

Design despite natural evolution?

Critical comments on Rope Kojonen's design approach

Reinhard Junker¹

Abstract. — Kojonen (2021) presents a biological design argument that differs significantly from classical design arguments. He understands “design” to mean biological constructs that exhibit empirically verifiable characteristics typical of goal-directed origin. According to his approach, however, the design of living beings does not arise in a goal-oriented manner in the process of origination (direct creation or guided evolution) but rather through purely natural evolutionary processes due to suitable preconditions and “laws of form”, which he sees as purposefully designed. The essence of his argument is as follows: Since (1) there is clear evidence of design in natural objects and (2) it is assumed that there is a natural evolutionary mechanism of origination, the design must lie in suitable, sophisticated preconditions. However, what these preconditions actually consist of and how they can cause design patterns are unclear, and the way in which they are creatively effective has not been shown. There is also a lack of independent evidence to date that the preconditions necessary for successful evolution exist.

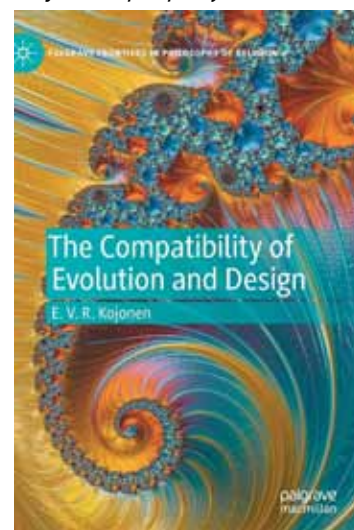
1 Introduction

Is the goal-oriented action of a creator (“design”) in the origination of living beings and a purely natural evolutionary mode of origination mutually exclusive? If purely natural processes are sufficient for an evolutionary origin of living beings, is the action of a creator superfluous? It is often claimed that since Darwin, this has been the case. Therefore, Darwin’s “greatest discovery” was that no designer was needed for design (Ayala 2007). However, to date, there is controversy as to whether the goal of explaining the origin of species solely on the basis of natural factors has actually been achieved (cf. Laland et al. 2014). Nevertheless, the great majority of biological experts assume that this goal is achievable.

Proponents of the classical design approach see it differently. They share with some evolutionary theorists the assessment that no mechanisms of *innovative* evolution have yet been elucidated but advocate an unbiased approach to evaluating the capability of evolutionary mechanisms. They point to a wide variety of characteristics of living beings that are

typical of a creative origin and therefore argue that the possibility of goal-directed creative causation should also be taken into account. The argument can be summarized as follows: A personal creator exhibits numerous capabilities, such as imagination, goal orientation, and planning, which are not inherent to purely natural processes in principle. Accordingly, products of mental causation typically have quite different characteristics and features than products of purely natural processes. In the field of technology, these are primarily *functional* (i.e., *teleologically analysable*) *complexities*; the constructed objects are designed highly specifically to be *purposeful*, i.e., to be able to perform a function; and there are often several purpose-means levels. Accordingly, one can speak of “*organized objects*” (Gr. *organon*, tool). The classical biological design argument refers to the following: The characteristics of living things are evaluated as to whether their origination can be better explained by design or by mere natural processes, and a conclusion is drawn as to the best (possibly even the only) explanation. “Design” is to be understood here as shorthand for “origination by creative causation”, while “evolution” stands for “purely natural evolutionary origination”.

According to the inference to the best explanation (Widenmeyer and Junker 2021), the design argument accordingly reads: if an object exhibits one or more characteristics that, on the one hand, are typical of a creative origination and, on the other hand, cannot



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be explained by the effect of only natural processes (despite intensive efforts), the best explanation is the assumption of creative origination. Features that point to createdness can be called *design indications*. Such design indications can be found, for example, in technical constructions, human language or works of art but also, to a special extent, in living beings: *functional complexity, plasticity (individual adaptability of a living being), building block systems², redundancy, robustness, fault tolerance, modularity, and the interconnectedness of modules or functional units*.

The classical biological design argument, characterized only very briefly here, is thus based on the fact that, on the one hand, specific characteristics of mental causation (design indications) are detectable and that, on the other hand, no concrete natural processes are known to produce these characteristics. By “natural processes”, we mean processes that are based solely on regularities, (statistically qualified) chance³ and plausible preconditions. In addition to the confirmation of design indications, the (persistent) failure of natural explanations is also decisive for the design argument. Therefore, a design argument can be strengthened or weakened by new findings or even lose its force, namely, if natural processes, as an explanation for the natural origination of certain biological structures, perform less or more than previously assumed due to new empirical findings. The performance of empirically verified mechanisms for the origination of evolutionary novelties thus enables a test criterion.

In his book “The Compatibility of Evolution and Design” E. V. Rope Kojonen builds on the efficiency of evolutionary mechanisms (Kojonen 2021): He thinks that even if a purely natural origination (“evolution” as defined above) is presupposed, a specifically biological design argument can be made. “Evolution” and “design” are not opposites for him – different from the classical design argument. His approach will be described and critically examined in the following.

