

The ongoing evolution of humanness: perspectives from Darwin to de Chardin

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The nature of humanness is discussed from observations made by Aristotle in 4th-century Greece, through to those of Charles Darwin, Teilhard de Chardin and William Shakespeare. Attempts to define humanness upon a narrow range of criteria, as some have tried, is argued as flawed, for humanness is more elusive than a single or a few demonstrated phenomena. The path that Darwin pursued in determining the place of humans in nature in his book *The Descent of Man, and Selection in Relation to Sex* is assessed from a 19th-century perspective; the difficulties he faced, both personally and with the broader public, are reviewed and then evaluated in a modern context. Darwin's thesis adheres to scientific principles, and is debated, defended and later verified on these principles. This is somewhat at variance to the approach adopted by the priest-scientist de Chardin a century later in his major work, *The Phenomenon of Man*—in which an attempt is made to reconcile a deep Christian faith with science. De Chardin scores well from a theological viewpoint, but fails on scientific grounds as his thesis moves beyond the realms of empiricism into mysticism. Surprisingly, de Chardin's predicament of a future wherein human evolution enters a new stage of consciousness through the noosphere (an invisible layer of thought encompassing the globe) has been partially realised through the worldwide web, although the nature of the web is almost certainly not what de Chardin might have anticipated, or desired. Science too fails to answer all, particularly the nature of God. Darwin considered the Creator in several of his works and does not dismiss the concept of a farseeing deity, although we are left with the notion that he died agnostic. Humanness is derived from an elevated moral code and this is reflected in our arts, particularly literature, wherein we may temporally reflect upon quintessential human traits such as mercy. However, expression of the arts is only achievable by the individual being part of a greater whole: the human community, the essence of which is distilled in the Bantu concept of *ubuntu*, wherein humanness is best realised through the act of living in harmony.

Key words: human evolution, Charles Darwin, Teilhard de Chardin, culture, morality, virtues

Introduction

Palaeontology and palaeobiology are sciences that deal with the history of past life. In particular they use the disposition, the remains and the impressions of fossils to reconstruct the phylogeny of taxa, their biogeographic patterns and the types of environments in which they once lived. On the whole, they deal with concrete concepts. Thus, an evaluation of humanness, a concept with no apparent fossil record, is a pursuit that one would not expect of palaeontologists. Nonetheless, the journey to understand and define character(s) of that phenomenon we call 'man' has felt the tread of some of our greatest palaeontologists, including Charles Darwin and Teilhard de Chardin. The objective of this paper is to explore several of the paths in mankind's quest

to understand the nature of 'being human'—the thesis being that if we do not know what we are, our ability to plan for the future is severely compromised. These two scientists are specifically chosen in this essay in recognition of the manner in which their theses so strongly challenged contemporary science, religion and philosophy.

Pursuing 'humanness'

In a simplistic way, humanness may be defined as being aware; indeed, Linnaeus embodied this concept as recently as 1758, when he coined *Homo sapiens*, or 'thinking man' to systematically define us. Much earlier, the philosopher Aristotle (384–322 BC) sought to define the very nature of the humanness that he saw as the end-purpose for humanity. The deductive path that Aristotle follows (below) illustrates that, although we share many features with other higher animals, it is an ability to 'reason' that distinguishes us:

The human function: What, then, could this be? For living is apparently shared with plants, but what we are looking for is the special function of a human being; hence we should set aside the life of nutrition and growth. The life next in order is some sort of life of sense-perception; but this too is apparently shared, with horse, ox and every animal. The remaining possibility, then, is some sort of life of action of the [part of the soul] that has reason... The human function is the soul's activity that expresses reason [as itself having reason] or requires reason [as obeying reason]. (*Nicomachean Ethics*¹)

