

What Is Specific about Humans?

with Paolo D'Ambrosio, "A Heuristic Science-Based Naturalism as a Partner for Theological Reflections on the Natural World"; Lluís Oviedo, "Religion as a Language: Exploring Alternative Paths in Conversation with Postreductionist Anthropologies"; and Ivan Colagè, "The Human Being Shaping and Transcending Itself: Written Language, Brain, and Culture."

THE HUMAN BEING SHAPING AND TRANSCENDING ITSELF: WRITTEN LANGUAGE, BRAIN, AND CULTURE

by Ivan Colagè

Abstract. Recent theological anthropology emphasizes a dynamic and integral understanding of the human being, which is also related to Karl Rahner's idea of active self-transcendence and to the *imago Dei* doctrine. The recent neuroscientific discovery of the "visual word form area" for reading, regarded in light of the concept of cultural neural reuse, will produce fresh implications for the interrelation of brain biology and human culture. The theological and neuroscientific parts are shown in their mutual connections thus articulating the notion that human beings shape and transcend themselves *both* at the biological and at the cultural level. This will have relevant implications for the timely topic of human uniqueness in science and theology, and in proposing a new research perspective in which theology may consider culture along with its biological import, but not necessarily in strictly evolutionary terms alone.

Keywords: active self-transcendence; brain and culture; cultural neural re-use; *imago Dei*; Karl Rahner; theological anthropology; visual word form area; written language

He may quite legitimately feel proud of being that creature who plans himself and of being the place (called "spirit" or "freedom") where the great world-machine not only runs its course in exalted clarity but also begins to steer itself. (Rahner 1966a, 140)

The anthropological question has been central to philosophical investigation since the very beginning of philosophy. From Socrates and Plato to modern times *Essays* or *Enquiries* by philosophers such as, for

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example, David Hume, John Locke, and Gottfried Leibniz, philosophy has reflected on human constituting aspects like perception, knowledge, conceptual thinking, language, sociality, politics, virtues, morality, freedom, and will. Christian theology, on its side, has always focused on the anthropological dimension in its investigations about God and God's Revelation. This is generally due to the fact that God's Revelation is addressed to humanity. More specifically, for Christianity Jesus Christ is "perfect God; perfect man" (as the fourth-century *Athanasian Creed* recites at line 32), and Incarnation is the assumption of human nature by God. Moreover, in the last century, Christian theology has experienced what is often referred to as an "anthropological turn": the study of the human being is regarded as a key for furthering the theological discourse. One of the most authoritative representatives of this turn is Karl Rahner, who stressed how God's Revelation is, in its apex, the manifestation of God in human form (Rahner 1974, 1:282). Therefore, the human being is central to theological investigations because God's Revelation is especially addressed to humanity and because a deeper understanding of the human being is perceived as a way to further theological enquiries. Philosophy and theology have regarded the human being not only as a specific object of enquiry, but also as something having *special* and *distinctive* characters.

The advent and development of modern science significantly affected the ways of looking at the human being. Discoveries in astronomy and physics triggered the birth of modern science. The developments from Nicolaus Copernicus to Isaac Newton's gravitational theory did not concern the scientific enquiry into the human being. Nonetheless, these developments started the quarrels between science and theology—epitomized by the so-called Galileo Affair (cf., e.g., McMullin 2005) centered on the implications of "the new astronomy" for the position and role of the human being in the universe.

Less than two centuries after the completion of the "Copernican revolution," Charles Darwin ushered in the era of modern evolutionary biology. The development of biology in the century following Darwin's path-breaking insights posed the human being as a central subject of scientific research. By the end of the nineteenth century, neurology and experimental psychology added further scientific approaches to the human being. Biology, neurology, and psychology converged to give rise, in the late 1970s, to the so-called cognitive neuroscience (Gazzaniga, Ivry, and Mangun 2002, 1–21).

These scientific developments uncovered many *similarities* between the human being and other life forms on Earth. The processes governing the evolution of life are virtually the same for all biological species; the genetic information is stored in the same kind of molecule in almost every life form; the human genome is more than 98% identical to that of chimpanzees. Neurons function essentially the same way in all creatures endowed with a

nervous system; basic mechanisms such as neural learning are common to higher mammals, reptiles, and even un-brained species such as sea mollusks; neurotransmitters and related receptors display significant inter-specific similarities at the molecular level. Perception, motor control, attention and memory have common features throughout the animal kingdom. These similarities challenge the philosophical and theological emphasis on the distinctiveness of humanity, and cause additional tension between science and theology.

It is not surprising that scientific research emphasizes commonalities, not exceptions and peculiarities, in several portions of reality; that follows from science tending toward universality and generalization. Science, however, is also self-corrective and founded on a methodology capable of revealing—sooner or later—mistakes, wrong conclusions, and groundless generalizations. Indeed, the last few decades of interdisciplinary scientific research into the human being show many efforts to grasp the “uniqueness” of our species (e.g., Deacon 1997, 2012; Lieberman 2013; Suddendorf 2013; Bickerton 2014; Tomasello 2014). Such developments represent an opportunity for anthropological research in “science and theology” (or “science and religion” more generally) and for overcoming the quarrels between the sciences and the humanities (see also Oviedo and Colagè 2015).

