

Factors Influencing Empathy During Short-Duration Space Analog Missions

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ABSTRACT

Empathy is the ability to understand and relate to the perspectives and feelings of another individual. A team's ability to prevent and manage social conflict is closely related to the team members' empathy, thus it is considered an important individual trait for astronauts operating as part of a spaceflight team. As part of a study monitoring crew psychological and behavioral indicators, twenty-six space analog mission crew members took pre-mission, during-mission, and post-mission questionnaires measuring empathy, stress, depression, irritability, loneliness, risk-taking, and intrinsic motivation. One mission was conducted at the Mars Desert Research Station (N=7), two missions at the Mars Arctic Research Station (N=10), and three missions at the Integrated Lunar/Mars Analog Habitat (N=9). Mission durations were between twelve and seventeen days. A multiple regression analysis with empathy as the dependent variable showed depression, irritability, loneliness, and several sub-categories of risk-taking and intrinsic motivation accounted for fifty-one percent of the space analog crew members' empathy score variance. The ability of the psychological and behavioral questionnaires to account for empathy variance during space analog missions provides information about how changes in crew psychology during spaceflight may influence empathy and subsequently the crew's ability to prevent and manage social conflict.

Keywords: Space, Analog, Mission, Empathy, Psychology, Behavior

Factores que influyen en la empatía durante misiones espaciales análogas de corta duración

RESUMEN

La empatía es la capacidad de comprender y conectar con las perspectivas y sentimientos de otra persona. La capacidad de un equipo para prevenir y gestionar conflictos sociales está estrechamente re-

lacionada con la empatía de sus miembros, por lo que se considera un rasgo individual importante para los astronautas que operan como parte de un equipo de vuelo espacial. Como parte de un estudio que monitorea los indicadores psicológicos y conductuales de la tripulación, veintiséis miembros de la tripulación de una misión análoga espacial respondieron cuestionarios antes, durante y después de la misión que medían la empatía, el estrés, la depresión, la irritabilidad, la soledad, la toma de riesgos y la motivación intrínseca. Se realizó una misión en la Estación de Investigación del Desierto de Marte (N=7), dos misiones en la Estación de Investigación del Ártico de Marte (N=10) y tres misiones en el Hábitat Análogo Lunar/Marte Integrado (N=9). La duración de las misiones fue de entre doce y diecisiete días. Un análisis de regresión múltiple con la empatía como variable dependiente mostró que la depresión, la irritabilidad, la soledad y varias subcategorías de toma de riesgos y motivación intrínseca explicaron el cincuenta y uno por ciento de la varianza en la puntuación de empatía de los miembros de la tripulación de misiones análogas espaciales. La capacidad de los cuestionarios psicológicos y conductuales para explicar la varianza de la empatía durante las misiones análogas espaciales proporciona información sobre cómo los cambios en la psicología de la tripulación durante los vuelos espaciales pueden influir en la empatía y, posteriormente, en la capacidad de la tripulación para prevenir y gestionar los conflictos sociales.

Palabras clave: Espacio, Análogo, Misión, Empatía, Psicología, Comportamiento

短期太空模拟任务期间同理心的影响因素

摘要

同理心是一种理解和体会他人观点和感受的能力。团队预防和管理社会冲突的能力与团队成员的同理心密切相关，因此同理心被认为是航天团队宇航员的重要个人特质。作为一项监测机组人员心理和行为指标的研究的一部分，26名太空模拟任务机组人员在任务前、任务中和任务后接受了问卷调查，这些问卷测量了同理心、压力、抑郁、易怒、孤独、冒险和内在动机。一项任务在火星沙漠研究站(N=7)进行，两项任务在火星北极研究站(N=10)进行，三项任务在月球/火星综合模拟栖息地(N=9)进行。任务持续时间为12至17天。以同理心为因变量的多元回归分析表明，抑郁、易怒、孤

独、以及冒险和内在动机的几个子类别占太空模拟机组人员同理心得分差异的51%。心理和行为问卷能够解释太空模拟任务期间的同理心差异，这提供了有关“航天飞行期间机组人员的心理变化如何影响同理心以及随后机组人员预防和管理社会冲突的能力”的信息。

关键词：太空，模拟，太空任务，同理心，心理学，行为

Background

Empathy is the ability to understand and relate to the perspectives and feelings of another individual (Gaumer Erickson et al., 2015; Ramón, 2017). It encompasses a cognitive component of decoding a mental state and an affective component that relates to an emotional response (Guhn et al., 2020). Deficits in empathy have been associated with impairments in social functioning and reductions in the ability to prevent and solve social conflict (Gaumer Erickson et al., 2015; Guhn et al., 2020), thus it is considered an important individual trait for astronauts operating as part of a spaceflight team.

