

# *How to Do Religion and Science?*

with Andrew B. Torrance, “Should a Christian Adopt Methodological Naturalism?”; Victoria Lorrimar, “The Scientific Character of Philip Hefner’s ‘Created Co-Creator’”; and Michael S. Burdett, “Assessing the Field of Science and Religion: Advice from the Next Generation.”

## THE SCIENTIFIC CHARACTER OF PHILIP HEFNER’S “CREATED CO-CREATOR”

by Victoria Lorrimar

*Abstract.* Philip Hefner’s understanding of humans as “created co-creators” has played a key role in the science and religion field, particularly as scholars consider the implications of emerging technologies for the human future. Hefner articulates his “created co-creator” framework in the form of scientifically testable hypotheses supporting his core understanding of human nature, adopting the structure of Imre Lakatos’s scientific research programme. This article provides a brief exposition of Hefner’s model, examines his hypotheses in order to assess their scientific character, and evaluates them against the relevant findings of contemporary science. While Hefner’s model is largely commensurate with contemporary science, he at times makes claims that cannot be scientifically falsified or corroborated. Hefner’s accomplishments in demonstrating the scientific compatibility of many theological notions is admirable; however, his overall position would be strengthened with a more tacit acknowledgment of the limitations of scientific knowledge. His anthropology draws also from extrascientific commitments and is all the richer for it.

*Keywords:* co-creation; Philip Hefner; Imre Lakatos; scientific method

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Philip Hefner’s understanding of the human as a “created co-creator” has been formative for various accounts of theological anthropology, particularly as theologians consider the relationship between continuing creation and the eschatological future. Co-creation theologies have been instrumental in exploring the theological implications of emerging technologies that allow us to manipulate both human and nonhuman nature. Ted Peters, for example, builds on Hefner’s understanding of co-creation in his

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own articulation of future-oriented human freedom (2003, 125). Ronald Cole-Turner, as well, highlights the co-creative agency of humans in his cautiously optimistic response to human genetic enhancement (2008, 929–44, 942–43).

Hefner's "created co-creator" model is the product of a long history of interacting with natural scientists, and an interest in fostering dialogue between science (particularly evolutionary biology) and theological enquiry. Hefner is blunt in his assertion that "theology as explanation is dead unless it learns to integrate within itself elements of scientific understandings that undergird explanation for our time in history" (1993, 219). It is not surprising, therefore, that his account borrows much from scientific methodologies. Hefner adopts the scientific research programme structure developed by Hungarian philosopher of science Imre Lakatos to articulate his anthropology.

At the heart of a Lakatosian research programme is the "hard core"—the basic idea. Generally the nature of the claims in the hard core means that it cannot be directly falsified or verified—it is "irrefutable" by the methodological decision of its proponents" (Lakatos 1978, 48). Instead, these claims can be indirectly upheld or rejected through the testing of associated "auxiliary hypotheses." These take the form of "observational" hypotheses that are flexible with respect to observed anomalies; they can be adjusted in response to counter-instances and thus "bear the brunt of tests" in service to the hard core (Lakatos 1978, 48).

A Lakatosian research programme articulates a set of methodological rules: the *negative heuristic* tells us "what paths of research to avoid" while the *positive heuristic* tells us "what paths to pursue" (Lakatos 1978, 47). In a bona fide research programme, the auxiliary hypotheses must be formulated in accordance with the positive heuristic, that is, they must represent an increase of knowledge (Lakatos 1978, 95). The negative heuristic redirects the burden of proof away from the hard core to the "protective belt" of auxiliary hypotheses (Lakatos 1978, 48). These hypotheses can then be reformulated in response to falsifying data, while the hard core remains intact. As Nancey Murphy points out, a certain "dogmatism" is required for scientific progress—the negative heuristic allows space for a theory to be fully developed instead of prematurely discarded (Murphy 1990, 60). The key evaluative criteria of a scientific proposal for Lakatos are its fruitfulness in generating new insights (Lakatos 1978, 52). A research programme is eventually discarded if it is judged to be degenerative, that is, no longer producing new ideas and waning in influence, rather than progressive (Lakatos 1978, 48).

Hefner is not the only, or even the first, theologian to find the Lakatosian structure valuable for theological explanation. Early in her career, Murphy adopted a Lakatosian framework in areas of her work (and Hefner owes much to Murphy's interpretation of Lakatos); however, she later rejected

Lakatos's model in favor of Alasdair MacIntyre's understanding of rationality (Murphy 1990; 2007; Hefner 1993, 23). In a conversation in *Zygon: Journal of Religion and Science*, Wolfhart Pannenberg accepted Hefner's application of a Lakatosian framework to Pannenberg's own theological work (Hefner 1989, 146–48; Pannenberg 1989, 258–59). Robert John Russell (2010, 238) considers the work of Imre Lakatos to be of great value for theological thought, while Karl Peters (1992), Philip Clayton (1989), and Gregory Peterson (1988) all engage with the model in their theological writings.

