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Divine 'Second Order' Design and Natural Self-Organization[1]

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Abstract: When we perceive some order or structure, the idea that it is the result of some 'design' seems a self-evident inference. This 'argument from design' has theological, philosophical and scientific roots, but also receives severe criticisms from these fields.

One of the objections against the design inference is based upon the phenomenon of 'self-organization' of many natural processes, which entails that the order of such processes can be explained without reference to external control or to centralized control. Thus, there is a tension between 'design' (especially 'divine design') and 'natural self-organization'.

In the context of this tension, some aspects of the philosophy of A.N. Whitehead and of his concept of God are introduced, in order to sketch a passable way out of this deadlock.

The adequacy of this Whiteheadian view of divine guidance, which may be characterized as 'second order design', is briefly explored from a scientific, philosophical and theological perspective.

Keywords: Argument from design; attractor; conflict; disorder; divine intentional agency; fitness function; fitness landscape; love; novelty; order; primordial nature of God; second order design; self-organization; state space; A.N. Whitehead.

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1. Introduction: Design - Arguments Pro and Contra

If in daily life something appears to us as having a structure that allows for a specific function or as having a specific order or pattern, it raises the thought that someone must have ordered it according to some plan.

It was according to this line of thought that the medieval theologian and philosopher Thomas Aquinas concluded from the goal-directedness of natural, not-knowing things to the existence of something intelligent by which the natural things are ordered 'ad finem', which we call God (Aquinas, *STh* I, q.2, a.3).

And two centuries ago, the British theologian William Paley explicitly interpreted the evident functionality of plants and animals, and of organs such as the eye, as 'made for purpose', and used it as an argument for the existence of God (Paley 1802).

At the moment, the design argument again receives a lot of attention. A number of natural scientists emphasize that the existence of intelligent observers (such as human beings) requires the universe at its very origin to have had an extremely precise fine tuning of its natural constants.[2] According to some, this is so remarkable as to constitute an insight of design. They speak of a 'strong antropic principle'.[3] Thus, despite the criticism of philosophers and theologians (see below), the argument from design here again comes to the fore, supported by the most advanced natural science.[4] And though this is not necessarily connected, for many people the notion of

[2] Mathematical physicist Roger Penrose estimates that the ratio of the original phase-space that meets this necessary condition to the total phase-space equals one part in 10exp10exp123, the latter being a number which is literaly unwritable in the ordinary denary notation (Penrose [1989] 1999, 445).

[3] As a standard work with regard to this so called 'antropic principle' in its different versions, counts Barrow & Tipler (1986).

[4] For a more extensive discussion of the design argument, the Kantian criticism on it, and its contemporary status also in relation to modern physics, see Worthing (1996, 35-47).

design refers to a designer, whereas the latter is sometimes equaled with the Christian God.[5]

In the course of centuries, the design argument has also often been critized by philosophers and theologians. Philosopher Kant, for example, emphasized that the argument from design can at its best demonstrate the existence of an architect of the world, whose efforts are limited by the qualities of the material with which he works, but not of a creator of the world, to whom all things are subjected (Kant, *KrV* B655, A627). After Kant this criticism was acknowledged by most theologians.

Recently, in an interesting debate with design proponent Michael Behe, theologian John Haught contended that the concept of design diminishes our understanding of God by looking solely at the element of order and by failing to reflect fully on the often disturbing fact of novelty and disorder in nature (Haught 1999b).[6]

There is also criticism from the side of the natural sciences. We may think here of the criticisms of Charles Darwin, Roger Penrose, Richard Dawkins, or Stuart Kauffman among many others. The criticism is that the argument from design overestimates the improbability of the observed order and evolution, either because it fails to recognize the influence of selective advantage, or that of self-organization. Thus, for instance, the former mentioned mathematician Penrose - despite the fact that he fully acknowledges that only an extremely tiny part of phase-space could have led to the present universe with its intelligent inhabitants - states nevertheless: "I cannot believe that the anthropic argument is the *real* reason (or the only reason) for the evolution of consciousness. There is enough evidence from other directions to convince me that consciousness *is*

[5] This view is characteristic for the proponents of the so called Intelligent Design Theory, such as Michael J. Behe (1996) and William Dembski (1998). Also many theologians who are not 'creationists' speak of an argument (or more cautiously of an 'insight') from design, for example John Polkinghorne (1995, 68-72) or Nancey Murphy (1997, 36-44).

[6] The debate concerns John Haught's recently published book: Haught (1999a).

of powerful selective advantage, and I do not think that the anthropic argument is needed." (Penrose [1989] 1999, 562). So, order needs not necessarily point to an orderer,[7] because it can also be the effect of a natural mechanism. According to (neo-)darwinism random variation plus natural selection is such a mechanism. That is the reason why Dawkins - as a parody on Paley's divine clockmaker - speaks of The Blind Watchmaker (Dawkins 1986).

