




December 2016

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Article 4

Human-Nonhuman Chimeras, Ontology, and Dignity: A Constructivist Approach to the Ethics of Conducting Research on Cross-Species Hybrids

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Developments in biological technology in the last few decades highlight the surprising and ever-expanding practical benefits of stem cells. With this recent progress, the possibility of combining human and nonhuman organisms has become a reality, bringing into question ethical boundaries that are not readily obvious. These inter-species hybrids are of a larger class of biological entities called “chimeras.” As the concept of a human-nonhuman creature is conjured in our minds, either incredulous wonder or grotesque horror is likely to follow. This paper seeks to mitigate those worries and demotivate reasonable concerns raised against chimera research from the vantage of a combination of two commitments: Constructivism and capacity-based dignity ethics.

In service of this overall aim, first, this paper argues that chimeras are far less foreign and fantastic in light of recent lab research. Second, it argues that anti-Realist (so-called “Constructivist”) commitments regarding species ontology render the species distinction (i.e., the divide between human and nonhuman) superfluous as a basis for ethical practice; this discussion draws from diverse views represented by Eberl and Ballard (2009), Badu-

ra-Lotter and Fangerau (2014), and Ludwig (2016). Third, it discusses some prevailing dignity accounts regarding the practical ethics of the creation, research, and treatment of chimeras. The goal of this essay is to show that the adoption of this particular set of views (Constructivist ontology, capacity-based ethics), in conjunction with recent research, ought to justify a parallel with what dignity we accord to human persons, and furthermore that the trajectory of chimera research allows for cases of moral permissibility.

The most obvious practical benefit of creating human-nonhuman chimeras is that through creating a *predominately nonhuman* organism we could be permitted to transplant *predominately human* vital organs. While the research is perhaps taboo, the dire need of hearts, livers, lungs, and other necessary organs is *prime facie* justification for proceeding. A common intuition is that animals do not have the same moral status as humans, but rather lower status, and therefore the use of their bodies as a means of growing vital human organs for the larger goal of saving human lives can be justified.

However, this presentation is too simplistic. As soon as there is talk of an organism that has animal *and* human parts, intuitions diverge regarding whether these organisms have moral status comparable or commensurate with that of humans. It is possible that they possess rationality or some other relevant capacities that make them *persons* or moral *agents*. Moreover, concerns over the ethical treatment of animals on grounds of suffering apply, if not to a greater degree, then equally to these organisms, since they are likely to be *moral patients*. That is, they are morally relevant since they can suffer, even if they cannot make ends for themselves, as Norcross argues (2004, 242-3). Hence, the whole discussion of chimera creation, research, and treatment quickly becomes complex and the relevant moral intuitions become difficult to parse out. The picture can also become unnecessarily complex due to our unrealistic preconceived notions about chimeras.

Realistic and Unrealistic Chimeras

Chimeras have long engaged the imagination, as depictions of hybrid creatures have emerged across cultures. Ancient myths and artwork often surrounded chimeric monsters: creatures with characteristics of two or more different species simultaneously, such as the eponymous Greek monster with lion and goat features. In the Ancient Near East, jarring images of human-nonhuman chimeras were common in religious and public life, including Egyptian gods with animal heads and human-like bodies (e.g., Horus with avian head; Anubis, canine; Sobek, crocodilian); Hebrew and Babylonian supernatural beings with human-like heads and animal bodies, especially winged animals (e.g., Cherub and Lamassu) as on display at the Louvre; and the famous Hindu god Ganesha, which has elephant and human features intermixed so as to make differentiation difficult. Depictions of this sort are a cross-cultural phenomenon, not always with positive connotations, as Karpowicz et al. comment (2005, 108).

Fascination with cross-species hybrids is not merely a vestige of a bygone age. Lore of mermaids and unicorns continued into the modern period, and festivals to Ganesha continue even in 2016 (“How to Celebrate Ganesh

Chaturthi 2016”). In popular television programming, human-human (intra-species) chimeras are featured; they appear in popular television shows with sci-fi elements, such as *CSI: Crime Scene Investigators* (Fink, 2004) and *Orphan Black* (Natali, 2015), as well as in Japanese animé (Toriyama, 2002). It is no wonder, then, that the recent journalistic pieces by Rob Stein in 2015 and 2016 on National Public Radio (NPR) reporting on human-pig chimeras garnered popular readership with divergent reactions.

