

Niche Construction and the Functional Model of the Image of God

Abstract:

The functional model of the image of God (FMIG), until recently, has often been overlooked in science-engaged theology and this is unwarranted. First, because it most closely follows the Genesis text out of which the very concept of the image of God arises. Second, it maintains relatively low friction when engaging with the evolutionary sciences and, third, because it has serious resonance with one particular mechanism of the Extended Evolutionary Synthesis: niche construction (NC). The FMIG and NC valorize the agency of the organism in an environmental and social ecology that contributes to the flourishing and even transformation of the organisms in the niche. I suggest that human agency directed at NC can be set within a theological framework wherein the behavior of constructing niches is given a divine calling or mandate with the advent of the image of God. This divine task is to create niches of flourishing for all of creation so that God's purposes in creation are brought to fulfilment.

Keywords:

Image of God, human uniqueness, providence, agency, Extended Evolutionary Synthesis, niche construction, human flourishing, stewardship, ecology.

One of the most fruitful areas of dialogue between theology and evolution pertains to the teaching of humanity as an image bearer of God. Because one of the central doctrinal loci of theological anthropology is the image of God, it isn't surprising that it has been given such attention in these circles. After all, evolutionary history tracks the developmental characteristics of any organism and some of the most important and interesting characteristics concern those that makeup human personhood. Most ink on the image of God and evolution has been spent devoted to the capacities and development of the human being in deep-time and how that might or might not give rise to the kinds of capacities associated with the image of God. Much of that dialogue has focused, as such, on structural components of the image of God or even so-called relational aspects.¹

However, often overlooked in these conversations is the functional model of the image of God (FMIG). I argue here that the FMIG has much to commend both for its close following of the Genesis text, but also the way contemporary renderings of niche construction (NC) in the Extended Evolutionary Synthesis (EES) cohere and resonate with such a model. As we will come to see, if the image of God for a functional model is about God gifting part of His dominion to human beings to order and deploy creation to its proper end, then something like NC valorizes that gift as being definitive and indicative for human beings for we are the ultimate niche constructors in creation—for good or for ill.

To begin, in section one I briefly define the four most common interpretations of the image of God before focusing more extensively on the functional model and what makes it distinctive relative to the other models. I argue that despite each model having an important perspective that tells us something important and genuine about theological anthropology and the image of God, the functional model most closely follows the original Genesis text and has the near support and consensus of modern biblical scholarship (Middleton 2005, 25). Furthermore, in section two, as other scholars have noted and I affirm here, the functional model enjoys low levels of friction when engaging with modern evolutionary science relative to several of the other models. Therefore, despite the prevalence and popularity today of these other models in theological circles, such as the relational and structural models, the functional model ought to be employed more in science-engaged theology.

I propose further that not only does the functional model benefit from less friction when engaging with the evolutionary sciences but that there is even a remarkable consonance with at

¹ For a good overview of how the different models of the image of God have figured in relation to evolution see my introduction in Burdett (2018).

least one component of the EES: niche construction. Therefore, in the third section I define and unpack NC as a mechanism within EES and explain not only how the overall EES emphasizes greater agency of the organism within evolution but that NC is one of the most significant mechanisms that manifests such agency by creating environmental niches not only for the acting organism but even others in the niche.

The fourth section directly compares FMIG with NC. I propose that both focus on agency as an important constitutive function of the human being and that this agency is typified by care of not only their own organismal flourishing but that of other organisms in the construction of niches. In this way we might say they both focus on humans as stewards of ecologies of flourishing.² I suggest that human agency directed at NC can be set within a theological framework wherein the behavior of constructing niches is given a divine calling or mandate with the advent of the image of God. Hence, one can discern continuity with other organisms that share in their own construction of niches that aids local and discrete flourishing but human beings, in being given a divine mandate, are distinct in that they are charged with a more universal and global scope of NC — that of all creation.

The conclusion considers some of the theological and ethical consequences of this proposal. Notably, it has repercussions for understanding related doctrines, among which we will consider here providence, eschatology and Christology. God's purposes in His creation are, at least partially, devolved to human beings according to the functional model of the image of God and, hence, our own providential agency must be animated by the divine character and purposes He has in place for the rest of creation and our place in it; directing it to God's good ends. These ends are eschatological in character and contribute to the final transformation and glory of creatures. There is also a significant ethical repercussion: clearly we have failed in stewarding well God's creation. It is plain to see global temperatures on the rise, the deforestation of the rainforests, increasing urbanization and the displacement and extinction of more species than ever before. We use our NC abilities to exploit God's creation for our own distorted ends at the expense of making it more habitable for other organisms. I argue that we need to say this is a failure in terms of image bearing. It isn't just a venial, ethical failure but a failure of the most central thing that means we image God — it is a failure of the very core of what makes us theologically human. However, when this failure is placed within a broader understanding of

² I recognise that this term 'stewardship' comes with potential complication in ecotheological circles, particularly the way it often implicitly references dominion language inherent in the very Genesis text which gives rise to FMIG I am defending here. However, I think stewardship is still the best term once the 'despoiling and despotic' accusations of dominion language are rebutted properly. See footnote three for my full response to this issue.

Christ as the very image of God, expanding our sense of the image of God to include the entire biblical writings, these failures get redeemed in Christ and Christ images God for us.

1. The Functional Model of the Image of God in Context

To best understand the FMIG one must understand how it differs from other models on offer. Historically, four different models are often stated in introductory work on the subject. The four models are the structural (SMIG), relational (RMIG), dynamic (DMIG) and functional (FMIG).

The structural model is the most commonly invoked model of the image of God and has been the most popular model throughout Christian history. It is often associated with diverse Christian Fathers such as Origen, Justin Martyr, Irenaeus, Clement of Alexandria, Gregory of Nyssa, Augustine and Thomas Aquinas. The structural model claims the image of God refers to some quality or faculty that is inherent in the human being. It is something in human nature, something it possesses that makes it an image-bearer. As Stanley Grenz (2001, 142) says the structural view understands the image of God “as referring to certain characteristics or capacities inherent in the structure of human nature. Because they resemble the corresponding qualities in God, their possession makes humans like God.” It is often referred to as the ‘substantive model’ as well because “it depicts something of substantial form in human nature, a faculty or a capacity that we humans possess over against animals” (Van Huyssteen 2006, 126). So, we might say that some quality or component of human nature is shared with God and that this is unique in both human beings and God relative to the rest of God’s creation.