Those who speak of 'self-organization' (such as Kauffman) often point out that the ordering during the evolutionary process is not only the result of random variation and external selection (as stated by the darwinists), but also of some ordering internal mechanism. According to this view, an improbability of the observed order is no longer at stake.[8] This, evidently, further undermines the argument from design. Indeed, the notion 'self-organization' expresses the very possibility of highly organized behaviour in the absence of external (*e.g.*, divine) design. And, *nota bene*, precisely those phenomena that traditionally were thought to be the best reason to speak of pre-ordained divine design, such as life and consciousness, cosmic and biological patterns, count as outstanding examples of natural self-organization. So, this insight from modern science challenges our modern theology.[9]

[7] Moreover, as it is often suggested, an Orderer would have created that order with less crooked ways and less deadlocks than the factual course of the historical evolution shows. However, John Brooke shows that in the last one and a half century the non-linearity of the evolutionary trends was sometimes used as an argument *against* the idea of Providence, whereas on the contrary, it was also sometimes used as an argument *pro* Providential involvement (Brooke 1989, 11-13).

[8] Kauffman expresses this by stating: "If I am right, the motto of life is not We the improbable, but We the expected." (Kauffman 1996, 45).

[9] Interesting examples of recent publications taking up this challenge are: Russell, Murphy & Peacocke (eds.) (1995), Coyne, Schmitz-Moormann & Wassermann (eds.) (1994, 2 Volumes), and a number of articles in *Zygon* 33:3(1998) and 34:1(1999) concerning the theme of autopoiesis and creation initiated by Niels H. Gregersen (1998).

In this article I will briefly present the notion of self-organization and explore its possible compatibility with some specific concept of divine guidance that I baptize as 'second order design'.

2. Exploration of the Notion 'Self-Organization'

An increasing number of scientists from many disciplines use the paradigm of 'self-organization'. More and more are they inclined to see many natural and cultural processes as self-organizing.

What does 'self-organization' mean?[10]

Self-organization may be described as the spontaneous emergence of a globally coherent pattern out of local interactions. A multitude of initially independent components end up working together in a coherent manner, without control from outside the system. The capacity for self-organization enables the system to develop or change its internal structure spontaneously and adaptively, and in this way to cope with, or manipulate, its environment (cf. Cilliers 1998, 90).

Moreover, one of the fundamental traits that distinguish self-organizing systems from the more traditional mechanical systems is the absence of centralized control. The 'control' is typically distributed over the whole system, often effectuated by circular or network relations among the components. The order seems to arise spontaneously in a bottom-up way from the multitude of interactions among the simple components. The laws that may govern this behavior are not yet well understood, but it is known, that the process is often nonlinear, using negative as well as positive feedback loops.

[10] In the subsequent exposition I make use of Decker (1997) and extensively of Lucas (1999) and Heylighen (1999). Besides these three articles which all are available via the Web, also the following publications are worth mentioning as introductory works with regard to the phenomenon of self-organization: Ashby (1947), which probably contains the first introduction of the concept of self-organization, Von Foerster (1960), Jantsch (1980), Maturana & Varela (1980), Kratky & Wallner (eds.) (1990), Paslack & Knost (1990), Kauffman (1993).

Self-organizing systems stretch from galaxies, planets, inorganic chemical compounds to living cells, organisms and societies. Examples of self-organization include magnetism, crystallization, lasers, autocatalysis in cells, evolution of life, structure of living organisms, bird & fish flocking, immune systems, brains and cognitive functions, ecosystems, economies etc.

For a theoretical description of a dynamic system in general the conception of a 'state space' is often used. Every dimension of such a state space represents one variable of the real system. Thus, the state of a real-world system can be represented by a point in that state space, and the dynamics of a real-world system can be represented by a trajectory in that state space.

So, technically said, the process of self-organization may be considered as a system's move from a large region of state space to a persistent smaller one, under the control of that system itself. This smaller region is called an attractor.

A somewhat more intuitive description of an attractor goes as follows. Imagine a two-dimensional state space. If we rate every option in that state space by its achievements against some criteria (fitness for example), then we can plot that rating as a (fitness) value on another dimension, a height that gives the appearance of a landscape.[11] This 'fitness landscape' has peaks and valleys. In other words: the fitness function attaches a certain number (the fitness value) to each state, in accordance with the immanent qualities of that state, and an attractor is a place with a relatively high fitness value, a mountain in the landscape. So, we can say that the higher a state scores in the landscape, the 'better' or the more 'fit' that state is.