2 Kojonen’s approach: Design despite Darwin

According to the classical design argument briefly explained here as the inference to the best (or possibly only) explanation, “design” (mental, creative causation) and “evolution” (purely natural causation) exclude each other: *either design or purely natural causation*.⁴ Against this background, the Finnish theologian Erkki Vesa Rope Kojonen attempts a synthesis: “evolution” and “design” are compatible

(Kojonen 2021). He argues that an exclusively natural evolution on the one hand and biological design on the other are not mutually exclusive. For his argumentation, he assumes (hypothetically) that the Darwinian mechanism, i.e., the interplay of mutation and selection, possibly in cooperation with other natural factors⁵, can produce all the biological design characteristics of living beings (pp. 7, 26, 98)⁶ and that any kind of creative *intervention* in this process is not needed (p. 133). He does not fundamentally rule out creative interventions or guided mutations but does not need this for his argumentation; rather, such interventions call his argumentation into question (see below). At the same time, he believes that, in this case, the characteristics of living beings nevertheless point to the past work of a creator, i.e., that biological design can be *recognized* by concrete biological indications. A biological design argument can be maintained. However, for Kojonen, evidence of the “design” of a biological pattern does not depend on the absence of mechanisms for the evolution of that pattern. Rather, he locates design in the *preconditions* of the evolutionary process (see below). He writes, “[E]volution pushes the explanation for life’s order back to the laws of nature at least to some degree, and probably to a large degree” (p. 152) and “[E]volution pushes the problem back to the wider teleology of the cosmos and the ‘laws of form’” (p. 154).

On the one hand, Kojonen explicitly advocates a *biological* design argument: He is of the opinion that there are specific (*meta-*)biological “laws of form” and that these are necessary for evolution to take place. On the other hand, it is not clear from his explanations whether his design argument goes beyond the *cosmological* design argument. According to the cosmological design argument, which Kojonen discusses in a section on the “Fine-Tuning Design Argument” (pp. 65–69), the laws and constants of nature and the

² Although one can also speak of a building block system with regard to the periodic table of the elements, this is of a distinctly different kind than building block systems in biology.

³ Statistically qualified is an appeal to the factor of chance for the explanation of an event E, if after thorough analysis a sufficient probability for the occurrence of E can be comprehended.

⁴ “Design” does not exclude the involvement of natural processes, but these are not capable of producing the designs of living beings as the sole cause.

⁵ Kojonen mentions evo-devo, epigenetics and niche construction as factors considered in an extended evolutionary synthesis (EES) (99).

⁶ He accepts the “essential scientific claims” (p. 7), including the Darwinian mechanism.

fine-tuning recognisable in them are seen as strong indications of a Creator. This is because, in addition to a customized architecture of the laws of nature, the constants of nature must be very precisely adjusted so that matter can be stable and, based on this, life is possible at all,⁷ although it is extremely unlikely that all these factors are extremely precisely matched to each other *by chance*. Kojonen seems to leave open whether these specific biological laws of form can be traced back to physical laws (labeled “Case 1” in the rest of the text). On the one hand, he writes on p. 132 that they “arise” from the laws of physics; on the other hand, many formulations about “laws of form” and specifically about biological preconditions (such as fitness landscapes) give the impression that they are additional laws that cannot be derived from physics (labeled “Case 2” in the rest of the text). What is important for him, however, is that one can recognize specific and objectively real biological design even if evolution could be fully explained by purely natural mechanisms. A systematic lack of explanation by natural evolutionary processes is not required for his argument. On this premise, he examines whether the biological design argument can nevertheless be sustained and, if so, how this can be done (p. 105).

On the one hand, Kojonen thus opposes the design argument presented above, as advocated by proponents of “Intelligent Design”; on the other hand, he also opposes the thesis that a purely naturally occurring evolution contradicts any biological design arguments. Rather, for Kojonen, exceedingly strong impressions of design are not an illusion (in contrast to Dawkins’s *The Blind Watchmaker*). The intuitive rational understanding of the world that design is real is not refuted by a closer scientific examination of biological design (p. 43f. ; cf. p. 32f.). On the other hand, if even the strongest impressions of design were illusions, our impression would deceive us. However, Kojonen does not believe that, and he wants to show that the impression does not deceive us (p. 43f.).

Kojonen argues for a “*conjunctive explanation*”. Just as in murder by poison, the scientifically describable effect of the poison is only part of the explanation; the natural Darwinian mechanism could also only be part of a conjunctive explanation. Just as in the case of a murder by poison, the poison must first be delivered so that it can take effect; in the case of evolution, suitable *preconditions* must also be “delivered” so that it can take place. The respective explanations answer different questions, and neither explanation is more fundamental than the other; however, both complement each other, and no part of the explanation is dispensable.⁸ Applied to the design argument as

Kojonen argues, evolution is the immediate historical explanation, while divine design (revealed in the appropriate preconditions) is the ultimate explanation that ensures the functioning of evolution (pp. 149, 154). The necessary preconditions cannot – according to Kojonen – be explained by evolutionary mechanisms, so that a conjunctive explanation is necessary: mechanism *plus* preconditions. The preconditions and the enabling of evolution through them have thus come into being through concrete divine action. What Kojonen means by preconditions is explained below.

3 Where is the “design”, and how is it recognized?

Kojonen notes that the complex teleology of the structures of life is obvious and, above all, intuitively very clear.⁹ For him, however, the (real, purposefully brought about) design is not in the process of bringing it about (be it direct creation or guided evolution) but rather in the *preconditions* of the process. Since, as mentioned above, he assumes for his approach that a natural process produces these designs, for him, it must be due to these *preconditions* that this process functions and enables innovative evolution (macroevolution). As mentioned above, however, it is unclear whether Kojonen means more than the preconditions of natural law that justify the cosmological design argument (essentially completely new, i.e., nonphysical laws would be the aforementioned case 2). In any case, he says that specific *biological* or actually *metabiological*¹⁰ preconditions must also be fulfilled; he also speaks of “laws of form”¹¹ and

⁷ Irrespective of how life originated.

⁸ Kojonen points out in this context that Occam’s Razor (superfluous explanatory elements can be omitted) is not used here.