In this essay, I will address the issue of human uniqueness from a specific viewpoint, and I will argue that human beings, and humanity as a whole, are unique because of the capability of “shaping and transcending themselves.” This means that human beings have an active and concrete role in forging their own constitution and in overcoming their limitations as they attempt to better their overall condition. My main argument is covered in the section titled “The Human Being Shaping and Transcending Itself,” where I will show that this capability (1) is actually distinctive of humanity, (2) is intentionally and consciously pursued by humanity in its history and cultural development, and (3) dynamically affects the human being at cognitive (mental/spiritual/cultural) *and* anatomical (physical/material/biological) levels. A key point is that my conclusion seems to be coherent with the theological understanding of the human being *and* with recent neuroscientific findings. Indeed, the task of the two sections following this introduction is precisely to outline some of the theological and scientific details involved in my argument. In particular, the next section shows that Christian theology understands the human being as a dynamic creature in which the material and the spiritual dimensions are strictly intertwined. The following section will cover key aspects of the neuroscience of reading and literacy, which are then understood as crucial for human beings’ shaping and transcending themselves.

The reader may consider skipping the next two sections at first, and come back to them after looking at the main argument presented in the

section titled “The Human Being Shaping and Transcending Itself.” The theological and the neuroscientific details will however put flesh on the argument and will let the reader appreciate the concreteness of the perspective undertaken in this paper. Indeed, the methodology beneath the argument aims at showing that *specific* consequences of the theological understanding of the human being as a dynamic creature may find a counterpart in the implications of *detailed* recent findings in scientific anthropology. Such a methodology will be briefly discussed in the “Methodological Conclusion,” which will clarify that the approach developed in this work, focused on writing and literacy, may be generalized to other essential features of humanity as addressed by both theological investigations and scientific research.

THEOLOGICAL ANTHROPOLOGY: A DYNAMIC AND INTEGRAL PERSPECTIVE

Karl Rahner’s (1966a) essay on “Christianity and the ‘New Man’” offers a dynamic and future-oriented understanding of the human being as a creature who overcomes him/herself “for a new and quite different future” (135). The author states that “the spirit of the approaching future is not at all as unchristian as the pessimists and the timid often think. Christianity has always been the religion of an infinite future” (153). The dynamicity of the human being is addressed in a genuinely transcendent stance (cf. Rahner 1966a, 135 and 146–47). It is God’s Revelation and message that give us “the boldness to believe” in an infinite future achievement to be considered as God’s “gratuitous gift of pure grace” to the human being (148). However, the transcendent perspective does not overshadow the immanent and “intra-mundane” reality of human dynamicity. Indeed, Rahner stresses that the belief in God’s transcendent future cannot prevent human beings from cooperating in God’s plan and from taking “an *active* part in working for the progress of the human race” by developing their “*immanent* powers” (149, italics added). When speaking of culture and technology, the author notes that “the man of today . . . is someone who applies his technical, planning power of transformation even to himself” (137).

Besides the specific theological interest of the acknowledgment of real, future-oriented dynamicity in Christian theology, Rahner’s claims have a wider scope. They quite generally emphasize the *active* role of the human being towards its own *cultural and spiritual constitution*; an active role that, as we will see, implies and requires intentional and conscious efforts by the members of our species and is not something just passively received or fortuitously happened.

In another essay, Rahner (1966b) linked human dynamicity (understood in terms of “becoming”) with the issue of *self-transcendence*:

If there is any “becoming” at all (and this is not merely a fact of experience but a basic axiom of theology itself, since man’s freedom, responsibility and perfecting by his own responsible activity would otherwise have no meaning at all), then “becoming” in its true form . . . must be conceived as something “becoming *more*” . . . This means, however, that . . . “becoming” must be understood as a real self-transcendence, a surpassing of self or active filling up of the empty. . . . self-transcendence cannot be thought of in any other way than as an event which takes place by the power of the absolute fullness of being. On the one hand, this absolute fullness of being must be thought of as something so *interior* to the finite being moving towards its fulfilment that the finite being is empowered by it to achieve a really *active self*-transcendence and does not merely receive this reality passively as something effected by God. On the other hand, this power of self-transcendence must at the same time be thought of as so distinct from finite, acting being that it is *not* permissible to conceive it as a constitutive principle of the *essence* of this finite being achieving itself. For otherwise, if the absoluteness of being . . . were to constitute the nature of the finite acting being, then this being would no longer be capable of any real becoming in time and history. (Rahner 1966b, 164–65)

Even in this case, Rahner maintains a fertile tension between the planes of the finite and the infinite and emphasizes active self-transcendence as “something so *interior*” to the finite being to ensure real becoming “*in time and history*.” Therefore, even if dynamicity, real becoming, and a human being’s “perfecting by its own responsible activity” find their ultimate grounds in God, they also maintain a concrete “thickness” in the finite, mundane domain. Rahner’s notion of active self-transcendence has far-reaching implications beyond Christian “technical” theological discourse. Active self-transcendence points to a dynamicity at the level of the fundamental constitution of the human being, and to the concrete possibility for women and men to be the makers of their own identity, possessing the ability to improve their own lives. Moreover, active self-transcendence is afforded “in time and history” and therefore not “from scratch” or as a consequence of uncontrollable happenings but as the result of continuous and communal efforts in pursuing self-imposed goals.