[11] The term 'fitness' refers to the biological context in which this way of modelling has risen. In the present context the term is used in a broader sense, viz. refering to each possible criterium in the light of which worse from better solutions are distinguished (such as 'profit', 'durability', 'beauty' etc.).

Systems tend to move to the locally highest region in the state space, which is called the attractor (or one of the attractors[12]).

In short: Self-organization is the emergence of a globally coherent pattern, in the absence of external and/or centralized control, resulting from the interactions among many local components maximizing the fitness value of the system (which requires a fitness function that distinguishes better from worse solutions).[13]

3. How Can Divine Intentional Agency be seen as Compatible with such a Natural Self-Organization?

The question we have to ask ourselves now, is, how such a self-organization as immanent capacity of nature can be seen as compatible with divine influence on nature.

In a recent paper, biologist Rudolf Brun remarks that "an updated Christian doctrine of Creation must ... be secured by the scientific discovery that nature creates itself, and in the fundamental dogma of Christianity that God is love." (Brun 1999, 97).

Well, love may express itself in a fixed plan or wish, such as: 'I want my child to become a medicist'. But love may express itself more fully in a 'second order' plan or wish, such as: 'I wish my child to become what, given its talents and opportunities, makes it

[12] Whenever there are more attractors, they are usually not equal in the fitness landscape representation. Each hill is an attractor, but the highest one is the best. However, the dynamics implied by a fitness landscape generally does not lead to the overall or global fittest state. The path followed by the system usually ends in a local maximum, not in the global maximum. The only way to get the system out of a local maximum is by 'noise' or random perturbations. Such perturbations usually drive the system out of the more shallow hills into the higher mountains. Thus noise usually increases fitness. This is what is meant by the provocing expression 'order from noise' (Von Foerster 1960; Heylighen 1999, 21-22).

[13] There are also processes that, under certain circumstances, can evolve into order *without* the involvement of a fitness function. In that case the order is simply the direct result of the system's own dynamics. Here such non-adaptive processes are not considered as examples of self-organization.

happiest'. Remarkably, in this 'second order' case, the content of the most desirable state changes whenever the circumstances change.

Analogously, one can conceive an eventual divine design as a design 'of the second order'. Contrary to the image that God ordains, for example, that a world has to emerge with living organisms and intelligent beings, or that dinosaurs will have to die out, or that at a specific place and a specific time an earth quake will have to occur - which would be the image of 'first order' design -, I propose a divine 'design' that involves the plan or wish that each nascent event will realize itself in the 'best' (*e.g.*, most beautiful) way possible for it. In this view, God does not direct to a predetermined end, but God gives each event an urge toward its most beautiful possible realization. I call this 'second order design'.

A similar view of God's influence on the world may be seen in the philosophy of A.N. Whitehead. And in the context of this article, it is an interesting fact that Whitehead used 'self-organization' as a metaphysical concept, long before it became a paradigm in science. It is common knowledge that in Whitehead's metaphysics it is not the (Cartesian) substance that is paradigmatic for reality, but the event, understood as an organism. According to this 'process' or 'organistic' paradigm, reality consists of interrelated organisms as self-organizing events. In Whitehead's view, each nascent event receives its urge to its 'best possibility' (best in relation to its particular initial situation) from God, or more accurately, from the divine atemporal valuation of all possibilities which Whitehead calls *the primordial nature of God*.[14] Sharing in this divine immanent nature makes the

[14] In Whitehead's metaphysics, this primordial nature represents only the abstract side of God, that is, God seen merely as envisagement and valuation of possibilities, without knowledge of the real world, without affection etc. Whitehead also recognizes a qualitatively different aspect of God: viz. God seeing in a subjective and affective way the concrete evolving world. All the processes of the changing world are everlastingly treasured up in God ('God's consequent nature'). Under certain conditions there is, apart from the primordial influence, also an influence from this 'growing treasure' upon the world. (Whitehead [1929] 1978, part V; Oomen 1998a and 1998b).

new event feel what would be its best shot at unifying the data of its particular past, viz. that possibility of synthesis which, if realized, will yield the greatest intensity of experience (Whitehead [1929] 1978, 27, 244).

Does this imply that, in order to be able to function in this way, God must know each particular event in advance? No. The comparison of the primordial nature with a computer game (e.g. a chess game) may elucidate this. The game program is a complex but unchangeable algorithm which makes possible an infinite variety of concrete changeable courses of the game. It is only because of the player's choices that a specific situation emerges about which the computer game as such had no foreknowledge, but to which it does have an adequate reaction as 'the best possible option'. The game is a possibility structure: for each possible situation, the game provides the best option. Consequently, despite the constancy of the program, the course of the game is not at all fixed nor foreknown. The divine primordial nature may be compared, *mutatis mutandis*, to such a computer game which gives - being in itself immutable and without foreknowledge - each contingent situation its most preferable solution.

