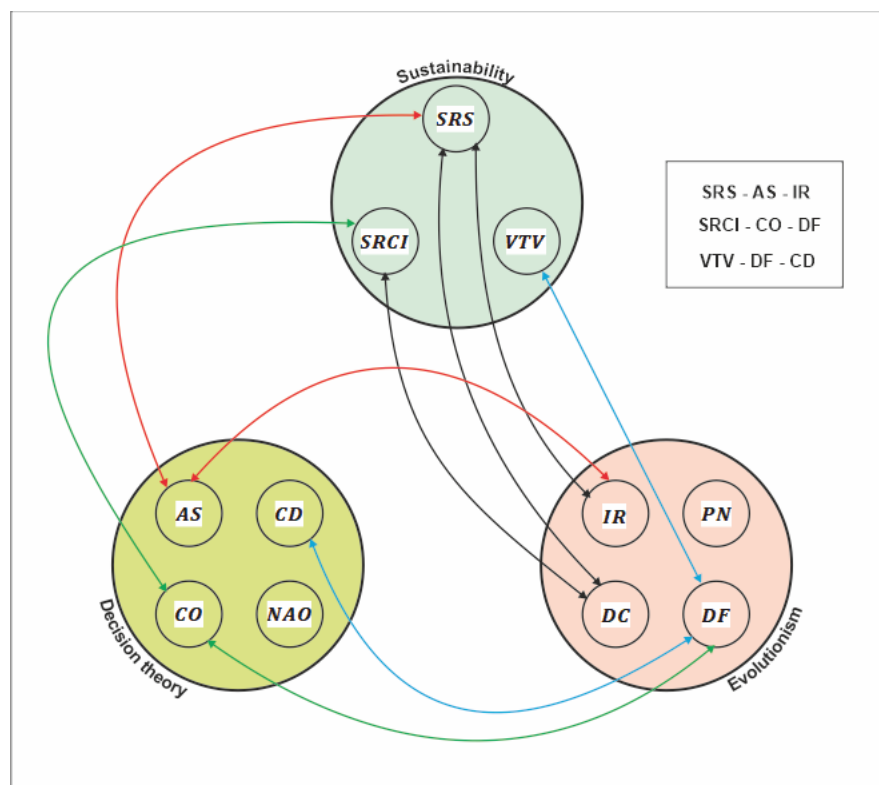
4.2. General scheme

As the three binomials have to be put at the basis of elaborating a new decision theory, a synoptic graph of the global (three bodies) compatibility among the sufficiency predicates is of obvious utility (Figure 1).

Discussion:

- except the sufficiency predicates NAO (of decision theory) and PN (of evolutionism) each other sufficiency predicates are connected at least with between two of the three symbolic species;
- two of the sufficiency predicates, SRS and $SRCI$ (of sustainability), AS and CO (of decision theory), and IR , and DC (of evolutionism) are double connected;
- the sufficiency predicate DF (of evolutionism) are triple connected;
- there are three complete connections, i.e., among the three symbolic species examined, although none of them of circuit type: (a) $SRS - AS - IR$; (b) $SRCI - CO - DF$; (c) $VTV - DF - CD$.

Figure 1: The global compatibility among sufficiency predicates of the triad: decision theory – sustainability – evolutionism



Source: author.

5. Some Conclusions

Decision theory must escape from the tutelage of the neoclassic economic theory, with its irreducible mechanicism, which ignores both free will and emotions in making economic decisions. Behaviourism could be an excellent guide in this required and urgent experience.

Decision theory must replace the optimality model of rationality with the sustainability one, as Nature always did.

Sustainability is a necessary result of evolutionism, so decision theory must integrate the evolutionary principles and processes in its very functioning.

The triad – decision theory-sustainability-evolutionism – must revisit our conceptions, theories, and policies regarding economic production, distribution/redistribution (including social justice) and consumption, based especially on providing the ethical capabilities in the society.

All the above mentioned require a re-construction of the economic theory, especially in its epistemological, and methodological coordinates.

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NOTES

¹ Many experiments have been done that show that naïve choice models are often superior (give better results, for example, in predictions) than more elaborate models. The explanation is that naïve models are much more intuitive, although sophisticated models are more likely to access causalities, possibly structural.

² We remember that, besides the substantial utility (or, usually, economic utility) there are also other two kinds of utility: (a) symbolic utility; (b) evidential utility (Dinga et al., 2022).

³ In last decades, many significant experiments (and interesting reasonings) have put into evidence the role of emotions in the economic choice (Kahneman, 2012), (Thaler; Sunstein, 2009), (Lo, 2017).

⁴ According to the theory of systems, by functionality of a system/process is understood as the relationships among the components of that system/process, i.e., the relationships inside its membrane, while by behaviour is understood the relationships among the components of the system/process, on the one hand, and the environment of the system/process, on the other hand. Both functionality and behaviour are anchored to and generated by the structure.

⁵ It is crucial to understand the basic difference between EGT behaviour and the classic game theory behaviour: in the last case, the „laws of movement” are invariant, and its output changes as the change of the independent variable occurs (Nota bene: the independent variables are the reaction-norms of the partner or partners). On the contrary, in the EGT, the output of reaction-function is the result of both the „law of movement” change and of the independent variables – of course, theoretically, one type of change could punctually neutralize the other type of change.

⁶ A theory on which the author is working now will be called the theory of the minimum entropic gradient interaction – it will be positioned as a challenger of evolutionism, since it is even more general than evolutionism, by applying on both living and non-living entities, while evolutionism is applicable to living entities only.

⁷ Many scientists consider, however, a theory of sustainability. In my opinion, such a qualification is a little bit too much, since, for example, one of the outcomes of evolutionism is exactly the property of sustainability, as shown in the principal text of this paper.

⁸ It seems that in the physical world, after a while of interaction among the three bodies, one of them will leave the triad and will remain two bodies only, whose interaction is stable.