How a Future Species of Superion Hominids Might Negotiate to Promote the Survival of Homo Sapiens: An Application of the Model of Hierarchical Complexity

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Abstract

Using ideas from evolution and stages of development, as conceived by the Model of Hierarchical Complexity, a hypothetical scenario, premised on genetic engineering advances, portrays the development of a new humanoid species, Superions. If such a species of Superions were created, how would this impact current humans? If the Superion scenario came to pass, might this eliminate Homo Sapiens? This might happen not so much because Superions would plan to eliminate current humans, but it might be an inadvertent effect, in which new occupations and niches are created that Homo Sapiens does not fill as well. Our purpose is to examine the processes and impacts that may come into play if a new species were genetically created from current humans. In order to explicate how the two species might interact most effectively, we introduce the use of the Model of Hierarchical Complexity. The Model describes what underlies stages of development and in addition has elaborated on the idea of higher stages of development. As will be discussed, in Homo Sapiens, the mean stage is formal operations, a stage during which individuals are able to effectively deal with single-variable causal relationships. Only some humans (about 20%) reason at the Systematic stage, in which multiple interacting variable systems can be considered. Even fewer reason at higher stages called Metasystematic (comparing two or more systems) and Paradigmatic (inter-relating metasystems). In developing Superions, scientists would be assumed to bring about changes that would raise the effective mean stage of the new species. The mean stage of Superions might be Systematic or above. The paper discusses how a new species would apply systematic, metasystematic and paradigmatic stage problem solving to the issue of how to maintain the survival of Homo Sapiens.

For probably interesting psychological reasons beyond the present scope to discuss, many parents want their children to be born and mature as "perfectly" as possible. In Western societies, people with the financial means to do so are already making genetic selections that ensure their children are born with the desired gender (Fugger, Black, Keyvanfar, and Schulman, 1998) and without certain genetic defects (Baker, 1999) that science has thus-far been able to engineer out.

More sophisticated means of performing genetic selection for many more characteristics would likely have its research funded by wealthy individuals and/or groups. Early on, this would not be an organized endeavor, but individually sought out. We would expect that scientists thus-equipped would begin to advertise, as fertility clinics already do. Instead of having crudely discriminated embryos implanted, parents could consult a long list of possible traits and pay for the design of embryos with those traits. Such embryonic engineering is possible by inserting the correct genes to produce the traits. This idea is not unique. Silver (cited in Danovsky, 2000) has already predicted that high-end baby making will be available in fertility clinics, and Stock (2002) believes such germline engineering is inevitable.

Creating non-human life forms with particular characteristics is already taking place. As a result it seems likely in the near future that some scientists will begin to genetically engineer human beings with much more superior capacities than have yet been attempted. This scenario, discussed here, uses ideas from evolutionary psychology (Buss, 1999) and the Model of Hierarchical Complexity (Commons et al., 2008; Commons & Miller, 1998; Commons & Pekker, 2008), among others, to project into the future some of the challenges this may present.

GENETICALLY ENGINEERED BIOLOGY

With the mapping of human genome, the foundations for this future have already been laid (About the Human Genome Project, 2002). Individual genes' locations and the characteristics they are related to are already archived in growing database form. This kind of information will enable this historic social change to become more prevalent, more rapidly: a gene is just a database search away. Finding information about a gene now takes only minutes, compared to the former method of finding out about a gene, PCR (Polymorase Chain Reaction), which would take hours.

Even so, acquiring the locations and characteristics of genes is not enough. A great deal of additional information exists and is needed, which is not available from inside genes. A larger portion of human DNA contains instructions on when genes should be activated (e.g. Plomin and Colledge, 2001). Furthermore, because the whole process underlying the heritability of behavioral traits is very complex (McGufún, Riley, and Plomin, 2001), it is not yet well enough understood to actually engineer such traits in a controlled, predictable manner .