Hybrids and chimeras evoke unrealistic fantasy, which likely affects our intuitions and evaluations about chimeras. Whereas some hybrids are likely to terrify (à la the *Island of Dr. Moreau*), the resulting organisms are quite different from expectation, and upon examination they seem completely benign. The popular notions of inter-species chimeras, then, can inflate our conception of the outcomes of such unnatural combinations: we can easily exaggerate what actually occurs in the lab into something that is bizarre and undesirable. Thus, we must guard ourselves from misleading intuitions.¹

Some combinations are familiar and fairly uncontroversial. We see inter-species mixtures in well-known cases, such as the mule (begotten of a donkey and horse), as well as with the rarer lion-tiger hybrids (i.e., liger: lion, tigress; tigon: tiger, lioness). Most surprising is the occurrence of chimeras within the same species. In such extremely rare cases of dizygotic (i.e., fraternal) twins fusing at an early embryonic stage in the womb, the result is a single human organism with two sets of DNA. Possessing two complete genomes, such a human has a patchwork or mosaic of tissues with different genetic origins. While such an anomaly is initially surprising to the reader, this naturally occurring phenomenon raises relatively few ethical quandaries. It is key to understand the concept behind the last chimera, since it is the closest analogue to the kind of case with which this paper is most concerned.

Whereas “chimera” bears reference in different research contexts, as noted by Karpowicz et al. (2005, 109-10) and Eberl and Ballard (2009, 471), in order to limit the scope, I will adopt the procedural definition put forth by the UK Academy of Medical Sciences, as quoted in Palacios-González (2015, 488):

Chimæras are formed by mixing together whole cells originating from different organisms. The new organism that results is made up of a “patchwork” of cells from the two different sources. Each cell of a chimæra contains genes from only one of the organisms from which it is made. (...) Primary chimæras are formed by mixing together two early embryos, or an early embryo with isolated embryonic cell types obtained from a different embryo or cultured stem cell line. The resulting chimæra has cells of different origins, in many tissues. Secondary chimæras are formed experimentally by transplanting (or grafting) cells or tissues into animals at later stages of development, including late fetal stages, post-natal or even adult animals. The donor cells are only present in a few tissues.

This definition classifies two kinds of chimeras, distinguished by procedure and outcome, as “primary” and “secondary” chimeras. The former

organism possesses genetically distinct tissues *throughout* the body, whereas the latter has foreign tissues *localized* and not spread out – as in the cases of tissue grafting or organ transplanting. This distinction is helpful for sorting out the ethical significance of policies. The “secondary” chimera is far less controversial, and there is far less ambiguity in determining what the organism is and whether it has any moral status commensurate with rational persons.² The “primary” chimera, however, resists neat categorization, and it requires greater care and scrutiny (perhaps, caution) with respect to whether it possesses any morally relevant attributes. Moreover, the procedure involved to create “primary chimeras” is far less predictable, given that many variables can alter the outcome drastically.

This definition is also limited to the intentional creation of chimeras. The precedent was set by landmark experiments (Polzin et al., 1987) on goat-sheep (a so-called “geep”) and chick-quail chimeras. The geep chimeras were created by removing live embryos from goats and sheep, isolating the relevant cellular masses of the goat embryos and inserting them into the sheep embryos while at the blastocyst stage. Of the twenty-two implanted organisms, only thirteen survived to birth, and of those that came to term only two were true chimeras — the rest were characteristically either only sheep or only goat. The central idea is that embryonic stem cells from a goat were placed into sheep embryo, with varied results. This method of creating chimeras by manipulating embryos will be the paradigm procedural case for the purpose of this paper. With this in mind, we now move to the processes involving human tissue.

The viability of chimeras and the transmission of the characteristics of a given species (including not only phenotypes, but also behavior) can vary widely. Eberl and Ballard (2009, 478) organize four major factors put forth by Karpowicz, Cohen, and van der Kooy (2005)³ for predicting what kind of creature will result from a given procedure: “(1) quantity of human material transferred,” as the greater the number of cells, the greater the influence on development; “(2) timing of the graft,” as an earlier introduction allows for the foreign material to have more influence; “(3) what type of cells are grafted,” as apparently drawing a distinction among totipotent embryonic cells, pluripotent embryonic stem cells, multipotent adult stem cells, etc.;⁴ and “(4) what host animal is utilized,” for two salient biological reasons: diverging development rates during gestation could result in one part outpacing the other, and the proximity in evolutionary tree (whether in the same genus or relatively recent genetic divergence in evolutionary history) could impact whether the body structure can accommodate the distinctive tissues to function properly.