However an ability to reason or to possess nous is not restricted to *H. sapiens*—and it is often in adversity that the most interesting challenges to this presumption are made. During the tragic forest fires that ravaged Victoria, Australia in February 2009, 173 humans and an estimated million 'large' animals died (Christine Nixon, pers. comm.). Some remarkable accounts of survival and interspecies interaction were made during the 2009 Victorian Bushfires Royal Commission hearings held in Melbourne in the months following the fires. In one, two survivors related that, in the face of an advancing wall of flames, they sought safety in a short, open culvert. Shortly after entering this, they were joined by a large eastern grey kangaroo, which remained in very close proximity to them until it concluded the danger had passed. At that point it hopped out and made its way through the cooling embers to safety. The fire front was recorded to pass through areas in about 30 minutes, so we may conclude that two humans and one large wild animal shared a small space for about that time. It is most unlikely that any wild kangaroo would approach humans under normal conditions. What happened here is remarkable, as the kangaroo clearly observed danger, was able to seek refuge, and although it would certainly have been aware that it was not alone in the drain, elected to stay there with animals that would normally be a threat to it until it determined outside conditions had returned to a safe level. A bold deduction would be that this was an excellent demonstration of a kangaroo exercising utilitarianism, but I could not possibly state this in a scientific journal. A further example of interspecies interaction during the fires involved a man leaping into a dam. He swam to the central, deepest part, where he repeatedly submerged

himself to keep cool and to douse the falling cinders. During the period of greatest conflagration he was tightly surrounded by a number of ducks, most which were within touching distance. It would be arrogant indeed to conclude that the actions of the kangaroo and birds were simply of instinct, and therefore fail to demonstrate any higher level of nous.

Although ability to rationalise is clearly not the prerogative of humans, it is nonetheless a capacity that is not held equally in other species. Rather, it is a progressive faculty, particularly within mammals, such that the ability to reason in different species may be arranged in a continuum.²

Other traits that must be assessed in a journey to define humanness include the development and sustainability of complex social behaviour; the ability to produce and appreciate art and music; the appreciation of beauty; spatial and temporal awareness; the development of complex oral and written language; religion; and not least, the moral virtues, 44 of which are: assertiveness, beneficence, benevolence, cleanliness, commitment, compassion, confidence, cooperation, courage, courtesy, creativity, detachment, diligence, enthusiasm, excellence, flexibility, forgiveness, generosity, gentleness, honesty, honour, humility, idealism, joyfulness, justice, love, loyalty, moderation, modesty, orderliness, patience, peacefulness, perseverance, purposefulness, respect, responsibility, self-discipline, service, tact, thankfulness, tolerance, trustworthiness, understanding, unity.

The virtues, espoused by Aristotle, are derived from the Greek *ἀρετή* (*arete*); a term encompassing goodness and excellence, wherein any choice made is one that lies between a deficiency and an excess. For example, courage is the mean between cowardice and foolhardiness. Any one of the above virtues alone does not define good, and it follows that practice of any in isolation cannot be seen as manifestly human—and may not even be moral. Whether animals are capable of moral judgement is unknown, although there is some evidence of this behaviour in primates, social carnivores and some cetaceans.³ Ironically, much of the journey to human dominance over the biosphere has been achieved through exercising traits that are clearly not in the least virtuous, although they may, in the short term, illustrate survival of the fittest, e.g. genocide and waging of war. The manner in which we address mankind's greatest crime, environmental degradation, will ultimately decide which species is the fittest. On past record, it may not necessarily be *H. sapiens*.

Returning to the earlier traits, humanness defined by the possession of social behaviour that permits coexistence in densely populated communities is flawed, as this character is demonstrated by many species, including invertebrates such as bees and ants. An appreciation of music, especially the creation of music, is sometimes cited as a uniquely human trait; however, there are numerous examples of song created by birds and cetaceans. Birds in particular are capable of mimicking human music, just as we do with birdsong. Music definitely has a calming effect—on humans, and also on many other higher animals. Farmers in many countries use classical music to placate cows during milking. However, when it comes to animals making music, there is still debate about the purpose—whether it is functional, or for pleasure, and whether we are simply trying too hard to anthropomorphise.⁴ A distinction humans do have however, is the ability to inscribe the music, e.g. in the written form, or digitally.