The idea of the divine primordial nature providing for each possible situation its most preferable option, means that the functioning of this primordial nature may also be compared to the influence of the fitness function mentioned above in the context of the theory of natural self-organization. For, the divine primordial nature gives direction to the worldly processes by giving them an aim as their most attractive possibility. In this way, the divine primordial nature enables to distinguish better from worse solutions, analogously to a fitness function.

4. Evaluation and Conclusion

May the functioning of God with regard to natural processes as presented above be seen as *design?* Not as 'first order' design, *i.e.* not as the imposed fixed will of a transcendent designer (Whitehead [1933] 1967, 130). However, the primordial nature of God does

express a divine purpose, viz. to evocate intensities (Whitehead [1929] 1978, 105). It lures every process to its best possibility given its particular situation. It does not determine in absolute sense the direction of the processes of the world, but without this 'rule of fitness' (Whitehead 1929, 90) there would be no worldly processes at all. Thus, the primordial nature of God, as conceptualized by Whitehead, may be seen as what I called 'second order design': it has the purpose to guide events to their best possibilities.

Is this concept of divine 'second order' design at variance with the paradigm of *self-organization?* I don't think so. If the primordial nature of God as second order design is something like an ultimate fitness function, as suggested above, then there is not necessarily a contradiction, because a fitness function is a natural companion to self-organization. For, without a rule of fitness by virtue of which there is the possibility of discrimination of appetitions, there is no possibility of preference and attraction, and therefore no possibility of self-organization. Thus, in this view, the autonomy of the event is not at variance with the aim it received from God's functioning as an ultimate fitness function; on the contrary, this autonomy is *constituted* by that 'aim', *i.e.* by the feeling of its most preferable possibility.

If God's way of guiding the world as presented in this paper, may be seen as a form of 'design', what to say then about the objections we mentioned before?

What to think of the criticism as given by theologian John Haught, which points to novelty and disorder? Above we compared the functioning of the divine primordial nature with the functioning of a computer game program and with that of a rule of fitness. This implies that such a divine functioning not only makes *ordering* possible but also *change* and *novelty*. For the 'best possibility' is never fixed and immutable, but changes with the changing circumstances. The primordial nature of God as a 'divine fitness function' is a permanent element which enables the changing of the world. Moreover, it does not lure the world as one whole, but each particular event to *its* best possibility. This entails that *conflict* and *disorder* can occur among the many events. This all makes this view more

acceptable to natural science - which after all points to struggle and non-linear trends in evolutionary history - than the received view of (first order) design, and, moreover, provides more depth for theology.

May the 'ultimate rule of fitness' be called *'divine'?* One of Kant's major points against the design argument was that the 'God' argumented for, looks more like an architect who gives form to material than like its creator. However, from a process point of view this criticism looses much of its weight. For, it is only by virtue of the reception of an aim as initial direction that an event emerges. Thus, within a process ontology giving direction involves creation. And in this respect, this primordial nature may be called 'divine' without scrupule. By the way, I wish to emphasize, however, that this concept of the primordial nature *considered in isolation* is far from an adequate concept of God, because it does not picture the hope and faith that God passionately knows, and judges and treasures the changing world, and what the influence may be of this 'consequent' side of God on man and world.[15]

May it be that we are allowed to consider this design as 'divine' without theological scrupules, but what to think of an a-theistic interpretation? Indeed, some propose - and probably Richard Dawkins and Roger Penrose are to be understood in this way - to consider this ultimate ordening principle as part of nature, which would entail that the designer of the universe is nothing but the physical universe itself (Worthing 1996, 46). Well, in the same vein, I want to stress that the ultimate second order design discussed above is not the imposition of a transcendent will, but is the primordial characterization of the universal creativity, and as such highly immanent indeed. However, I think something more must be said here. Characteristic of a process approach is that each event develops into the direction of some state which not yet is, but which attracts as a possibility. Therefore, 'nothing but the physical universe itself' does not suffice. Apart from that which *is*, there is need of something

[15] See the preceding note.

expressing what is possible, and even more, of a *valuation of the possible options* as the better or the worse ones for the various possible situations. In other words, something like an ultimate rule of fitness is needed, which as valuation of all possibilities *transcends* physical reality.

I prefer to see this transcending valuation more as God than as Nature itself, because I want to emphasize the difference between actuality with its possibilities and the valuation of these possibilities. For this difference enables us to conceive the *persuasive power* of possibilities and therewith the dynamics of a world which is ever organizing itself and evolving.

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