These multiple variables limit our ability to predict what the outcome will be, and they simultaneously raise legitimate questions regarding exactly *what kind of thing* results from this process. Below I will discuss some problems latent in the ontology of species. However, it should be noted here that researchers recognize some salient limitations in what can occur when grafting a nonhuman embryo and human stem cells. The quantity and timing of cell introduction are two of the most significant factors when determining whether the organism will become simply nonhuman with minor differences, simply human with minor differences, or distinct from

both simultaneously. At the time Karpowicz et al. were writing, an important mice-human experiment had not yet taken place. Piotrowska (2014, 4) reports on the results of this experiment: upon injecting mice with human neural tissue, the mice were still clearly mice but with some enhancement in learning capabilities over the control group. However, there is a point of no return in an embryo's development (although the point when this occurs may be unknown), at which time the organism cannot become something other than the genome's original plan.

The fourth factor, regarding how different the two species in question are, is also relevant to our discussion, since it likely deflates concerns about the most bizarre combinations we can imagine. We cannot expect embryonic chimeras of vastly different species to come to term, let alone function in a healthy way so as to have rational capacities relevant to moral status. In light of this, Karpowicz et al. (2005, 125) speculate that human-ape chimeras in which we expect a human brain to replace or significantly amend the ape's brain would likely fail (i.e., not be viable), since the cranium would need to be "swollen many times [its] ordinary size" in order to house a functioning human brain. Moreover, the organization of chimp and other primate brains would prevent adequately similar neural pathways to function as a simple replacement of a cortex or lobe. While they admit that embryonic chimeras that are "undissociated" could allow for human-ape chimeras theoretically, they will most likely not occur.⁵ Given that viability and rationality is unlikely with human-primate chimeras, so is it even less likely with human-mice chimeras due to even greater incompatibilities.

What I have outlined thus far are some outcomes of some available procedures in creating chimeras. I have given examples of those occurring in nature and in the lab, and discussed some major factors that shape the development and expression of various genetic traits. We have some confidence in how to create organisms that can acquire traits that may be characteristic or typical of humans, but the procedures that would likely create beings with rational capacities are unlikely to be fruitful – exceptions being nearby primates, with qualification and hesitation. So, we recognize key sources of uncertainty, as well as the current low probability of rational chimeras. These factors serve to calm our knee-jerk reactions. It is now necessary to address species ontology more explicitly in order to locate the ethical concerns more clearly.

Chimeras, Species, and Ontology

Eberl and Ballard (2009) emphasize that the study Piotrowska comments on above, and studies like it, show that the mice that receive human brain cells did not undergo any "substantial change," but did undergo "accidental change" (to use Aristotelian terminology). In other words, the mice remained the same *kind* of thing, even with the introduction of human parts. Ontologically, this is analogous to when a human acquires a heart valve from a cow or a pig. This acquisition does not change what *kind of thing* the human is. For example, the mice that became smarter did not cease to be mice and essentially become something else in the process.⁶ This interpretation is a "Realist" approach; the *kind* (what it is, its essence)

exists *independently* of the categories and names we assign to natural things. According to Eberl and Ballard (2009, 472-473, 477), this approach admits that our taxonomy of species does not (or cannot) perfectly align with all and only essential distinctions. An implication from this frame of thinking is that it is theoretically possible for ethics to hang on whether we correctly assess relevant substantial changes contra accidental changes. It is Eberl and Ballard's aim in their paper to show exactly this point, while avoiding the charge of arbitrariness of favoring the moral status of humans, as in "specie-sist" or "anthropocentrist" positions.