As to beauty, the concept, and appreciation, of it entertained Aristotle,⁵ and Darwin deliberated long on its significance in human evolution—and concluded that an awareness of beauty within the environment, as opposed to a response to beauty as a

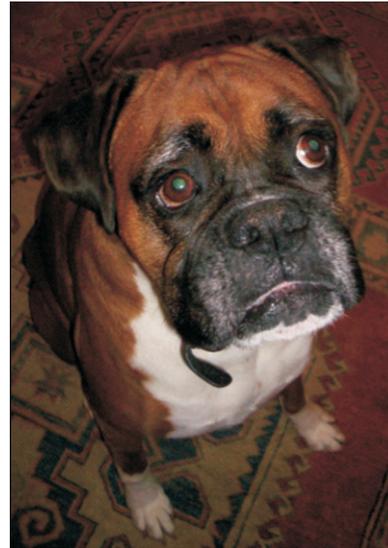


Fig. 1. To think is to know. However, knowing is not an exclusively human characteristic. (*Canis familiaris*, alias Buster the boxer.)

sexual attractant (as in many animals), was a trait refined and acquired in humans through culture. We should remember however, that Darwin was a keen observer of nature, and in *The Descent of Man, and Selection in Relation to Sex* (hereafter *Descent of Man*) he notes that some animals deliberately collect bright objects with which to adorn their nests.² Thus an appreciation of beauty in itself is not useful in defining humanness.

Nor is an appreciation of human language restricted to humans, for example, that most domesticated of species, *Canis familiaris* is certainly capable of understanding not just nuances, but simple words. Many dogs can comprehend the spelled word, e.g. 'w-a-l-k' and respond accordingly (Fig. 1). A sceptic may state that dogs do not understand words—rather they are just very good at reading human body language. Indeed this may be so, but also so for human infants. In language then, it is perhaps only our ability to manipulate symbols in a complex manner that is distinctly human. Some animals have demonstrated an ability to count,⁶ and most animals have an awareness of space, although an appreciation of the relationship between time and geography is much more difficult to assess. Many animals migrate: they clearly know where to go, and when, although this is for the most instinctive rather than cognitive. Although we currently have no way of knowing exactly what animals are capable of thinking of, it is perhaps the human ability to think beyond the realms of reality, to model present trends and hypothesise on both the distant past and the future that is distinctive. Nonetheless, this does not significantly reduce the elusiveness of the concept of humanness.

Until the inception of the Enlightenment in Western Europe at the beginning of the 18th century, man was generally considered distinct from the biosphere. This Judaeo-Christian view has humans created separately from all other living organisms, being differentiated by creation in the image of God. Not surprisingly, man was given dominion over nature. This was to change in the mid-1800s, when one philosopher in particular, Charles Darwin, took a different turn when he ventured to suggest that humans were part of a continuum with other animals, rather than the product of any special creation.^{2,7}

Evolution and the emergence of human culture

Whilst the preceding section pursued, and in part assessed the essence that defines humanity, the following reviews the climate

of aversion that had, up to the mid-19th century, obstructed the placement of *H. sapiens*—with respect to all other living organisms – into the scheme of origins through natural selection.

Man's journey away from immortality

As a young graduate student I was very much preoccupied with the phylogeny, evolution, and geographic and temporal distribution of barnacles. This provided an extraordinary opportunity to research the group of organisms that had, some 130 years earlier, sufficiently inspired Charles Darwin for him to devote more than eight years to their study. However, it is how he interpreted the barnacles that is relevant here—for in four volumes ranging over 1851–1854, the barnacles were described in an order that we would find acceptable in today's systematic taxonomy.^{8,9} Darwin began his study of barnacles (or cirripedes) after finding a minute, rather unusual, burrowing cirripede in the shell of the South American gastropod *Concholepas*. His dissection and description of this taxon aroused his natural curiosity of the whole group, which had only recently been recognised as crustacean rather than molluscan. Cirripedes were, at that time, not well understood, but a growing amount of excellent fossil material, supplemented by collecting considerable numbers of recent specimens, provided an irresistible opportunity to unravel the taxonomic relationships of the group.⁹ Finally, it was the encouragement of John Edward Gray, then Keeper of Zoology at the British Museum, that ensured his long dedication to the group.¹⁰ It is reasonable to conclude that it was the cirripedes that provided Darwin with the insight into how natural selection functioned. Surprisingly, he referenced them little in his seminal work *On the Origin of Species by Means of Natural Selection* (hereafter *Origin of Species*), although it was his barnacle research that confirmed his status as a biologist, and for this he was awarded the Royal Society's Royal Medal in 1853.⁹