⁹ Darwin was also impressed by an “‘overwhelming force’ of the idea of design” (38). In this context, Kojonen quotes Ratzsch: “Teleological thinking has been steadfastly resisted by modern biology. And yet, in nearly every area of research biologists are hard pressed to find language that does not impute purposiveness to living forms” (38). In addition, Kojonen concludes: “In my view, these reasons do lend support to the idea that design beliefs have a strong intuitive component, and that such common sense beliefs can be reasonable when no sufficient counterargument exists” (39). He then defends this against criticism (39–44).

¹⁰ These preconditions can also be called “meta-biological”, as they represent certain prerequisites for biology.

¹¹ Kojonen uses this term almost 30 times, but does not define it. He replied to a personal enquiry on 31/1/23: “This is defined only in practice – It functions as a loose um-

“constraints” that make it possible for evolution to proceed along paths that lead to the designs of living beings. Only then are evolutionary explanations possible (cf. his abovementioned statements on a “conjunctive explanation”). This approach should, as it was, contribute to “salvaging” the biological design argument (pp. 109, 133). *Design despite Darwin*.

Thus, according to Kojonen, the evolutionary explanations in themselves do not provide a complete explanation for why organisms with purposeful constructions exist. The aforementioned preconditions must be added; they are seen by him as something that God created for this purpose (the enabling of innovative evolution) (p. 153). Starting from the premise that a purely natural evolution has produced living beings, Kojonen concludes that the *conditions for evolvability* must be fastidiously set up and that evolution therefore requires much *biological fine-tuning* in the sense mentioned (p. 119). Otherwise, for example, irreducibly complex constructions could hardly arise by natural-evolutionary means. In other words, the fact that evolution “works” at all, even though this seems improbable to him (which is especially true for irreducibly complex systems), in Kojonen’s view shows that there must have been those suitable, in some way controlling preconditions.¹² This is where Kojonen specifically locates its biological design. “Supposing that these preconditions are the result of design, then it would no longer be true that evolution proceeds without design” (p. 104). These preconditions allow for a direction in evolution, and this becomes more apparent the more advanced the understanding of evolution becomes. Evolution is subject to general principles and is more than a sequence of contingent historical events. New “layers of teleology” emerge the more we study the universe (p. 133); Kojonen speaks of “wider teleology”. The explanation for biological teleology is at least partially relegated to metaphysics (p. 133); the argument is primarily philosophical, not scientific; but this also applies to the thesis of the incompatibility of evolution and design (p. 6).

In the case that additional biological laws are required that cannot be derived from physics (case 2) – only in this case would Kojonen present a substantially new approach – Kojonen’s argument can be formalized as follows:

1. It is assumed that evolution in the sense of a purely natural process (without intervention) is the correct explanation for the existence of living beings.
2. There is a strong appearance of teleology in biology (biological design argument).

3. Evolution based solely on natural laws and physical constraints is surprising¹³.

Conclusion 1: There is a deeper explanation for teleology in biology.

4. Preconditions such as biological laws of form provide a deeper explanation.

Conclusion 2: Preconditions exist and explain the biological design of living things.

4 Indications that there are suitable preconditions

According to Kojonen, carefully established preconditions of evolution make the design of living beings possible. Which preconditions are we talking about? How can one concretely recognize the presumed *design of the preconditions* themselves? How did these preconditions come into existence? How exactly do they explain biological design?

Preconditions. Kojonen describes this as a prerequisite: “For evolution to be possible, viable forms must be close enough to each other in the space of possible forms, and must form a network that can be navigated by evolutionary search” (p. 132). The distance between different viable forms must therefore be overcome by evolutionary steps. This would be possible because the evolutionary process is guided by the structure of the space of forms as well as the laws of form, which arise as a consequence of the laws of physics (p. 132; see above). “Consequence of the laws of physics” means, as mentioned above, that it is cosmological design, and the laws of form in Kojonen’s approach, as specifically biological prerequisites, would be derived from this (case 1).

brella term for the way physics and other factors influence what kind of forms are possible to evolve, as discussed in the book. It is originally a structuralist term, though I use it a broader sense.”

¹² Kojonen quotes Asa Gray several times in this context, who was of the opinion that Darwin’s explanation did not weaken the design argument. “Gray (1860), for instance, thought that the case for design is very strong *simply based on the end result*, with the discovery of the evolutionary process not reducing the strength of the case” (105, emphasis added). Darwin himself, however, saw things differently (100–102).

¹³ This is how he puts it on p. 155: “However, as long as the conjunctive explanation succeeds in increasing explanatory power, such as by responding to more explanatory questions, and makes the result less surprising, then the more complex explanation can be justified.”

However, Kojonen argues largely as if these were additional laws (case 2).

Evidence. Kojonen points to circumstantial evidence from several fields that, in his estimation, fulfills the above preconditions.

- *Genetic algorithms* (p. 105–115) and *irreducible complexity* (p. 115–119). Kojonen addresses simulations of evolution by means of suitable algorithms. Such algorithms only lead to useful results if certain concrete conditions are given. However, there may also be a certain degree of freedom. In other words, contingency (inability to deduce) and directionality can be combined. He concludes *from the products of evolution that he presupposes* that the biological evolutionary algorithm also runs under suitable, planned preconditions and thus enables evolution through natural processes, including the origination of irreducibly complex structures.

