

The evolution of behavioral modernity and the evolution of science

Hisashi Nakao^{1*}, Akira Ota², Mineo Kumazawa³, Shigeo Yoshida⁴

¹Graduate School of Informatics, Nagoya University, ²Graduate School of Informatics, Nagoya University, ³School of Science, Nagoya University, ⁴Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University

It is almost a truism that as the community sizes and the number of researchers increase in a scientific field, the number of papers published and the pace of its development will also increase. Moreover, Ota (2013) suggested that although a number of experiments have been accumulated in a specific scientific community, the setting or results of the experiments have not been properly transmitted maybe because of the community size. In fact, the community has some institutions needed for accumulation of decent scientific knowledge such as a peer-reviewed journal though the community size is smaller than other fields. So it is possible that the size partially constrains the decent accumulation and improvement of the scientific knowledge.

Although this view is almost a truism as I said at the beginning, it has not often been supported by scientific approaches. This talk supported this view by referring to some researches on a historical fact of the evolution of behavioral modernity. The evolution of behavioral modernity has been one of the challenging problems in archaeology and paleoanthropology. It has been widely thought that behavioral modernity including the use of symbols suddenly evolved around 50 kya and some hypotheses developed for explaining the sudden evolution have referred to the sudden evolution of some cognitive capacities (e.g., Klein 1999; Mithen 1996; Cochrane and Harpending 2009). However, more recent researches have casted doubt on this cognitive hypothesis: Archaeological or paleoanthropological evidence suggest that (1) we find primitive forms of behavioral modernity even before 50 kya (e.g., in Middle Stone Age) (e.g., McBrearty and Brooks 2000), and that (2) in some areas, after behavioral modernity once evolved, it had disappeared for a while (e.g., Allen and O'Connell 2008). If behavioral modernity evolved because some cognitive capacities evolved, we would not expect these phenomena. Thus it is likely that the evolution of behavioral modernity cannot be explained in terms of cognitive capacities. The alternative is the population-dynamics hypothesis (Henrich 2004; Powell et al. 2009; Sterelny 2012). If the community size and the density increase to some degree, some mechanisms for retaining novel cultures and techniques such as redundancy of learning models would evolve, which makes it possible that novel cultures and skills, even if they may have been created accidentally, are retained and improved gradually, and also that behavioral modernity evolves.

If the population-dynamics hypothesis is right (at least I think so) and a certain community size is needed for behavioral modernity and novel cultures are to be retained and improved, it is suggested that also in scientific community, the size is important for novel ideas and experimental settings to be properly accumulated.

Keywords: The evolution of science, science of science, philosophy of science