Darwin was somewhat reluctant to publish his views on humanity's place in evolution, and this probably reflects his concern with public acceptance, or otherwise, of his 'species theory'. Although 'enlightened' with respect to the previous century, Britain in the mid- to late-19th century was not the secular society it is today; further, it is important to reflect upon the very considerable influence that the established church (i.e. the Church of England) had at that time—in all aspects of life, including science. Darwin was all too aware of this, and agonised over the polarising effect he knew his work would have—as many saw it as a direct threat to the widely accepted and socially cohesive relationship between man and God. In light of strong criticism, he did remove one significant impediment to wider acceptance of his work by including suitable reference (and reverence) to a Creator in the closing sentences of later editions of the *Origin of Species*.^{11,12}

Although he had planned to include reference to human beings in his 1868 book, *The Variation of Animals and Plants under Domestication*, he did not do so, apparently because the size of this work, which, as two volumes, ended up much greater than he had originally planned.¹³ It was ultimately in 1871, more than ten years after the publication of *Origin of Species*, that Darwin was sufficiently emboldened, or believed his *Origin of Species* was sufficiently well accepted, for him to publish *The Descent of Man* (Fig. 2).

The key tenet in the *Descent of Man* is that *H. sapiens* is descended from some less highly organised (= evolved) form. Amongst the evidence for this that Darwin cites:

- A shared embryonic development.
- A shared morphology (e.g. the structure of the skull, limbs and musculature, especially with other mammals).

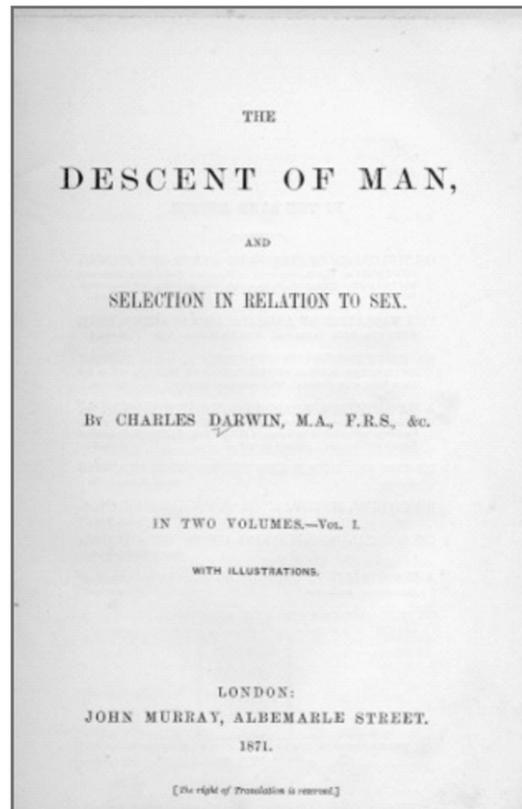


Fig. 2. The title page from the first edition of Darwin's *The Descent of Man and Selection in Relation to Sex* (1871, John Murray, London).

- Geological succession (i.e. the fossil record).

Although he acknowledges that there are individual differences between man and other animals, Darwin concluded that any perceived differences would have been induced by the same general causes and therefore must obey the same laws (i.e. those of natural selection) as the lower animals. He takes great effort to emphasise this principle:

The great principle of evolution stands up clear and firm... it is incredible that all these facts should speak falsely. He who is not content to look, like a savage, at the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation. (Descent of Man²)

One area where Darwin does see distinction between humans and other animals involves the level of intellect and the moral disposition of humans. He acknowledges that these mental powers exist in higher animals, and that they are of the same nature; but he concludes that the difference is simply the degree to which they are developed.

However, Darwin views the principal distinction between man and animals as religious: with the special essence that defines humans being the impact of a deity. He was confident that humans were spiritual creatures, and that belief in 'spiritual agencies' was ubiquitous in human societies; however, it may well follow from this that an instinctive belief in God is the self-fulfilling argument for God's existence.

The belief in God has often been advanced as not only the greatest, but the most complete of all the distinctions between man and the lower animals. It is however impossible, as we have seen, to maintain that this belief is innate or instinctive in man. (Descent of Man²)

That Darwin was unable to resolve whether or not a beneficent God arose in humanity as a direct result of the advance of culture

is demonstrated by his apparent agnosticism at his death. More than a century later, this issue remains unresolved in science.