In contrast, what may be called an anti-Realist account, or as Badura-Lotter and Fangerau (2014, 21) call it, a "Constructivist approach," is the ontological commitment that there is no such essence or substance in nature. Rather, what we taxonomize as "species" is, if anything, merely a label that denotes a bundle of properties with a family of resemblances commonly associated together. This conception of species resists rigidity, as all boundaries are vague. Of course, it is far more plausible that on the evolutionary account this would be the case – looking back, any species' ancestral line will meet with the ancestral line of another species. (Indeed, that is precisely the point of common descent.) What follows from this is that ethical judgments would not hang on essential or substantial differences (i.e., what a thing is), but rather they would hang on the properties that we consider most relevant for taxonomic differentiation (i.e., what characteristics a thing has).⁷ Or, as Badura-Lotter and Fangerau (2014, 21) explain:

Instead of referring to a specific ontological status of "species" (which can be violated), one can regard the concept of species as a human construction or interpretation used to handle the complexity of the environmental surroundings—a tool for categorization that faces persistent conceptual challenges reflected in the many definitions that have been used for "species" in the past and present. As a consequence, we can bestow to "species" no greater value than people are willing and able to do in a given context.

What follows from the broader Constructivist approach is that, as Piotrowska (2014b, W9) argues, we need not be concerned with statistical distributions of traits or some kind of set natural range of exhibited characteristics in order to ascertain that some animal is a member of a given species. Especially in cases where half of the genetic material involved in an embryonic chimera is of the species *homo sapiens*, it is sufficient that an organism descends from *homo sapiens* to be a member of *homo sapiens*. To make this point, Piotrowska (2014a, 7) draws from the intuition that a child who is the biological descendent of some mother is sufficient to include the child in its mother's genealogy and genetic family. The import of this discussion is that in a Constructivist approach, species membership is more flexible than may be commonly construed. Hence, when speaking of inter-species chimeras as being "unnatural" (in a negative sense of being "unfitting" or "inappropriate") or as disallowing species membership, the Constructivist can recognize that the extension of these categories – like words — can expand over time.⁸

Thus, with this anti-Realist ontology, the very concept of a “half-breed” human-nonhuman chimera will not determine ethical considerations immediately. Whether the organism is of one species or another may be heuristically helpful, but it does not address the ethical matters on the most basic level. Rather, what characteristics it has — not the label or name it is given — will inform what level of care and dignity ought to be afforded it.⁹ We would not determine the moral status of an organism based on species membership. It is the prevailing accounts of dignity that we will discuss next.

Human-Nonhuman Chimeras and Human Dignity¹⁰

Ethical arguments regarding the creation, research, and treatment of chimeras has been framed in terms of whether the organism is, in fact, human or sufficiently human. This strategy of assessing the ethics of chimera research has a parallel in abortion and embryonic stem cell research debates. There may be an appropriately low expectation for a neat and tidy resolution to these issues. In the Constructivist view, simply assessing whether or not the chimera is human is hasty, and the debate requires greater nuance. As we have discussed, membership in the *homo sapiens* species for chimera is debatable in a way that does not extend to the debate over embryonic stem cells and abortion. Nevertheless, how a zygote or blastocyst ought to be treated, if it has moral status at all, *will* be informed by those debates.

The previously cited authors align with several different positions. The various accounts interpret the basis of (human) dignity, or what is most relevant for an organism to be considered in the moral community. We may categorize these interpretations as follows:

- (a) Anthropocentric approach/*homo sapiens* membership;
- (b) Rational nature approach/inherent capacity for reason; and
- (c) Rational psychosocial capacities approach.

As a test case for assessing these different views, and as a way of limiting the scope of the discussion, I would like to consider a single scenario: the chimera of an embryo of an animal (nonhuman) and the stem cells of a human. For the sake of argument, let the animal be a chimpanzee embryo (totipotent cells), and the human cells not be derived from an embryo but from adult human stem cells (multipotent, not pluri- or totipotent). This will avoid arguments about the moral status of human embryos, but will allow that any human traits and any organs could potentially be developed in the organism. Let the proportion of cells originating from the chimp and human be even, so as to avoid fitting either category “predominantly nonhuman” or “predominantly human.”

Let us then assume that Constructivism and Dignity-based ethics are the appropriate routes. To capture the respective concerns of *creation*, *treatment*, and *research* of chimeras, the central questions to answer are: (1) “Is it morally permissible to create such an entity?”; (2) “What is the necessary respect or dignity due to such an entity?”; and (3) “Would research performed on such an entity contravene its dignity?”