Though Hefner acknowledges a lack of consensus concerning the falsifiability of theological ideas, he nevertheless sets out to construct theological proposals within the parameters of a scientific research programme—that is, he contends that potential falsifiers and permissible conditions can be identified with respect to the claims he places in the hard core (Hefner 1993, 25). Furthermore, the theological task requires that “theological statements will be used in theory-construction that conforms to the criteria of falsifiability and fruitfulness” (Hefner 1988, 268). The current objective is to examine the “fit” of Hefner's “created co-creator” model within the structure of a Lakatosian research programme, and whether he achieves the stated objective of articulating his theological claims in the form of hypotheses subject to scientific falsification. Though Lakatos's model has been widely criticized, the focus here will not be on the validity of the model itself as an explanation of scientific knowledge acquisition.<sup>1</sup> Instead, Hefner's claims will be considered with respect to their scientific character more generally. Given that Hefner insists that the protective belt of hypotheses is empirically testable, the scientific testability and evidential support for each hypothesis will be evaluated. Though Hefner often uses the term “science” in generic ways, the scope here will largely concern insights from evolutionary biology, and evolutionary psychology in particular (and climatology to a lesser extent), as most relevant to Hefner's claims.

Hefner's oft-cited summary statement on the subject of the “created co-creator” actually functions as the hard core of his proposal within the Lakatosian framework.

Human beings are God's created co-creators whose purpose is to be the agency, acting in freedom, to birth the future that is most wholesome for the nature that has birthed us—the nature that is not only our own genetic heritage, but also the entire human community and the evolutionary and ecological reality in which and to which we belong. Exercising this agency is said to be God's will for humans. (1993, 27)

Having provided this empirical description of human nature, Hefner proceeds to articulate a theological theory within a Lakatosian framework that aims to explain the empirical description and form part of the normative grammar of Christian faith (1993, 32). Building on this core claim,

he elaborates on the “theological theory” by breaking down its essential aspects into “core elements” and identifying various “auxiliary hypotheses” associated with each that can be tested for their fruitfulness and thus support the core of his proposal.

#### CORE ELEMENT ONE

The first “core element” is as follows: “The human being is created by God to be a co-creator in the creation that God has brought into being and for which God has purposes” (Hefner 1993, 32). He summarizes this in the more recognized term “created co-creator.” The adjective “created” denotes the “conditionedness” of human beings, both as located within an ecosystem and as recipients of a genetic nature that is bestowed on the individual rather than chosen. Humans did not place themselves within the evolutionary process, thus are not superior to any other creatures within the same ecosystem (Hefner 1993, 36). Rather, humans are characterized by a sense of belonging among all creatures (Hefner 1976, 163).

“Co-creator,” on the other hand, emphasizes the freedom of humans to make decisions and construct contextualizing narratives within which these decisions are made. Hefner considers co-creation a distinctive quality of humans, though he warns against its application in service to anthropocentric ends. Yet the co-creator remains contingent on God as creator and is creative in a derivative sense (Hefner 1993, 38–39).

This brings us to the auxiliary hypotheses that Hefner assigns to the understanding of humans as “created co-creators.” The first of these concerns teleonomy, the apparent purposefulness of various structures and processes in biological systems (unlike “teleology,” teleonomy does not ascribe purposefulness to human or divine intent). While Hefner believes that *teleological* claims about nature can only be asserted on the basis of faith, *teleonomic* responses to certain biological structures and processes can be discerned empirically. He argues for a teleonomic axiom that hypothesizes the purpose and meaning of something based on its structure (Hefner 1993, 39–40). Theologically, Hefner argues for a version of natural law theology by grounding this teleonomic axiom in God’s creative action. Both naturalistic and theological perspectives “would conclude that nature is all we possess as the chief source for understanding what the world is about” (Hefner 1993, 40). He formulates the testable hypothesis as follows:

*Hypothesis 1:* Integral to *Homo sapiens* and its evolutionary history are certain structures and processes, the requirements for whose functioning may be said to constitute, at least in a tentative way, goals and purposes for human life (Hefner 1993, 40).

Hefner preempts challenges to this hypothesis on the basis of the naturalistic fallacy, arguing that the teleonomic axiom does not involve crass,

unreflective moves from is to ought, but rather speaks in tentative and careful ways of both the possibility and the necessity to make such moves (1993, 58). According to Hefner, this hypothesis is testable in the same way that all descriptions of structures and processes can be evaluated for their accuracy and adequacy (1993, 41). Hefner argues that the meaning and purpose of creatures must be continuous with the equipment with which they are endowed. Humans are equipped with “self-awareness, decision-making, action, and self-assessment based on the reception of complex feedbacks”—Hefner argues that this natural equipment is a good fit for the purpose of the created co-creator (1993, 58–59). It is this fit that can be subjected to testing. Hefner speaks in terms of kinship, citing nucleotide sequence comparisons and comparative morphological studies as evidence for human continuity with processes applicable to the “whole of nature.” He presents the ecological model as empirical support for the natural structures in which humans live (Hefner 1993, 65).

There are plenty of scientific studies to support the continuity of human morphology with that of other species. Until it was superseded by molecular analyses, comparative morphology (comparing observable characteristics between species) was the major tool underpinning the construction of phylogenies (branched diagrams representing the order in which a group of species share a common ancestor) (Ridley [1993]2004, 425). Entire “trees of life” are built through the identification of homologous structures in two separate species that are derived from a common ancestor. Advances in molecular analyses have only added to what was already inferred from the cruder morphological comparisons (Bertranpetit and Calafell 2004).