South African links

In 1836, during the voyage of HMS *Beagle*, Darwin visited South Africa and stayed several weeks at Simon's Bay, Cape Town.¹⁴ Although we are not able to differentiate FitzRoy's words from those of Darwin's, the comments they made at that time in a letter to the *South African Christian Recorder* are relevant here because they give us an insight into Darwin's worldview.¹⁵ In the process of writing in defence of land acquisition by missionaries, they extolled the elevated place of Europeans, especially English gentlemen and Church of England missionaries, who, they asserted, began the civilising process of native peoples through the teaching of the gospel. Although Darwin lived at a time when there were widespread and very different perceptions of the tribes of the human race to those we currently have, it is clear from his abhorrence of slavery that he was deeply disturbed by the inequity and harsh treatment that much of humankind received.

His views on women too are, from a 21st-century perspective, politically unacceptable—even though he was viewed as a seditious liberal by many of his countrymen. Again this must be seen in context of his times, for the resolution of universal suffrage for women was still many decades away. Charles Darwin's perceptions were a reflection of 19th-century morality. Nonetheless, I cannot even begin to appreciate how his capable and indefatigable wife Emma would have viewed his observation that:

Man is more courageous, pugnacious, and energetic than woman, and has a more inventive genius. (*Descent of Man*²)

Reconciling the religious–science nexus

The French Jesuit palaeontologist, Pierre Teilhard de Chardin was born in 1881, one year before Darwin's death; like Darwin, de Chardin was to visit South Africa. He did so twice—in 1951 and 1953, inspecting the Pliocene *Australopithecus africanus* caves at Sterkfontein in the company of the distinguished South African hominid palaeontologist John T. Robinson.¹⁶ De Chardin's remarkable career was by this time almost over; although he made a significant contribution to anthropology, this was not achieved in Paris or Rome, for he had spent most of his adult life living in exile overseas. His formative years as a priest were in Europe, but his notions of life, although germinated in youth, were to come to fruition in China where he worked for two decades and where, amongst other extraordinary achievements, he was co-discoverer of Peking man. (He was also 'co-discoverer' of the now infamous Piltdown man, found in an English quarry, which was subsequently demonstrated to be a hoax¹⁷).

De Chardin's most widely known work, *The Phenomenon of Man*, completed in 1938, was not published until 1955, shortly after his death.¹⁸ In this book, de Chardin the scientist confirms his acceptance of the antiquity of the Earth and the progression of life, from the simplest forms to the most complex, as reflected in the fossil record. He is a Darwinist. However, this science is somewhat compromised by mysticism when introducing the ubiquitousness of spirituality—a concept with which, he is confident, we must all be most familiar.¹⁸ Although de Chardin is forthright in recognising that spirituality is opaque scientifically, human spiritual evolution develops as the more profound aspect of de Chardin's polemic. It is apparent from the outset that *The Phenomenon of Man* was intended as a scientific, rather

than a theological work. Nonetheless, it is a work that many scientists would not recognise as science—this book is not founded in empiricism, although this should not detract us from the message. De Chardin seeks to unravel the greatest question humanity faces: Who are we, and what is our purpose? As noted, Aristotle saw the end point of being human as the exercise of rational capacities like excellence and intelligence; he concluded that these are generally best developed within the context of friends, or community.¹ To de Chardin, however, the end point for humanity (hominisation) was still some considerable way off.

De Chardin believed that all species mutate: they either evolve through time or become extinct. Of course this process also includes humans. He saw the end point of human evolution as the formation of the noosphere, a term coined to describe an invisible layer of thought that would surround the Earth, and which would equate to the sum total of humanity's mental and spiritual state.¹⁸ In his noosphere, all human culture, love and knowledge would be subsumed into a shared mental and spiritual state. This would follow the evolution of a more self-reflective humanity, and would end at what he called an 'omega point'. He deemed every individual as possessing a vital role in the evolution of the world, with each, through cooperative effort, being clearly cognisant of his or her individual task in achieving the 'omega point'.