The Anthropocentric approach (a) argues that species membership (i.e., being of the taxon *homo sapiens*) is a sufficient (and necessary) condition for

moral status and dignity, and the corollary is that nonhumans have less or no moral status. As we have discussed, species membership ought not be the determiner of moral status in a Constructivist view; it potentially puts the cart before the horse. Species membership is not sufficient for moral consideration, as living human beings without any rational capabilities are thought to be without moral status, whether having lost rational capabilities, as in the case of sufficient brain damage, or never having possessed them, as in the case of genetic anencephalic infants (Eberl & Ballard, 2009, 475). It is also not necessary, as we can imagine an alien like Spock to have moral status even though he's not human (Palacios-González 2015, 490). It is also relevant that other animals may be rational to some lesser degree, such as dolphins, higher primates, and pigs (Eberl & Ballard 2009, 473).

If these untoward conclusions do not dissuade the reader, one may also find that from the Constructivist vantage, this position could suggest that chimeras do have moral status the same as humans by virtue of their biological inheritance. As Piotrowska (2014a, 6) argues, lineage and genealogy matter for species membership, as a matter of genetic historical and interpersonal social fact.¹¹ In this case, human-nonhuman chimeras would be an uncommon, but legitimate member of *homo sapiens*. They would have the same moral status as humans; in other words, whatever dignity and status that a human would have by virtue of species membership, the same would be true for the chimera. That would answer questions (2) and (3), but one may wonder whether it denigrates the human species to create the entity in the first place; however, the intuition could easily go the other direction: the increase in capacity would exalt the nonhuman to a privileged moral position.

The Rational nature approach (b) attempts to avoid these charges of anthropocentrism and the arbitrariness of speciesism by anchoring ethical status to having a rational nature. As mentioned before, this view adopts a less popular Aristotelian metaphysics, seeing substance as being “fixed,” more or less. An implication is that as long as the animal's *nature* is rational, it has moral status. This need not require the organism to be capable at any and every moment to exercise those abilities of reason yet, but rather rationality is possessed in some sense at conception. This is a kind of capacity view, expressed in terms of active and passive potentiality (or potencies) that inhere as a part of a thing's nature (Eberl & Ballard, 2009, 475). In other words, if the organism has the DNA encoding to generate the kind of capacities to reason, then it *inherently* possesses the ability (latent, unused, or being used) to exercise rationality. That quality alone is sufficient for moral status; if one were to undergo some “substantial change” and lose those rational capacities, then moral status would likewise be lost. There is much to say regarding the merits of this philosophical tradition. Briefly, however, I merely point out that if evolutionary biological history is assumed, this position is, *prima facie*, not the favored ontology. In other words, this position suffers from lack of coherence with other scientific disciplines.

Likewise, if the apparently undesirable implications of the Rational Nature approach fail to turn the reader away, there may be more untoward consequences of this view. The determination whether an organism is in the moral community or not seems to hinge upon the probabilities of possess-

ing the nature to develop that way. Thus, when asking if it is an immoral act to create or perform research on the organism, the answer can only be answered in terms of risk: it is a statistical or educated guess that we may continue or must refrain.¹²

One may be concerned that the *creation* of such a being would be impermissible: as Eberl and Ballard (2009, 480) claim, “probably no justification is sufficiently strong to justify the creation of these kinds of chimeras.” It is unclear why no justification is probable to the authors. Perhaps organ harvesting would be impermissible; perhaps unnecessary suffering would be created. But from a dignity approach, creation of this kind of chimera may be permissible within reproductive rights, just as bringing to term an infant with Downs Syndrome is permissible. Perhaps, then, if one could find some capable, informed, consenting individuals who intend and contractually agree to care for the chimera (and, say, subsidies were afforded them to remove financial burden), would this practice violate the chimera’s dignity, or would its dignity be upheld? Wouldn’t this simply be another, albeit bizarre, means of reproductive ends? The lack of justification *now* does not make it probable that there will never be justification.

The Rational psychosocial capacities approach (c) is quite similar to (b) in that the grounds for ethical status is capacity and not species membership; however, the capacity in view is broader than merely possessing rational faculties – it can include the psychological, social, empathetic, and other sentient capacities that we consider intrinsically valuable and typically, though not necessarily, associated with humans and their dignity. As Karpowicz et al. (2005, 120) claim, “That is, human dignity is a multi-faceted [sic] notion that is characterized by a family of unique and valuable capacities generally found in human beings. No one of these capacities is definitive of human dignity, but taken together, they set out a paradigm case of what it is to have human dignity.” Likewise, Piotrowska (2014a, 7-8) summarizes, “our moral obligations to others ought to be determined by a creature’s capacities and the moral upshot of those capacities. [...] [W]hether it is wrong to treat a creature merely as a means to an end may depend on its capacity for rational thought, not its biological makeup. Similarly, whether it is wrong to torture a creature may depend on its capacity for sentience.” This is a compelling account for how capacities would be morally relevant, but there are some concerns.

