

Light and color as biological stimuli for the well-being in space long duration missions

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Foreword

In a microgravitational space environment the human biorhythm, its sensory perception and all its psycho-physiological system, comes completely upset by the absence of gravity and of external terrestrial references, beyond the effects of constraint in a limited space. This type of environment is defined extreme confined. In order to create a "human centered design", in sight of missions of long duration. We will have to consider, above all, these factors, in order to try to increase the well-being, the comfort and the productivity of the astronauts. In this context we have elaborated a design concept that forecasts to resume the variety and the variability of the terrestrial stimuli, through factors like the light and the color, so as to recreate the input of the normal circadian cycle.

0.0.1 Light and color and psycho-physiological well-being

The human "circadian rhythms" (day all around cycle of the organism's function), are regulated by a sort of "biological clock", presumably localized in the hypothalamus. The more obvious examples of this "clock" are the heartbeat, the menstrual cycle, the variation of the body temperature and the hormonal production during the day the behavior of plants and animals. Those organism functions are influenced by the variation of the light around of the 24 hours.

The emission of an environmental light can restores the earthly solar cycle: irradiating the subject with the same frequency beams present on the Earth, this irradiation should vary the intensity during the day like the sunshine. This kind of environmental light sustains factors like the perception of passing of time, the regulation of the biological clock and the hormonal production, beyond that the production of the D vitamin very important for the astronauts to reduce the risk of osteoporosis.

In microgravity the inputs sent from the organs that regulate the space orientation (as the vestibule organ) may go in conflict with the visual perception and create discomfort. The organism answers to these events making silent the information from

these organs and giving the control to the information from the visual system. For this reason it is necessary to use an immediate visual arrangement, created according to instinctive answers to “natural signals” to which we are accustomed in the earthly life, like the sky “up” and earth “down”.

The colors can guide the user to the orientation in the several functions through biological inputs active on the Earth: “what is observed by the person must be coherent to its ability to interpret the information as it happens in the terrestrial environment” says Bretagna, (2005).

The absence of natural light or an alteration of the light-dark frequency, such as in a rotating orbiting Unit, and the isolation in the confined space and from the earthling natural biological inputs, creates unavoidable changes of the psico-physiological conditions of the astronaut. An artificial environment without variety and variability of color and light takes to strong psico-physiological consequences like the depression, while artificial environmental stimulations like the light, the colors, the variations of the air, the wind, the warmth, the cold, the scent, the flavors, normally present on Earth, can activated implicit vital mechanisms.