The dynamic conception of the human being can also be drawn from a core topic in theological anthropology: the doctrine of the *imago Dei*. According to this doctrine, whose scriptural root is in *Genesis* 1:26–27, the human being has been created in the image and likeness of God. The so-called functional interpretation of this doctrine stresses that being God’s image means receiving from God the mission of stewarding and presiding over the world (cf. Ladaria 2011, 147). Elaborating on Wolfhart Pannenberg’s and F. LeRon Shults’ insights, Wentzel van Huyssteen notices that the functional interpretation of the *imago Dei* alludes to the more general theological topic of the “call and task” of humanity in the universe (van Huyssteen 2006, 141) and addresses what we are *dynamically* called to do more than what we *statically* are (van Huyssteen 2006, 134–5; cf.

also Shults 2003, 231–3). The elaborations of early Christian authors acknowledged the dynamic character of humanity and argued for the distinction between the *image*, which is meant as directly stemming from Creation in rather *static* terms, and the *likeness*, which points to the need for the human beings to *dynamically* progress and perfect themselves in reference to the divine model. Being created in the image and likeness of God, the human being is called to an ever greater conformation to Christ (cf. Ladaria 2011, 154).

These insights from the Bible and early Christian theology are at the basis of Rahner's notion of active self-transcendence. The dynamicity of the human being plays a relevant role also in the investigations of other great theologians of the twentieth century: Paul Tillich, Wolfhart Pannenberg, and Jürgen Moltmann, for example. All these theologians, in spite of the often significant differences in their approaches, value the dynamicity of the human being without overlooking its actual relevance for the immanent, mundane and historical path of humanity. One might even say that the twentieth-century anthropological turn in theology finds a key and characterizing feature in this standpoint.

The doctrine of the *imago Dei* has a further implication for what I will address in the following paragraphs. It suggests an integral and unitary understanding of the human being in its various dimensions, with specific reference to the bodily one. Contemporary theological anthropology acknowledges that both the Old and the New Testament give us a genuinely integral view of the human being. According to Luis F. Ladaria, in the Old Testament “we will find just a few traces of the conception, habitual for us, of the human being as composed of soul and body” (2011, 112). Giorgio Bonaccorso notices that the radical contraposition between “the corporeal and the incorporeal” is absent in the New Testament (2006, 20).

The early Christian authors, in close reference to the book of *Genesis* (both 1:26–28 and 2:7) and the Pauline letters, further stressed the theological and eschatological centrality of the human *body* and connected this topic with the doctrine of *imago Dei*. For St. Justin Martyr (ca. 100–165 AD) “the Spirit can come only in the human body because it has been modelled in the image of Jesus” (Ladaria 2011, 125). Tertullian (ca. 160–225 AD), in interpolating *Genesis 2:7* with *1 Corinthians 15:44–45*, emphasized the relevance of the body and the flesh (cf. Ladaria 2011, 128). St. Irenaeus (ca. 130–202 AD) considers the human being of *Genesis 1:26* (made in the image and likeness of God) together with that of *Genesis 2:7* (made from the dust of the ground), and understands the image of God as primarily referring to the “*fleshly* human being” (Ladaria 2011, 127, italics added). According to Bonaccorso, Irenaeus' *Against Heresies* makes it clear that the *incarnated* Word, and not only the eternal Word, is the image of God that the human being reproduces, so that incarnation and the

resurrection of the body are part and parcel of the faith and do not admit “Gnostic dualism” (Bonaccorso 2006, 49). Rahner shares such intuitions when he vividly stresses that “it would be quite wrong and unchristian to conceive matter and spirit as realities simply existing side by side in the actual order of things while being quite unrelated to each other. . . . spirit and matter have more things in common (to put it this way) than things dividing them” (1966b, 161).

The conception of the human being emerging from the Christian tradition in theological anthropology is an integral, unitary, and non-dualistic one. Consequently, all what we have seen previously in this section (about the future-oriented dynamicity of the human being, its capability for active self-transcendence, and its being endowed with a concrete mission within this world and “in time and history”) should be intended as concerning the human being in its integral entirety, without overlooking the bodily (material and biological) dimension as well as the intentional and conscious efforts required by the striving for self-transcendence.