The notion that structure in some way implies function is also well attested in scientific thought. In molecular biology, for example, functional protein studies infer information about the putative function of a protein based on structural elements and the underlying DNA sequence. Among its many applications, this principle underpins the prediction of transmembrane proteins through the identification of coding regions for hydrophilic protein segments (i.e., segments able to cross a membrane) using the entire genome sequence of an organism (Krogh et al. 2001). As many similar examples could be offered, Hefner can reasonably claim that this first hypothesis receives some support from available scientific evidence.

Yet there is a difference between inferring function from structure and Hefner’s more ambitious claim that purposes and goals can be constituted by natural structures and processes. Scientists would generally balk at extrapolating a larger purpose or goal from the structure of an organism. The debate surrounding teleology in the natural sciences was well under way at the time of Hefner’s writing, and continues today. An exploration of this debate is beyond the current scope; however, Pier Luigi Luisi (2016) provides a helpful summary.

While Hefner does use the term “teleonomy” in place of teleology, it is questionable whether the function of “created co-creator” can be extrapolated from teleonomic notions alone. Some would argue that all uses of the term teleonomy are thinly veiled teleological statements. There are sustained attempts to reconcile contemporary science with the notion of teleology, such as Terrence Deacon’s (2012) account of emergence that rejects substance dualism in favor of property dualism. While Hefner’s choice to use teleonomic language is certainly more palatable to many scientists, the validity of defining the human as co-creator on this basis is debatable. Therefore, while parts of this hypothesis are supported by scientific conclusions, in its entirety it makes claims potentially beyond the reach of scientific discovery.

Hefner’s second auxiliary hypothesis is closely related to the first:

*Hypothesis 2:* The meaning and purpose of human beings are conceived in terms of their placement within natural processes and their contribution to those same processes (Hefner 1993, 41).

Nature is the “progenitor” of *Homo sapiens* and thus gives insight into human purpose, with humans defined as “the diviner[s] of ultimate meanings within the natural processes” (Hefner 1993, 73). The ultimate purpose of humans is not to build up the human community, or even service to God, but rather to serve the whole creation. “The direction God-ward leads us reflexively to nature” (Hefner 1993, 60).

In testing this hypothesis, “nonhuman nature may provide clues to the character and purpose of human being,” and the consequences of certain human behaviors (wholesome or destructive) toward the rest of nature are taken into account (Hefner 1993, 41). In some ways, this is an expansion of the first hypothesis, considering human function not only in light of its own structures but in the context of the structure of the entire natural order in which it is embedded. If assuming a goal or purpose based on an organism’s biological structure is problematic for some, assuming a purpose beyond the organism’s own requirements to those of other species is even less plausible to those who would reject teleological arguments. The problems associated with scientifically supporting the teleological claims of the first hypothesis thus apply to this hypothesis as well.

It is straightforward enough to argue that human behavior has consequences for the rest of nature—such a claim would be more or less universally accepted. We can even say, as mentioned above, that it is in our best interests to act in ways that are wholesome for the rest of nature. But does it necessarily follow that the purpose of human being is therefore to act beneficially for the whole of nature? How do we understand situations in which a judgment is required over which aspect of nature to prioritize, that is, various interests are in competition? This shifts this hypothesis into the speculative realm, and if Hefner is to properly avoid challenges on the

basis of the naturalistic fallacy then his proposal must retain its tentative nature. This is not a claim that can be sustained or rejected on the basis of scientific insights alone.

A pragmatic criterion for truth emerges with the second hypothesis and leads to the third:

*Hypothesis 3:* A concept of “wholesomeness” is both unavoidable and useful as criterion governing the behavior of human beings within their natural ambience, as they consider what their contribution to nature should be (Hefner 1993, 42).

Hefner suggests that a definition of wholesomeness, which appears to be an ambiguous criterion, can be arrived at via consensus (1993, 42). He describes the criteria for this hypothesis as pragmatic, arguing that human action will have to be “empirically discernible as in some way beneficial” (Hefner 1993, 61). Indeed, the assertion that humans should act to benefit nature is hardly objectionable. Many examples of humans acting in opposition to this goal could be provided; however, Hefner is not hypothesizing that all action must be beneficial, only that wholesomeness is an appropriate criterion for action.

It makes logical sense that in the context of an ecosystem, where the harming of one participant is detrimental to all, it is in the interests of humans that their action toward the rest of nature should be wholesome. This goes for all participants, however, not only those capable of conscious reflection. Such a statement does not necessarily constitute a hypothesis or merit a place in a scientific research programme. Nor does his stated means of validation with respect to this particular hypothesis—consensus. Scientific consensus has been incorrect at various points in history and this is likely to continue (hence the requirement for ongoing research and the construction of sophisticated philosophies of theory acceptance and change). If granted the status of a hypothesis, however, we might ask how the wholesomeness criterion could be falsified? By identifying a different criterion that serves equally well? The difficulty of articulating a means of falsification is another indication that the hypothesis is not adequately formulated. In this case, it appears that Hefner is stretching the understanding of what constitutes a hypothesis. His claim that wholesomeness should govern human behavior toward the rest of nature is reasonable, though perhaps optimistic when it comes to reaching a consensus, but not significant when it comes to the scientific validation of his model.

As the first three hypotheses establish that nature is the domain for human purpose, Hefner proposes a fourth hypothesis concerned with this special status accorded to the natural order:

*Hypothesis 4:* Nature is the medium through which the world, including human beings, receives knowledge, as well as grace. If God is brought

into the discussion, then nature is the medium of divine knowledge and grace (Hefner 1993, 42).