De Chardin's premonition of a global web through establishment of the *noosphere* has, in a way, been realised much earlier than he would have anticipated—in the worldwide web. However, the breadth and magnitude of this web is probably not what de Chardin would have anticipated, or have wished. As he would have hoped, the worldwide web does constitute a medium in which individuals may express their potential (online) to the full, and it also represents, to an increasing degree, an accumulation of much of human expression. However, it cannot currently be categorised as a vehicle that is advancing humanity to a spiritual communion with a personal God. Importantly, it is through the latter that De Chardin saw fulfilment of his *noosphere*.

De Chardin's work attempts to weave together both science and a deep Christian mysticism in a manner imbued with optimism and anticipation. His argument is often difficult to follow, especially if viewed from a scientific perspective; as a rational, empirical scientific thesis then, it fails—but as a reflection on the potential for humanity to reach nirvana, it is a truly wondrous success.

Drawing the threads together

The way in which humans perceive themselves is, in the main, the substance of literature—the written word thus provides a cogent reflection of the nature of a particular society at a fixed point in time and place. This reflection comes to us not simply through the art of poetry and prose, but through the utilitarian languages of commerce, engineering, law and science. However, there is another less rigid usage, wherein language defines those quintessential human genres of satire, irony, mockery, censure and humour. Indeed, it is through the use of these that we may gauge the level (and depth) of a civilisation. For example, as the first decade of the new millennium draws to a close, humanity is at last becoming painfully aware of the outcomes of both its success and its excess. Faced with what is an apparently inexorable and imminent global warming, and an intransigent Intergovernmental Panel on Climate Change that is adamant that the change is driven primarily by anthropogenic carbon dioxide, it is more than refreshing to read a novel and moderately well-argued satirical dissertation that claims that a strong causal pathway exists

between global warming and Aztec blood sacrifice rituals,¹⁹ rather than carbon dioxide levels. The use of satire and humour to probe, to expose and to question all in the pursuit of truth is uniquely human.

On a more sobering note, the 16th-century writings of the poet William Shakespeare, challenge us to conclude that, of the many human traits we possess, one has primacy in separating humans from other animals, and that is the concept of mercy. Shakespeare argues that it is through exercise of mercy that one adopts a godly trait, and thus demonstrates the best in a human. Importantly, it is this approximation of behaviour to that of a (beneficent) deity that is used to demonstrate the highest good, i.e. the quality of human action is judged on the basis of how closely the activity approximates to those anticipated of God.

*The quality of mercy is not strain'd,
It droppeth as the gentle rain from heaven
Upon the ground beneath: it is twice bless'd;
It blesseth him that gives and him that takes:
'Tis mightiest in the mightiest: it becomes
The throned monarch better than his crown;
His sceptre shows the force of temporal power,
The attribute to awe and majesty,
Wherein doth sit the dread and fear of kings,
It is an attribute to God himself;
An earthly power doth then show likest God's
When mercy seasons justice.*

(*The Merchant of Venice*²⁰)

Last words

Wherein these last words, the essence of 'being a good human' is determined and a rationale for religion, and the order that this may inspire, is entertained.

Humans are social animals. This in itself is not the essence of humanness, as many other species are social, or colonial. What is important about the social behaviour of humans is the manner in which society has evolved, and the mechanisms through which social cohesion are achieved. Edward Wilson, who coined the term sociobiology, recognised the uniqueness of human language, with its intricate symbolism, quality and grammar.²¹ Wilson also reminded us that humans are remarkably easy to indoctrinate. Further, he concluded that although this intellectual plasticity has many advantages, if uncontrolled it would lead to social anarchy. He thus saw the evolution of religion as the antidote to this plasticity.²¹ How Darwin would have viewed Wilson's conclusions is somewhat intangible; in his early years Darwin was a theist, and even at the end he was agnostic rather than an atheist.²² Darwin did not close the door on religion, although he clearly entertained the idea that God (the Creator) was potentially a manifestation of human culture:

The idea of a universal and beneficent Creator of the universe does not seem to arise in the mind of man, until he has been elevated by long-continued culture. (*Descent of Man*²)

Darwin's understanding of the evolution of spiritual awareness in conjunction with the evolution of community, continues the link evidenced in the works of Aristotle (and de Chardin), namely that humans are best able to reach true happiness through positive interaction with friends and community.¹

In an interesting parallel, recognition of the significance of community lies within the Bantu concept of *ubuntu*, a process that seeks to establish unity through the act of living together as harmonious communities.²³ The essence of *ubuntu* is the realisation that a man is not an island, and that a single human individual cannot reach full potential in isolation.