However SMIG and its construction by medieval Catholic scholarship became increasingly challenged by the Reformers and led to the development of the relational model of the image of God, particularly in the 19th and 20th centuries. Both Martin Luther and John Calvin contended that the ‘image’ (*tselem* in Hebrew, *imago* in Latin) and ‘likeness’ (*dēmuth*, *similitudo*) distinctions that were the basis of much scholastic scholarship on the *imago dei* were simply due to a poor reading of scripture and a false theological anthropology. Calvin (2017, I.15.3) considered ‘image’ and ‘likeness’ to be used synonymously in the biblical text and, hence, the distinction had no bearing on the doctrine itself. Luther (1958, 60-62) was more sceptical of medieval anthropology than Calvin with its valorization of the will and intellect and was reticent to speak positively of the image of God in any terms. Doing so would only obscure the important contention that sin overwhelms all aspects of human nature and human life—the

intellect and will included. In its place arose an account of the image of God which recognized that the very imaging of God depended upon a prior relationship to the divine. Paul Ramsey (1993, 255) provides a helpful definition of RMIG:

The image of God is...to be understood as a relationship *within which* man sometimes stands, whenever like a mirror he obediently reflects God's will in his life and actions...The image of God, according to this view, consists of man's position before God, or, rather, the image of God is reflected in him because of his position before him.

Associated with scholars such as Soren Kierkegaard, Emily Brunner and Karl Barth, the image of God for the relational model depends upon the divine address and roots the image of God in a 'verb' rather than a 'noun' so that the image is about a special relation and corresponding activity initiated by God (Grenz 2001, 162). That is, humanity is in the image of God because of the unique relationship it has with God and the way that the human being is responsible to God in a special way relative to the rest of creation. RMIG can sometimes assert that it isn't just our unique relationship to God that makes us image bearers but that because we are relational beings, as God is relational in the Trinity, we too reflect God's image in the world.

Scholars will not often represent the dynamic model of the image of God as a separate model instead they will usually collapse it into one of the other models, most often the relational. However, it is distinct enough from the others to consider it separately. DMIG is sometimes referred to as the Christological or eschatological model and for good reason for both help better define what makes it unique: its focus on both Christ and eschatology. In relation to the former, when moving to New Testament texts on the image of God it becomes clear that Christ is the very fullness of the image of God (e.g. 2 Corinthians 4:4, Colossians 1:15-6). In reference to the latter, Grenz (2001, 177) explicitly links the image of God to eschatology when he says this model "sees the *imago dei* as humankind's divinely given goal or destiny, which lies in the eschatological future towards which humans are directed." It proposes that the image of God is not something entirely held or completed at the beginning of history, but is instead the *telos* or end of the human being to be completed in the future. So, instead of it being a protological concept rooted in Adam, it is actually an eschatological concept rooted in Christ and our glorification within Him.

The final model, and the one most relevant to this study, is the functional model of the image of God. Despite the close following of the relevant Genesis texts and clearly being the most supported by biblical scholars (Middleton 2005, 25), the model itself is a relatively recent arrival in the history of the doctrine. In spite of its young age, surely it being the most likely

understanding of the biblical authors (Harris 2018, 49) means it demands serious attention in constructive theological circles where biblical scholarship is taken seriously. As we shall see in the coming sections, it also benefits from considerable consonance with evolutionary science.

The FMIG most significantly draws on the famous passages from Genesis 1:26-28 and, in particular, the clause in verse 26 that states “and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth” (NRSV). The Hebrew term *radab* is often translated as ‘dominion’ in this passage and can refer to any managerial relationship: “a master over servants, an administrator over employees, a king over subjects, one nation over another, or a shepherd over a flock” (Harris 2018, 56). Simply put, the FMIG focuses on the unique managerial role (‘dominion’) given to human beings. As such the FMIG is about distinctive human agency and divine representation in creation. As John Walton (2012, 883) succinctly summarizes it “In the biblical view, people in the image of God embody God’s qualities and do God’s work. They are symbols of God’s presence and act on God’s behalf as God’s representatives.” This devolution of divine power and representation to human beings was not unique amidst the surrounding tribes of the Ancient Near East (ANE) at the time. However it was only royalty in the ANE that was said to image the deity whereas the distinctive advancement of the Genesis text is that it is applied to all peoples everywhere (Middleton 2005, 204). What is more there was existing precedent to link image-bearing with dominion in the ANE. ANE rulers (Egyptian and Assyrian) would place statues of themselves in the remote reaches of their territories as a way to convey their presence and power when they were physically absent (Middleton 2005, 104-108). Hebrew Bible scholar Gerhard von Rad helpfully captures all of this contextual and linguistic information in defining the FMIG:

Just as powerful earthly kings, to indicate their claim to dominion, erect an image of themselves in the provinces of their empire where they do not personally appear, so man is placed upon earth in God’s image as God’s sovereign emblem. He is really only God’s representative, summoned to maintain and enforce God’s claim to dominion over the earth. The decisive thing about man’s similarity to God, therefore, is his function in the non-human world. (Von Rad 1961, 60)

In other words, humans reflect God by their actions in creation. The imaging of God in this context signified their dominion. Hence, the decisive element of this model relative to the others is the focus on human agency. It is worth noting here that this rulership only has its authority and existence because of God’s prior authority as divine creator and pantocrator. It is because of

God's freedom to gift that power and responsibility that human beings even have this role. One might even say, as Joshua Moritz (2011) has, that human beings have been 'elected' to this role as stewards and representatives of God to creation. As such human activity in creation is always under the mandate of God and creation is clearly not something humanity has unfettered rule over.³

2. The Image of God and Evolution

Each of these models have relative strengths and weaknesses when considering developments in the evolutionary sciences and the impact this might have on the model in question. As preparation for how FMIG coheres with the EES it is important to consider not only how it has related to the evolutionary sciences prior to the coalescence of the EES, but to see its relative merits alongside the other models when considering evolution. As will become apparent, the FMIG has been a neglected model in scientifically-engaged theology and yet it bears little friction with evolutionary findings. As I will argue in section four, it even has deep resonances with NC in the EES.

Aku Visala (2014) identifies several reasons why SMIG has fallen out of favor amongst theological scholars, and those engaging with the sciences in particular, in the last century. The most relevant to this study claims that SMIG's essentialist rendering of the image of God, by locating a particular capacity or quality as the seat of the image of God, makes it vulnerable to findings from evolution. Visala (2018, 68-69) contends that evolution challenges SMIG in two related ways: by calling into question the essentialist definition of the human being as such and by disputing the relative uniqueness of human beings in sharing a unique capacity with God.⁴ For the former, it is a basic tenet of evolution that species are not fixed but gradually change over time. Human beings are not exempt from this, hence, deciphering between theologically-valourised human beings in the archaeological record from that which precedes it is very difficult when such evolutionary development is contiguous and gradual.⁵ Thus, in practice, it is difficult

³ It is important to recognise that FMIG does not valorize the kind of despoiling and despotic rulership that is mistakenly attributed to it by Lynn White (1967) in his famous article "The Historical Roots of Our Ecologic Crisis." Instead, as Peter Harrison (1999, 108) has shown the picture is much more complex in the early modern period where accounts of nature as fallen and sinful lead them to "manipulate it, to improve it, to experiment upon it, all with a view to restoring it to its original perfection." Indeed, as Harrison (1999, 108) continues "during this period of history at least, the impulses of dominion and stewardship were directed toward a common goal."