The Empathy Formative Questionnaire (EFQ) is one method for measuring someone's empathy. The EFQ is designed to measure two essential components of empathy. The first component is whether an effort is made to understand others' contexts, feelings, and behaviors. The second component is a measure of proficiency to communicate one's understanding of someone's personal situation. Questions in each component category are scored on a Likert scale from one to five with one mean-

ing “not very like me” and five meaning “very like me.” Combining the component scores yields a total empathy score (Gaumer Erickson et al., 2015).

Methods

As part of a study monitoring crew psychological and behavioral indicators, twenty-six space analog mission crew members took pre-mission, during-mission, and post-mission questionnaires measuring empathy using the EFQ, stress (Levenstein et al., 1993), depression (Lasa et al., 2000), irritability (Craig et al., 2008), loneliness (Russell, 1996), risk-taking (Blais & Weber, 2006), and intrinsic motivation (McAuley et al., 1987). One mission was conducted at the Mars Desert Research Station (N=7), two missions at the Mars Arctic Research Station (N=10), and three missions at the Integrated Lunar/Mars Analog Habitat (N=9). Mission durations were between twelve and seventeen days.

A multivariable regression analysis with empathy as the dependent variable was conducted. Each of the psychological and behavioral questionnaires served as independent variables potentially influencing the empathy

scores. Any variable not statistically significant ($P \leq 0.05$) was removed from the regression model and the analysis was re-calculated until all variables were statistically significant. Post-hoc Pearson's correlations were conducted to provide further information regarding the relationship between empathy and other psychological and behavioral questionnaires.

Results

Twenty-six participants generated 372 questionnaire results during their mission lifecycles. The multiple regression analysis with empathy as the dependent variable showed depression, irritability, loneliness, health/safety risk-taking, social risk-taking, and the intrinsic motivation sub-categories of perceived competence, effort/importance, and relatedness accounted for fifty-one percent ($R^2 = 0.51$) of the space analog crew members' EFQ score variance. The results of the regression

analysis and the post-hoc correlations are displayed in Table 2.

Discussion

These results show that in a short-duration spaceflight analog environment, higher depression, irritability, loneliness, and social risk-taking scores are associated with lower empathy scores. Additionally, higher levels of intrinsic motivation, particularly the sub-categories of perceived competence, effort/importance, and relatedness, are associated with lower empathy scores.

The ability of the psychological and behavioral questionnaires to account for empathy variance during space analog missions provides information about how changes in crew psychology during spaceflight may influence empathy and subsequently the crew's ability to prevent and manage social conflict.

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Table 1. The Empathy Formative Questionnaire (Gaumer Erickson et al., 2015).

<i>Understand Others</i>	<i>Communicate Understanding</i>
1. I try to see things from other people's points of view.	9. When a friend is upset, I try to show them that I understand how they feel.
2. When I don't understand someone's point of view, I ask questions to learn more.	10. I say things like "I can see why you feel that way."
3. When I disagree with others, it's hard for me to understand their perspective. (N)*	11. I've been known to say "You are wrong" when someone is sharing their opinion. (N)*
4. I consider people's circumstances when I'm talking with them.	12. When a friend or family member is sad, my actions let them know I understand (like a hug or a pat on the back).
5. I try to imagine how I would feel in someone else's situation.	13. I say things like "Something like that happened to me once, I understand how you feel."
6. When someone is upset, I try to remember a time when I felt the same way.	14. I've told my friends things like, "You shouldn't be upset about that" or "Stop feeling that way." (N)*
7. When I'm reading a book or watching a movie, I think about how I would react if I was one of the characters.	15. When I know one of my friends is upset, I try to talk to them about it.
8. Sometimes I wonder what it would feel like to be in my parents' situation.	

* Questions that are framed negatively and therefore reversed scored are designed with (N).

Table 2. Empathy Multivariable Regression Analysis Results.

<i>Independent Variable</i>	<i>Coefficients</i>	<i>Standard Error</i>	<i>P-value</i>	<i>Pearson's Correlation</i>
Intercept	125.442	5.955	6.31E-65	N/A
Depression	-0.644	0.085	3.01E-13	-0.440
Irritability	-0.213	0.079	6.98E-03	-0.277
Loneliness	-0.135	0.059	2.36E-02	-0.129
Health/Safety Risk Taking	1.242	0.261	2.90E-06	-0.043
Social Risk Taking	-3.827	0.420	5.59E-18	-0.383
Perceived Competence	-2.790	0.453	1.90E-09	-0.343
Effort/Importance	-1.649	0.681	1.59E-02	-0.165
Relatedness	-5.128	0.588	1.05E-16	-0.348

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