To summarize, in the *theological* perspective the human being should be conceived (i) as a dynamic, historical, and future-oriented creature characterized by true becoming, (ii) as a creature whose dynamicity is eschatologically oriented but also has a real import in the mundane dimension, up to the point that such a creature is empowered with *active* self-transcendence, and (iii) as a creature whose being created in the image of God (iii-a) concerns its entirety and quite specifically its bodily dimension and (iii-b) refers to its purpose and mission in the world. We will see in later sections how these theological insights find a counterpart in recent scientific developments and how scientific research might in turn profit from such a perspective.

Bearing all this in mind, with the next section I will “jump” to a different ground to focus on some recent achievements in cognitive neuroscience concerning the acquisition of written language and literacy by humanity.

CULTURAL NEURAL REUSE AND WRITTEN LANGUAGE

The notion of “neural reuse” has been recently proposed in cognitive neuroscience (cf. Anderson 2010; see also Colagè 2013) and states that for a new cognitive function to emerge, the formation of new, dedicated cortical areas is not needed; on the contrary, pre-existing neural circuits (endowed with certain basic information-processing capabilities, or “workings”—Anderson 2007) may be reused and put at the service of the incipient, new cognitive function. Neural reuse has links with the notions of “evolutionary tinkering” (Jacob 1977) and “exaptation” (Gould and Vrba 1982; see also Anderson 2007; Colagè and D’Ambrosio 2014) and is to a large extent an evolutionary thesis. Indeed, for a pre-existing neural circuit to be put at the service of a new cognitive function, it must become part

of a specific *network* of brain areas capable—as a whole and thanks to the information-processing capabilities of *all* the involved local neural circuits—to support that new cognitive function. However, the most common way in which a *new* brain network may be formed is by changing the inter-regional anatomical connectivity of the brain at the white-matter level. And that, in turn, generally requires the modification of the species-specific genetic–epigenetic program responsible for the formation of the brain gross functional anatomy during development. In other words, this requires truly biological evolution and often also speciation events. An example will better clarify the matter.

In the 1990s, Giacomo Rizzolatti and his group in Parma, Italy, discovered the Mirror Neuron System (MNS) in the macaque brain (Rizzolatti et al. 1996a; Gallese et al. 1996; see also Fogassi and Ferrari 2011). The mirror neurons display the specific property of responding both to the *execution* of an action and to the *observation* of a similar action. In the monkey, this happens almost exclusively with *object-related, goal-oriented* actions. The macaque MNS involves neurons located in three brain regions: premotor area F5, the superior temporal sulcus, and area PF in the inferior parietal lobule. The MNS enables the monkey to understand an observed action by matching it with similar actions that the monkey is able to perform. Essentially, this is the “only” role that the MNS plays in the macaque.

Mirror properties have also been acknowledged in the human brain (Rizzolatti et al. 1996b; for review: Rizzolatti 2005; Fogassi and Ferrari 2011). It has been proposed that the human mirror system supports an array of additional functions besides action understanding. These include intention understanding (Bonini, Ferrari, and Fogassi 2013), tool use (Higuchi et al. 2009), imitation learning (Buccino et al. 2004), pantomime (Grèzes et al. 2003), conceptual knowledge (Gallese and Lakoff 2005), semantics (Buccino et al. 2001; Marino et al. 2013), and language more generally (Rizzolatti and Arbib 1998; Arbib 2005; Arbib 2013).

It is reasonable to assume that the macaque mirror system has been reused several times in the course of the 25 million years of evolution (and the several speciation events) separating us from the macaque. The specific information-processing capabilities of the mirror system may indeed be useful for, for example, pantomime, imitation learning and language; but for this to be the case, the mirror system must be embedded in larger brain networks whose *overall* configurations can subserve those functions. Now, the three regions assumed to be involved in the mirror system extensively overlap the three areas traditionally considered to compose the language network (i.e., the inferior frontal Broca’s, the superior temporal Wernicke’s, and the inferior parietal Geschwind’s territories). There is evidence that the main white-matter fiber tracts connecting these three regions, namely the arcuate fasciculus and the superior longitudinal

fasciculus, have significantly expanded and strengthened from macaques to chimpanzees to humans (Rilling et al. 2008; Friederici 2009). Therefore, truly evolutionary processes have been responsible for the reuse of the mirror system, embedding it in larger and larger networks able to support the emergence of, for example, pantomime, imitation learning, and language.

Having clarified what neural reuse implies in its evolutionary understanding, it is worth stressing that there may be cases of neural reuse that should *not* be considered as a direct outcome of truly biological evolutionary mechanisms. *Nonevolutionary* neural reuse specifically means that the reuse of a neural circuit for supporting a newly emerged cognitive function does not require the evolutionary modification of the genetic–epigenetic program mastering the formation of the brain anatomical connectivity during development. Such cases could be labeled as “*cultural* neural reuse” (Colagè and D’Ambrosio 2014; see also Dehaene and Cohen 2007). The best example of this may be the case of the Visual Word Form Area (VWFA).