⁴ For my approach to human uniqueness/distinctiveness in relation the image of God and evolution see Burdett (2015c).

⁵ Of course rapid evolutionary change is visible in the evolutionary record causing some to talk about 'evolutionary leaps', such as might be seen with the proliferation of plants on land or the emergence of vertebrates, but even this is contiguous with previous generations so some kind of gradualism is still apparent and assumed within the very

to invoke such human uniqueness that is clearly a feature SMIG. Related, scientists are increasingly finding rudimentary instances of the kinds capacities associated with SMIG in other species. Caledonian Crows ‘reasoning abilities’ in solving complex, multi-step puzzles outstrip even some young children (Cheke, Loissel, and Clayton 2012). Lest we think language is reserved only for human beings, apes have shown some capacity for language and often surprise scientists with their abilities. In relation to self-awareness, elephants, magpies and certain apes have passed an initial assessment for self-awareness using the mirror test (Parker, Mitchell, and Boccia 1994; Prior, Schwarz, and Güntürkün 2008). And, in response to cultural exceptionality, crows, apes and elephants have all been found to have robust cultures with some capacity for social learning (Avital and Jablonka 2000; Box and Gibson 1999). Scientists have even observed elephants and primates aiding others of their species even when an individual reward is absent (Cronin 2012). So, endeavors to clearly demarcate between humans and animals ironically find that line more difficult to establish than perhaps initially suspected. Hence, SMIG is often represented as the most challenged of the models even where it’s clear there are convincing variations of SMIG on offer that can cope with these challenges (Deane-Drummond 2012; Vainio 2014; Visala 2014, 2018).

The RMIG is often represented as the savior of the doctrine today and for several reasons. It tends to align with favored movements in theology around relational ontology, social trinitarianism, contextual and practical theology and renewed interest in theological accounts of the body.⁶ For our purposes in this section, it also seems to have less pressure from evolution primarily because the model doesn’t necessarily depend on a particular capacity within the structure of human nature to image God as SMIG does. However, primatologists and other animal scientists are discovering other animals have complex social networks and robust relational capacities; more so than commonly known. From the rigid social hierarchies of ant colonies and beehives to the intricate social relations within most primate groups, not only the survival but the thriving of many species depends upon successful and robust relationships.⁷ However, two items make human beings distinct relative to this model of the image of God. First, human societies and relationships are much more complex and harmonious, when considering chimpanzees, than our nearest primate relatives. It is astounding how flexible, robust

mechanism of evolutionary change itself. For more on the debate about evolutionary rates and phyletic gradualism see Gould and Eldredge (1977) and Rhodes (1983).

⁶ For examples of such advocates see Grenz (2001, 161-177); Cortez (2010, 24-27, 144); Shults (2003, 217-242).

⁷ Robin Dunbar is famous for studying group size in primates and its relation to cognitive and social capacity. Dunbar’s number refers to how primate brain size is directly proportional to social group size. The trend extends to human beings and helps to explain why a relatively larger brain size is noted in human beings: complex relational networks. For more information see Dunbar (2010).

and orderly our social relations are; even in stressful situations with others we might never have met. Second, theologically, we are the only creatures to have a special relationship to God that is dictated by divine address. As Robert Jenson (1983) so aptly puts it, God does not just speak about us, but to us. This relation to God is manifest in intricate religious rituals, prayers and liturgies. Indeed, many scholars are finding that human beings are distinct in that they are *homo religiosus*: the religious primate with great capacity for ritual and belief (Atran 2002; Fuentes 2019; McCauley and Lawson 2002). Perhaps, then, this appearance of religious practices amongst humans is just the empirical correlate of the theological tenet that human beings enjoy a unique relationship instituted by God.⁸ We praise, worship and speak to God as a creature bound for fellowship with Him. Despite finding robust relational and even rudimentary religious elements amongst other creatures (Kühl et al. 2016; Schaefer 2015), it is clear the RMIG does well when considering the evolutionary evidence.

The dynamic view of the image of God similarly enjoys less friction and even serious consonance when considering evolution. In the first place, it agrees with the inherent plasticity of the human being that is required for conformity to Christ. As such, it is much more open to the development of the human being in history and evolutionary time. Soft accounts of human uniqueness can still be maintained for DMIG despite the claim to plasticity. One might argue it is humanity's ability to reach out beyond itself and grow that makes it distinct. What is more, it is specifically moral and spiritual transformation to Christ that makes it unique. Recent challenges to human uniqueness do not alter humanity's inherence in and conformity to Christ. Even if this transformation is separated from its Christological roots, human beings still exhibit greater moral and spiritual awareness and progress than any other creature in creation. Indeed, Helen de Cruz and Johan de Smedt (2014) have argued that the DMIG is best suited to an evolutionary account of the human being. Indeed, they assert:

Our account of the mosaic evolution of human-specific abilities resonates remarkably well with the Irenaean view of *imago Dei* and the Eastern Orthodox concept of *theosis*. As we saw, hominins over time acquired more capacities that enabled them to be in closer union with God, including the ability to share attention with him over creation, become compassionate and moral beings, and symbolically communicate with him in fellowship with other human beings. These evolutionary developments can be regarded as gifts

⁸ I am not saying other creatures are not related to God. But rather our relationship to God is special and has been divinely ordained as such. I am in agreement with Gijsbert van den Brink that this does not jeopardise God's relationship with non-human creatures nor that other creature's lose their dignity in this assertion either. We still maintain significant responsibility to non-human creation even if we also assert human beings have a unique relationship with God. See Clough (2014, 65-69); Deane-Drummond (2012, 942-945); van den Brink (2011, 327-9).

from God that enable humanity to achieve *theosis*. In particular, they allow humans to fulfill a unique mediatory role between God and the rest of creation. (De Smedt and De Cruz 2014, 150)

So, not only do contemporary scientific findings fail to substantially challenge DMIG, but it can actively accommodate the most recent evolutionary evidence.