- As a second area where Kojonen recognizes circumstantial evidence for planning through suitable preconditions, Kojonen discusses *protein evolution* (p. 119–123). Here, he refers to publications by Andreas Wagner, especially his book “Arrival of the fittest” (Wagner 2014). Wagner was able to show that an immense number of amino acid sequences of proteins enable the same or at least a similar function of the protein. These different amino acid sequences can be generated in small steps, and despite the same function, they can eventually have different amino acid sequences in which, in extreme cases, only 10% of the amino acids are identical. He uses the image of a “library” of amino acid sequences. Subsequently, Wagner argues that protein evolution runs along this “library”, thus providing direction. Kojonen sees this as a precondition for evolution established by design.

Kojonen argues here that the landscape of possible biological forms has some rather favorable properties – this is where design shows itself. These properties, which must be very precisely specified, are, like the genetic algorithms mentioned above, prerequisites for biological evolution to take place (p. 122).

- Kojonen sees a further indication of the directionality of evolution through suitable, goal-oriented preconditions in the very frequent occurrence of *convergences* (p. 132). Convergences are similarities in the construction or other features of living beings that cannot be traced back to common descent. However, how can the frequency of convergence be explained? According to Kojonen, this is possible by the fact that suitable preconditions and laws of form preferentially allow certain directions of the course of evolution. For him, convergences seem to show that there are indeed “laws of form” that influence or even *direct* the

course of evolution. According to this argumentation, it becomes particularly clear that the inference to the existence of suitable preconditions, in which, according to Kojonen, biological design resides, depends on the assumption that macroevolution takes place and that it proceeds purely according to natural law.

In this context, Kojonen criticizes an (in my opinion apt) analogy by Daniel Dennett, according to which the laws of physics make possible the creation of countless human artifacts but do not themselves create any artifacts; in biology, it would be no different. Kojonen counters: “However, Dennett’s analogy is not fully convincing, since evolution is much more restricted than human engineering. ... evolution must create its products by stepwise tinkering where intermediate states must not hurt chances of survival. *This difference grounds the necessity of the library of forms as a precondition of evolution*” (p. 130; emphasis added). Kojonen thus thinks that the “library of forms” must necessarily be assumed. However, again, this is true only if evolution is presupposed. Only then can we conclude from the finding of the distinctive design of living beings that there is a directive in evolution that is supposed to explain this design.

Kojonen summarizes his argument thus: The “library of forms” seems to shift much of the “explanatory work” (p. 123) – away from mutation and selection to the environment that conditions them. He interprets random mutations and natural selection as a “search engine” that searches for the space of possible forms. Evolutionary change is based on “laws of form”, and therefore, the role of natural selection and mutation in explaining biological forms seems comparatively “less all-encompassing” (p. 123). In this context, Kojonen discusses the contrasting ideas of contingency (nonpredictability) and predictability of evolution.¹⁴ He argues that there is evidence for both concepts; both contingency and regularities in the emergence of new biological structures are evident. Kojonen’s approach is based on the idea that evolutionary change is based on law regularities that lead to “irresistible attractors” (S. Conway Morris) or “stable nodes toward which evolution gravitates” (M. Denton).

¹⁴ The protagonists of the two poles are Stephen J. Gould (contingency) and Simon Conway Morris (predictability due to regularities).

5 Criticism

Kojonen wants to save or preserve the biological design argument—he often uses the term “salvaging”—by locating design (i.e., divine planning and creation) *not in the process of forming* living beings or their constructions (whether by direct creation or by guiding evolutionary mechanisms) but rather in (what he understands to be) the *preconditions* of a naturally proceeding evolutionary process. In this way, he claims to “preserve” (“salvage”) the inference from observed design, which in his estimation is also particularly evident intuitively, to actual planning. The organized, purposeful features of living beings can thus be interpreted as design indications even if they have developed through a natural evolutionary process.

5.1 What do the known evolutionary factors accomplish?

Kojonen’s approach is relevant only if the known evolutionary factors actually produce the sophisticated designs of living things. Otherwise, there would be no reason to postulate underlying laws of form that enable the designs of living beings via evolutionary mechanisms. Preconditions such as laws of form or fitness landscapes are not needed as prerequisites for evolution if living beings originate through direct creative intervention or guided mutations. Kojonen undertakes several efforts to demonstrate the plausibility of innovative evolution. This will be discussed in the following section.

Kojonen claims that “a process of gradual evolution can already be traced for many complex organs” (p. 106). He seems to agree that there are indeed irreducibly complex structures in living beings but considers a natural-evolutionary path to be feasible. However, he does not elaborate on this. Furthermore, he refers to the extended evolutionary synthesis (EES; see Laland 2015) as an essential extension and revision of evolutionary theories (pp. 99, 210). However, the factors included in this process, such as epigenetic factors, evo-devo (evolution through modifications of development) and niche formation, do not exhibit any innovative effects but are based on already existing mechanisms, which themselves require explanation (cf. Junker and Widenmeyer 2021).

Against this background, it is not surprising that—as already noted above—numerous evolutionary biologists believe that the mechanisms of an innovative evolution have not been elucidated (cf. Laland 2014).

Additionally, some authors, from a biophilosophical perspective, argue that a mechanism of innovative evolution is not known and that macroevolution cannot be derived from natural laws, at least according to the current state of knowledge. For example, Braillard and Malaterre (2015: 10) state, “[E]volutionary contingency undermines the very possibility for biological laws.” Beatty (1995: 75) maintains that evolution can lead to different results from the same starting point, even if the same selection pressure prevails and “the rules of evolution are themselves changing”. Natural history is not a theory of evolution but rather a bundle of evolutionary scenarios, as argued by Fodor and Piattelli-Palmarini (2010: 159). Müller (2017: 2) describes the theory of evolution as “fundamental conceptual framework of biology all scientific explanations of living phenomena must be consistent with”. It does not describe a “universal law” but rather “the principles of organismal change over time”.