The VWFA has been identified in the left fusiform gyrus, within the ventral visual cortex, approximately at the lateral occipito-temporal sulcus (Cohen et al. 2000; also Dehaene and Cohen 2007 for review). The VWFA has been shown to respond selectively to orthographic stimuli in literate individuals (Vinkier et al. 2007). *If the VWFA does not function properly* (or if it does not receive the visual orthographic stimuli from primary visual cortex) *the individual is unable to read* (cf. Cohen et al. 2000). Three considerations suggest that the implication of this brain region in reading cannot be considered as a direct outcome of strictly biological evolutionary processes. Written language was invented less than 6,000 years ago and until recently only a tiny minority of humanity was literate. Furthermore, the specification of the VWFA as an area for reading does not show critical periods and happens in approximately the same way even in individuals who learn to read in late adulthood. Finally, before learning to read, or if an individual does not learn to read at all, this brain region subserves other functions such as the processing of high-resolution, sharp-edged shapes or face recognition; this holds true, interestingly, even if the right-hemisphere (non–language-dominant) homologue of the VWFA in literate individuals is considered (Caspers et al. 2014; see also below). Taken together, these facts suggest that the specification of the VWFA should not be taken as the direct outcome of biological evolutionary processes.

However, the specification of the VWFA constitutes an instance of neural reuse, although at a non evolutionary level. To see why, it should be kept in mind that the basic information-processing capabilities of this brain region (a) depend on evolutionary processes that, however, concern functions *different* from reading, and (b) are *potentially* useful for reading competence. The ability to process fine visual details and an exalted capability for recognizing face emotional expressions are part and parcel of

the evolutionary history of primates, likely linked to food-procurement activities (such as finding edible seeds or using tools for fishing ants) and to the primate complex social and communicative lifestyles. These abilities are much older than the emergence of *Homo sapiens* and have nothing to do, from the evolutionary viewpoint, with reading. However, both of them may well turn out to be helpful in managing written language as the latter requires the capability of processing detailed shapes and of recognizing tokens of specific types (such as the same syllable or word written with different orthographies or fonts, or even in upper or lower case).

A further point should be discussed. As we have seen, neural reuse is characterized by the embedment of the reused circuitry in a new network able—as a whole—to support the new function. The network in which the VWFA should be (anatomically) embedded to function as an area for reading is the wider spoken-language system. There is evidence, although indirect, supporting this view.

First. Recently, two *cytoarchitectonic* areas have been identified in the human posterior fusiform gyrus, and have been labeled FG1 and FG2 (Caspers et al. 2013). The anatomical location of area FG2 seems to coincide largely with the so-called fusiform face area (FFA) and to overlap the VWFA for the most part. A differential pattern of co-activation of the left and right FG2 has been found (Caspers et al. 2014). Specifically, the *left* FG2 displayed a stronger co-activation with other language areas in the left hemisphere, particularly with inferior frontal areas, pre-motor areas, and middle temporal areas; on the other hand, the right FG2 showed more pronounced co-activation with left amygdala, which suggests the involvement of right FG2 in emotional face processing crucial in social interactions. As the authors conclude, “the present results point to a hemispheric-specific involvement of FG2 in two apparently distinctive functional systems, that is, visual face [at right] and word processing [at *left*], with putative correspondence to FFA and VWFA, respectively” (Caspers et al. 2014, 10). Now, the difference in the patterns of co-activation of the left and right FG2, together with the consideration that face recognition is by far older than reading, is in agreement with the idea that the *left* FG2 is reused for subserving reading and embeds, at the time scale of the individual lifespan and *not* at the phylogenetic time scale, into a wider network encompassing other language areas. In this way, *left* FG2 becomes the functional area now known as VWFA.

Second. Another recent study (Thiebaut de Schotten et al. 2014) has revealed a significant correlation between the proficiency in reading and the fractional anisotropy of the posterior, temporo-parietal portion of the *left* arcuate fasciculus. Since fractional anisotropy is an index of anatomical connectivity, these results suggest that learning to read determines a strengthening of the anatomical connectivity of ventral occipito-temporal areas (VWFA included) with superior temporal and inferior parietal

language areas. This increase in fractional anisotropy has been revealed not only in individuals who learned to read at school age but also in those who acquired such a skill during adulthood (Thiebaut de Schotten et al. 2014). These results are in line with the idea that the region hosting, in literates, the VWFA is reused to deal with written language at whatever age the individual acquires such a skill.

Now, if the VWFA is an instance of neural reuse, then, on the basis of what we have seen so far, it must be considered as a case of *cultural* neural reuse in two interconnected senses (Colagè and D'Ambrosio 2014). First, it cannot be considered as a direct outcome of truly biological evolutionary processes. Second, it is the consequence of a *cultural* invention of humanity: writing. The invention of writing is not a response to a survival challenge but is helpful in complex societies characterized by an elaborated institutional dimension (built upon trade, justice, collective memory, politics, religion, etc.). Not by chance, written language has been invented just 6,000 years ago, that is much later than the appearance of anatomically modern humans (ca. 200,000–160,000 years ago) and the emergence of so-called behavioral modernity (ca. 80,000–50,000 years ago).