Rather, for better or for worse, we are the products of our community. A form of the global community, and global communication, that de Chardin envisaged is now with us. How we exercise the knowledge this system provides will determine the future of our species.

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1. Aristotle (1985). *Nicomachean Ethics*, trans. T. Erwin. Hackett Publishing, Indianapolis, IN.
2. Darwin C. (1871). *The Descent of Man, and Selection in Relation to Sex*, 1st edn. John Murray, London.
3. Pierce J. (2007). Sentience and cognition: morality in humans and animals. In *Encyclopedia of Human-Animal Relationships. A Global Exploration of our Connections with Animals*, vol. 4, ed. M. Bekoff, pp. 1307–1311. Greenwood Press, London.
4. Patterson-Kane E. (2007). Music, dance, and theater: music as a shared trait among humans and animals. In *Encyclopedia of Human-Animal Relationships. A Global Exploration of our Connections with Animals*, vol. 4, ed. M. Bekoff, pp. 1227–1231. Greenwood Press, London.
5. Tropp S. (2008). "The Esthetic Instinct in Action": Charles Darwin and Mental Science in *A Portrait of the Artist as a Young Man*. *James Joyce Q.* 45(2), 221–244.
6. Callaway E. (2009). Animals that count. *New Sci.* 202(2713), 37–39.
7. Darwin F. (ed.) (1887). *The Life and Letters of Charles Darwin, including an Autobiographical Chapter*, Volumes I–III. John Murray, London.
8. Foster B.A. and Buckeridge J.S. (1987). Barnacle palaeontology. In *Crustacean Issues 5: Barnacle Biology*, ed. A.J. Southward, pp. 43–62. A.A. Balkema Publishers, Rotterdam.
9. Buckeridge J.S. (In press). Barnacles, biologists, bigots and natural selection... Confound and exterminate the whole tribe! *Evol. Educ. Outreach*.
10. Darwin C. (1852). *A Monograph on the Sub-Class Cirripedia. The Lepadidae; or Pedunculated Cirripedes*. Ray Society, London.
11. Darwin C. (1859). *On the Origin of Species by Means of Natural Selection*, 1st edn, p. 409. John Murray, London.
12. Darwin C. (1869). *On the Origin of Species by Means of Natural Selection*, 5th edn, p. 579. John Murray, London.
13. Darwin C. (1868). *The Variation of Animals and Plants under Domestication*, Volumes I & II, 1st edn. John Murray, London.
14. Barnard W.S. (2004). Darwin at the Cape. *S. Afr. J. Sci.* 100, 243–248.
15. FitzRoy R. and Darwin C. (1836). A letter, containing remarks on the moral state of Tahiti, New Zealand, &c. *S. Afr. Christ. Rec.* 2(4), 221–238.
16. Coppens Y. (1981). Pierre Teilhard de Chardin, palaeontologist and field worker. UNESCO International Symposium on the occasion of the centenary of the birth of Pierre Teilhard de Chardin. In *United Nations Educational Scientific and Cultural Organisation Conference Proceedings SS-81: 809(24)*, 1–4.
17. Weiner J.S. (1955). *The Piltdown Forgery*. Oxford University Press, London.
18. De Chardin P.T. (1975). *The Phenomenon of Man*, Harper Colophon edn. HarperCollins Publishers, New York.
19. Kile M. (2009). The Aztec solution. *Quadrant* 53(6), 26–29.
20. Shakespeare W. (1955). *The Merchant of Venice*, ed. J.R. Brown, Act 4(1): 180–197. Methuen & Co, London.
21. Wilson E.O. (2006). *Nature Revealed: Selected Writings, 1949–2006*, p. 145. The Johns Hopkins University Press, Baltimore.
22. Spencer N. (2009). *Darwin and God*, p. 124. Society for Promoting Christian Knowledge, London.
23. Forster D. (2007). Identity in relationship: the ethics of *ubuntu* as an answer to the impasse of individual consciousness. In *The Impact of Knowledge Systems on Human Development in Africa*, ed. C.W. du Toit, pp. 245–289. Research Institute for Religion and Theology (University of South Africa), Pretoria.