Despite this criticism, one can pursue the question in favor of Kojonen’s approach: What if it were possible after all to describe a natural evolutionary mechanism that could produce the designs of living beings without planning, intervention and guidance, as has been claimed since Darwin and is seen as such by the vast majority of biologists today? Does the “salvaging” of the biological design argument succeed in the way described by Kojonen? To answer this question, we need to look at the design of preconditions according to Kojonen’s approach.

5.2 What are the preconditions and what can they accomplish?

Kojonen, following Christian de Duve, interprets that the laws and properties of the universe act as constraints that “shape the evolutionary roulette and restrict the numbers that it can turn up” (p. 98). However, in what way should the properties of matter, laws and constraints, have an evolutionary *innovative* effect? How is an assumed sufficiently effective adjustment of real processes toward the known, highly complex constructions of living beings supposed to take place here? This seems to be completely unclear. Reference to environmental conditions channelling selection¹⁵ does not help either because, on the one

¹⁵ “... selection itself is a result of the environment, and thus not an independent actor in the same way as the architect in Darwin’s analogy” (103). Darwin’s comparison of selection to an architect is completely misguided anyway,

hand, the change in environmental conditions does not follow a target direction and, on the other hand, channelling through the environment does not *produce* anything new but only has a *limiting* or selecting effect. Moreover, a certain arrangement of environmental conditions that would truly be suitable for producing the constructions of living beings to be explained would either be a divine intervention or mere coincidence. In both cases, Kojonen does not reach his goal.

The fact that the material properties (laws of form) and regularities and the environmental conditions have a *limiting* effect and thus restrict chance is comprehensible but not how they can be constructive or have a *formative* effect. To illustrate this with an example from technology: Anyone who builds a washing machine must, of course, take into account, for example, the properties of the water, but these have no influence whatsoever on whether or how a washing machine comes into being (except through the mind of a designer taking such properties into account). Accordingly, it is unclear how laws of form and environmental conditions are supposed to bring about innovations in conjunction with natural mechanisms.

Kojonen compares the course of evolution with human construction, where individual elements of, for example, a building designed by humans could be considered accidental. The necessity of design becomes apparent only when we consider the whole building (p. 103). If we consider the mechanisms of evolution, this comparison seems misleading. It is not typically the case in human construction that the presence and essential features of the elements that are *necessary* for the design of a construction are left to chance. Even if some elements may appear random in constructions, they involve, on the one hand, only peripheral aspects and, on the other hand, are usually the result of certain intentions of the architects or craftsmen (or as a byproduct). Creation means purposeful generation under the restriction of chance. It admittedly is possible to use a statistically qualified coincidence creatively, but these are special cases that occur within the framework of concrete acts of planning and producing and are therefore not suitable for Kojonen as an analogy example.

The comparison of evolution with economic life, which is apparently dependent on many coincidences and is guided by an “invisible hand” (p. 104), seems equally unsuitable. The “invisible hand of the market” averages out the market value and supply of goods but is in no way a substitute for designers and workers who develop and produce products.

Moreover, the economy is centrally based on goal-oriented actors who generate demand or pursue goals such as profit maximization and make (more or less rational) permanent means-ends decisions.

Genetic algorithms. Kojonen mentions simulations with programmes such as *Avida*, through which an evolution of “digital organisms” is simulated. In doing so, the preconditions must be carefully chosen (as Kojonen himself points out) in a way that cannot be assumed for evolutionary processes (Bertsch and Waldminghaus 2005; Vedder 2015). In general, one can say that in simulations of evolution, a large, if not essential, part of the information contained in the targeted construction must be “built in” to the algorithm to be able to achieve the desired target at all. Kojonen himself puts it in a nutshell: “Instead of being an example of how information can arise without a designer, the algorithm does not generate any new specified pattern that was not already built into the program at the start” (p. 111). He writes this in reference to a well-known example by Richard Dawkins: the sentence “METHINKS IT IS LIKE A WEASEL” from Shakespeare’s *Hamlet* can – starting from a random sequence – be achieved only by simulating mutation and selection if the target sequence is specified. Otherwise, the algorithm would not “know” at all how mutations (here: individual changes in the sequence of letters) should be evaluated.

A comparison of simulations by programmed algorithms with the processes and preconditions of the evolution of living beings reveals fundamental differences. Jeavons (2022: 1066), commenting on Kojonen’s book, concludes that the design of evolutionary algorithms requires many “sophisticated refinements and careful adjustments”. An evolutionary algorithm must be “carefully tailored to the problem in hand, and the problem itself must have appropriate properties.” The prerequisites need to be “carefully tuned to ensure success but also the details of the algorithmic implementation itself” (p. 1052). A “combination of choices that together achieve some desired quality” is required (p. 1055). Knowledge about the desired outcome would need to be incorporated (p. 1056). A simple reference to the general direction of natural selection is not sufficient

since Darwin himself explicitly rejects any directionality in the evolutionary process: “The view that each variation has been providentially arranged seems to me to make Natural Selection entirely superfluous, and indeed takes the whole case of the appearance of new species out of the range of science” (Darwin, cited on p 100).

to explain biological phenomena (p. 1066). "Only by making coordinated changes to whole sets of variables at once can we move to an improved system overall, and this requires a more sophisticated approach than simply making changes at random to individual variables and selecting for increased fitness" (p. 1057).

