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## A FIELD STUDY ON THE ROLE OF ART IN SPACE EXPLORATION

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### ABSTRACT

Since 2007, the Extreme-Design Research Group has been working on researching the role of art and humanities in space exploration. Interviews, experiments, and questionnaires have been collected on how artistic/creative expression may enhance a person's well-being in space, and on the cultural value of such expressions. New hypotheses were also established and validation was carried out regarding the role of an artist on the mission design team. In particular, both theoretical and scientific investigations focusing on open questions and psycho-physiological reactions were carried out in parallel to artistic expression in space. The investigations were performed with the participation of experts and astronauts, as well as during mission simulations. In particular, since 2010, as members of the ILEWG EuroMoonMars Campaign at the Mars Desert Research Center, all of the authors have experienced living in isolation and in an enclosed space with limited resources at their disposal and a specific diet. During this experience, the authors expressed their own perceptions and feelings about daily life in MDRS through artistic and creative means. Interviews and psycho-physiological tests were also performed both on the experts, the astronauts, and other crew members who experienced isolation at MDRS. As the astronaut Prof. Messerschmid explained in response to the question of which role art and creativity play in space, in space exploration, astronauts are also there to represent the entire human race, which is why it is so important to send not only machines but also humans who are creative. This paper presents the conceptual, artistic, and scientific results in order to define the possibilities and the role of art in space.

**Keywords:** Space Art, Humanities, Creativity, Psychological Support, Space Mission, Cultural Progress, Well-Being.

### 1. INTRODUCTION

Art<sup>1</sup> is the highest form of expression of human culture. Cultural application of space is an intrinsic step of the civilization progress.

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<sup>1</sup>Art, *Ars* from Latin, is the translation of the Greek term *techne*, which means every activity that enables production (Dolera, 2012). Aristotle defined it in this way: "Every art (*techne*) is related to the production, and the search with the skill and the theory on how something will occur [...] in which the principle is in the producer and not in what is produced" (Aristotle, quoted from Modica, 2002)<sup>1</sup>. Today the term art is still related to the producer more than to the product, but it focuses on specific activities related to personal and creative expression. Moreover, art is now getting closer to science and research every day. In the Liquifier document of the ESA proposal for the "Art and Science Space Workshop", the media art professor Herbert Lachmayer explains, "We can observe a convergence of arts and science. We as researchers, artists, cultural theorists and scientists, investigate and interpret aspects of the everyday world through imitation, illustration, description and mirroring. We are part of the same laboratory situation, we are researchers, objects of investigation and experiment at the same time" (Lachmayer personal conversation Vienna 2008, as reported in Liquifier, 2011). In the document, it is also explained that "Art is one way of creating a new whole and thus can inspire scientists with their research. The philosopher Sheldon Richmond stated that science and art are interconnected in a functional way: science relies on the imagination of art to find new hypotheses and the arts rely on the critical mind of science which animates the imagination for action.

Pierre Comte defines space art as "not the real or supposed representations of extra-terrestrial landscapes but as proposals, relying on the emerging space technology, for aesthetics acts" (Comte, 1997<sup>1</sup>). However, Annik Bureau points out that space art is much more than aesthetics: "the artistic experiences, the means, the "materials", the forms and nature of the artworks, the aesthetic and conceptual questions" are covered by works of space art (Bureau, 1997<sup>2</sup>). Roy Ascott also explains that "art is no longer an act of representation and appearance but of emergence and apparition, of coming into being" (Ascott, 1993<sup>3</sup>).

Since its beginning, space research has been mainly oriented towards scientific and engineering research. Today, the importance of cultural and humanities research for it is clearly emerging, but the logistical structure of a space mission is not made to support the integration of these kinds of disciplines, which causes great difficulties regarding their application in this sector.

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The interdependence of rationality, cognition and irrationality shows the reality of overlaps. Arts and science interact through a functional interdependency" (Liquifier, 2011).

The reason lies in the origin of space exploration during the Cold War. At that time, the exploration goals were military based and astronauts were selected from among Soviet and U.S. military pilots, while the mission was developed by the best German<sup>II</sup> engineers (Messerschmid & Bertrand, 1999<sup>4</sup>).

After 50 years, the methodology and the approach applied to space exploration are still based on the original engineering/military approach, which leaves no place for cultural and humanities applications.

Integrating multidisciplinary experts also from the humanities right from the beginning of space mission design will create the basis for the development of cultural applications in space (Schlacht, 2012<sup>5</sup>). This will also affect the selection of astronauts, allowing persons with artistic sensitivities and cultural needs to also be included. The result will also affect communication in space exploration, as art has been the media for communication since prehistory (Schlacht & Ono, 2009)<sup>6</sup>.



Fig.1: Rupestrial Art from Val Camonica, Italy (© Emmanuel Anati, Centro Camuno di Studi Preistorici)

Moreover, artistic activities<sup>III</sup>, such as creative and cultural expression, can also function as psychological support, increasing the motivation and well-being of the astronauts (Schlacht & Ono, 2009)<sup>7</sup>.

Indeed, space exploration has focused on engineers and scientific applications to date, but with the utilization of orbital stations for long duration missions, astronauts started to express the need for better living conditions, a factor that is different from science and engineering but related to human factors and culture (Schlacht, 2012).