THE HUMAN BEING SHAPING AND TRANSCENDING ITSELF

This section will show the mutual relevance of what has been presented in the last two sections, also in view of a potentially new anthropological perspective in “science and religion.” The first point to be stressed has to do with the overwhelming relevance of written language: our present-day societies and lifestyles would be inconceivable without it. The invention of writing and reading has deeply transformed human life: from economics, law, and politics to science, theology, and religious practices (e.g., Ong 2002). Merlin Donald claims that writing and the “external symbolic storage” it enables represents the core of the last stage of human culture and cognition; he also maintains that written text and the possibility to examine it repeatedly and critically prompted the rise and accelerated growth of “theoretic culture” (Donald 1991). Walter Ong and Donald, moreover, acknowledge that the invention of writing systems not only affects the societal and institutional dimension but individual cognitive endowment, consciousness, and self-identity as well (see Donald 1993). Written language has specific relevance for the human religious and spiritual complexion. Any religious or spiritual tradition has its own reference texts playing a hardly deniable role in such practices. Resorting to written text also strengthens the identity of peoples and social groups, because their members constantly have stable reference points protecting core messages from the vagaries and contingencies of history. Moreover, writing allows exchange of information beyond the limits of the groups that share specific rituals; in this way, groups with local traditions may have access to

alternative views and conceptions that would be much more difficult or rare without writing systems. The result is the possibility of making more pondered choices about religious and spiritual “frameworks” (it would be enough to recall the *Letters* to early Christian communities). This may also favor a higher degree of awareness of one’s own spirituality as the outcome of an explicit and elaborated decision-making process. In this line, it may also be worth mentioning (although I cannot treat such a huge topic here) that the works of recent “continental philosophers” like Hans-Georg Gadamer, Jacques Derrida, and Paul Ricoeur also attest the relevance of written language for human nature, culture, and the existential dimension.

Seen from this viewpoint, the invention of written language may easily be considered as an instance of human beings’ “real becoming more in time and history,” according to Rahner’s insights. The invention of written language is a real and tangible betterment of the human condition that opens up opportunities of self-transcendence at the personal level and for humanity as a whole.

We have also seen that Rahner understands self-transcendence as an *active* process that is not just passively undergone but actively undertaken and pursued. Now, the invention of written language matches these characteristics. Once invented, writing has been soon acknowledged as something valuable. Humanity promptly devised strategies to transmit and expand such an innovation: formal schooling and compulsory education have been eventually established, improved, and developed in several parts of the world by different peoples. Therefore, writing and literacy exhibit key characters of active self-transcendence.

Now, what we have seen thus far in this section may convince the reader that the invention of writing and the establishment of literacy are instances of active self-transcendence. But what is the relevance of the neurological findings about the VWFA for all this? I think there are two main implications of those findings.

First. The case of the specification of the VWFA shows that the active self-transcendence manifested by the invention of writing and literacy reverberates into the human fabric at the physical, biological level. As we have seen, Donald regards writing as the key element of the last (present) stage of human culture and cognition. He also maintains that the exposure to literate culture is capable of modifying the individual *cognitive* architecture and of adding up new *cognitive* modules (cf. Donald 2001). The suggestion that the specification of the VWFA requires modification of white-matter inter-regional connectivity implies that the cognitive enhancement pointed out by Donald also has an *anatomical* counterpart involving changes in the brain’s *anatomical* architecture. In this sense, the invention of written language should be regarded as an instance of active self-transcendence involving the cognitive (mental/spiritual/cultural) *and* the anatomical (physical/material/biological) structuring of the human

being. After all, the specification of the VWFA is the final outcome of: (a) a long and patchy, *biological* evolutionary process which brought to the formation of area FG2 dedicated to emotional face recognition (and sociality), and *potentially* useful for reading; (b) a *cultural* invention that brought written language and literacy; (c) cultural neural reuse through which such a cultural invention reverberates into human brain anatomy so that the left FG2 becomes the VWFA; and (d) the implementation of cultural strategies to preserve and boost this new achievement (and the cultural neural reuse it involves). Isn't it a beautiful example of the strict entwining between the material/biological and the mental/cultural dimensions of the human being? Doesn't it make it harder to draw sharp separations among brain biology, culture, and "mental life"? It is not perhaps by chance that theology considers culture as the point in which the physical and the spiritual dimensions of human life interlace with one another (Ladaria 2011, 163). We will see below that this has even further significance.

Second. That the specification of the VWFA as an instance of *cultural* neural reuse and not a direct outcome of biological evolutionary processes is crucial for the claim that writing and literacy represent *active* self-transcendence (or better, that human self-transcendence is really active). It is nowadays widely acknowledged that biological evolution is not targeted, not intentionally directed, and not even generally controllable or predictable in the details. If the invention of writing and literacy were a pure outcome of biological evolution, then the "active component" (so to speak) of self-transcendence in such an invention would not exist. In other words, the fact that the specification of the VWFA is a consequence (at the ontogenetic time scale) of a cultural invention and *not* an outcome of biological evolution (at the phylogenetic level) allows for considering writing and literacy as something actively and tirelessly achieved by humanity and not something happening outside the intentional and conscious control of the human being.