Kojonen quotes Dembski and colleagues: "Their overall conclusion is that each genetic algorithm only works to solve a specific problem, and only because it is guided by the parameters built into it by the programmers" (p. 112). He counters them with a countercriticism by Boudry et al. (2011) that evolutionary algorithms must contain control information in such a way that they simulate natural selection. However, this raises the question of what control information natural selection can contain. It seems to be assumed here that natural selection enables innovative evolution, but this would presuppose what is to be proven. Selection can be controlled by environmental conditions, but these conditions are not goal oriented but rather more or less random. A transfer of genetic algorithms to natural selection therefore does not seem justified. In addition, selection can only take effect when a certain function is already present.

For these reasons, it is not apparent how such demanding requirements for successful algorithms and comparable programming can be hidden in the mechanisms and preconditions of evolutionary processes.

Ultimately, the crucial question is whether a stepwise progression to new complex-functional structures is possible and can be demonstrated. Are functional morphs performing different functions close enough to each other to be accessible to stepwise evolutionary search, as is the case with genetic algorithm simulations? (p. 113) This would have to be shown *concretely and in detail*.

Kojonen's conclusion is as follows: "*Thus, in these simulations, the possibility of evolution depends on design, demonstrating that there is no necessary contradiction. One can further argue that due to the strong dependency of the algorithm on design, the products of the simulated evolutionary process are revelatory of the intelligence of the programmer*" (p. 113; emphasis added). Furthermore, "This would contribute to the case that, at least to some extent, evolution pushes back the problem of the origin of biological teleology to the conditions that make evolution possible" (p. 114). To successfully apply his approach, however, he would have to show, among other things, that this "design dependence" can be successfully applied to

the interaction of mutation and selection together with the preconditions he understands in this way. For the reasons mentioned, this does not seem to be the case thus far.

The argument that genetic algorithms could be a source for the design of living beings puts the cart before the horse: It is assumed that evolution proceeds by mere natural mechanisms without guidance. From the statement that it is unlikely that the sophisticated designs of living beings would originate in this way, it is concluded that a sophisticated algorithm is required and that it must exist. However, the existence of such an algorithm would have to be demonstrated independently if a circular argument is to be avoided, but Kojonen does not do that in his book.

The fact that the algorithms used to simulate evolution in the technical field are not suitable for explaining innovative evolution can be made clear as follows: Such algorithms start with a target built into the algorithm and/or already with a functional structure that is optimized by trial and error. *Optimization* can indeed be simulated, where the Darwinian mechanism can be used successfully. However, no algorithm can give itself a target and invent something. The target is first in the mind of the programmer. This is exactly what is missing in the Darwinian mechanism or other evolutionary processes and therefore cannot be convincingly compared with genetic algorithms.

Irreducible complexity. Kojonen concludes from the design of living things that evolution has "very demanding preconditions" (p. 98) and that the evolutionary origination of irreducible complexity requires much fine-tuning (p. 119). Referring to the prime example, the bacterial flagellum (more precisely, the miniature bacterial outboard motor), he writes that there must be a continuous series of functional forms leading from no flagellum to flagellum so that no change is too great to be managed by natural selection. The development of such complex systems, he argues, is difficult, and an evolutionary path has strict conditions. However, nature nevertheless would allow it (p. 118).

However, what the precondition is and what exactly has to be fine-tuned remain vague. Basically, again from the result ("there is irreducible complexity") and from the presupposition ("there is natural evolution"), it is concluded that the design, as Ko-

jonen then thinks, must be in the preconditions he assumes. The following questions must be answered to avoid circular reasoning: What evidence is there, independent of this presupposition, that these preconditions actually exist in such a way and that they make possible evolution, which – according to what we know today and according to Kojonen – is actually very improbable? What exactly salvages the biological design argument? Where exactly is the design that makes it possible for evolutionary mechanisms to lead to exceedingly purposeful, functionally complex structures? How can we recognize this design, if it is to be found, for example, in the programming of the mechanisms? There is an empirical problem here because it is not clear what this design consists of and how this design finds its way into biological constructions. In any case, it must be shown that there is a continuous evolutionary path to irreducible complexity. In the case of irreducibly complex constructions, it is assumed that existing parts are reused (cooption). In fact, in the case of the bacterial motor, for example, the individual protein components still fulfill other functions. The existence of similar parts in other systems and their additional use in a new system is taken as evidence of evolvability (p. 118).

However, the transfer of a protein into a completely new functional context is a challenging matter. What has been experimentally demonstrated here? The multiple components (e.g., proteins) used occur so frequently that this is probably the case. However, how did these multiple uses come about? Multiple use is in itself a very strong design indicator because, in all our experience, an enormous amount of planning and coordination are required to design parts so that they can be used simultaneously in different contexts. It is not a valid inference to conclude evolvability from the fact of multiple use since evolution must be *presupposed* for this conclusion. What needs to be clarified here is which co-option processes have actually been experimentally demonstrated and what they prove.

Protein evolution. With regard to protein evolution, Kojonen relies primarily on the ideas of Andreas Wagner, as described above. According to Wagner, different proteins are closely interconnected in a large “genotype network” of functional forms; evolution can traverse this network (p. 121). Wagner’s concept, however, is very theoretical, with little relation to the chemistry of real proteins, and accordingly leaves the crucial question open: Is it possible to get from any of the more than 1000 known protein folds to any other?