Finally, FMIG is one of the most overlooked models of the image of God when considering the import of the evolutionary sciences. Of course specialists such as John Walton, Richard Middleton, Mark Harris and Joshua Moritz support this model in their work on the evolutionary sciences and theology, but it has not enjoyed the same level of commitment from constructive and philosophical theologians working within the field of science and religion or even outside it. And yet as Mark Harris (2018, 61) has noted “The functional view poses relatively few problems in the modern evolutionary paradigm.” For example, FMIG does well when considering purported challenges to human uniqueness. The functional model doesn’t entirely rely upon distinct capabilities as the seat of the image of God like SMIG.⁹ Thus, it maintains greater flexibility when the evolutionary sciences are increasingly finding instances of other creatures exhibit greater capabilities than initially thought. For example, other animals exhibit much more sophisticated agency and behavior than was even thought several hundred years ago. In the next section on NC and FMIG I will speak in detail about how other animals create environmental niches and manifest significant agency in their environments and actively shape it. Here it is sufficient to note that other animals are robust agents: caribou and geese migrate significant distances for better environmental conditions, chimpanzees learn from each other and craft tools to help get food and meerkats have complex social structures that require a robust level of agency in navigating their social worlds. Human uniqueness for FMIG can be said to focus on humanity’s unique agency in the world in that no other creature can be said to act in the same way as human beings: humans can reflect upon their actions, consider different courses of action and act for given reasons. What is more the impact of that agency on not only discrete localities but the entire globe is certainly unique amongst the animal kingdom—we are, after all, in the Anthropocene. I will say much more about FMIG and evolutionary mechanisms that relate to agency, the environment and the Anthropocene in due course, but it is important to

⁹ Eventhough FMIG doesn’t seem to entirely rely upon structural capabilities inherent in human nature, I am aware that the relevant biblical material suggests that human function derives, at least in part, on physical likeness to the divine, which would seem to suggest FMIG cannot completely unmoor itself from the problems SMIG faces. Both Aku Visala (2018, 66) and Mark Harris (2018, 62) indicate as much. But, certainly how such ‘physical likeness’ conditions function allows greater freedom in relation to human uniqueness than SMIG can offer because it is more indirect and not the definitive core of the model.

consider here that FMIG has not enjoyed the same level of support or even reflection in theological appropriations of evolution rather SMIG, RMIG and DMIG have enjoyed much more attention. This is unfounded given how little FMIG is challenged by evolution and, as we will come to see, even enjoys considerable consonance with it.

3. Niche Construction and the Extended Evolutionary Synthesis

Having considered definitions of the different models of the image of God and how they have reacted to evolutionary findings in the past, it is now time to define and unpack one of the central evolutionary mechanisms of the EES that is the central topic of this article, niche construction. The following section will then consider the different areas of consonance between FMIG and NC.

NC is one of the most important elements in the EES and is certainly one of the most cited mechanisms of the EES by theologians in recent years (Deane-Drummond 2018; Van Huyssteen 2018). Much like the other mechanisms in the EES, such as phenotypic plasticity, developmental bias and extra-genetic inheritance, NC focuses on mechanisms which bias the evolutionary selection space and challenges a common view that selection occurs in entirely passive ways for the organism in question. As I have stated elsewhere about how the EES is tinkering with the Standard Evolutionary Theory (SET):

It is uncontested that variation occurs in populations and is subsequently winnowed by natural selection, generating biological change over time. SET contends biological diversity is mostly explained by natural selection, defined as the confluence of random phenotypic variation, genetic inheritance, and differential reproductive success. However, some scientists (proponents of the “extended evolutionary synthesis,” or EES) are challenging the tenet that phenotypic variation is entirely random and that natural selection is entirely driven by genetic inheritance. (Burdett 2015a)

Indeed, as Laland et al. (2014, 162) contend in their famous article in *Nature* creatures are not programmed from birth to fit into a static and changeless environment but instead they “co-construct and co-evolve with their environments, in the process changing the structure of ecosystems.” Proponents of the EES give greater agency to organisms in shaping not only their future species, but even other organisms that share a common niche or environment. NC is one of the most visible mechanisms in the EES that manifests this organismal agency.

Simply put, NC describes the way in which organisms actively alter their environment to create ‘habitable niches’ for them, their descendants, others of their species and other organisms in the niche. Earthworms and beavers are two oft-cited examples. Earthworms change the biochemistry of the surrounding soil in which they dwell which makes it more advantageous for their offspring and other organisms in the soil. Beavers create vast wetlands by building dams which can help their population thrive by, for example, increasing their food supply because the wetlands bring greater plant and animal diversity and population. In this way, the beaver has also aided other organisms in the niche making it more abundant and habitable for certain plant and animal species to live were the wetland not constructed in the first place.

Laland, Matthews, and Feldman (2016, 193) provide a three-point criteria for NC that is derived from the work of Matthews et al. (2014).

1. An organism must significantly modify environmental conditions.
2. Organism-mediated environmental modifications must influence selection pressures on a recipient organism.
3. There must be an evolutionary response in at least one recipient population caused by the environmental modification.

What is important to note is that “niche construction is not simply a source of environmental change but is a driver of selection that may produce novel evolutionary outcomes” (Laland, Matthews, and Feldman 2016, 195). In other words, the directed change in environment actually changes the selection pressures and evolutionary trajectory of the species in the niche. The changes cannot be incidental or short-lived but rather must be “sufficiently substantial in scale, duration and impact to plausibly affect selection” (Laland, Matthews, and Feldman 2016, 193).

NC is sometimes conflated with the notion of the “extended phenotype” (Dawkins 1982) and they certainly share much in common. Both consider the genetic, environmental and cultural components of evolution to be integrated and important for considering the phenomena of evolution. Indeed, both connect explicitly the phenotype to its surrounding environment which can include actively shaping that very environment. But Laland, Matthews, and Feldman (2016, 193-4) give three points of diversion. First, the extended phenotype focuses on genes and their extension as the almost exclusive site of selection. What is important about the ‘extension’ is that it has genetic consequences, but NC suggests that selection pressures can change without requisite changes to underlying genes as the sole focus of selection. Indeed, extra-genetic factors can often be the source of selection (e.g. the dam for beavers). Second, NC argues that the

selection pressures do not necessarily die out with the organism and their genes, a consequence of the extended phenotype. Because the source of the selection pressures can be outside of the genes, the modification to selection exists so long as the source itself exists. For example, John Odling-Smee (1988) first introduced the notion of ‘ecological inheritance’ which describes the way in which ecologies and niches get passed from one generation to another so that not only are genes inherited and act as a cite of selection, but even one’s niche can be inherited and provide a source of selection. As an example, the beaver that originally constructs a dam passes it to its descendants who in turn benefit from the dam that can outlive the original beaver. The extended phenotype is limited in giving a sufficient account of selection that depends on ecological inheritance. Finally, Laland, Matthews, and Feldman argue that, unlike the extended phenotype, because selection needn’t occur in congruence with or because of genetic factors it is less tied to adaptive fitness being a requirement for selection. The extended phenotype requires that “the phenotype that underlies the organism-mediated modification of the environment must have a genetic basis, and be the target of the altered selection regime caused by the environmental modifications” (Laland, Matthews, and Feldman 2016, 194). NC doesn’t require such a genetic basis and “byproducts can be consequential for the constructor’s own evolution where, through niche construction, they precipitate bouts of selection in the constructor population by inducing selection on other traits, and hitchhiking to fixation on the back of this selection that they generate” (Laland, Matthews, and Feldman 2016, 194). So, while the extended phenotype and NC share a certain similarity, according to Laland, Matthews, and Feldman NC is more flexible and broad in its explanation of where selection occurs and how it is related to genetic causal factors.