## 2. SPACE ART AS A NEED<sup>IV</sup>

The potential for photographers, filmmakers, painters, sculptors, theater makers, choreographers, writers, and

musicians to draw inspiration from space facilities to add to world culture is enormous (Arts Catalyst, 2006<sup>8</sup>). Since prehistory, art has always been an element of human expression to communicate with the external world (Rubano, 2005<sup>9</sup>). Art can be applied to record the mission and communicate it not only to the space specialist, but also to the world community. Including humanities experts in mission design will provide the opportunity to effectively support not only the gain, but also the communication of knowledge from multiple perspectives.

As explained by Ayako Ono (Space artist), “JAXA’s art projects are a part of the educational project. If the art project has the impact to know space environments, it could be the education for general public, and children will have more interest about science including outer space. As another reason point, the art may be helpful for astronauts to make their mood better. Some artists’ idea is that artistic activities are not only for relaxation but also the stimulation to have new viewpoints. JAXA’s consideration vision is that cultural artistic activities are a part of human beings, when the human being expands the area place where he lives and works in from earth to outer space, he will expand the activities area and cultural activities will also be part of the life.”

Another aspect is public interest. Public interest is a key element for any industry because it brings support and sponsors. The public is attracted to things that everyone can do, like painting or playing, facts of everyday life, experience and emotions, and things that can be easily apprehended as visual art (Schlacht & Ono, 2009<sup>10</sup>). The Space Art expert Roger Malina points out that the work of some of the most important illustrators not only “anticipated some of the results of Space exploration, but in some senses made Space exploration possible by generating public interest and support as well as helping scientists to plan and illustrate their experiments” (Woods, 2001<sup>11</sup>).

To gain public interest, astronauts must be able to communicate their personal experiences to the general public. As shown by Rubano (c.f. paragraph about Art Therapy), visual representation was used from prehistory to communicate man’s experience (Schlacht & Ono, 2009<sup>12</sup>). Visualizing personal experience through artistic expression brings astronauts knowledge of their emotional dimension and at the same time helps them to communicate it to the public (Rubano, 2005<sup>13</sup>).

Art as a cultural heritage was used in the past as advertising because it attracts public interest. Music has been sent into space aboard the Voyager mission (NASA Voyager, 2009<sup>14</sup>). Also in the Cassini mission, music was sent to Saturn’s moon Titan. ESA explains that it was “aiming to leave a trace of our humanity in the unknown and to build awareness about this

<sup>II</sup>After World War II and the defeat of Germany, Russia and the United States rushed to recruit the best engineers and scientists working in Germany under the Hitler regime (Hentschel, 1996 p.xciii, Sobolev & Khazanov, 2001).

<sup>III</sup> Artistic activities are considered activities related to the artistic process, which can either lead to the production of art or not, with the result being merely personal creative expression.

<sup>IV</sup> This part is an extract from the PhD thesis “Space Habitability” (Schlacht, 2008).

adventure, especially among young people” (ESA, 2009<sup>15</sup>).

Artistic expression is a way to bring inner emotions outside. This process helps to feel, understand, learn about, and control our inner experience. It is a challenge to expand us. As explained by the positive psychologist Csikszentmihalyi<sup>V</sup>, “People who learn to control inner experience, will be able to determine the quality of their life, which is as close as any of us can come to being happy” (Csikszentmihalyi, 1990, p. 2<sup>16</sup>). Optimal experience is when people report a feeling of concentration and deep enjoyment, and “depends on the ability to consciously control what happens moment by moment, each person has to achieve it on the basis of his own individual effort and creativity<sup>VI</sup>” (Csikszentmihalyi, 1990, p. 5<sup>17</sup>).

To get an idea of the joy, risk, and hardship involved in creative endeavors, we all know that when we are involved in creativity, we feel that we are more satisfied than during the rest of our life. The excitement of the artist at the easel or the scientist in the lab comes close to the ideal fulfillment that all of us hope to get from life, and so rarely do. Perhaps only sex, sports, music, and religious ecstasy – even when these experiences are satisfied and leave no traces – provide as profound a sense of being part of an entity greater than ourselves. But creativity also leaves an outcome that adds richness and complexity to the future (Csikszentmihalyi, 1996, p. 2<sup>18</sup>).<sup>VII</sup>

## 1. SPACE ART & SPACE AGENCIES

### 1.1 NASA<sup>VIII</sup>

NASA has had its own art program since 1962, and in 2004 had an artist in residence for two years: Laurie Anderson, American experimental performance artist and musician. The artist was able to work in direct contact with the NASA engineers and scientists, fully filling the idea of multidisciplinary with contributions from the humanities. Bertram Ulrich, curator of the NASA Art Program, said in a telephone interview that “her mind works very much the same way a scientist’s would. They’re both reaching out to try to understand what’s unknown” (Gross, 2004<sup>19</sup>). “Art is what’s left behind of history,” said Ulrich, “It’s a way to document

something for future generations” (Hull, 2004<sup>20</sup>). NASA’s goal is perhaps far from the cultural utilization of space, but aims mainly to achieve educational and promotional purposes; in fact, “artistic and cultural activities relating to space are an important way of strengthening public engagement” (Arts Catalyst, 2006, p. 2<sup>21</sup>).

