

# Exaptation, Bottlenecks, Aptitude Selection and Terrestrial Mimesis: Issues for the Outer Space and Extreme Environment Peopling

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## Introduction

We are adapted to our planet, but what may be of an imaginary humanity that *does not* (at present-day)... populate the Moon? Adaptation in this field means evolution, the question of adaptation, without reaching the border of extinction, is still unexplored within unexpected neighborhood. The adaptation mechanism requires an extremely long time, and involves the structural *design* (quoting Monod's *Teleonomie* with a non-teleological approach - Monod, 1970) of the whole organism, even when it acts on a specific character. In the theory of evolution. We want to mention here, because we need to clarify the problem, a very imaginative first vision of Gould and Lewontin who argued that the biological characteristics (physical and behavioral) can be developed by analogy with the *spandrels* of San Marco in Venice. A spandrel, i.e. the plume of the Renaissance domes, provides an open area between two arches that allows artists to exercise their imagination to decorate and transform a space without any architectural constraints or, metaphorically, apparently without a specific environmental constraints. The Mars Habitability Project (Masali *et al.*, 2010; Schlacht, 2010) is a pilot study investigating sensory perception and creativity for a crew of planetary exploration missions. The studies were carried out during a Euro-Moon-Mars Campaign (February-April 2010) Mars Research Station (MDRS) in Utah Desert, where the crews of six people (PhD Students and Cadets of the French Armée de l'Aire in this case) have been isolated for two weeks at a time. The sensory experience was carried out with the display and interaction with the colors, plants, sounds and fragrant essences, prepared by specialists. Methodologies were based on observation of the behavior tests, questionnaires, interviews and proxemics distances.

## A possible route

The task may be perhaps achieved only with the co-option (Exaptation) of existing characters through aptitude selection or... holistic development of the ergonomic design that takes into account all the Human Factors. The genetic code continually copied and extremely preservative (even if packed of mutations) gives, perhaps, the most important biological answer to the historical question of the actual

natural history. While in a general context, biology without a historic perspective cannot be understood, however, in the dawn of a new world, it may be the only way to comprehend evolution. S.J. Gould proposed that exaptations and spandrels traits may be more important than adaptations for evolutionary approach in a culturally modified domain (Gould, 1991; Buss *et al.*, 1998). Gould suggested that many primary cultural characters, although evolutionary in origin, are complementary spandrels of the human brain. Anthropological and psychological sciences may draw the conceptual and evidentiary to think about the relative utility of these concepts in the domain of in a completely new environment. Within the studies of shape in space, the neutral posture was defined, inter alias, by the experiment 'Human Posture in Microgravity'. Results confirm the excellent capability of mutation of motor planning by the central nervous system in order to best exploit environmental constraints. Moreover the system allowed constructing anthropometric mannequins with 'Jack® computer graphics (Ferrino and Gaia, 2003). Our cooperation, albeit limited to the anthropometric method to measure the astronaut and the provision of an Anthropometer has enabled our team to get to the heart of the problem by stimulating the search for behavioral archetypes present in humans. Although there is 'no difficulty walking', as stated by Armstrong, the difference of gravity on the Moon affects the upright posture and suggested Aldrin to test methods for moving around, including two-footed kangaroo hops. Which, perhaps not incidentally, reminds us the walking of some Sifaka Lemurs who keep on the soil the upright posture acquired in the forest by their arboreal vertical clinging.

## Concluding remarks

The main question that arises is whether the solution is adapting humans or, in the near future (say the next 10,000 years in an evolutionary perspective, even considering some very recent positive selection observations about the adaptation of modern humans to local conditions) is adapting the environment to humans. Earth's mimicry of vital parameters and life environment, should be mostly obtained with a careful design of outer space crafts, both vehicles and planetary living structures according to human factors and ergonomics principles. At last, trying

to understand the outcome on genetics, morphology and culture that aptitude selection may affect the future space human, the risk is to create a new human population, through another 'bottleneck effect'. There is a strong consensus that modern humans originated in Africa, have spread in different events. During the expansion process, much of the variability has been lost, creating a linear gradient of decreasing diversity with increasing distance from Africa. However, the exact manner in which this loss occurred remains unclear: we must take in account one, several or a continuous series of "bottlenecks" events (Amos and Hoffman, 2009). And yet one or more of these events in Space, with a further reduction of biodiversity?

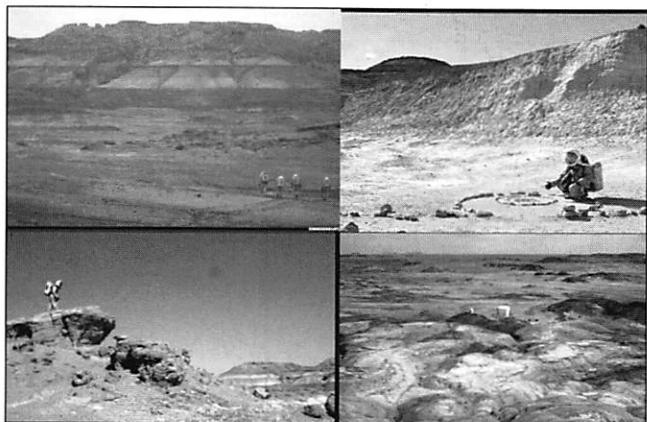


Fig. 1. Euro Moon Mars Habitability Project on Sensory Stimulation in Space (Crew 91), Utah, US.

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