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*Original Paper*

# Psychology of Astronauts and a Metamemetic Approach Using Citizen Science

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***Abstract***

*Regarding studies that prepare astronauts for space missions, psychologists have assessed candidates' qualifications. The following proposal is to collect astronaut diaries and look for trends in management skills for future astronauts in psychologically draining and risky situations. In the long term, approaches can be made and/or applied to prepare them for future space missions. This includes acknowledging the relationships individuals have to uncertainty, including productivity and sustaining cognitive aloneness (intended as a cognitive skill capable of limiting the interference of external thoughts and psychologies). Points of the proposed methodology include multilogical thinking skills, first principles thinking, trained attentiveness, and critical thinking as it pertains to communication, organization, self-regulation, and allowing people the time and silence needed to properly respond. Lastly, individuals should separate the interference of thoughts as a result of psychological conditioning (including biases) from applied critical thinking.*

***Keywords***

*Citizen science program, Space exploration missions, Multidisciplinary approach, Emotional regulation, Memetic algorithm*

## 1. Introduction

According to Dawkins (1999), memetics is an evolution of ideas that propagate from mind to mind, and group to group. Studying how infectious memes work is what Diego Fontanive proposed by looking at the meanings we make throughout our thought processes. Decoding the premises behind the meanings and various interconnected interpretations is crucial, combined with multilogical thinking, or seeing from different perspectives to understand something (N/A, 2019).

Fontanive's approach is called Metamemetic thinking, which is a combination of applied critical thinking, metacognition, and multi-faceted logicality. The latter include deductive reasoning, first principles

reasoning, and analytical philosophy. Metamemetic thinking entails developing the cognitive skills required to identify a fallacious meme (such as a biased assumption, theory, idea, method, approach, narration, etc.). It also entails dismantling the unsound parts, progressing through the process of developing more refined thinking skills.

A metamemetic approach is essential in the field of citizen science and its contributions. Citizen science is a process of collecting and analyzing information. Indeed, it aids in making critical thinking more applicable, effective, and less methodological. It also supports the absolute necessity of removing biased approaches to citizen science-based inquiries and theorizations (and even mainstream science), such as spiritual constructs, pseudoscientific viewpoints, and incorrect interpretations.

Understanding the approach of Metamemetics and multilogical thinking will help individuals think about psychological situations in terms of uncertainty and mental aloneness. Mental aloneness refers to the cognitive state and inherent thinking processes that individuals have been trained and educated to implement, intending to avoid the interference of memetic psychological structures throughout the activity of thinking about anything, especially when the subject of the reasoning is important (personal communication with D. F., 2022). For example, psychological aloneness combined with metamemetic thinking can assist an astronaut in detecting and discarding faith-based thought processes during decision-making or problematic existential reflections during space travel, or even in permanently inhabiting another planet/space station (Fontanive, 2020).

This proposed work is a preface and summary for a tentative research project that could be executed. Eventually, it could help to compile a book based on volunteers' experiences in extreme environments. More specifically, this overview is composed of examples of this approach, methodology, tasks, and suggestions for assisting in research, application, and discussion regarding the psychology of astronauts in space missions. It could also be used for people living in confined, isolated spaces as well.

Intelligent and critical observation of problematic thoughts is the best and only way to understand certain things in-depth, by excluding the intrusion and interference of thoughts. This is because thoughts refer to events that have passed and are sustained by memories. Its psychological cognitive fabric is essentially accumulated knowledge, which is a good and necessary thing because we would otherwise be cerebrally lost. Yet, intelligent observation should never be accumulative; otherwise, it will always be the mere replication of the mnemonic past, with no new understanding, only repetition (personal communication with D. F., 2022).

The following is an overview of the project experimentation and execution of activities. Phase 1 consists of gathering tools, resources, and discussion to encourage understanding and application of Metamemetics. Relevant sources should be compiled to prevent further issues, such as the overload of information and disinformation. Phase 2 constitutes providing and searching for examples and applications of Metamemetics, requiring data collection. These include papers, inquiries, mind maps, infographics, and other forms of media. Phase 3 entails a continuation of research with analysis, discussion, application, and assessment. It includes questions directed at antimemetic, multilogical, and

metametacognitive approaches.

## 2. Methodology

Research has historically been carried out through citizen science. Volunteers have helped aid researchers in a variety of fields including biology, environmental sciences, history, and astronomy. It is also widely used in libraries and schools.