Nevertheless, this science is progressing rapidly, such that we believe it is not so distant in time when these greater intricacies of heritability will be known to future humans. At this time, most such research is done with other animals, and only some with humans. Johnson and Harding (2001) reported the birth of the first genetically modified non-human primate: a rhesus monkey with a jellyfish gene (which controls the ability to fluoresce) inserted into its DNA. To correct infertility problems, Barritt, Brenner, Malter, and Cohen (2001) transferred a small amount of genetic material from a fertile woman into the egg cells of infertile women. The material is detectable in the cells of the resulting, healthy offspring. Blaese et al. (1995) initiated some of the first human gene therapy, which involved two children. It was designed to treat severe combined immunodeficiency that stemmed from a mutation in the adenosine deaminase gene. Although the therapy did not produce the ideal results intended, it demonstrated that such gene therapy should become possible.

Genetic engineering has become ubiquitous, especially with animals. Rather than forecasting bans on it, it is more realistic to note that there is so much of it happening already that government regulations may only be able to regulate it, but not stop it. There is such demand for some of the beneficial effects, the work will continue. One indicator of this is that the U.S. Food and Drug Administration recently issued a "guidance document" for comment on how Genetically Engineered animals should be regulated (U.S.F.D.A., 2011). In the market of customers likely to be most interested in this, financial means are currently ample. This is probably as true for human engineering as for animal engineering.

WHENCE COMETH THE SUPERIONS?

In the conception we present here, the new species is developed rapidly. Scientists and their sponsors could select a whole complex of beneficial genetic traits, from humans representing a variety of cultures, to engineer it. *Superions*, as we call them, could be engineered more efficiently than current humans with superfluous parts eliminated and organs designed for easy transplant and upgrades. The expected result is that all of this expertise, paired with human motivations to innovate, would result in an extremely smart species of hominids. We predict they would be smarter than humans, initially by at least one standard deviation, but with greater numbers of individuals engaging in more complex thought than seen in current humans. They would also be healthier and longer-lived by 30–60 more years, and more attractive, emotionally stable, creative, and yet still genetically diverse. With the benefits of a number of current genetic engineering techniques, plus others to be developed, the entire species could be developed in a relatively short period of time (surely less than 20 years), with the following caveat. Gene manipulation alone would not be enough to create Superions. In addition, an interdisciplinary group of scientists would have to apply what is known about environmental influences in order for Superions' development to reflect their genotype to the greatest extent possible.

While there are clear ethical concerns that arise from possibly creating a new species, it is also the case that genetic engineering of humans needs to also be seen as just part of evolution. People think of it as artificial selection, but because we were created through natural selection anything we do to genetically engineer ourselves is also part of natural selection. Extracting and modifying DNA is just another mechanism for adapting to one's environment. Humans are applying to themselves the same type of engineering they have done with other species.

THE EFFECTS OF SPECIES-SEPARATION OF SUPERIONS AND HOMO SAPIENS

An assumption of this scenario is that creators of Superions may have the generation of a separate species as their objective. Such a species would be unable to breed with humans, just as humans cannot breed with other species. To create a new species, they would insert or delete whichever genes could make it impossible to reproduce with humans. For example, they might design an allergy to human sperm into Superion women, or render Human/Superion crosses infertile.

What impacts could be hypothesized for humans if such a new species were developed? It would depend on the designed-in characteristics of Superions by different groups, including by some governments. If militant low-stage functioning Superions were even developed, and happened to be in power, they would likely just kill the humans off, much like humans' ethnic genocides. However, in this scenario we are proposing the most beneficent case. Even in that case, the future for humans may not necessarily be all positive. Superions would be genetically superior, and thus they would compete more effectively for the resources that humans currently control. Superions would occupy the niche of humans more effectively than humans have, without a need to be violent, competitive, or unethical. They would also be likely to create niches that would most likely be a better fit for Superion characteristics rather than human characteristics, thus potentially leaving humans without constructive roles in their new society. Superion capacities would simply make them more successful.

The replacement of humans by a more advanced form, as proposed here, has a basis in the evolution of Homo Sapiens. Although historically the evolution of Homo Sapiens has resulted in only one hominid species, there were many earlier hominid species throughout the previous six or so million years of human evolution. Even as recently as 35 thousand years ago Neanderthal co-existed with Homo Sapiens (Brown, 2001). At some point, only one species remained, although there is not enough information yet to know how that came to be the case.