In this Hefner follows the urging of Joseph Sittler, who emphasized that human history only transpires within the larger context of natural history (Sittler 1978, 31–32). Hefner makes the additional point that the human mind must also be perceived as an entity of nature, citing representations of the mind's emergence in the context of evolutionary epistemology (Karl Peters 1982, 293; Richards 1987, 574–93; Hefner 1993, 61).

In his location of human meaning and purpose within the natural order, Hefner challenges what he considers to be the dominant understanding of our relationship to nature.

Instead of relatedness and kinship, [prevailing symbol systems] speak of our responsibility for nature as its stewards or masters, and of the possibilities nature presents to us for exercising our creative abilities and propensities to reshape it, to make it conform to us and serve us. In the main, humans have symbolized their work upon nature as furthering its development and improving it, thus placing the weight of the good on the side of *doing unto* nature rather than accepting a place *within* it. (1993, 67)

Rather, nature is “God’s great project”—we must resist instrumentalizing nonhuman nature and instead recognize that our task concerns the most wholesome future for all of nature (Hefner 1993, 74).

Hefner construes this hypothesis as a truism, yet contends that it can be tested by determining the plausibility of statements about knowledge or grace derived from nature in light of our understandings of human nature (1993, 42, 61). This leads to the question of whether plausibility is an appropriate scientific criterion. Certainly the claim that all knowledge that humans can obtain is mediated through nature is unobjectionable—scientists would be in agreement with this. The human brain is a natural entity and the medium by which we acquire knowledge.

Hefner does not stop with the mediation of knowledge, however, but also hypothesizes that nature mediates grace. What he means by grace is not immediately clear, especially as he distinguishes between grace and divine grace. Regardless of his meaning, however, the inclusion of divine grace in his statement puts the burden of proof (if he wishes his hypothesis to be scientifically sound) on the existence of divine grace. The hypothesis that nature is the medium by which divine grace must be experienced, *should divine grace exist*, is acceptable scientifically, supported by current understandings of epistemology and potentially falsified if an instance of received knowledge unmediated by nature could be identified. As it stands, however, this hypothesis again makes claims that extend beyond the purview of scientific verification.



## CORE ELEMENT TWO

Hefner identifies a second core element to his thesis that humans are “created co-creators”:

The conditioning matrix that has produced the human being—the evolutionary process—is God’s process of bringing into being a creature who represents the creation’s zone of a new stage of freedom and who therefore is crucial for the emergence of a free creation. (1993, 42)

Hefner reduces this statement to the challenge of “interpreting the evolutionary process as the work of God”—a major challenge, in his view, for the contemporary theologian (1993, 42). Natural selection processes, in particular, raise questions of theodicy that Hefner addresses later in the volume (Hefner 1993, 271). The emphasis here is on the freedom that emerges from the evolutionary matrix. For Hefner, the unavoidability of human freedom is almost tautological, which only makes sense when he goes on to define freedom not primarily in terms of liberty or ability to shape the world but rather as a “condition of existence” (1993, 97). Despite their apparent negation of each other, freedom and determinism are dialectical for Hefner—“freedom requires the structure of determinism for its becoming” and the “causal context” is enabled by freedom “to persist in new and different ways” (Hefner 1993, 115). Insights from the field of epigenetics “clarify how a deterministic biological system can favor the emergence of freedom.” While freedom and determinism can exist in conflict, producing fear, we are constantly seeking situations in which they are consonant with respect to our human destiny (Hefner 1993, 116–17).

Associated with the conditioning matrix core element are, further, two auxiliary hypotheses.

*Hypothesis 5:* Freedom characterizes human existence as the condition in which humans have no choice but to act and to construct the narratives and symbols that contextualize that action. Such contextualization provides justification, explanation, and norms for guiding and assessing the action. This condition is intrinsic to the evolutionary processes at the level of *Homo sapiens* (Hefner 1993, 45).

The testability of this hypothesis is linked to its utility for understanding humans and their relationship with nature (including other humans). Hefner gives two examples to make his case: the choice of whether to prolong a parent’s life using medical intervention and the development and implication of environmental policies that require assigning comparative values to different forms of life. Both instances require not only human decision but also the construction of stories that justify such decisions (like instructions to honor our parents and to serve as stewards to the creation) (Hefner 1993, 98). With respect to the latter, the centrality of narrative

construction to the human mind is well attested in the human sciences. Karl Peters (1989), to use one of the examples put forward by Hefner, highlights the constructivist element of the human central nervous system—the ability to construct contextualizing narratives has enabled humans to evolve as they have. Hefner also cites neuroscientist William Calvin in his argument that the brain’s capacity to observe and interpret information through the constructing of meaningful narratives is crucial for survival (Calvin 1989). More recently, this is supported by social psychologist Jonathan Haidt, who argues that the human mind is essentially a story processor (2013, 287).

The question of freedom is more complex. Scientifically speaking, Hefner points us to Theodosius Dobzhansky’s exploration of genetically determined phenotype plasticity and the explanation this offers for the emergence of freedom within an evolutionary framework (Dobzhansky 1956, 68). He cites the more recent (at the time of his writing) work of Rodney Holmes (1991) and Terrence Deacon (1992) as an extension of Dobzhansky’s insight. More recently, Armin Moczek et al. (2011) have connected phenotypic plasticity with evolutionary innovation. This should not be equated with freedom, however; indeed, Moczek et al. struggle to reconcile the apparent paradox between the Darwinian notion that every new trait is somehow derived from an old one, and the existence of complex novel traits. The language of freedom, and an understanding of how it fits within processes of evolution, again seems to reach beyond the explanatory capacity of science, though such an understanding may be commensurate with scientific knowledge.