In 2004, NASA’s investment in art represented \$50,000 out of a total budget of \$15 billion. These costs were highly criticized and there was no follow-up to the art in residence program. However, one solution could be to work “with contracted companies to seek external funding and sponsorship for cultural utilization” (Arts Catalyst, 2006, p. 7<sup>22</sup>) of space, as suggested by Arts Catalyst for ESA.

### 1.2 ESA

ESA’s main purpose is to support scientific progress; for this reason, humanistic research has been just a small part in the program of the agency. However, it has shown interest in the field on different occasions.

ESA had experience with an artist in residence in ESTEC in 2006-7, hosting Ayako Ono (co-author of this paper), a Space Artist, graduate in Fine Arts and Music and currently a researcher in the field of behavioral medicine at Tohoku University in Japan. ESA, unlike NASA, tries to conciliate different goals, integrating cultural utilization of space, educational and promotional purposes, as well as using art to improve the astronauts’ living conditions. “If suitable art can be created for a weightless environment, it will not only improve the mental health of astronauts, but also inspire people to learn about the universe and space exploration”, explains Ayako Ono (ESA, 2006<sup>23</sup>).

In 2007, ESA organized “On the eve of ‘Space Exploration - A Global Societal Project’” in Berlin. During the conference, a special presentation showed why artists, as important opinion formers in society, should be part of the whole picture of exploration. The potential cultural dimension of ESA’s exploration activities was shown in a group of projects specifically devised to accompany Europe’s activities in space, collaborating with the European astronauts on the ISS, highlighting Europe’s ground-based space facilities such as microgravity facilities, mission control and launch sites, and looking towards the future of Moon and Mars missions. The artistic projects were designed to have a high profile in the European media and also to show how the world of the arts is engaging seriously with space issues (ESA, 2007<sup>24</sup>).

Another artistic activity supported by ESA was the workshop “Arts & Science: Transfer of Scientific Aspects into the Arts”, performed at ESA Cologne in 2011.

<sup>V</sup> Prof. Mihaly Csikszentmihalyi is a positive psychologist, former chairman of the department of psychology at the University of Chicago. Famous for his research on flow state and creativity, he supports Aristotle’s theory that “more than anything else men and women seek happiness” (Csikszentmihalyi, 1990, p. 1).

<sup>VI</sup> The creative process is part of what Csikszentmihalyi (1990) defines as flow; it is a moment of concentration to pursue a goal, where the person momentarily forgets everything else. “The periods of struggling to overcome challenges are what people find to be the most enjoyable times of their life” (p. 6): “it’s fun, a great fun, to come upon something new” (Csikszentmihalyi, 1996, p. 4)

<sup>VII</sup> This part is an extract from the PhD thesis “Space Habitability” (Schlacht, 2012).

<sup>VIII</sup> This part is an extract from the PhD thesis “Space Habitability” (Schlacht, 2008).

### 1.3 JAXA

JAXA is really active regarding the cultural utilization of space<sup>IX</sup>. JAXA has been allocating cultural activities to astronauts since Kibo joined the ISS in 2008.

In the context of the cultural utilization of the ISS, JAXA has provided a variety of different art experiments and ways of cultural utilization for the Kibo module. The goal is to “make new discovery through artistic expression”, to “lead productive lives in space”, but not only there (JAXA, ca. 2010 p. 1<sup>25</sup>). The JAXA philosophy, which supports the application of Space Art, is reported in the “Pilot Mission of Utilization for Culture/Humanities and Social Sciences”:

*Human beings have looked up at the starry sky, been moved by it and achieved evolution driven by curiosity since our earliest days. Even in modern society we have extended the range of our activities to space, many space-related areas remain uncovered. One of the objectives of the ISS is to introduce impressions that human beings have never experienced and to expand the wisdom of human beings by exploring the space environment. JAXA has long considered the significance of space exploration in the field of culture/humanities and social sciences. At last, the opportunity aboard Kibo...of artistic expressions that utilize the microgravity environment, and lead to the creation of social values on the ISS (JAXA, approx. 2010 p. 1<sup>26</sup>)*

JAXA “invite cultural and humanistic scientific ideas to realize its concept of ISS as developing global citizenry, expanding the future of mankind, and creating new values through utilization of space and will implement these ideas in Kibo” (JAXA, 2010, p. 8<sup>27</sup>).

The JAXA astronaut Takao Doi, who set up the first part of the Kibo module, said: “I think we are opening a new horizon or a new world for mankind by flying in space” (Doi, 2008)<sup>28</sup>. During his mission, he drew and sketched with crayons the view of the Earth. As mentioned by Prof. Takuro Osaka, “Floating out of the Space Shuttle and looking at the Earth, he strongly felt that human beings never get any new discovery nor enthusiasm nor moral without having a viewpoint from outside of the earth. The new ethics that change the way of living as repeating wars and destruction, and the consciousness that is trying to find a new way, may not come into being without having a viewpoint from outside of the earth”<sup>X</sup> (Osaka, 2005).<sup>29</sup>

<sup>IX</sup> JAXA’s art projects are part of an educational project called Education Payload Observation (EPO).

<sup>X</sup> The second part of the quotation is reported here: “Through utilization and development of outer space based on the ISS, we will be able to see a new world. In such an opened world by science and technology, it would be the role of art to propose how to live. And it would be the role of design to propose a rich environment for life”.