As such, this approach appears to succeed in avoiding speciesism, which is an advantage over the Anthropocentric view. It seems more flexible and conducive to an evolutionary biology paradigm, which appears in conflict with commitments in Realist ontology. However, there are some tensions here because it seems as though the capacities referred to are things that must be “in hand,” or actual and not merely potential. This is suggested by the fact that Piotrowska explicitly denies biological makeup as grounds. Capacities could supervene on biology, but prior to the sufficient development of them to supervene, the organism would not appear to have the relevant capacities and thus not be of a moral status. Potentiality of capacities would not justify moral status, because potentiality is merely predictive biology. This means that an infant or someone with severe mental disabilities may be considered to have no more moral status than a dolphin has, or perhaps

be in an even worse state. One implication for this then is that appropriate treatment of chimeras apply when the relevant capacities are developed; chimeras ought not suffer when they become sentient, but they may justifiably be used as a means of research until the capacities for reason and deliberate goal-making are present.

Karpowicz et al. (2005), however, do not seem to give themselves the same room or to hedge themselves. Rather, they explicitly turn in the other direction. Their view appears to amount to, in the end, a kind of potentiality view of capacities, as Palacios-González (2015, 491) likewise comments. In reference to avoiding untoward consequences for infants and those with severe disabilities having lower moral status, Karpowicz et al. argue that “We tend to ascribe it to all humans, no matter how seriously impaired they may be, because there is no clear agreement about just how many dignity-associated capacities a person must possess to be said to have human dignity” (2005, 121-2). In order to reduce false negatives, we err on the side of safety. I assess that this is insufficient, for as Palacios-González (2015, 492) argues they appear to be “proposing an *ad hoc* speciesist solution”; or, in other words, the motivation that capacities would be valuable is that they are *actually* possessed by the organism, not that they are *generally* possessed by a species class. Consequently, Piotrowska (2014a) seems to be more consistent than Karpowicz et al., but in either case, there are situations in which chimeras’ moral status would depend on the capacities they actually possess, not generally possess.

Finally, Karpowicz et al. (2005, 124) make the case not only that chimeras would have certain moral status by virtue of possession of these capacities, they argue further that even the mere *creation* of a chimera would contravene dignity: “if human-like capacities associated with human dignity were to emerge in such animals to some degree, the creation of this research subject would contravene human dignity.” But how would this follow? The association of characteristics with human dignity being expressed in a limited way does not imply that the original source (human) is thereby denigrated. Why would it not fall the other way: that the organism that tends to have characteristics associated to not have morality is elevated to the status commensurate (or tending toward) human value? Even assuming a potentiality account, it is not as though the organism existed as possessing capacity, which then is pulled down into a less-dignified state. Rather, an entity would emerge with those valuable capacities, thus having dignity when it would have had less or none.¹³

There are two remaining concerns. One may reject chimera creation and research on grounds of species integrity. This concern may be adequately addressed by Karpowicz et al. (2005, 115-8), as they argue this rejection is morally irrelevant. Finally, one way in which dignity may necessarily be contravened is by the very act itself: the procedure alone may render the organism as a means to an end. However, this argument would speak not only against chimera creation and research, but also against IVF procedures. (Perhaps in all cases in which IVF is permissible, this procedure is also.)

Thus, of the three capacity views, the most plausible, coherent, and practical view for Constructivism is that of (c) the Rational psychosocial capacities approach. The result is that human-nonhuman chimeras may be

created, researched, and respected in cases where they have capacities that dignify them. These capacities are comparable with human capacities, but this ought not prevent us. Recent research might mitigate our concerns that these creatures will even come into being. But should they occur, according to these positions, it follows that the ethics of the creation, treatment, and research of human-nonhuman chimeras (in the scenarios I have given) do not relevantly differ from human IVF research and treatment. If there is any remaining hesitation to produce, raise, or care for chimeras, it would need to be justified apart from the anti-Realist and capacity-based positions here adopted. In other words, the further denial of human-nonhuman chimera creation may only suggest the denial of Constructivism or the Rational psychosocial capacities approach, or both.