The second hypothesis attached to this core element reiterates one of the central ideas in Hefner’s core claim.

*Hypothesis 6: Homo sapiens is a two-natured creature, a symbiosis of genes and culture (Hefner 1993, 45).*

We see here an idea that is prominent in Hefner’s theological anthropology—human beings are the product of “biocultural” evolution. This is a natural process in which our genetic and cultural heritages combine to produce free agents that are now capable of shaping future evolution (Hefner 1993, 28–29). Hefner describes this “two-natured character” of humans as follows:

*Homo sapiens is itself a nodal point wherein two streams of information come together and co-exist. The one stream is inherited genetic information, the other is cultural information. Both of these streams come together in the central nervous system. Since they have coevolved and co-adapted together, they are one reality, not two. (1993, 29)*

This understanding is not original to Hefner, but draws heavily from the work of Timothy Goldsmith (1991). Hefner resists a tendency toward

dualism in his insistence that both of these streams of information form one reality. Whether this dualism is completely resolved in the outworking of his model remains to be evaluated. He does acknowledge the difficulty in adequately describing the relationship between genes and culture; however, he gives his own support to the symbiosis model proposed by Ralph Burhoe (1979). He also commends Gerd Theissen's interpretation of biblical faith through the lens of Burhoe's model as constitutive of a proposal for cultural evolution that transcends certain biological constraints (Theissen 1985). Furthermore, Hefner argues that this complex gene–culture symbiosis that is the contemporary human has emerged from a deterministic evolutionary process as truly free—a freedom “rooted in the genetically controlled adaptive plasticity of the human phenotype” (1993, 30). Yet this freedom exists in tension with conditions that are “suitable for the emergence of values,” reinforced through the evolutionary context in which they were fashioned (Hefner 1993, 31). The two-natured character of human beings is antithetical to dualism, contends Hefner, as both streams of information have emerged from the one process of nature (1993, 102).

Hefner suggests that this hypothesis is tested and supported by a large body of relevant scientific literature. Indeed, this is possibly the most straightforward of Hefner's hypotheses when it comes to testing. There are a wealth of studies that demonstrate the influence of cultural factors on our biological function and vice versa. Cultural food options tend to conform to preferences influenced by genetically predisposed nutritional requirements—which explains why many prefer the taste of foods high in sugar, fat, and salt. Conventional evolutionary theory has been expanded to include the phenomena known as “niche construction”—the ability of organisms to modify sources of natural selection within their environment. According to Laland, Odling-Smee, and Feldman, “culture amplifies the capacity of human beings” for niche construction (2000, 131). Lactose digestion is an often cited example, with genetic mutations producing lactase persistence beyond weaning increasingly distributed among particular populations since the beginning of animal domestication (Gerbault et al. 2011, 863).

Similarly, the cultural activity of yam cultivation in West Africa has been associated with an increase in the frequency of the sickle cell anemia gene in the local population, offering protection against the higher risk of malaria that comes with yam cultivation. Laland et al. (2000) do point out, however, that this is not direct causation by the cultural variable but rather the ecological variable that standing water is exerting selection pressure. They propose a particular model of gene–culture coevolution in which

instead of being exclusively responsible for allowing us to codirect our own evolution, in contrast to what happens in every other species, culture now

becomes merely the principal way in which we humans do the same thing that most other species do. (Laland et al. 2000, 137)

A number of molecular signatures likely generated by cultural selection pressures have been identified in the human genome, with calls for cross-disciplinary studies to illuminate further the evolutionary relationship between genes and culture (Laland, Odling-Smee, and Myles 2010, 146). More recently, insights from the field of epigenetics (which was in its infancy at the time of *The Human Factor's* publication, therefore unsurprising that Hefner only briefly mentions it) have improved our evolutionary models and afforded a place to environmental factors (some of which are cultural) in inheritable characteristics (Skinner 2015). Novel patterns of brain waves have emerged since the increased usage of smartphones and other handheld Internet devices; we can only speculate as to whether and how soon such changes will be reflected in the genome (Swingle 2016, 63). Therefore, although there are more nuanced understandings available, it does seem evident that Hefner's hypothesis concerning the human as a gene-culture symbiont is supported by scientific accounts of coevolution.

### CORE ELEMENT THREE

The final core element that Hefner outlines within the "created co-creator" hard core elaborates on the freedom that exists in tension with conditionedness.

The freedom that marks the created co-creator and its culture is an instrumentality of God for enabling the creation (consisting of the evolutionary past of genetic and cultural inheritance as well as the contemporary ecosystem) to participate in the intentional fulfillment of God's purposes. (Hefner 1993, 45)

This freedom is itself chosen by the creation, and means that the world is defined not by its past or present but rather by what it is becoming (Hefner 1993, 46). The understanding of freedom is therefore eschatological. When it comes to the participation of the creation in God's purposes, and the human role in this, Hefner understands the doctrine of the *imago Dei* to mean that "humans can be the vehicle for grace toward the creation" (1993, 238). Associated with this core element are three further auxiliary hypotheses.

