Is it likely that superhuman intelligence has evolved anywhere in the universe?

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There is much discussion about the number of planets in the universe that might sustain life. It is also assumed that if such planets exist, some will have evolved life forms more primitive than those on earth, whereas others may well have evolved more advanced and more intelligent organisms than human beings. It is this last possibility that I question here, and I propose instead that, from the basic biological principles that we have learned from the study of life on this planet, it can be deduced that higher forms of intelligence are unlikely to have evolved anywhere else in the universe.

The assumptions are, first, that life depends on replication or reproduction, and second, that there is heritable genetic information that codes for the structure and function of any given organism. These organisms might contain nucleic acids and proteins, or they might have very different macromolecules, not necessarily carbon-based. The genetic code itself may be very different from that with which we are familiar, but for evolution to occur, it must have intrinsic variation, on which natural selection can act. Such selection will result in the better adaptation of organisms to the environments that are available. To colonise the maximum number of available habitats or environments, more and more complex adaptations must evolve, comparable to the situation that we know on planet earth. For this to occur, environments would have to be reasonably stable and the range available may well determine the diversity and degree of complexity of the various organisms occupying different environmental niches.

This scenario is broadly what has taken place on earth, with the adaptive radiation of a huge number of microbial, plant and animal species. When humans finally appeared, a new type of evolution began to occur, which was very much more rapid than Darwinian evolution. This was social evolution, depending on communication by language, the use of tools, and the transmission from generation to generation of new skills, knowledge and experience. This proceeded in hunter-gatherer communities until the development of agriculture, which included both the growth and harvesting of crops, and the domestication of other animal species. For the first time, a regular supply of food then became available, and this increased the probability of the survival of offspring, and therefore a large increase in population size. It is evident that this was also accompanied by new migrations to the previously unoccupied areas in the various continents. (Note that in the absence of agriculture in communities existing today, population density is always much lower). As a result, a high proportion of all available land habitats across the globe has become occupied by human societies.

During the early evolution of humans, natural selection still operated on such features as intelligence and memory, resistance to disease, and defence or escape from predators. As time went on, increased survival lead inevitably to a decrease in birth rate, which has already occurred in developed countries, and is also occurring in many developing ones. When this happens evolution essentially comes to an end, because the opportunities for natural selection are severely reduced. There is still some evolution taking place, such as the ability to avoid traffic accidents or resistance to some serious diseases, but there is almost certainly none that will result in an increase in intrinsic, genetically determined intelligence. The evolution that is occurring is social, and particularly an increasingly complex technology, a much better understanding of the human genetic blueprint, and of the human brain and behaviour. This may well lead to superior artificial intelligence, increased technological expertise, and all the social consequences of this, but it will not lead to any fundamental change in the genetic determination of human intelligence.

On any other planet where one species becomes dominant, and transmits information and skills from one generation to the next, social evolution will also become dominant. A similar control over the environment, and exploitation of what it can provide, will also lead to the extensive colonisation of all available habitats. This will also result in the cessation of Darwinian evolution, just as has occurred in the human species on this planet. Therefore, we can expect that the evolution of intelligence on any planet to lead only to that point where all available habitats are colonised. So the extent of evolution of brain power, or its equivalent, is unlikely to much exceed that which has occurred in human beings. The basic assumption that is being made is that whatever the evolved design of the organism, whatever the nature of the nervous

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system, whether or not there is a brain as we know it, once information and knowledge is transmitted from generation to generation, then social evolution takes over. This is vastly more rapid than Darwinian evolution, and the increase in population size and the filling of all available habitats will effectively end further physical change, irrespective of the actual sophistication and complexity of the evolved society.

There are possible exceptions to this scenario. One involves the colonisation of other planets. This is easiest to envisage within a single planetary system, where, for example, there are two or more habitable planets. However, any population that developed the technological expertise to travel to another planet, will either reject that planet if it is uninhabitable, or colonise it if it is favourable. Such colonisation would be expected to occur relatively quickly, and allow insufficient time for further biological evolution, which is necessarily a slow process. Travel from one planetary system to another introduces a very severe time factor, which could probably only be overcome by the transmission of desiccated or frozen eggs, embryos, or equivalent biological structures. It is doubtful whether intelligent beings would ever invest the resources and commit themselves to such risk-laden travel. (Note that the theory of colonisation by panspermia is normally discussed in the context of the transmission of very simple or primitive organisms.)

It could also be argued that natural selection leading to the evolution of an intelligent organism, might subsequently be followed by artificial selection for greater intelligence, or the use of techniques of genetic manipulation to increase intelligence. Neither of these possibilities can be regarded as normal biological evolution, but leaving that aside, one has to consider the likelihood that intelligent organisms would deliberately create derivative forms with greater intelligence. This could probably only be done in an elitist society, where those already in a privileged position of power could cement in or further enhance their dominance over less intelligent members of the community. This is comparable to the scenario in Aldous Huxley's **Brave New World** and, whilst not impossible, would probably depend on the existence of an elitist minority that survived for a reasonably long period of time. From what we know about human history, it seems that the dominant rule of autocrats, tyrants or dictators is invariably transient. The very human features of morality and altruism, which allowed successful social evolution to occur in the first place, do not seem to be readily compatible with the emergence of a master race over a long period of historical time. The same conclusion can be drawn about any intelligent species that used co-operative social behaviour to make itself dominant on some other planet elsewhere in the universe. In the absence of such beneficial social interactions, it is doubtful whether any species could evolve beyond the creative status and successful adaptation to the environment that is the major characteristic of past and present human populations.