(cf., e.g., Reeves et al. 2014) In addition, not only the origins of individual proteins and protein families or protein folds need to be explained but also their sophisticated networking and, at the genetic level, the development of gene regulatory networks. What does the fact that very many changes in amino acid sequences are possible without changing the basic function of the protein in question prove? In any case, it does not prove that a *different basic function* can be achieved in this way. However, that is exactly what would have to be explained. To take up the image of the fitness landscape that Kojonen also uses: What is the use of an enormously large “library” of functionally similar proteins (Wagner 2014) if these are ultimately only more or less large islands in the fitness landscape that are thus far separated from other such islands that the gap between them cannot be overcome with the known evolutionary processes?¹⁶

Kojonen is optimistic that the library of seamlessly connected proteins will even allow the evolution of molecular machines such as the bacterial motor: “This then would allow for the seamless transition from no flagellum to a flagellum over time, through small successive steps” (p. 122). In addition to the difficulty just discussed with regard to new protein folds, this is further complicated by the fact that molecular machines are far more complex than individual proteins. Wagner’s approach to protein evolution does not apply here because molecular machines are *complexes of many coordinated proteins*. In evolutionary terms, the question here is how the components can be combined and matched to each other—a question to which Wagner’s approach cannot provide an answer in principle.

Kojonen also used the finding of the *frequency of convergences* to justify the *directness* of evolutionary processes. He argues that “laws of form” make it possible that evolution repeatedly leads *independently* to similar constructions (= convergence).

This argument is also based on the unproven assumption that innovative evolution can occur through natural processes. Natural processes are not goal-oriented; nevertheless, convergences are frequent and therefore seem to require a hidden goal orientation, which Kojonen locates in the preconditions of the evolutionary process. The convergence

¹⁶ Kojonen quotes JIMÉNEZ and colleagues (2013) who highlight the problem: “... that ‘the landscape is composed of largely disconnected islands of active sequences. Natural selection under these conditions would be constrained to local exploration of sequence space’” (124).

argument in favor of the existence of directing laws of form thus stands or falls with the assumption that natural evolution produces the designs of living beings. However, complex convergence is unlikely to occur due to known evolutionary mechanisms. Therefore, as is well known, one tries to explain similarities by descent from common ancestors—i.e., not convergent. The more often convergence has to be assumed, the weaker the evolutionary similarity argument becomes. For in the case of convergences, similarities precisely do not speak for common descent. Historically, convergences were still regarded as problem cases for evolution, and it is not for nothing that, when constructing cladograms, those versions are preferred that manage as few convergences as possible.

Kojonen would probably reply here: Precisely because convergences are improbable but occur frequently and because the evolutionary mechanisms themselves do not contain any guidance or goal orientation, guidance must be hidden in the preconditions. However, this once again assumes that what is to be proven is a given—that is circular reasoning. Independent evidence is needed for the effectiveness of the formal laws. As mentioned, it is unclear what the guiding factors are supposed to be.¹⁷ Whatever laws of form represent in Kojonen's sense, they should not in themselves have any causal effect. Even if one assumes that there are laws of form, this does not provide any answer to the question of how the concrete forms in question (here the constructions of living beings) come into being in space and time. The same applies to constraints. It remains unclear where in the preconditions, the design lies and how the constructions of living beings are produced by way of nondirectional evolutionary mechanisms. Kojonen cites Michael Denton's view that evolution *searches* the space of possible forms and *discovers* biological forms in the process instead of creating these forms out of nothing. However, against the aforementioned background, this seems to be pure speculation, which is also anthropomorphically loaded here ("searches", "discovers").

6 A fundamental difficulty: What is the design in Kojonen's concept?

A fundamental difficulty of Kojonen's design concept is that it is not clear what this design truly consists of. Here, Kojonen speaks of "laws of form" as central entities. It remains unclear in his book whether these laws of form can be derived from physical-chemical

laws (case 1) or whether they are additional laws (case 2).

Case 1. As mentioned, on the one hand, he writes on page 132 that the laws of form "arise as a consequence of the laws of physics", so that case (1) would be given. However, his approach would not go beyond the cosmological design argument. He also refers to a "wider teleology", but without clarifying what exactly is meant by this; it could be about fine-tuning in physics and therefore also about cosmological design (case 1). In this case, Kojonen's concept would contain nothing new and would collapse in this respect, as we would then simply be dealing with evolution on the basis of the known laws of nature. On the other hand, biological laws of form and the specific biological preconditions for evolution play such a central role in his book that the impression is given that they are something independent in the sense of case 2. According to Kojonen's approach, one would then have to assume that these laws of form are something that God specifically created. Otherwise, there would be no specific biological design. Therefore, if Kojonen understands biological design as something additional to cosmological design, these laws of form must also be something that is in addition to the laws of nature and specifically concerns living beings but not inanimate nature (case 2).

Case 2. Only in case 2 would Kojonen's contribution be interesting and innovative. Then, a world would have to be conceivable that has exactly the same (physical) laws of nature as our world and is also identical with regard to the physical preconditions of the universe but does not contain these (meta-)biological laws of form; consequently, evolution would not be possible in such a world. For these laws of form are, in the case of Kojonen, a decisive factor that makes evolution of life possible.

However, this is exactly what is not to be seen—or at least not in a way that would fit into Kojonen's concept. What is or would be the ontological status of these laws of form? Are they Platonic entities? This would involve a whole series of difficulties of its own. Platonic entities are abstract, nonmaterial and, at the same time, nonspiritual as well as typically causally effectless entities outside of space and time. It is then impossible to see, for example, how such entities would manage to produce concrete effects in space and time. Plato, to whom the concept of these entities goes back, therefore provided for a "demiurge" (workmaster), a god-like, personal creator being, to

¹⁷ It has already been pointed out that Kojonen does not describe more precisely what he means by "laws of form".

create concrete, spatiotemporal things, according to appropriate forms (or “ideas”). Furthermore, Platonic entities exist eternally and necessarily and typically independently of God.