In the case of the creation of Superions, various causes could contribute to the extinction of Homo Sapiens. Easiest to imagine is that during droughts or other adverse conditions, for example, competition for resources would intensify between humans and Superions. The intellectual superiority of the latter predicts they would have enough of an edge to win out in the end. For example, they may be more creatively adaptable in conserving water and other resources while still producing bare essentials, coping more successfully with effects of climate change worldwide. The wiping out of humans might also be inadvertent. For example, Superions could be created to be resistant to diseases to which humans are not, because scientists could design built-in disease resistance (see Leal and Zanotto, 2000). Finally, humans might still die out even if Superions did everything possible to prevent it. The more benevolent Superions might want to save the humans, but the evolutionary problem could be the lack of a role for humans.

BEHAVIORS PREDICTED FOR SUPERIONS

To attempt predictions of how Superions would behave, we use the Model of Hierarchical Complexity (Commons et al., 2008; Commons & Miller, 1998; Commons & Pekker, 2008). It enables us to consider the kinds of actions they could take in a Superion–human co-existence, depending on their stage of development.

The Model of Hierarchical Complexity (MHC) is a measure of the a priori difficulty of tasks. Because less complex tasks must be completed and practiced before more complex tasks can be acquired, the Model argues that this accounts for the developmental changes seen in individuals' performance on tasks. For example, persons cannot perform arithmetic until they can truly and correctly count. In order for difficulty to be precisely measured, the Model proposes a metric. That is, that Task A is considered to be hierarchically more difficult or complex than Task B if Task A is made up of two or more simpler actions (such as Task B and a third task, C), and these simpler task actions are coordinated in a non-arbitrary way. If Task A consisted of a combination of Task B and Task C, then it would be what is called one Order of Complexity higher than Tasks B and C. This is shown in Figure 1.

The Model specifies that there are 16 orders of complexity, starting with tasks that are completed by the simplest animals and infants, and progressing to highly complex tasks that only some adults complete. These orders are shown in Table 1.

An individual's stage of development or performance is based on the order of hierarchical complexity of the task that he or she correctly completes, and because of that is given the same name and number as the order of complexity of the task. So, if an individual completes a task that is at Order 10 (Formal), their performance on that task is also considered to be at the

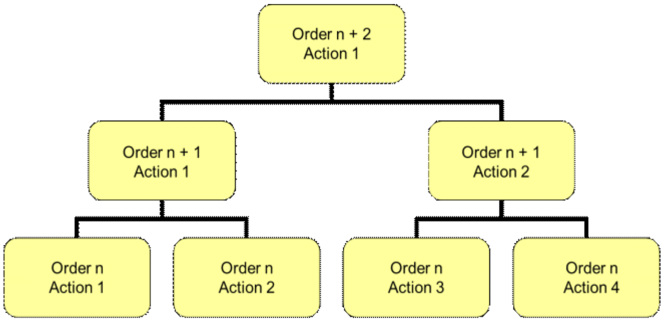

Figure 1. Order of Hierarchical Complexity

Table 1. Orders of Hierarchical Complexity

Order	Complexity Name	Order	Complexity Name
0	Calculatory	8	Concrete
1	Sensory or Motor	9	Abstract
2	Circular Sensory-Motor	10	Formal
3	Sensory-Motor	11	Systematic
4	Nominal	12	Metasystematic
5	Sentential	13	Paradigmatic
6	Preoperational	14	Cross-Paradigmatic
7	Primary	15	Meta-Crossparadigmatic

Formal Stage. Some of these stages in Table 1, it will be noted, have the same name as the stages proposed by Jean Piaget and colleagues (e.g. Inhelder & Piaget, 1958). There are several differences between Piaget's theory and this Model. One important difference is that the Model allows for the characteristics of the task to be specified and varied separately from the individual's performance on the task. In Piaget's research, characteristics of the tasks were not systematically varied; instead inferred mental structures (such as 'schemas' or 'operations') were inferred based on the performance and also named as the explanation for the performances observed. We have found in research with humans, particularly in research across the stages from Stage 7 to Stage 12, that the order of task complexity accounts for large amounts of the variance in the task performance, up to $r = .988$ (Commons et al., 2008; Commons & Li, in press). The *average* (although not highest possible) stage of development attained by humans worldwide is probably formal operations. In multiple studies that we have completed (citations), we have not only found that formal operations is the mean stage among educated adults, but also that there is roughly one standard deviation between stages. In a recent study of 1263 individuals (Commons, Miller, and Li, submitted) we also found that the distribution of humans at the different stages is most likely as what is seen in Table 2. We will use these percentages to inform some of the discussion to follow.