Volunteering to help researchers may carry a stigma of untrustworthy contributions. However, in many cases, volunteers are aided by the research. There has been extensive research into the motivations of volunteers (Raddick, Prather, & Wallace, 2019). This suggests that research may be necessary if there is a relevant need or desire to participate, and if the outcome of participation is relevant to approaching the shared issues. The goal for volunteers is to identify, apply, and analyze examples and approaches relevant to potentially helping the topic of psychology and astronauts during space missions. One of the reasons for these tasks is to identify a belief that may interfere with the task based on what can be analyzed about someone's reflection.

The first task includes finding diaries or written reflections related to experiences in space missions. Diaries and reflections can be found in databases or repositories related to astronomy and repositories or archives such as EBSCOhost or worldcat.org. Searching Jstor.org or Google books may also produce results for astronauts' diaries. You can use the Boolean method via typing keywords in quotation marks and linking the keywords with 'AND,' 'OR,' and 'NOT' when searching for available sources. With the consent of sharing information for research, participants should record their observations if they have any regarding psychological issues and management during the space mission or space stimulation experience. Psychological issues are based on experiences in a confined space for long periods. Volunteers can analyze certain parts of the experience by the writer and apply multilogical and metamemetic thinking (this poses concerns and may require adaptive techniques). It would be important to see a trend in what does not work and why.

The second task includes identifying emotional regulation techniques and assessing research previously done in studies about confinement. In the context of dysregulation, an example of a belief that is a result of psychosocial conditioning is the desire to have friends or the fear of being mentally alone. One thematic problem could be regarding uncertainty, as one of the memetic interferences is related to bias, like the normalcy bias, which is the inability to react in a situation that threatens security. There are strategies for emotional regulation including situation selection, situation modification, conflictive change, and response modulation. The attentional deployment includes distraction (it is separated from what stimulates emotion), which can be turned into inquiry and an attempt to understand what we want to escape and why. Other subcategories to inquire upon include situation modification, rumination, worry, and thought suppression (Emotional Self-regulation, 2022).

### 3. Examples of Mitigating Psychological Crisis

The following is a summary of points from a thesis written by Morgan Eudy with some inquiries. Eudy (2018) investigated the dynamics of group interactions leading to success. In a survey about resilience, the majority of respondents reported a high sense of resilience was needed to adapt in orbit. In another survey on positive factors of space missions, earth viewing led to more interactions and interest in caring for the earth. Another finding was that growth and resilience are needed, depending on circumstances caused by stressful situations (Eudy, 2018). Respondents emphasized concern for adaptability and cognitive flexibility over resilience. Among one of the negative responses was a desire to return to earth (overview effect). Negative factors during events surrounding space missions might include monotony, isolation, and confinement. Eudy stated some recommendations to conduct further research including investigation into factors distinguishing the constructs of resilience, adaptability, and cognitive flexibility.

A curious topic could be memetic and non-memetic, and dangerous and not dangerous memetic interferences. We carry our conditioning with us, despite there being training to understand bias and being able to identify it. In a magazine article, Kelley Slack stated: "...On the psychological side, we train them on stress management, conflict management and something we call space flight resource management, which is communication, situational awareness, leadership...." (Clay, 2016).

Eudy's questions include: How do astronauts contribute to success among members of a group? What are common personality traits for success in crew member performance? Some main qualities are motivation, competitiveness, resilience, and emotional stability. Depending on optic flow and frame of reference can help change the perspective of astronauts in microgravity (Eudy, 2018). If, and when necessary, how can we continually evaluate, make predictions about personality and related outcomes regarding performance, and responses to situations as a result that may need different approaches (Eudy, 2018)?

It would be relevant to consider applying a Metamemetic approach to events and situations that would take place during earth-based stimulation experiments, long-duration space missions, and interplanetary inhabiting. One instance is regarding how a behavior may lead to the inevitable need to fire someone on Mars, where a form of policy-making would use this approach, even with decentralized or AI-based debater technology (Fontanive, 2020). Working in groups, there are roles and expectations. If there is a necessary change in group dynamics, how would we adapt without dysregulation?