Notes

1. While it may seem counter-intuitive to bring these images to mind given the warnings I have outlined, the inclusion of these chimeric depictions is to emphasize a stark contrast with what research has actually involved, so as to clip the wings of our flights of fancy and consequently weaken irrelevant moral intuitions.
2. This paper takes as uncontroversial the creation of “secondary chimeras” that do not involve grafting functional human brain or other neurological tissues into nonhuman organisms. It is outside of the scope of this paper to comment on the procedures that introduce human brain tissue in this particular manner. For a fuller discussion of the ethical boundaries of these methods, see Karpowicz, Cohen, and van der Kooy (2005), and Eberl and Ballard (2009).
3. While Eberl and Ballard identify the source as Karpowicz, Phillip, Cynthia B. Cohen, and Derek van der Kooy. “It Is Ethical to Transplant Human Stem Cells into Nonhuman Embryos.” *Nature Medicine*, 10(4) (April 2004): 331–35. However, it is actually the aforementioned 2005 article. This is indicated by their citing the page number (p. 125) when the 2004 article that has a page range of pp. 331-5, whereas the 2005 article which discusses these factors has a range of pp. 107-34. Hence, I cite the 2005 article.
4. According to New York State Stem Cell Science (NYSTEM) website, accessed June 30, 2016, the differences among these terms can be summarized as follows: “Totipotent cells can form all the cell types in a body, plus the extraembryonic, or placental, cells. Embryonic cells within the first couple of cell divisions after fertilization are the only cells that are totipotent. Pluripotent cells can give rise to all of the cell types that make up the body; embryonic stem cells are considered pluripotent. Multipotent cells can develop into more than one cell type, but are more limited than pluripotent cells; adult stem cells and cord blood stem cells are considered multipotent.”
5. Dissociation is a process of separating cells so that they are more likely to be receptive to the host’s “control” in determining what the tissue will become. Undissociated cells, then, are more likely to retain their native organization. The cited authors regard as impermissible the use of undissociated human cells for the creation of human-nonhuman chimeras.
6. Eberl and Ballard (2009) also emphasize that their view is not strictly speaking an “anthropocentric view,” which suffers the charge of moral arbitrariness called speciesism.
7. A theoretical possibility, then, is that how we ‘carve up nature’ with respect to species can, in some cases, be determined posterior to ethical concerns instead of prior to them. If so, another option emerges: the ethical values could in some cases determine our taxonomy. See also David Ludwig, “Ontological Choices and the Value-Free Ideal” (2016). There he argues that we have epistemic values and legitimate non-epistemic values in our sciences, and far from seeking to remove them, our next step should be to discern which non-epistemic values are legitimate and why. Appealing to this general principle, I suggest that ethical values could be prior to ontological decisions; Ludwig, however, does not appear to commit himself to this suggestion.
8. That is, the set of objects of which the predicate “human” or *homo sapiens* applies can accommodate more diverse objects over time. On the Constructivist

- paradigm, this should not concern; it fits nicely within evolutionary biology.
9. As hinted in note 9, it may be heuristically helpful only with respect to evoking the idea that particular characteristics imply ethical consideration, but this is only done after ascertaining those ethical considerations. To the point: if one of the desiderata of categorizing *homo sapiens* is to flag them as members of the moral community, then a Constructivist ought to take that flag as a strong suggestion and no more. On the other hand, the Constructivist who seeks that desideratum might attain it by including marginal cases like human-nonhuman chimeras as *homo sapiens* in light of the relevant capacities the organism has.
 10. The title of this section should evoke tension given the prior discussion.
 11. Piotrowska nevertheless hesitates to give anthropocentric view full credit with this conclusion. She offers some thought experiments where intuitions diverge despite having lineage/ancestral relation. Consequently, she is quite critical of the anthropocentric approach, favoring a capacity-based account of moral status.
 12. Eberl and Ballard (2009) explain: “Our moral premise based on this view is that if an a-h [animal-human] chimera has the intrinsic capacity to develop self-conscious rational thought, it is a rational animal and thereby possesses the same moral accord as a human person; research on such a chimera would, thus, be akin to conducting research on a human being and it should be protected under the ethical standards protective of human research subjects.”
 13. Palacios-González (2015) p. 493–5, 498 has a fuller account of chimera creation arguments. There, the same argument is made as I give above, and he provides additional avenues that Karpowicz et al. may consider – his conclusion is that arguments against the creation of chimeras are thus far unsuccessful.

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