*Hypothesis 7:* The challenge that culture poses to human being can be stated thus: Culture is a system of information that humans must construct so as to adequately serve the three tasks of interpreting the world in which humans live, guiding human behavior, and interfacing with the physicobiogenetic cultural systems that constitute the environment in which we live (Hefner 1993, 48).

This hypothesis carries a great deal of weight for the entire theory according to Hefner (1993, 49). He points out that “whatever the human being acts out culturally fully implicates the genetic and ecosystem symbionts.” Yet “culture is also always seeking to stretch genes and ecosystem in order to fulfill what seems from the cultural perspective to be desirable and useful novel ends” (Hefner 1993, 47).

Hefner again refers us to the scientific literature for the testing of this hypothesis. He argues that neuroscientific evidence “supports the notion that our biogenetic equipment as human beings is built to sustain the formation of culture” (Hefner 1993, 163). This he relates back to the previous hypothesis that humans are gene–culture symbionts. He gives the example of the comparatively premature birth of human offspring compared with other species; the skull continues to grow long after birth in order to develop the neurological equipment necessary for culture (Hefner 1993, 163–64).

A potential falsifier for this hypothesis would be the existence of a group of humans with no identifiable culture, who are still able to carry out Hefner’s identified tasks of interpretation, guidance of behavior, and interaction with the environment. No known example exists, which appears to support the hypothesis. Yet the hypothesis is constituted by multiple claims. The claim that culture is constructed by humans is well attested by the scientific literature. Karl Popper, for example, distinguished the cultural world—“the products of the human mind”—from the physical world (1972, chapter 4).

The purpose of culture is less straightforward. Anthropologist Clifford Geertz would agree with Hefner, defining culture as “the fabric of meaning in terms of which humans interpret their experience and guide their action” (1973, 144–45). Psychological explorations of culture have spoken of its function as an evolutionary adaptation (Barkow, Cosmides, and Tooby 1992; Lehman, Chiu, and Schaller 2004, 691). While scientific research into the purpose of culture remains fairly scant (and this largely seems to be carried out by human scientists, garnering less interest among physical scientists), it is possible that further developments in the field may support Hefner’s hypothesis, to the extent that its claims can be considered scientific ones. At the very least, it has not been falsified by existing scientific data.

*Hypothesis 8:* We now live in a condition that may be termed technological civilization. This condition is characterized by the fact that human decision has conditioned virtually all of the planetary physicobiogenetic systems, so that human decision is the critical factor in the continued functioning of the planet’s systems (Hefner 1993, 49).

Essentially, all natural systems are now affected by the human cultural overlay—there are no longer any locations completely untouched by human decision. Again, human freedom is emphasized in this hypothesis.

The “created co-creator” is the agent in technological civilization, recognizing it to be the form of the natural world “commensurate with their particular epoch in evolutionary history” (Hefner 1993, 153–55).

There are two parts to this hypothesis—the pervasion of technology globally and the critical role accorded to humans for the planet’s future. With respect to the first, there is strong scientific corroboration when it comes to what Hefner describes as the cultural overlay of natural systems. The beginning of the millennium was marked by a coordinated effort to consider the present environmental conditions at the global level, with the United Nations Environment Program issuing a report in 2000 outlining the pervasive impact of human activity on the natural environment. More recent reports from the Intergovernmental Panel on Climate Change, which reviews, evaluates, and synthesizes the latest scientific research to do with climate change, offer a sobering assessment of the vulnerability of various natural systems—largely as a result of human activity. Scientists continue to argue this point, with polar researcher Peter Wadhams capturing eloquently one example of this human impact on the natural world in his comments on the diminishing polar icecaps:

Our planet has actually changed color. We all remember the first beautiful photograph of planet earth rising from behind the Moon, taken by the Apollo-8 astronauts, a delicate blue sphere, isolated in the cosmos, which contains all that we know of life. That sphere was white at both ends. Today, from space, the top of the world in the northern summer looks blue instead of white. We have created an ocean where there was once an ice sheet. It is Man’s first major achievement in reshaping the face of his planet, and it is of course an unintended achievement, with dubious and possibly catastrophic consequences to follow. (2016, 2–3)

The second part of the hypothesis concerns the centrality of humans for determining the planet’s future. Again, many scientists would agree with Hefner’s premise. The plethora of international climate conventions and agreements, as well as growing research into sustainable technologies, suggests that the majority of scientists and policy developers at least operate under the assumption that human action plays a critical role. Sociobiologist Edward O. Wilson (2016) recently published what can only be described as a desperate plea for humans to exercise their decisive capacity in order to avert global environmental catastrophe. Sir John Houghton, atmospheric physicist and previous chair of the IPCC, urges us to take our environmental stewardship responsibilities seriously as we consider the impact of our actions now and in the future (2015, 357).

Hefner’s identification of the current global situation as a technological civilization, in which human decision is decisive, is expressed in neutral terms. It could be argued, however, that the way to foster the wholesomeness of nonhuman creation is to reduce the impact of human activity on the rest of nature. We see this frequently today in the language of

environmental advocacy groups calling for a reduction in our “ecological footprint”—possibly this framing of the problem is more helpful than simply drawing attention to the centrality of human agency.

Whether this hypothesis makes sense of novel facts, a key idea of the Lakatosian model, or explains data already available to Hefner at the time of writing, is another question. As it continues to be corroborated by up-to-date research in the interaction of technology and the environment, however, this hypothesis may be considered to be validated by scientific knowledge.