One example is the Poem Chain, here described by Mamoru Mohri:

*“I came to understand the meaning of “let there be light” in the midst of the darkness of the universe. I came to understand the “origin of life” on the earth shining blue in the light of the sun. And I came to feel that what I needed was not scientific expression, but rather artistic expression, to be able to tell this to many people. I hope to share my experiences with many people on the Earth through the medium of the Space Poem Chain”. (Mohri, 2009)<sup>30</sup>*

The text shows how cultural activities of an astronaut who has a personal interest in it may be able to improve the communication of personal emotions and thus add artistic expression to space utilization.



Fig. 1: Microgravity tea ceremony experiment: Preparing Matcha (powdered green tea). Prof. Yoichiro Kawaguchi. I'm happy that the microgravity tea ceremony experiment has been successfully performed. It surely will facilitate our research. Specially, transparent water refraction in the cup was breathtaking. Seeing the beautiful aggregation of water particles was the first experience for me. A beautiful aggregation of delicate bubbles of Matcha was just amazing. I have never seen such delicate bubbles before. It was also great that the CG designed Kimono was bright and floating, which made the atmosphere very impressive. (Credit: Yoichiro Kawaguchi/JAXA). [http://iss.jaxa.jp/en/kiboexp/news/110930\\_spacematch\\_a.html](http://iss.jaxa.jp/en/kiboexp/news/110930_spacematch_a.html)

## 2. ASTRONAUTS' OPINIONS

### 2.1 Interviews with Astronauts

To verify the potentialities of space art, several astronauts were interviewed regarding the cultural utilization of space intended as the utilization of the Space Station for artistic and creative cultural activities such as writing poetry, composing music, and painting. The questions were:

1. Is cultural utilization of space<sup>XI</sup> relevant to space exploration?

<sup>XI</sup> “Cultural utilization of space” was explained to the astronauts as the utilization of the Space Station for cultural activities such as writing poetry, composing music and painting.



2. Can the possibility of performing *cultural activities* (e.g., poetry, music, and painting) improve an astronaut's quality of life and performance?

The replies are reported here anonymously.

Astronaut A (male) explained that in short duration missions, one might not have time for cultural activities, as every simple task requires more time in comparison to Earth; however, the presence of *music* was appreciated by him. Also, he underlined how cultural activities may improve well-being in long duration missions. "Staying eight days in weightlessness, you are in a different environment and too busy, because things that take two hours in a 1G environment could take three hours in weightlessness. During the mission, there was background *music* and that was nice. In long-term flights, cultural activities may be helpful to improve quality of life." (A, courtesy communication, 7 Oct. 2011, IAC Gala Dinner, Cape Town, South Africa).

Astronaut B (female) replied positively to the questions. She thought that artistic activities may support communication, both with people on Earth and between astronauts. In particular, she enjoyed making *music* with other astronauts, also as a way of communication. "Yes, I do. They are helpful for communication. For example, a flower became a topic and the national flag was helpful to explain the meaning of the universe to children. Also, I was singing, with the guitar being played by another astronaut, and that was fun and a good way to communicate" (B, courtesy communication 5-6 Oct. 2011, IAC, Cape Town, South Africa).

Astronaut C (male) focused his considerations on visual art, saying that "astronauts are satisfied visually" because they can watch the beautiful surface of the Earth. Regarding the improvement of well-being through art, he explained that the contribution of an artist in the noisy sound environment may improve the quality of life. "The environment is really noisy and needs to be considered by artists. Astronauts listen to *music* because of the noise." (C, courtesy communication, Congress of the Association of Explorers, Tokyo, 2003)

Astronaut D (male), who spent six months in orbit, said that the quality of life was fine. He had the opportunity to take pictures and his colleague played *music* with a flute. Such things are, of course, important and meaningful if you live there.<sup>xii</sup> "I brought with me

<sup>xii</sup> The rest of the reply by astronaut D is reported here: I was allocated to a second short duration mission, but for a series of reasons I find myself in a mission of long duration, and when I started the training I thought 6 months in orbit will be hard; instead, these times pass well. It all depends on how you approach it. One time I was taking pictures from the cupola and I saw strange clouds. At night, I was observing those pictures and I thought, *look how it is beautiful, it looks like a pizza!* In the next one I thought, *it looks like*

playing cards, without thinking about how to play them because they will all float; we never used them,... my colleague brought four flutes, one of Ian Anderson and Jethro Tull... Sometimes she was playing around. Those are important things because one needs to live there. For me photography is important, taking pictures, send those to Earth, read the quiz sent from Earth of the people that saw them – that was really important and meaningful for me." (D, courtesy communication 20 April 2012, Politecnico di Milano, Italy).