It is surely useful to have formal operations. For many issues there can often be single variable solutions (e.g. what is wrong with my car?). We predict, however, that the mean stage for Superions would be higher than this. Genetic engineering should enable Superions to function at postformal stages of development. Since the Model of Hierarchical Complexity would suggest that development, even in Superions, would still need to progress through all of the stages, there would be two mecha-

Table 2. Distribution of Stages on the Laundry and Identically Structured Problems

Stage	Percent	Number
Metasystematic	1.5%	19
Systematic	18.5%	234
Formal	37.7%	477
Concrete and Abstract	29.0%	367
Primary	13.1%	166
Total	100%	1263

nisms by which more individuals would reach higher stages. One mechanism would be somehow modifying human genes so as to allow more individuals with higher stages to develop. One way to accomplish this would be to make it possible for progress from one order of complexity to another to proceed more rapidly. The second mechanism would be ensuring that Superion environments would also encourage rapid development. Both the genetic and the environmental modifications would ensure these higher stages of performance would be available in all domains: problem solving, moral reasoning, beneficence toward others, and so on. This breadth of the development of higher stages would help Superions take more beneficent perspectives on the conditions and eventual extinction of humans than humans have taken toward other species' extinctions.

To show specifically how issues of species competition might be addressed at each of the stages, we will now take each stage in turn.

At the formal operational stage, responses to another species and what should happen to them may only be considered in terms of simple one variable causal systems. For example, if humans are having a hard time surviving impacts of climate change, fighting over water or sharing land they are crowded onto, Superions solving these dilemmas at the formal operational level, might do the same kind of thing that humans currently do at this stage for other subgroups of humans. That is, based on their analysis of the situation, they would design a solution they considered beneficial, such as to provide well-supplied, segregated conditions, and impose it on the humans. This might mean placing humans into some kind of a protected or controlled environment (a reserve or a zoo-like situation). Another possible formal stage solution to the "problem" of humans, might be to provide them with limited and predefined roles within Superion society. So, Superions might hire humans to perform personal services and other manual labor jobs, just as some wealthy individuals do with members of other demographically distinguished groups.

It seems unlikely, however, given the possibility that they could be engineered and socialized for higher stage reasoning, that Superions would address this dilemma at the formal operational stage. In data shown in Table 2, we found that about 20% of participants solved problems at the Systematic Stage. We could expect this proportion to greatly increase, if this was the predominant stage for Superions. At the systematic stage, Superions would not act as if there was continuity from one species to the other; that is, they would tend to behave as if the current humans would be subsumed under one system, and that they, the Superions, would function under a different system. Thus, Superions would not judge that they and humans had similar rights for similar reasons. Their solution-finding for humans' issues would be much like humans' prevalent methods: coming up with solutions without real consultation with *all* stakeholders. For instance, they might decide there would be separate elections for the humans, divorced from election systems developed for the Superions. Likewise, there might be separate systems for due process. As do others with similar assumptions, the Superions would grant themselves more rights because of their inherent superiority (Colby & Kohlberg, 1987).

If the average stage attained by Superions were systematic this would have far reaching connotations outside of just how they would deal with humans. For example, it might be easier to pass legislation dealing with climate change, since a greater proportion of the population would be able to understand the environment as a system that changes. It might be easier to change the penal system to be one of reform rather than punishment for multiple reasons. First, the understanding of systems means that the majority of the population could see more clearly that the prison system is failing. Second, there would be enough complex Superions for it to be possible to train and hire more reformers. Third, if the population of humans was drastically decreased, and thus the average stage was one higher, there would be fewer individuals who function at low enough stages in the domain of social perspective taking to commit crime in the first place. The types of crimes would differ somewhat, but the frequency of crimes would go down because of improved perspective-taking.