Of course SET recognizes the impact of NC on evolution but Laland et al. (2014, 142) argues that it treats the environment as merely a ‘background condition’ rather than an important component that can drastically impact the evolutionary process. NC and indeed the entire EES takes into consideration the entire ecology of the system where the environment and organism live in a mutual relationship and where both are substantial players in the evolutionary process.

4. Consonance Between FMIG and Niche Construction

Now that the necessary background, definitions and context have been elucidated the FMIG and NC can be compared directly. Both FMIG and NC valorize the agency of the organism in an environmental and social ecology that contributes to the flourishing and even

transformation of the organisms in the niche. Allow me to unpack this statement and each of its elements more fully.

Agency is an important feature of organisms. Not only do organisms react to other agents or the environment as a whole in a passive way, but actively move, shape and create in mutual relations with those other agents and the niche in which they dwell. Both FMIG and NC contend that agency is an important marker of creatures—indeed we can't expect to understand or even characterize creatures without reference to activity and agency. In the specific case of human beings, that particular agency is robust and unparalleled. They exhibit some of the most impressive, self-reflective and radical agency when compared to any other creature. Set within the theological framework of FMIG, this human agency is valorized as meaningful and of ultimate significance—God doesn't do everything directly but devolves some of His power and activity to other creatures and certainly the largest mandate is to human creatures. As such, humanity is not only passive to divine action, but charged with a particular activity and work that is genuinely meaningful and binding for that which is “loosed on earth will be loosed in heaven” (Matthew 18:18, NRSV).

That work is directed towards a particular object and end. Agency in light of FMIG and NC isn't just about movement within an environmental niche. Certainly creatures of all types exhibit freedom in relation to their environment and other creatures in that they can move out of or into another environment or niche. Packs of predators will travel great lengths across a vast array of environmental conditions to hunt their prey, migratory birds will fly considerable distances for better climate and food sources depending on the season and humans will abandon cities and other niches when political, economic and environmental conditions make the location less habitable. This is certainly impressive agency—not least given the exposure, risk and uncertainty of leaving one niche in the hope of finding a better one. But, the kind of agency associated with FMIG and NC is about the directed shaping of a particular niche one presently inhabits. It is agency directed towards the niche so that one need not leave it and face the uncertainty and risk associated with leaving it. It is a mutual activity whereby the initial agency on the environment reverberates back on the acting creature (and others within it), making it more habitable and, hence, the niche acts on the creatures and directs and shapes the evolutionary trajectory of the creature and its offspring. What is more, this human agency on the environment has a divine mandate. The human being acts on the environment because (s)he acts as God's proxy and reflects the divine image within God's creation. That human agency arises out of a calling, an election or even a vocation to act on behalf of God for the sake of creation's providential development. Hence, NC activity within the framework of FMIG unites the

common faculty of human agency upon an environment, which is in continuity with other creatures that construct niches, with the divine calling of representative action in God's creation.

This divinely given human agency in the environment is providential and transformative in that God tasks human beings to do the work of shaping and transforming His creation for the explicit purpose of bringing about the flourishing of that creation. The end of creation, the very *telos* is the transformation of it to be bountiful, exceptional and harmonious. In the first instance, NC agency contributes to the productive transformation of similar organisms. So other worms will benefit from activity of other worms in the soil. What is more, the descendants of the acting organism will also benefit so long as the niche remains and will be shaped phenotypically by the selection pressure afforded by the niche. When considering NC human agency in light of FMIG and the impact this has on other humans, we are talking about right rule of other human beings because God is a just ruler. That rule is aimed at the flourishing of other human beings who are ruled. It is about their transformation and development in the economy of creation. The environment/niche is not at the complete disposal of human beings to act upon anyway it chooses because human beings are responsible to God for how the niche gets developed for the purpose of aiding others. We might even say something similar theologically in that God, the ultimate actor on creation, makes our living more habitable as inheritors of a creation that has been ordered to the flourishing of all that is in it. And those rulers that make their dominion more habitable for others leads to changes in subsequent generations who enjoy ongoing social and political flourishing. For example, a ruler that develops policies that maintains stability and security, helps to generate abundant resources, supports the free movement of people and greater equality amidst various socioeconomic measures will undoubtedly help to make happier citizens. What is more these measures will be felt by subsequent generations because of the inertia developed by the store of resources that gets passed down to subsequent generations and due to the inertia of social, cultural and political forces—not to mention possible epigenetic benefits (Ahmed 2010). So NC human agency within the FMIG framework impacts not only present human beings within our societies and communities but those that will be in those societies and communities in the future.

That NC agency also contributes to productive transformation of the acting organism itself. As an organism in that niche, of course they will benefit from the productive transformation of it. For the organism flourishes in a niche that they've created to be more habitable. Birds that build nests are better protected from the elements and can flourish in a way they couldn't without it. Bears that construct dens to hibernate can flourish in a way they wouldn't be able to without them. When considering NC within the frame of FMIG, clearly

acting well and as a proxy for God, ie as God would act, contributes to the development of the human being who acts well. A judge who judges well, will themselves be shaped by the activity of judging: knowing what evidence to weigh and applying it in the right context, developing prudence and other associated virtues. What is more, those judges that act well then benefit from a well-functioning judiciary system. Our actions shape who we are so acting Godly likely means we are shaped in Godly ways and thus contributes to a more Godly environment, too.

But this NC agency also contributes to the productive transformation of unsimilar organisms when compared to the acting organism in the niche. Beavers constructing dams which leads to wetlands not only benefits the beaver population to thrive, it also positively impacts other wildlife such frogs, fish and birds that might feed on the influx of wildlife to the new wetland. When this human NC agency is set within the FMIG framework, it means that environmental transformation should never aim at just our own organismal flourishing, but needs to encompass all of creation—everything within the niches we construct. This is certainly part of that FMIG mandate given by God and has deep resonances with contemporary eco-theological arguments that human beings need to consider more deeply the way their actions impact the rest of creation. What is so arresting about this claim is that it radicalizes those eco-theological claims since the FMIG localizes this divine representative activity in creation as being definitive of not only divine image bearing, but one of if not the most important markers of being a human creature. I will return in the last section to consider this more fully, particularly our apparent failures to promote the flourishing of other creatures.