Astronaut E (male) thinks that the cultural utilization of space is important in particular to put space exploration into the historical memory of the people: "Yes. It is very important and part of exploration to translate experience. I tried to relate to people on Earth. Will they remember the ISS? The astronauts' footprints on the Moon will be remembered." To the second question he replied that to perform art is a very personal thing; he said he was not an artist and would not like to perform art, but does enjoy sharing his culture with music. "If you asked this question of my friend Bob Thirsk, he would say yes. For me, *music* was really helpful. Every evening, one crew member brought his culture by choosing the music to play. I played Flemish rock music because this is what I like. That exposes you to different cultural environments, and I really liked that. For the rest, I'm not a scientist and I'm not an artist. Having been obliged to do something that is art, ...so to be exposed to it and to have to look into it, annoyed me terribly, because this is something I do not relate to on Earth, so why should I relate to it in space. But that is a very personal opinion. Other people like Bob who enjoy going to museums and enjoy art, I'm sure that they would like to be exposed to art in space. We are ordinary people, with all kinds of varieties, different tastes and interests." (E, courtesy communication 30.6.2012, ESA Art Workshop, Germany).

Astronaut F (female) gave a very similar reply as astronaut E. She explained that the reaction to being asked to do some cultural activity depends on the person. As a consequence, to improve the variety of

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*a Margherita!*, at the Capricciosa pizza I thought that it was something wrong because it couldn't be all pizza those clouds! Then I thought that I was missing the food. The American work strongly on the food on the station but indeed it is unsatisfactory, because those are all canned food or in any case a bit artificial, so I was missing the healthy food, the simple food, the food not full with garlic as they do Italian food: they use 4 kg of garlic and this is the Italian food. I was missing also what I do with pizza that is getting out with friends, drink a glass of beer and be calm, so this social aspect probably. Maybe those were the things that I was missing more. However the station is enough comfortable, you sleep well, you live well, you eat discretely, you have a lot of communication, we have telephone on board, ..we make video conference with family. ..If I will improve something I will improve the access to space to send easily experiments. The process is now too expensive and long..

space utilization, artistic requirements need to be added to astronaut selection and training. “It depends on persons, doesn’t it? If you give a cultural activity as an obligation, then it leads to stress. There are many astronauts who like physical training, and such types of people may feel stress when they need to write a poem or paint a picture. If it was passively received, it might not be good, but it would be good to have as a choice. So, when a person is interested in trying out art, then positive opinions will support what they did. Therefore, preparing various kinds of choices would be good”. She explained that “every professional person has their own background and approach to solving problems. E.g., I use a medical approach in space to solve engineering problems. Artistic expression and cultural activities may help only some of the people. If persons with different backgrounds are obligated to perform artistic expression and cultural activities, they may have a negative impression or get stressed. Cultural activities should be one possible choice to improve astronaut life; another activity may be gymnastics. It should be supported but it should not be obligatory. Training and selection with artistic requirements may improve the choice of activities to perform in space, giving more variety.” (F personal communication 15 Aug. 2011, Agnes, France)

## 2.2 Conclusions from the Interviews

From the interviews, there clearly emerged a positive feedback to the questions. Out of eleven replies, there was no negative reply. This is why it is here concluded that the astronauts interviewed, of mixed gender, nationality (e.g., European, Japanese,...), and profession (e.g., pilot, scientist, doctor,...), were in favor of cultural utilization of space. In particular, *music* emerged as the most quoted (five astronauts out of six) and enjoyed cultural activity, both in terms of making music and listening to it.

The most important observations are summarized in the table below.

*Table 1: Astronauts’ interviews regarding cultural activities in space*

Astronaut	1. Need for Cultural Activities		2. Positive Effect of Cultural Activities	
A	Ma ybe	No time in short duration missions, apart from listening to music*	Yes	In long duration missions *
B	Yes	Is good for communication	Yes	Is good for communication & fun
C	-	No clear reply	Yes	On quality of life
D	Yes	Because you need to live there	Yes	For me it was important and meaningful
E	Yes	To be remembered in history	Ma ybe	Depends on the person, should not be obligatory
F	Yes	To have more variety of space	Ma ybe	Depends on the person, it should not

	applications	be obligatory. Yes, if included in artistic training and selection
(*) Long duration mission, more than 2 weeks; short duration mission, less than 2 weeks as reported by Kanas and Manzey, 2010 <sup>31</sup>		

It is interesting to note the relevance of the following elements related to cultural activities in space:

- *Music*: Music as a cultural activity emerged as the most common and appreciated activity.
- *Mission duration*: Cultural activities are more appropriate in long duration missions.
- *Communication*: Cultural activities may improve communication between astronauts, the communication of events with Earth, and help to be remembered and communicated in history.
- *Variety*: Cultural activities may add more variety to space utilization.
- *Personal interest*: The performance of cultural activities may be important and positive for people who have a personal interest in them. People who have no vocation and interest should not be forced to do artistic and creative tasks.
- *Training and Selection*: Select people with cultural interest and add creative and artistic performance to the training. This will create a target in space that will be able to support cultural utilization of space while also getting positive effects from it.

In conclusion, the interviews revealed the importance of cultural utilization of space, but in order to allocate cultural activities to astronauts we need to integrate it into astronaut selection and training. In this way we may be able to perform it with subjects who like it and have this kind of interest (as mentioned by astronauts E and F).

Indeed, being given the opportunity to perform art is beneficial if the astronaut likes this kind of activity, as the psychologist Csikszentmihalyi explains: “People that spend their time in an activity that they like may experience happiness, increasing the quality of life” (Csikszentmihalyi, 1990, p. 4<sup>32</sup>).

## 3. MDRS EXPERIMENT

In order to fully understand the role of art in space, the authors performed a creative and artistic activity during a space mission simulation.