In our previous studies, as shown in Table 2, we have found that about 1.5% of participants solved problems at the metasystematic stage. The proportion of Superions who would function at the metasystematic level would be expected to greatly increase, perhaps to about 20%. There would be several implications of this. Just as humans begin to develop methods to provide seriously and justly for the rights of other beings at the Metasystematic stage, so also would Superions begin to take the rights of the human species more seriously at this stage. The reason for this is that people begin to feel that they must treat others as they themselves would like to be treated in the same situation (Rawls, 1971). Such societies do not kill retarded people or those of other ethnicities, for example, whereas less morally developed societies may, and do. Superions would be compassionate and devise education and other support systems to help humans adjust to their changed status in the world.

Again, based on our previous data, somewhere between 1.5 and 2 percent of the Superions would perform tasks at the Paradigmatic stage 13 (if each stage of hierarchical complexity is one standard deviation, and Superions are designed to develop to two standard deviations more complex than humans). At that stage, we would expect them to influence and improve processes for dealing with humans—and improve processes for humans dealing within their own species. We would expect these high-stage Superions to be in positions of influence and creative leadership. Although they would be a minority, they would exercise significant positive influence. Even if the culture as a whole is not yet functioning at the paradigmatic stage this minority population of Superions would ensure that humans—and Superions—co-constructed multi-perspective frameworks[1] (each one a metasystem; see Ross, 2006a, 2006b, 2007) to help them ensure they developed ways for humans to co-exist with them without detriment. A key question throughout such discourses would be: What role for humans? Such frameworks would be developed to have deliberative discussions of central issues that could impinge on humans' survival and just treatment. These would surely include apartheid, majority rule, distribution of labor, and other economic considerations.

SUPERIONS' NEW TECHNOLOGICAL PRODUCTS

Superions may become proficient in developing cyborgs, a cybernetic organism that adds to its in-built abilities by using technology. Fictional cyborgs are frequently portrayed with a mixture of organic and non-organic parts, such as the Borg in Star Trek: The Next Generation (Rodenberry, Berman & Piller, 1987-1994). Cyborgs' partially organic composition makes them less versatile than robots for certain tasks. Humans have not yet succeeded in creating very sophisticated robots, but it is likely that Superions will master the innovations required. A robot is a device that can perform either under the guidance or direct control of humans, or autonomously and independently of humans—or Superions. Robots may function in environments that neither humans nor Superions could; for example, deep-space or deep-earth resource mining.

Superions may create new robots or androids, robots that look just like humans (or Superions in this case) to adapt to such hostile environments. Because androids look like hominids, people may treat and them as human (or Superion). Although androids would not necessarily pose a threat to humans' existence, Superions may find androids easier to co-exist with than humans. As humans die out, androids may take whatever functional place in society Superions had helped make for humans. The only difference between Androids and Homo Sapiens is that there would be no reason for Superions to make Androids that resemble current humans; they most likely could make androids who were more similar to them, than to current humans.

To develop technologies such as these, Superions may significantly elevate the state of nanotechnology. This may allow uploads to the brain of any information or problem solving process. Thus, someone sitting at a Learning Center might easily learn a new language, how to do calculus, or how to think in more hierarchically complex ways. Because major advances in science are carried out by people performing at Paradigmatic stage 13 and Cross-paradigmatic stage 14, one could expect more rapid advances in that domain (Commons, Ross & Bresette, 2011).

The downside of having more Systematic, Metasystematic and even Paradigmatic-performing beings around might be the increased power to be effectively destructive. To avoid this, one would need to select against antisocial tendencies. It would also be important for there to be socialization that increased empathy and attachment, among other prosocial tendencies. Also, if many decisions would have to rely on co-construction between disparate parties, this might complicate getting things done.

CONCLUSION

It is natural to expect that the notion of a new species like Superions could be met with fear and negative judgments. However, such a new species could introduce positive improvements more rapidly and without the same kinds of unintended consequences, something that Homo Sapiens seem to have more trouble with. Some positive implications include eradicating most disease and genetic defects. It may also be possible to eradicate or greatly decrease many current mental illnesses. Such benefits developed for Superions could be extended to benefit humans. If Superions were developed to function at least at the Metasystematic stage, with some members of the new species at even higher stages, local to global progress would be accelerated and applied to solving many contemporary issues. Perhaps the damage to the Earth wrought by humans to date could be reversed and sustainable modes of production become the harmonious norm.

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