The case of the VWFA and the perspective of cultural neural reuse have further consequences for theological anthropology. They may add up to a fresh perspective about the key topic of the relationships between culture and biology. The twentieth-century anthropological turn in Christian theology (mentioned much above) made theologians more attentive to the human cultural dimension *tout court*. As a consequence, theologians began carefully considering the findings and theories of the so-called humanities or human sciences. However, the humanities usually consider culture in abstraction from biology. Another major happening in the second half of the last century was the rise and rapid development of the field (or meta-discipline) of "science and theology" ("science and religion," or "science and faith") itself. Thanks to this, theologians imported the "evolutionary worldview" into their investigations, so that biology influenced the theological reflection almost exclusively from the evolutionary viewpoint. Now,

the case of the VWFA, interpreted in the light of cultural neural reuse, may unveil the relevance of the biological underpinnings of cultural dynamics in theology and in “science and religion.” Such a general perspective may complement the abstraction from biology characterizing the humanities and promote the consideration of human biology not in evolutionary terms alone.

So-called “gene-culture co-evolution” (Laland, Odling-Smee, and Myles 2010) is the main approach in contemporary evolutionary biology to address the issue of culture and the relationships between culture and biology. This approach states that information passed on via genetic inheritance interacts with culturally transmitted information. The point is that cultural strategies are able to affect genetic evolution by changing the selective pressures on the biological traits transmitted from generation to generation within a population. Mechanisms of gene–culture co-evolution have likely played a relevant role in hominin evolution (i.e., in the 6.5 million years of biological evolution that eventually resulted in our biological species). It is also a key factor in the microevolution of our species during the last 200,000 years. However, although it takes culture as an effective factor, gene–culture co-evolution entirely resorts to more general evolutionary mechanisms such as population genetics and niche construction (cf. Laland et al. 2010; Odling-Smee, Laland, and Feldman 2003). These mechanisms characterize the evolution of *every* life form on Earth: from bacteria and algae, to plants, insects, and higher animals. Therefore, following the gene–culture co-evolution perspective, culture may eventually turn out to be just a selective factor among many other ones. Thus, gene–culture co-evolution may be less decisive than previously thought as an argument in favor of “human uniqueness.”

All this is not to downplay the importance of the humanities and/or of biological evolution for theology and for the anthropological research in “science and religion,” but just to emphasize the opportunity to disclose an additional and fresh approach to the matter, centered in cultural neural reuse and able to complement the current opening of theological reflection to the findings of both the human and the natural sciences (see also Turner 2013).

In concluding this section, I would like to link what we have seen so far with some recent proposals in the anthropological debate in science and religion. A first notion to be mentioned is that of “created co-creator,” which Philip Hefner (1993; 2003) proposed for capturing human specificity and uniqueness. This notion, in line with the functional interpretation of the *imago Dei* doctrine, points to the idea that humanity has the mission to partake in God’s creation and to let the inner potentialities of the world and of humanity come out and develop. I think that this notion applies to the VWFA case: with the invention of writing and literacy, humanity has prompted the expression of latent potentialities at the level of *both*

biology and culture. Moreover, Hefner's notion of created co-creator has recently been linked to the conception of the human being as a creature "called to *become* created co-creator" *through education* (cf. Uytterhoeven 2014). In the light of what I mentioned above, I think that education plays a crucial role in fostering the genuine cultural dynamics characterizing the human propensity for active self-transcendence. Moreover, education and active self-transcendence, once regarded in the light of cultural neural reuse, embrace the integral unity of the human being in all its dimensions.

A second point is that the human constitution may be seen as a "work in progress" even if we understand it as being created in the image of God. Johan De Smedt and Helen De Cruz (2014) recently put this proposal forward on the basis of updated evolutionary perspectives in paleoanthropology. The authors clarify how the set of "uniquely human capacities did not evolve in isolated minds, but within communities of interacting people. Moreover, these capacities did not emerge at a single point in human evolution. . . . Instead, "the authors continue" the *imago Dei* evolved, and continues to evolve" (De Smedt and De Cruz 2014, 148). I think that the idea of humanity (and *imago Dei*) as a work in progress is an interesting one and is also quite sympathetic to the perspective proposed in this essay. After all, the dynamic conception of the human being and the notion of active self-transcendence are explicitly related to such a stance. Moreover, the evolutionary path of primates and of the genus *Homo* should be carefully considered in the field of "science and religion," especially as far as the human social complexion and the relational interpretation of the *imago Dei* doctrine are concerned (see, e.g., Colagè 2015). However, in the light of what we have seen so far, I think that already the pre history and history of our own species *Homo sapiens* have interesting elements that point to a real dynamicity and becoming even without considering the *evolutionary* process that brought us to the present time; this dynamicity is visible simply by focusing on the ways in which human beings have continuously and unceasingly *shaped and transcended themselves*.