Finally, it is worth reflecting more fully on human beings as the ultimate niche constructors relative to other organisms and the consonance this has with human distinctiveness inherent in FMIG. As I have been arguing throughout, the NC capacity of human beings is shared with other organisms even when it is clear that some organisms exhibit greater NC agency than others. Termites that create mounds and beavers that construct dams are sophisticated NC activities that require complex and sustained behavior that leads to significant transformation of local environments. Perhaps less sophisticated but certainly more global NC activity can be seen in the “Great Oxygenation Event” that occurred over 2 billion years ago when cyanobacteria (blue-green algae) released extensive amounts of oxygen into the atmosphere because of photosynthesis and completely transformed life on earth in the process (Tomlinson 2018, 35-37).¹⁰ These examples highlight the shear sophistication and scale of NC in other

¹⁰ This transformation of the globe into a new niche was disastrous for those anaerobic protists that became virtually extinct. But it also meant new life developed within the new niche itself. Certainly, niche’s need not be productive for all organisms.

organisms certainly. However, human NC agency is both exceedingly sophisticated in the complexity of environmental alterations and in its global scope. Consider the complexity of the largest cities on our planet. These cities provide clean, running water, remove our waste, supply an abundance of food that is shipped in from all over the world, provides spaces for working and living where we can adjust the temperature to our exact specifications and are protected from the elements. Our cities manifest just how radically we can transform our environment and create niches for ourselves. What is more, the trend to increasing urbanization since the industrial revolution around the world speaks of the global nature of that NC as well. After all, even geologists and ecological experts are referring to our age as the Anthropocene (Crutzen and Stoermer 2012) which manifests directly the impact human beings are making to almost every ecosystem and environment on earth today. No other organism seems to have had such directed, significant and global impact on creating niches on the earth as human beings.

Human distinctiveness has long been associated with the image of God and FMIG is no exception. As I have stated elsewhere the FMIG roots human distinctiveness in that humanity “has been tasked with ruling over, caring for and shepherding the rest of creation. For the functional model, it is humanity’s special task as ‘vice-regent’, and in representing God that makes it unique amidst the rest of creation. In other words, one could say that it is humanity’s agency in the world that is distinctive” (Burdett 2015c, 5). As such there is great consonance between human NC agency as distinctive amidst other creatures and this divine mandate that calls humanity to a special work in creation. Indeed, no other creature exhibits self-directed and self-aware actions like human beings and, as I’ve argued here, all other organismal NC is either entirely local and limited or less sophisticated in its construction of niches. The task of cultivation bestowed upon human beings is distinct because it is a divinely imparted mandate to create niches of flourishing which includes all of creation.

5. Conclusion: Theological and Ethical Implications

I’ve argued here that the FMIG has often been overlooked in science-engaged theology and that this is unwarranted. First, because it most closely follows the Genesis text out of which the very concept of the image of God arises. Second, it maintains relatively low friction when engaging with the evolutionary sciences and, third, because it has serious resonance with one particular mechanism in the EES: niche construction. As I argued in the last section, both FMIG and NC valorize the agency of the organism in an environmental and social ecology that contributes to the flourishing and even transformation of the organisms in the niche. I suggested

that human agency directed at NC can be set within a theological framework wherein the behavior of constructing niches is given a divine calling or mandate with the advent of the image of God. This divine task is to create niches of flourishing for all of creation so that God's purposes in creation are brought to fulfilment.

This account of the image of God has implications for the doctrine of providence. John Webster (2012, 203) helpfully defines divine providence this way:

The Christian doctrine of providence concerns God's continuing relation to the world he has created. In his work of providence, God acts upon, with, and in each particular creature and created reality as a whole. As God so acts, God preserves created reality and being, maintains its order, and directs it to the end that he has established for it. God's providence enacts his enduring love for that which he has made and shows him to be a faithful Creator.

FMIG is about God devolving some of His power to humanity with the aim of productive transformation of His creation. Humanity images God by acting on behalf of God, acting like God and by ordering and directing creation to its final end. Hence, at least some of God's providential activity must be seen in relation to human providential activity that is rooted in divine image bearing. Traditionally this has been referred to as primary and secondary causation whereby human actors in creation act on behalf of God and only because God has created them with the faculty to act. As John Webster (2012, 220-221) states:

God is the first cause of all things, and only by virtue of his acts of bringing all things to be and ceaselessly maintaining all things can the creature act at all. But the fact that God produces, guides, and maintains creaturely actions does not mean that the creature is entirely passive, and God the only agent, for omnicausality is not sole causality. It simply means that the creature is a particular kind of cause—a “secondary” or “caused” cause, a cause that mediates God's causality but is no less really active for being caused. . .

Providence directs the creature from within, supplying and directing the inner movement by which it lives its life at the hands of the Creator.

Hence, NC activity/causation of all kinds is secondary causation and providential for the way it guides organisms within niches towards a particular developmental end.¹¹ Human providential

¹¹ For further discussion of the adequacy of primary and secondary causation in relation to the sciences see Dodds (2012); Silva (2014).

activity that is based on the FMIG extends, radicalizes and universalizes this NC secondary causation found in other creatures and is given a divine mandate and responsibility.

Providence isn't the only doctrine of relevance here for eschatology is also impacted by this account of the FMIG and NC. How so? NC isn't just about the flourishing of the creature within a niche, but it's about creaturely transformation by the pressures afforded by the niche. This invites the question: what kinds of creatures are we becoming because of the environments we create that impact our very morphology and transformation? Set within the FMIG, this providential activity on niches has ultimate ends as it's scope. This isn't just proximate transformation or flourishing, but the real goals, purposes and ends of creation as a whole and every creature within it. As such, our NC activities have eschatological value. Any eschatology which maintains some continuity between present creation and the eschaton must consider how these niches are contributing to or frustrating that final, glorious kingdom of God. Indeed are we contributing to the very glory of consummated creatures by creating niches today?¹²

But perhaps this has too sanguine a tone when we consider the actual niches we construct today. I suggested in the last section that humans are distinct in their NC abilities and that this radical and global ability to create niches comes with a deep responsibility for its clear we are transforming the globe today. However, we aren't necessarily doing so for the betterment of all organisms in our care. Our niches on the whole benefit only a small section of our human population and even less other non-human creatures in those niches. Air and sea pollution, global warming, the deterioration of species diversity, mass extinction, deforestation on an unprecedented level: these are just a few of the symptoms of our NC abilities and some of the central reasons experts are calling this the Anthropocene. This term, on the whole, is negative and signals that we are failing at this divine calling. It is a failure of the very thing that, for FMIG, means we image God. It is a failure at the very core of being distinctively human—indeed one of the things that makes us human! It isn't just an incidental, venial failure, it is a failure of who we are.

And yet this is precisely where considering the final doctrine might help: Christology. I've been fully aware that FMIG derives mostly from texts in Genesis and the Hebrew Bible but that, at least for the Christian, this is not the final say on the image of God. For we find in the New Testament that the image of God gets applied most directly and fully to Christ. So much that to speak of the image of God after Christ means to speak of Christ as the very image of God for He is the Son of God. We then image God so long as we follow after and are in Christ.