During pre-mission selection of astronauts going on long-duration missions, researchers should identify optimal factors for candidates to perform successfully (Eudy, 2018). Technical tasks will have indirect psychological factors of conditioning. Ariel Ekblaw, Space Exploration Initiative Founder at MIT, listed some challenging tasks during an expedition that involve effective interpersonal and communication skills, including launch and payload systems and self-assembling habitats, system failure in orbit, communication problems, geoengineering structures, and searching for exoplanets (Colonize Mars vs Colonize Space, 2022).

## 4. Materials and Research Recommendations

For a start in analyzing astronaut reflections, there is a blog site entitled "*Diary of a Space Zucchini*". There are also entries from a diary written by Ilan Ramona, an astronaut who did not survive on *Columbia*, and interviews with astronauts on Repository on Nasa.gov. One co-authored account is *Homesteading Space* by David Hitt, Owen Garriott, and Joe Kerwin. Examples of published diaries include *Diary of an Apprentice Astronaut* by Samantha Cristoforetti, *Diary of a Cosmonaut* by Valentin N. Lebedev, *An astronaut's diary* by Jeffrey A. Hoffman, *Homesteading Space: The Skylab Stormy*, The way of the Explorer by Dr. Edgar Mitchell, and *Inside the space race: a space surgeon's diary* by Lawrence E. Lamb. BBC has an evidence series called *How to Build an Astronaut*. For space stimulation, *Once Upon A Time I Lived on Mars* by Kate Greene is an example that is recommended.

## 5. Conclusion

For further research suggestions, this proposal aims to create a Google form for comments and reflections based on volunteers' experiences or analyses of others' experiences. This is aimed to interest volunteers who are interested in contributing data to empirical approaches using psychological, multilogical, and metamemetic approaches.

Considerations in future applications are considered. In the modern world, four factors, among others, interfere with how we process information on average: information overload (too much information), the decline in critical thinking skills, and the decline in attention span (combined with what`s known as Flynn Effect), and AI-based platforms remain in need of regulation.

Conclusively, citizen science may provide a place to make relevant observations on local issues. It is also necessary in data collection and personal lives, space simulation environments, and in the future in interplanetary conditions.

Glossary for Context:

Interference of thought with thinking: Metamemetic Thinking is a process that is aimed to identify and discard, invalid, and/or irrelevant thoughts that are based on opinions that are affected by biases and accumulated through and into memories which become relevant when we think. (Yet, thinking Multilogically and metamemtically aims to apply metacognition on a daily level as opposed to only, for example, educational matters). Thinking tends to be conditioned, but critical thinking, or Metamemetics aims to distinguish what is valid and sound from what isn't.

Metamemetics: Memesare replicators of Information, and memetics is the study of how these influence the way we think. Metamemetics, then, is the study of violent memes. A short, useful tool is Virus of the Mind notes pdf.

Memes: Units of culture replicating in the mind that twist ideas and apply meaning with information. Memes are also abstractions of objects, like avatars and perception of technology and how we utilize it. There are helpful memes such as art, symbols for the pharmacy, egg carton boxes, paying for goods. There are unhelpful memes such as indoctrination, common sense, assumptions, and expectations. This

psychological phenomenon will likely be around for as long as humans exist.

Multilogical thinking: Analyzing things from different perspectives through different ways of thinking with the goal of understanding and coming out with a new way to perceive something (in order to see the reality about it, avoid stagnation and reduce confusion). For example, different theories to approach the question about aliens made people ask different questions which return to biases like anthropocentrism, normalcy bias, or the Dunning Kruger effect.

Multilogical Thinking: This involves different ways of understanding, such as lateral, analytical, dynamic, negative, and critical. Models of awareness are created through these examples of thinking (Glossary of Critical Thinking terms).

Metamemetics: Diego Fontanive's adaptation of memetics, studying the viral memes and violence caused by devotion to them. "It also involves the decoding of the premises behind the meaning to understand whether the premises are valid or not" (Fontanive, 2020).

Psychological Conditioning: The result of memories that are transferred into thoughts with value that operate in worldviews, belief systems, behaviors, etc. Studying this approach would allow people to see dynamics of operant conditioning.

Psychological pictures: Continuously operating cognitive filters that we use to interpret the world. Certain filters work for certain things because we were not taught how to identify filters and interact without them to use to see things, like laws, values, norms, problems, values, beliefs, and information. It's similar to psychological images, or what our mind perceives.

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