The research was performed as part of Habitability research done by the Extreme-Design Research Group during the ESA-ILEWG EuroMoonMars campaign directed by Prof. Bernard Foing at the MDRS facility of the Mars Society in Utah. The MDRS is located in the San Rafael Swell, a desert in Utah. It is an analogue Moon-Martian habitat for human exploration, where a crew of six people worked and lived together in a closed-system environment simulating a space mission. In the desert around the station, the only human presence is the Hab, your Habitat. During EVA (Extra Vehicular Activity), the Hab view gives you a feeling of safety and when you lose visual contact with it, you

can feel disoriented. You need to consider that the EVA difficulties are numerous - your helmet gets fogged up, you are carrying 5-6 kg in air circulation backpack and instrumentation, and walking on the sand is making you tired.

Every day of living in isolation, things that you are missing, from your normal daily life, became more and more precious. In this context, the following creative task was performed:

#### Task Content

During the mission, allocate time to perform a creative activity in order to freely express yourself in relation to the environment and the situation that you are living in during the space mission simulation.

#### Report Content

What was the task?

What have you done and why?

What was your feeling before and after the creative performance?

Which impact did it have on the crew and on you?

Do you think that the performance increased your well-being in isolation?

In a space mission, is it important to have creative and artistic expression and why?

### 3.1 Valentina Karga

Valentina Karga<sup>xiii</sup> is an architect specializing in closed loop and self-sufficient systems. She took part in mission 113 (from 12 to 25 February 2012) as the crew's health and safety officer, as well as the crew architect. She developed her project on closed loop and self-sufficient systems and the habitability project for the Extreme-Design Research Group.

Valentina applied her creative expression to the preparation of food. For her, the ephemerality of food as material is interesting. She sees a social ritual in communal dinners, something that can be important for a Space mission. According to the food study, there were days that the crew had to eat the defined meals, being allowed only to add water, and days of cooking using the available ingredients. She felt that she had to develop a new language of cooking with the unusual dehydrated or freeze-dried ingredients. Therefore, as her creative performance, she filmed a series of cooking shows for Mars and experimented with cooking both inside and outside the Hab. Outside the Hab, she cooked during EVA with a solar cooker that made use of the site with available materials. She believes that this creative expression has something to do with the feeling of conviction by the system and

isolation. A closed-loop system uses the people as input-output (oxygen, CO<sub>2</sub>, excretion, etc.) but there is no space for intellectual input. By being playful and creating something from the given restrictive parameters (in this case the food), she tried to open a window through the rules and create a personal language inside the impersonal system of the habitat. The prepared meals were shared with the other crewmembers. The crew seemed to appreciate the effort but was not so intrigued as to also be creative with food, maybe because of general gender reaction (only males).



Fig. 1: Frame from the video "Cooking in Mars Hab", creative performance task (© Valentina Karga, 2012).

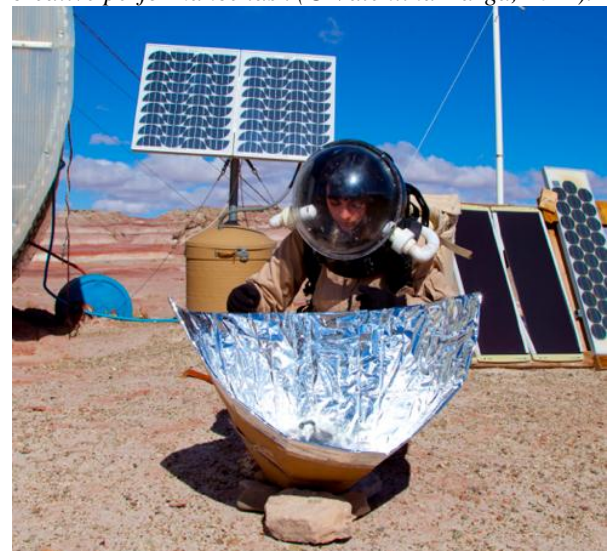


Fig. 2: Solar Cooking in Mars EVA, creative performance task (© Valentina Karga, 2012).

### 3.2 Pieterjan Grandry

Pieter<sup>xiv</sup> is a designer and artist and attended the EuroMoonMars mission by ESA-ILEWG as part of

<sup>xiii</sup> **Valentina Karga** holds a master's degree in architecture from the University of Thessaly, Greece. Sustainability, reuse, closed loop systems, self-containing systems, environmental and food quality are key words in her work. Currently she is doing a research fellowship at the Graduate School of the University of Arts Berlin; a postgraduate, interdisciplinary and international program whose goal is to advance the dialogue between the arts, sciences and humanities. One aspect of her project "Machine for sustainable Living" is to build a self-sufficient habitat based on space know-how.

<sup>xiv</sup> **Pieterjan Grandry** is a young Belgian graphic designer and visual artist, living and working in Berlin. He graduated in 2010 as a



crew 113 (from 12 to 25 February 2012). He took part in the mission as the crew journalist and photographer, and he assisted in carrying out the project on “Closed loop and self-sufficient systems” by Karga and the “Habitability Project” by Extreme-Design.