METHODOLOGICAL CONCLUSION

I have proposed that the approach disclosed by cultural neural reuse has interesting connections with some implications of theological anthropology. Now, at the methodological level, it should not be overlooked that the planes of enquiry of theology and science are different. Science builds upon empirical data and tries to frame them within coherent theoretical constructs, whereas theology works up its propositions from Revelation and tradition. Theology springs from the explicit consideration of the transcendental and the infinite, and never loses sight of the "eschaton" (i.e., the future, ultimate destiny of humanity). From this plane, then, theology—especially *Christian* theology, I would say—is also called to

look at the immanent, the finite, and the “present.” It is in this dimension that the implications of theology and those of science may (and should) meet in dialogue. And it is in *this* dimension that I have tried to show how some consequences of fresh scientific findings and some implications of theological investigations may be put in fruitful relation.

I would like now to convey the impression that such a methodological stance may actually turn out to be “prospectively fruitful” (i.e., helpful and promising for *future* research paths—cf. Colagè 2014) not only for anthropological research in “science and religion” but also for interdisciplinary scientific research as such. To this aim I will hint at a further topic to which the approach proposed in this work might be applied: the emergence of so-called behavioral modernity and spoken articulated language.

Behavioral modernity encompasses a number of cognitive abilities of *Homo sapiens* such as artistic production, use of personal ornaments, not-just-lithic tools, complex institutionalized societies, and religious practices, as well as, crucially, spoken articulated language. The point is that the origin of behavioral modernity is far more recent than the appearance of *Homo sapiens* as a biological species: the former being dated at ca. 80–50,000 years ago while the latter at 200–160,000 years ago (see, e.g., Tattersall 2004; 2009). Archaeological data indicate that elements of behavioral modernity appeared, disappeared, and reappeared (i) at different time-points, (ii) in different geographical areas, (iii) in various combinations, and (iv) not only in *Homo sapiens* but also in Neanderthal populations (see, e.g., D’Errico 2003; D’Errico et al. 2003; D’Errico and Stringer 2011). Providing an explanation for these facts turns out to be very hard because of the intrinsic complexity of the matter and the fragmentary nature of archaeological and paleoanthropological remains, as well as absence of direct cognitive and physiological evidence about human beings living tens of thousands years ago.

Nonetheless, great efforts have been dedicated to this topic in recent decades, and two main trends may be identified. The first one posits that a genetic change affecting the brain of *Homo sapiens* occurred in Africa ca. 80–50,000 years ago and determined the explosion of behavioral modernity; the second one claims that the emergence of behavioral modernity is the outcome of cultural invention processes substantially independent of genetic mutations or speciation events (see, e.g., D’Errico and Stringer 2011). Now, the perspective proposed in this essay would be closer to this latter trend, because it claims that cultural invention processes have primarily driven the emergence of behavioral modernity and spoken articulated language.

Consistent with this trend is a recent proposal by Daniel Dor and Eva Jablonka (2014), who stress that “language began exactly like writing or the wheel Language evolved as a collectively developed *communication technology* . . . before individuals acquired the capacity to handle it efficiently. . . . *First we invented language, then language changed us*” (16).

Again in line with this trend, Michael A. Arbib (e.g., 2005, 2013), in the context of his “mirror system hypothesis” for the emergence of spoken language, proposes that one should distinguish stages of biological evolution from stages of cultural evolution. At first, a long, truly biological evolutionary process spanning primate and hominin evolution resulted in the language-ready brain, that is, a brain apt to support language when such ability was not yet developed. Thereafter, the last stage in the acquisition of full-blown spoken language (bridging from the language-ready brain to the actual implementation of languages) was a process of cultural invention involving little if any biological evolution.

These two proposals, although acknowledging a prime role to cultural dynamics (and thus pertaining to the second trend mentioned just above), have a fundamental difference, at least as far as their potential extreme consequences are considered. Arbib’s view might imply that the last cultural stage did not require any biological modification of brain anatomy. Dor and Jablonka maintain that the first moves in the cultural invention of language triggered a gene–culture co-evolution process whereby the genetic constitution of human beings became accommodated to the invented cultural practice.

Now, the approach in terms of cultural neural reuse that we have explored in relation to written language might be a possible option even in the case of *spoken* language (and to behavioral modernity more generally). Indeed, it would imply (1) that the emergence of spoken language was the result of a cultural invention, (2) that such innovation brought about anatomical modifications of the brain via cultural neural reuse, and (3) that such modifications do not occur at the truly evolutionary level. Much work is still needed to translate this idea into a real working hypothesis. However, it is a promising and “prospectively fruitful” perspective that might contribute to shed light on human constitution and uniqueness, or at least to influence future research in the matter. If further work will show this perspective to be viable and realistic, then it will lend additional support to the notion that human beings are endowed with the capacity to shape and transcend themselves and to all the implications this has for anthropological research in the field of “science and religion.”

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