*Hypothesis 9:* Myth and ritual are critical components of the cultural system of information and guidance. They are marked in linguistic form by declarative or imperative discourse, and their concepts are vastly underdetermined by the data of evidence. In light of human evolutionary history, these marks were necessary if culture was to serve its evolutionary function (Hefner 1993, 49).

Hefner elaborates on the role of myth and ritual, speculating that they are the chief carriers of cultural information that both motivates and interprets human behavior beyond the purely physiological (1993, 149). In agreement with Paul Ricoeur, he affirms the intrinsic meaning of myth and ritual (Hefner 1993, 151). He describes their relation to each other, and to praxis: “myth portrays reality, ritual presents symbolically the action that reality requires, while praxis translates the ritual into ordinary, everyday living” (Hefner 1993, 156). He considers fruitful Julian Jaynes’s (1977) proposal that over 3,000 years ago the human mind functioned bicamerally, with the informed right hemisphere of the brain “speaking” commands to the left (and such commands were heard and interpreted as the voice of the gods). Though Hefner resists a completely adaptationist account of myth and ritual, he considers them facilitators for imprinting information (1993, 172).

Hefner suggests that this last hypothesis is highly speculative and “has no possibility of being tested in a scientific manner.” However, it can be scrutinized for blatant scientific errors (Hefner 1993, 49). Hefner concedes that we have no conclusive evidence when it comes to the evolutionary origins of ritual or myth, suggesting they are underdetermined by data (1993, 159, 202). The nonscientific nature of this hypothesis does not invalidate its potential fruitfulness, but it does not comply with Hefner’s stated aim of articulating falsifiable hypotheses (1993, 25). Perhaps the inability of this hypothesis to be properly tested lies with the contemporary human stance toward the nature and reality of myth. Hefner traces the history of how humans have understood myth, from a premodern position of naive realism, through the Enlightenment debunking of myth using critical reason, to the simultaneous deconstruction and affirmation of myth—“we believe in myth under the conditions of *irony*” (Hefner 1993, 187).

Hefner does cite research suggesting that the human central nervous system has “mythopoeic requirements” for ordering the information at its disposal (1993, 185). The works cited by Hefner include Charles Laughlin, John McManus, and Eugene d’Aquili (1990) and Edward O. Wilson (1978). A more explicit scientific proposal is offered by Jaynes, which Hefner approves of but also acknowledges to be speculative (and eccentric). With respect to Jaynes’s theory of bicameral brain functioning, the scientific jury is still out. The theory has been controversial since its inception; however, it has been suggested that neuroimaging studies support Jaynes’s hypothesis (Sher 2000, 240).

The underdetermination of myth presents no problems for Hefner with respect to its unfalsifiability—the very nature and function of myth in evolutionary history requires action prior to the gathering of data that could support or falsify it (Hefner 1993, 204). Hefner does point out, however, that this hypothesis rejects the possibility that humans could have survived this long without the information provided by myth and ritual (1993, 267). A potential falsifier may therefore be the existence of human culture that does not possess any form of myth or ritual—and no examples have been discovered thus far. Despite this, the inability to specify how this hypothesis might be corroborated scientifically suggests that Hefner’s characterization of it as speculative and nonscientific holds.

#### HOW SCIENTIFIC IS THE “CREATED CO-CREATOR” MODEL?

Having examined each of the auxiliary hypotheses that constitute Hefner’s “created co-creator,” we now return to the methodological framework that undergirds his model. How faithful is his theological construction to the Lakatosian structure he aims to employ?

At the close of *The Human Factor*, Hefner offers his own evaluation of how successful the “created co-creator” model is as a Lakatosian research programme. He identifies a number of novel facts associated with his model, including the referral of human meaning to nature, the emphasis on teleonomy when it comes to humans, the inclusion of the biocultural evolutionary model into his theological anthropology, more complex conceptualizations of freedom and determinism, the integration of technology into evolution and human nature, the conceptual role afforded to myth and ritual within culture, and the identification of evil and theodicy as potential falsifiers (Hefner 1993, 268–71). He also considers his various doctrinal reinterpretations to comprise novel facts, including the relation of nature to grace, the purpose of human existence, and his definitions of atonement, justification, and original sin (Hefner 1993, 272–75).

Whether any of Hefner’s doctrinal reinterpretations are truly novel is questionable, though they of course meet his definition of novel. The particular concern here is not the fruitfulness of Hefner’s proposal, however,



but instead the scientific character of the hypotheses he constructs. When it comes to scientific corroboration, several of Hefner's auxiliary hypotheses do appear to hold up against scientific knowledge that has arisen since Hefner's formulation. Though comparative morphology is not a new discipline, the discovery of the polymerase chain reaction technique for the amplification of DNA in the 1990s has allowed the extension of morphological studies to include traits at the molecular level (Zardoya and Meyer 2004, 209–17). Along with increasingly sophisticated bioinformatic tools, this has made a vast difference to the field of phylogenetics, which maps the relationships and evolutionary history of the various species. These developments have only confirmed Hefner's argument in the first auxiliary hypothesis that humans will exhibit continuity with the rest of nature in the realm of structures and processes. Similar arguments could be made for the ongoing corroboration of Hefner's hypothesis concerning the interplay of culture and genes and the predisposition of the human mind toward narrative construction.