The result of his creative performance is reported by him in the following. He wrote: “I think the word Art is quite strong and for something to be Art it has to reflect some ideas or concepts, or give comments on society at large. I think what I felt there was not so much an urge to make Art but more a feeling of having to be creative. Being creative or manifesting a creative urge in a non-creative atmosphere, by which I mean the world of the logic and rational, isn't an easy task. If you are for 2 weeks in a closed space where everything is controlled and organized around you I think one starts to feel the need to create something where one has total control over. It is more a manifestation of creativity than a work of art. The act of creating (like God) distracts us from our daily routines and (like a dream) we can create a micro world of our own. By doing this we can regain or re-enforce our self-awareness or self-consciousness in an environment not controlled by ourselves. The act of creation itself is contagious, and just like in a big office, productivity increases when workers have the opportunity to express themselves. During my time at MDRS I did not schedule a specific time for artistic expression. Creativity gets evoked in a moment, by objects, persons, smells, tastes or touch. A found object on one of the EVA's drew my attention and a few meters further I found another (it is very unlikely to find 2 non-native objects in an empty desert-like environment in such close distance). Combining both they form a flag, which holds historical connotations with conquering and marking land, such as planting a flag as symbol of achievement or landmark (ex. planting a flag on the moon). In this specific case the flag consists of a deflated empty balloon and a simple processed wooden stick. The deflated plastic bag contradicts extremely with the natural environment and reminds us of the time it has spent in the air, much like the stop of a moon lander.

Another example of creative expression based on my time spent at MDRS is a simple outdoor activity. In this case observing the stars. While holding a torch in my hand, and positioned myself in front of the eye of a camera and team members, I drew figures in the dark, evoking other team members to participate. The act of creating in a non-forced, spontaneous way relieves one, in this scenario, from a certain pressure. When failing

is not an option and working pressure is high this could be a way to ventilate and stimulate one's mind”.



*Fig. 3: Landmark. Creative performance task during the day (© Pieterjan Grandry, 2012).*



*Fig. 4: Lightmark. Creative and cultural performance during the night (© Pieterjan Grandry, 2012).*

### 3.3 Ayako Ono

Ayako Ono<sup>xv</sup> is a space artist and a PhD student specializing in space psychology and psychiatry for long-term space missions. She attended the EuroMoonMars mission of ESA-ILEWG in crew 100A

Master in Arts and Design from St. Lucas School of Arts in Antwerp, Belgium. Besides graphical work, Pieterjan Grandry experiments with furniture, design, and technology, often integrating them into installations. Research into the properties of material, open-source technology, and functionality are key elements of his work. With attention to form and tactility and the use of simple materials, Pieterjan builds, assembles, or rebuilds objects for domestic or commercial use. As an organizer and curator of communal and participatory exhibitions, he tries to highlight the changes in contemporary visual culture, inviting photographers, furniture designers, graphic designers, and architects.

<sup>xv</sup> **Ayako Ono** was the first artist in residence at ESA/ESTEC during 2006-7 and was selected as a principal investigator of the Japan Aerospace Exploration Agency Education Payload Observation (JAXA EPO), a kind of competition, to produce space musical instruments for weightless performance at the International Space Station (ISS). She is currently a PhD student in the Department of Behavioral Medicine at Tohoku University Graduate School of Medicine in Japan, researching the effects of sounds on brain waves, the heart, blood pressure, stress-induced secretion of salivary amylase, and mood states, particularly in relation to the ISS.



(from 12 to 26 February 2011) as the crew safety and medical support, as well as a crew artist and scientist, and she carried out the work on the “Habitability Project” by Extreme-Design.

About her creative performances, she wrote: “I took photos and wrote a poem during my two weeks stay at MDRS. It was just like my normal hobby when I traveled and felt something somewhere. If I stayed there longer I might have tried to play a musical instrument which I had found there. I took photos at MDRS and on the desert around, I was impressed in particular on the changing of light and time, I enjoyed to capture the sunrise, the sunset and also the night time with long-exposure photos. And it was during the night time that I was also inspired to write a short poem:

*Complete Darkness*

*After everybody went to bed, I went outside of MDRS.  
It was cloudy that day.*

*I started out being scared without any stars above nor  
the Moon.*

*After a little while, I felt the Moon through the clouds.  
Soon afterwards, I also felt the existence of the bright  
stars through the clouds.*

*Then, darkness was not darkness anymore.*

*Darkness need not be scary.*

*Darkness is just the opposite side of the lighting.*

*Our body is always adjustable and flexible.*

*We can feel more and more.*



*Image: MDRS during the night: a long-exposure photo. Creative and cultural performance (© Ayako Ono & Jeffrey Hendrikse 2011)*

Before the creative performances, I was excited, and after that, I had fun and satisfaction, but felt I had to have more time to do them again. Such preferences and hobbies could combine people who have similar interests. Also, the poem and photos could be shared by all crew members. I think that the creative activities and positive feelings are important for quality of life and well being in isolation and during space missions,

because the missions could be stressful with isolation and many other stresses.



*Image: In front of MDRS: sunset and stones. Creative and cultural performance (© Ayako Ono 2011)*

### 3.4 Irene Lia Schlacht

Irene<sup>XVI</sup> is a Human Factors researcher for extreme environments, with a background in industrial design. She attended the EuroMoonMars mission by ESA-ILEWG in crew 100A (from 12 to 26 February 2011) as the crew human factors specialist and crew journalist, and she carried out work on the “Habitability Project” by the Extreme-Design Research Group. In her report she described the experience: “After extensively discussing and researching the positive effect of creativity in isolation, I posed the question to myself: Does creative performance have a positive effect on well-being?