¹² See my related work in Burdett (2015b).

Therefore, our failure to govern well and create niches of flourishing today need to be situated within Christ as the one who not only redeems humanity from sin and failure — even, especially of this kind — but to recognize that Christ is the very Logos, the preexistent Son, out of which creation itself has been issued and continues to be upheld. As Athanasius (2011, 33) has said:

What - or rather Who was it that was needed for such grace and such recall as we required? Who, save the Word of God Himself, Who also in the beginning had made all things out of nothing? His part it was, and His alone, both to bring again the corruptible to incorruption and to maintain for the Father His consistency of character with all. For He alone, being Word of the Father and above all, was in consequence both able to recreate all, and worthy to suffer on behalf of all and to be an ambassador for all with the Father. For this purpose, then, the incorporeal and incorruptible and immaterial Word of God entered our world.

Christ, the incarnate Logos, is ordering and bringing to completion all that is. The world is His to create, govern and rule well. The kingdom of God He has established is the true and ultimate NC. As such, we do not fail as image bearers but not because of our own abilities or individual imaging but because Christ simultaneously redeems us from our failure to image and act on God's behalf and images for us what we could not by providentially ordering and bringing to completion that creation which has always been His in the first place.

References

- Ahmed, Farooq. 2010. "Epigenetics: Tales of Adversity." *Nature* 468 (7327):S20-S20. doi: 10.1038/468S20a.
- Athanasius. 2011. *On the Incarnation*. Yonkers: St Vladimir's Seminary Press.
- Atran, Scott. 2002. *In Gods We Trust: The Evolutionary Landscape of Religion*. New York: Oxford University Press.
- Avital, Eytan, and Eva Jablonka. 2000. *Animal Traditions Behavioural Inheritance in Evolution*. Cambridge: Cambridge University Press.
- Box, Hilary O., and Kathleen Rita Gibson, eds. 1999. *Mammalian Social Learning: Comparative and Ecological Perspectives*. Cambridge: Cambridge University Press.
- Burdett, Michael. 2015a. "The Changing Face of Evolutionary Theory?". <https://biologos.org/articles/the-changing-face-of-evolutionary-theory>.
- Burdett, Michael. 2015b. *Eschatology and the Technological Future*. London: Routledge.
- Burdett, Michael. 2015c. "The Image of God and Human Uniqueness: Challenges from the Biological and Information Sciences." *The Expository Times* 127 (1):3-10. doi: <https://doi.org/10.1177/0014524615598675>.
- Burdett, Michael. 2018. "The Image of God and Evolution." In *Finding Ourselves after Darwin: Conversations on the Image of God, Original Sin, and the Problem of Evil*, edited by Stanley P. Rosenberg, Michael Burdett, Benno van den Toren and Michael Lloyd. Grand Rapids, MI: Baker Academic.
- Calvin, John. 2017. *Institutes of the Christian Religion*. Translated by Henry Beveridge. Peabody, Mas.: Hendrickson Publishers.
- Cheke, Lucy G., Elsa Loissel, and Nicola S. Clayton. 2012. "How Do Children Solve Aesop's Fable?" *PLOS ONE* 7 (7):e40574. doi: 10.1371/journal.pone.0040574.
- Clough, David. 2014. *On Animals Volume I: Systematic Theology*. London: T & T Clark.
- Cortez, Marc. 2010. *Theological Anthropology: A Guide for the Perplexed*. London: T&T Clark.
- Cronin, K. A. 2012. "Prosocial Behaviour in Animals: The Influence of Social Relationships, Communication and Rewards." *Animal Behaviour* 84 (5):1085-1093.
- Crutzen, Paul J., and Eugene F. Stoermer. 2012. "The "Anthropocene"." In *The Global Warming Reader: A Century of Writing About Climate Change*, edited by Bill McKibben, 69-74. New York,: Penguin Books.
- Dawkins, Richard. 1982. *The Extended Phenotype: The Long Reach of the Gene*. Oxford: Oxford University Press.
- De Smedt, Johan, and Helen De Cruz. 2014. "The Imago Dei as a Work in Progress: A Perspective from Paleoanthropology." *Zygon* 49 (1):135-156.
- Deane-Drummond, Celia. 2012. "God's Image and Likeness in Humans and Other Animals: Performative Soul-Making and Graced Nature." *Zygon* 47 (4):934-948. doi: 10.1111/j.1467-9744.2012.01308.x.
- Deane-Drummond, Celia. 2018. "Evolution: A Theology of Niche Construction for the Twenty-First Century." In *Theology and Ecology across the Disciplines : On Care for Our Common Home*, edited by Celia Deane-Drummond and Rebecca Artinian-Kaiser, 241-256. London: T&T Clark.
- Dodds, Michael J. 2012. *Unlocking Divine Action: Contemporary Science & Thomas Aquinas*. Washington, D.C.: Catholic Univ. of America Press.
- Dunbar, Robin. 2010. *How Many Friends Does One Person Need?: Dunbar's Number and Other Evolutionary Quirks*. Cambridge: Harvard University Press.
- Fuentes, Agustin. 2019. *Why We Believe: Evolution and the Human Way of Being*. New Haven, CT: Yale University Press.
- Gould, Stephen Jay, and Niles Eldredge. 1977. "Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered." *Paleobiology* 3 (2):115-151.