As argued in the previous section, however, not all of Hefner's hypotheses are scientifically valid. Of the nine hypotheses put forward by Hefner, only three could be considered falsifiable by scientific data (Hypotheses 6, 7, and 8). The remaining hypotheses all make claims that extend beyond that which could be scientifically falsified—Hefner himself points out that his last hypothesis is incapable of being subjected to scientific testing (1993, 49). Even though the three hypotheses formulated sufficiently to be scientifically falsifiable appear to be supported by current scientific knowledge, this hardly constitutes a successful Lakatosian research programme. Within the assumptions of the Lakatosian framework, the majority of Hefner's auxiliary hypotheses would require substantial reconfiguration (and it is questionable whether this is even possible) in order to reasonably protect his hard core.

But should a successful Lakatosian research programme be the goal? Perhaps in claiming scientific falsifiability for his theological statements, Hefner does theology (and epistemology more generally) a disservice. The intent to explain theology in scientific terms is vulnerable to Peter Hacker's "illusion of reason"—the notion that the natural sciences and the humanities are methodologically homogenous (Hacker 2001, 73). Yet is Hefner really so unaware of this danger? Hefner acknowledges the limits to science, especially in later works. For example, he writes that "science must learn from religion that even though the ships that science builds are huge and impressive, the sea is even bigger and rougher" (Hefner 2006, 130). He insists that science can raise questions that cannot themselves be resolved using scientific reasoning (Hefner 1993, 147). It seems that many of the critiques made of Lakatos—for example, that his model does not sufficiently account for the contextual character of scientific enquiry—do not then apply to Hefner, or at least not to the same extent. Revisiting his

epistemological commitments, Hefner allows that knowledge is conditioned, pointing out that “we can neither understand nor participate in the ongoing life of faith and theology apart from the mediation of social reality” (Hefner 1980, 427). Ultimately, Hefner acknowledges the limitations of methodology, his verdict approaching the poetic: “Like a twig caught in the raging current of a storm-roiled river, the fruits of the method are more in the realm of hope than of certainty” (Hefner 1993, 152).

It would appear that, despite the methodological insufficiencies in Hefner’s approach to scientific knowledge, his “created co-creator” model is largely compatible with the findings of contemporary science. Perhaps Hefner’s transgression is not that he reduces theology to scientific explanations, but rather that he gives the impression that such a move can be performed. Hefner’s model is actually far richer than a scientific account alone could provide. He makes claims about human nature and reality that, while not contravened by scientific knowledge, are not evident without recourse to nonscientific sources of knowledge. That Hefner misrepresents his work is unlikely a conscious deception, and we can reasonably attribute to him the best of intentions in the project of harmonizing theology and science. Ultimately, however, we can learn from Hefner’s example that theology suffers when scholars attempt to reduce it to scientific explanations. It is his fundamental commitments concerning ultimate reality that allow Hefner’s model to make sense of insights from the natural world.

Hefner’s model may also be refined and nuanced if combined with more recent developments in the area. Deacon’s account of emergence has already been offered as a more robust attempt to understand human freedom and self-awareness in a framework that is not reductionist. In recent years, Hefner has engaged with the scholarship of Donna Haraway. He suggests that Haraway’s cyborg and the “created co-creator” are sibling images (Hefner 2004b). Even then, however, Hefner still insists on reducing createdness to “kinship with the processes that have created us” (2004a, 5). This sits in uneasy tension with his contention that “we cannot avoid the question of God, because we create as if it matters” (Hefner 2004a, 7). In his most developed exposition of the “created co-creator,” Hefner appears reluctant to bring his own theological convictions into his understanding of anthropology and the human future, yet ultimately cannot avoid doing so. More recently, looking back over his career in science and religion, Hefner offers an updated conception of the theologian’s task: they are to reflect on findings of scientific research (2015, 11). Viewed through the lens of Hefner’s later thought as to how science and religion relate to one another, which no longer includes reference to a criterion of falsification or to Lakatosian philosophy of science, many of the methodological concerns raised here with respect to Hefner’s earlier work are alleviated (Hefner 2015).

This critique does not negate the potential value of the “created co-creator” for theological anthropology. An affirmation of the extrascientific metaphysical commitments involved may give the position more worth in the eyes of many theologians (and scientists!), and the scientific commensurability of many elements recommends the model for communication in a pluralistic context. Such a synthesis of scientific and theological content provides a far more convincing response than an account derived from either scientific sources or sources more traditional for theological construction (e.g., Scripture) alone. Hefner does appear to have shifted in his views over time, referring a decade later to the “created co-creator” as a “diagnostic idea” that “interprets ordinary existence.” He is content to summarize his construction as “the common experience that we are able to do things that are novel; that we are able to change the world around us and the world within us in ways that seem important and desirable” (Hefner 2004b).

An understanding of humans as “created co-creators” has much to offer theologians in the present age, particularly as they respond to the rapid developments in technologies that may significantly affect the human future. If Hefner’s model is viewed as one that encompasses more than just a scientific approach to anthropology, and its hints of extrascientific components such as the role of the human imagination in human becoming are fully realized, the “created co-creator” may occupy a central place in ongoing dialogue concerning the future of humanity and our role in bringing that future to pass.

#### NOTE

1. Several major criticisms of Lakatos are provided by Feyerabend (1970, 125), Kuhn (1970, 143), Chalmers ([1976]1982, 125), and Musgrave (1976, 457).

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