During the EuroMoonMars mission as part of the Habitability experiment, coordinated by me also in the following years, I planned to express myself creatively. During the day I allocated a free task to myself, where I was staying inside the pressurized area but in the tunnel outside the habitat. The tunnel is a place where you do not need to wear the EVA suits, but it is also outside

<sup>XVI</sup> **Irene Lia Schlacht** is a human factors researcher from Europe. Her aim is to increase the quality of life in complex habitat systems. In particular, she has been focusing on space as the most high-tech and self-sufficient environment for people to live in. During her career, she has led students and professionals in the design of quality of life in space with a multidisciplinary approach including art and science. She has been investigating sensory perception and creative performance during three space mission simulations. Currently she is researching space technology transfer to improve the quality of life on Earth.

the Hab. I went around in the tunnel making some drawings and I was impressed by the different colors of the sand layer that was surrounding the station. With an EVA I collected different kinds of sand that I found around the station. At the Hab I analyzed the different colors' properties and after a few times, I decided to express myself creatively by making a color composition with them. I scheduled my time and I decided to perform the creative activity in the pressurized tunnel that connects the Hab with the Observatory. Inside the tunnel I just spontaneously began to create shapes with the different sands. The result was a kind of mandala, with local colored sand. The Mandala shape was a spiral like a galaxy configuration, I called it Gaia. As a matter of fact, I could feel that putting my inner emotions into the external artistic "vase" helped to release tensions and implement the feeling of satisfaction. In the crew, no interest was shown for the mandala and it did not prompt any discussions. To verify again the interest of the other crew members, I configured the possibility of 'composing' with colored sand inside the habitat: raising interest and curiosity but no active interaction. At the end of the mission I discovered that the sand composition was a typical ritual performed by the local indigenous population (Native Americans) from more than 10 000 years ago until today. So through this action I was performing the same creative expression that has been done in that place since 10 000 years ago. This confirmed to me that, as also mentioned by Rubano, visualizing feelings as an external thing has another important effect: it brings more knowledge. (Rubano, 2005)<sup>33</sup>. You get to better know the environment that you have around you. You also become more aware of your experience in it. After the performance I wrote: What surprised me the most during the mission was the absence of life outside. When you perform an EVA, you see something that has been preserved uncontaminated by human life until now. Each step that you make on this surface is a trace that will last ever. You feel like being in another time. In an ancestral time.

### 3.5 MDRS Experiment Conclusion

After the performance of Irene Lia Schlacht in 2010, the creative experiment was carried out by Ayako Ono in 2011, and by Valentina Karga and Pieterjan Grandry in 2012. All of these people were isolated for two weeks during the ILEWG space mission simulation at MDRS in Utah. All the persons who took part in this experiment were selected as persons with a multidisciplinary and humanities background and cultural interest. The experiment was totally voluntary and had no restrictions. Everyone reported a positive effect from the performance, in particularly considering such a stressful and constrained environment as a mission simulation.



Fig. 5: Irene in front of Gaia, Mandala at MDRS. Creative performance task (© I.L. Schlacht 2010)



Fig. 6: Gaia, Mandala at MDRS. Creative and cultural performance (© I.L. Schlacht 2010)

## 4. CONCLUSION

- Space Art may include a cultural dimension in space utilization.
- Artistic activities in Space may increase the chances for knowledge acquisition and communication.
- Cultural activities will improve quality of life if performed by an astronaut with this kind of interest.

The role of art in space exploration is to create cultural progress behind scientific progress. Art is one way of



creating a new whole and thus can inspire scientists with their research (Liquifer, 2011)<sup>34</sup>. An art project could have the impact of divulging and communicating knowledge in space environments; it could be education for the general public, and could increase interest in children for science, including outer space. Being exposed to art as well as producing creative and artistic expressions may be helpful for astronauts to improve their well-being and performance. Artistic activities may be used for relaxation as well as stimulation to get new viewpoints and find creative solutions to unforeseen problems. To achieve this, astronaut training and selection should contain artistic activities so as to allocate astronauts with cultural interest to a mission. The exposure to art as well as possible creative performance should be supported as free activities by astronauts with an interest in it. JAXA is really active regarding the cultural utilization of space. This agency believes that cultural activities are a part of human beings and expand life in other space. As stated by JAXA: "From the viewpoint of arts, in particular, composure, which can be obtained only when one is free from tightly scheduled activities, and free and spontaneous state of mind, which is born from it, are quite important. In other words, relations with official responsibilities, which include duties, are not so essential for artistic missions. Instead, relations with the dimension that contains private consciousness and free emotions are more required. Subjective and individual data obtained in that dimension will provide important clues for artistic plans in space in the future and clarification of the mind and body of human beings, unlike common data obtained from scientific and technical viewpoints" (JAXA, 2010, p.42<sup>35</sup>). As explained by Roger Malina, human Space missions are aimed, of course, at furthering knowledge for the sake of human progress. Indeed, the involvement of arts and humanities in Space exploration is itself "inextricably tied to the process of creating human civilization" (Malina Communication, 1989, as cited in Woods, 2001<sup>36</sup>).

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