Or are the “laws of form” dispositions for building complex biological constructions in the things themselves, e.g., in certain molecules? This approach, too, would not be suitable for Kojonen. The dispositions of chemical compounds, for example, can hardly contain the information that comprises complex biological functions. One and the same compound can be used for quite different biological and nonbiological constructs. Therefore, the disposition should be present only if it is already in a biological context. God would then have to implant the disposition in an amino acid molecule, for example, as soon as it becomes biological. Such dispositions would also have to condition a highly specific, complex and intelligent behavior of the entities that have them, which in cooperation with countless other entities then produces biological entities. All of this is extremely implausible and is not observed: An amino acid molecule, for example, behaves exactly the same inside an organism as it does outside an organism, according to all we know.

It therefore remains unclear what these laws of form actually are, to what extent they are a result of design and how they work to produce real biological forms. In case 2, it also remains unclear what independent empirical evidence exists for such laws of form: How are the laws of form recognisable, and how can we clarify whether they cannot be derived from something else?

Are the forms, then, simply the familiar, very particular arrangements of matter in space and time we find in biology, designed to have the concrete functional characteristics they do? “Laws of form” would then most likely be abstractions on our part. They would be nothing beyond the “normal” laws of nature (case 1). Without recourse to classical design approaches, Kojonen’s concept would collapse to a usual (neo-)Darwinism. In contrast, however, the forms could also be essentially concepts in the mind of God or correspond to such concepts, while God acts according to these concepts to bring about the special arrangements mentioned. Then Kojonen’s approach is equivalent to the classical biological design approach.

Overall, Kojonen is left with three possibilities:

1. A consistent (noninterventionist) (neo-)Darwinism (or an EES) without specific biological design; design would at most be located in the laws and constants of nature.

2. His actually intended specifically biological, irreducible “laws of form”. Here, however, it is not possible to see what such laws of form could be or how they could contribute to concrete biological forms in space and time.

3. A classical design approach.

Kojonen’s concept of a specific biological design that does not require the intervention of a creator in concrete world events therefore suffers from a serious deficit: First, it is not at all clear what this design should consist of. Second, it is equally unclear how this design can be implemented in concrete biological forms. Furthermore, (third) no good reasons are recognisable as to why such a design would be preferable to a classical design (with concrete interventions by the Creator).

7 Summary and conclusion

Kojonen considers the evidence for design in biology to be very strong and therefore defends a biological design argument. He understands “design” as a teleologically analysable biological construction that can be recognized on the basis of concrete biological evidence. He argues that this preserves the validity of intuitive design perceptions in nature (p. 212).

However, he does not advocate the classical biological design argument, according to which design is explained by a goal-oriented action in *the process of origination* (be it direct creation or a guided evolutionary process) under the assumption that purely natural processes fail as an explanation. Rather, he places design in certain *preconditions* of the process of origination, which itself can be described by purely natural processes. He wants to show that the wisdom of the Creator can manifest itself in the products of *an automated process* in which an essential causal role is left to chance (p. 206). Evolution appears to be highly organized and constrained in the directions it can take and thus guided. This is predictable to a certain extent, perhaps even with inevitable results (p. 209). The exact extent of biological fine-tuning through deliberately chosen preconditions is still disputed (p. 209), but the progress of related research indicates that the compatibility of design and natural evolution could be better and better justified (p. 210).

I find Kojonen’s approach unconvincing for two reasons:

1. The progress of evolutionary research has just not shown how a purely natural process produces the designs of living beings. This is because the newly added factors referred to in extended evolutionary

synthesis (EES) do not exhibit any innovative power (Junker and Widenmeyer, 2021). For example, the explanation of the epigenetic regulation and plasticity of living organisms places even greater demands on evolutionary explanations. With increasing knowledge, this demand is becoming increasingly high because life is proving to be even more complex and information rich than was previously known. Epigenetic mechanisms in particular are an immense hurdle for evolutionary hypotheses of origin. It is far more challenging to create (or evolve) nested levels of regulation than to create (or evolve) fixed traits. The degree of foresight required for the teleological features of life is increasingly proving to increase. Niche construction, the influence of living things on evolution, also contributes to preconditions but does not concretely explain how this process gives rise to evolutionary novelties.

The existence of a natural evolutionary process is necessary for his approach because, otherwise, it would not be possible to conclude the existence of preconditions in which design (according to Kojonen) can be located. Otherwise, we would be dealing with the classical design approach, for which it is indispensable that purely natural mechanisms are insufficient for innovative evolution (see above).

2. Kojonen argues that the progress of evolutionary research shows how sophisticated and well-planned the preconditions must be so that the Darwinian process, in which chance plays a major role, can produce the designs of living beings. The design is thus placed within the preconditions of the laws of form of life. The exact mechanism through which these effects occur and how they can have a causal effect on real biological structures remain open questions. Independent evidence for the existence of the preconditions needed for successful evolution does not exist (thus far). Their existence is inferred indirectly 1. on the assumption that evolution produces all constructs by purely natural means and 2. on the basis of strong evidence that there are biological design indications. Therefore, it is not shown that these preconditions actually exist. It seems that the existence of these designed preconditions is derived by circular reasoning. Even if these preconditions do exist (or are taken for granted), they have not been shown to have a causal effect or to be factors that are significantly involved in bringing forth the constructs of living beings. Only if this could be shown independently could the circular argument be avoided.

Preconditions, protein libraries and laws of form are prerequisites for the *existence* of biological constructs but do not create them. In addition, the concept

of such laws of form (if not reducible to physical laws) is probably inappropriate for combining a purely natural Darwinian evolution with design (i.e., specific planning by God that leads to corresponding biological constructions).

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