- Grenz, Stanley. 2001. *The Social God and the Relational Self: A Trinitarian Theology of the Imago Dei*. Louisville: Westminster John Knox Press.
- Harris, Mark. 2018. "The Biblical Text and a Functional Account of the Imago Dei." In *Finding Ourselves after Darwin: Conversations on the Image of God, Original Sin, and the Problem of Evil*, edited by Stanley P. Rosenberg, Michael Burdett, Benno van den Toren and Michael Lloyd. Grand Rapids, MI: Baker Academic.
- Harrison, Peter. 1999. "Subduing the Earth: Genesis 1, Early Modern Science, and the Exploitation of Nature." *The Journal of Religion* 79 (1):86-109.
- Jenson, Robert W. 1983. "The Praying Animal." *Zygon* 18 (3):311-325. doi: 10.1111/j.1467-9744.1983.tb00517.x.
- Kühl, Hjalmar S., Ammie K. Kalan, Mimi Arandjelovic, Floris Aubert, Lucy D'Auvergne, Annemarie Goedmakers, Sorrel Jones, Laura Kehoe, Sebastien Regnaut, Alexander Tickle, Els Ton, Joost van Schijndel, Ekwoge E. Abwe, Samuel Angedakin, Anthony Agbor, Emmanuel Ayuk Ayimisin, Emma Bailey, Mattia Bessone, Matthieu Bonnet, Gregory Brazolla, Valentine Ebua Buh, Rebecca Chancellor, Chloe Cipoletta, Heather Cohen, Katherine Corogenes, Charlotte Coupland, Bryan Curran, Tobias Deschner, Karsten Dierks, Paula Dieguez, Emmanuel Dilambaka, Orume Diotoh, Dervla Dowd, Andrew Dunn, Henk Eshuis, Rumen Fernandez, Yisa Ginath, John Hart, Daniela Hedwig, Martijn Ter Heegde, Thurston Cleveland Hicks, Inaoyom Imong, Kathryn J. Jeffery, Jessica Junker, Parag Kadam, Mohamed Kambi, Ivonne Kienast, Deo Kujirakwinja, Kevin Langergraber, Vincent Lapeyre, Juan Lapuente, Kevin Lee, Vera Leinert, Amelia Meier, Giovanna Maretti, Sergio Marrocoli, Tanyi Julius Mbi, Vianet Mihindou, Yasmin Moebius, David Morgan, Bethan Morgan, Felix Mulindahabi, Mizuki Murai, Protais Niyigabae, Emma Normand, Nicolas Ntare, Lucy Jayne Ormsby, Alex Piel, Jill Pruetz, Aaron Rundus, Crickette Sanz, Volker Sommer, Fiona Stewart, Nikki Tagg, Hilde Vanleeuwe, Virginie Vergnes, Jacob Willie, Roman M. Wittig, Klaus Zuberbuehler, and Christophe Boesch. 2016. "Chimpanzee Accumulative Stone Throwing." *Scientific Reports* 6 (1):22219. doi: 10.1038/srep22219.
- Laland, K., T. Uller, M. Feldman, K. Sterelny, G. B. Müller, A. Moczek, E. Jablonka, J. Odling-Smee, G. A. Wray, H. E. Hoekstra, D. J. Futuyma, R. E. Lenski, T. F. Mackay, D. Schluter, and J. E. Strassmann. 2014. "Does Evolutionary Theory Need a Rethink?" *Nature* 514 (7521):161-4.
- Laland, Kevin, Blake Matthews, and Marcus W. Feldman. 2016. "An Introduction to Niche Construction Theory." *Evolutionary Ecology* 30:191-202. doi: 10.1007/s10682-016-9821-z.
- Luther, Martin. 1958. *Lectures on Genesis*. Vol. 1. Saint Louis: Concordia.
- Matthews, Blake, Luc De Meester, Clive G. Jones, Bas W. Ibelings, Tjeerd J. Bouma, Visa Nuutinen, Johan van de Koppel, and John Odling-Smee. 2014. "Under Niche Construction: An Operational Bridge between Ecology, Evolution, and Ecosystem Science." *Ecological Monographs* 84 (2):245-263.
- McCaughey, Robert N., and E. Thomas Lawson. 2002. *Bringing Ritual to Mind: Psychological Foundations of Cultural Forms*. Cambridge, UK: Cambridge University Press.
- Middleton, J. Richard. 2005. *The Liberating Image: The Imago Dei in Genesis 1*. Grand Rapids: Brazos Press.
- Moritz, Joshua M. 2011. "Evolution, the End of Human Uniqueness, and the Election of the Imago Dei." *Theology and Science* 9 (3):307-339.
- Odling-Smee, John. 1988. "Niche-Constructing Phenotypes." In *The Role of Behavior in Evolution*, edited by Henry C. Plotkin, 73-132. Cambridge, MA, US: The MIT Press.
- Parker, Sue Taylor, Robert W. Mitchell, and Maria Boccia, eds. 1994. *Self-Awareness in Animals and Humans: Developmental Perspectives*. Cambridge: Cambridge University Press.
- Prior, H., A. Schwarz, and O. Güntürkün. 2008. "Mirror-Induced Behavior in the Magpie (*Pica pica*): Evidence of Self-Recognition." *PLoS Biology* 6 (8).

- Ramsey, Paul. 1993. *Basic Christian Ethics*. Louisville: Westminster John Knox Press.
- Rhodes, Frank H. T. 1983. "Gradualism, Punctuated Equilibrium and the Origin of Species." *Nature* 305 (5932):269-272. doi: 10.1038/305269a0.
- Schaefer, Donovan O. 2015. *Religious Affects: Animality, Evolution, and Power*.
- Shults, F. LeRon. 2003. *Reforming Theological Anthropology: After the Philosophical Turn to Relationality*. Grand Rapids: Eerdmans.
- Silva, Ignacio. 2014. "Revisiting Aquinas on Providence and Rising to the Challenge of Divine Action in Nature." *The Journal of Religion* 94 (3):277-291. doi: 10.1086/676024.
- Tomlinson, Gary. 2018. *Culture and the Course of Human Evolution*. Chicago: University of Chicago Press.
- Vainio, Olli-Pekka. 2014. "Imago Dei and Human Rationality." *Zygon* 49 (1):121-134.
- van den Brink, Gijsbert. 2011. "Are We Still Special? Evolution and Human Dignity." *Neue Zeitschrift für Systematische Theologie und Religionsphilosophie* 53 (3):318-332.
- Van Huyssteen, J. Wentzel. 2006. *Alone in the World?: Human Uniqueness in Science and Theology*. Grand Rapids: Eerdmans.
- Van Huyssteen, J. Wentzel. 2018. "Questions, Challenges, and Concerns for the Image of God." In *Finding Ourselves after Darwin: Conversations on the Image of God, Original Sin, and the Problem of Evil*, edited by Stanley P. Rosenberg, Michael Burdett, Benno van den Toren and Michael Lloyd. Grand Rapids, MI: Baker Academic.
- Visala, Aku. 2014. "Imago Dei, Dualism, and Evolution: A Philosophical Defense of the Structural Image of God." *Zygon* 49 (1):101-120.
- Visala, Aku. 2018. "Will the Structural Theory of the Image of God Survive Evolution?" In *Finding Ourselves after Darwin: Conversations on the Image of God, Original Sin, and the Problem of Evil*, edited by Stanley P. Rosenberg, Michael Burdett, Benno van den Toren and Michael Lloyd. Grand Rapids, MI: Baker Academic.
- Von Rad, Gerhard. 1961. *Genesis*. London: SCM.
- Walton, John H. 2012. "Human Origins and the Bible." *Zygon* 47 (4):875-889. doi: 10.1111/j.1467-9744.2012.01301.x.
- Webster, J. B. 2012. "Providence." In *Mapping Modern Theology: A Thematic and Historical Introduction*, edited by Kelly M. Kapic and Bruce L. McCormack. Grand Rapids, MI: Baker Academic.
- White, Lynn. 1967. "The Historical Roots of Our Ecologic Crisis." *Science* 155 (3767):1203-1207.