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A Critical Period of Adaptation: The Third-Quarter Phenomenon in Extreme Environments

Xianghe Zhu

Faculty of Psychology, Beijing Normal University, Beijing, China

Abstract: Psychosocial adaptation is crucial for mission success as well as the safety and well-being of people working in isolated and confined environments (ICEs), such as space and Antarctica. Exposure to such environments has been associated with significant psychosocial responses. Notably, people tend to experience an increase in emotional and interpersonal stress just past the midpoint of the mission, an observation known as the "third-quarter phenomenon". In this review, evidence for and against the existence of this phenomenon from different types of ICEs was presented. Factors that might contribute to this phenomenon and implications for coping strategies were discussed. We concluded that the adaptation patterns might be influenced by many factors instead of any single one. Psychological studies and lessons must be valued in helping people cope with these extremely stressful environments.

Key words: Isolated And Confined Environments · Psychosocial Adaptation · Stress · Affect

INTRODUCTION

Increasingly more importance has been attached to the psychosocial adaptation of people working in isolated and confined environments (ICEs), such as space and polar research stations [1-5]. The stressors in these environments are well-documented [2, 3, 5 - 7]. Astronauts and polar explorers are, to a large extent, isolated from their accustomed physical and social environment, live and work in confined space and endure risks in the physical environment such as microgravity and radiation, to name just a few. These stressors can induce reactions including somatic discomfort, affective disturbance, cognitive impairment and interpersonal problems [2]. In particular, these adaptation responses, especially emotional and interpersonal ones, seem to show certain patterns with the passage of time. For instance, in reviewing findings about mood changes in the polar environment, Palinkas [3] pointed out three patterns, which are associated with: 1. latitude and exposure to day light, 2. cold-related changes in thyroid and 3. the psychosocial factor. The psychosocial factor has been much studied under the framework of the "third-quarter phenomenon" [8], which has been adopted beyond polar research into space and other ICE research [5, 6, 9]. It is argued that people in ICEs experience the most emotional and interpersonal difficulties just past the midpoint of their stay. This paper provides a brief review of the evidence regarding the third-quarter phenomenon from various types of ICEs. The aim is to examine whether a critical period of significant changes in adaptation might exist so that support and intervention are most needed.

The Third-Quarter Phenomenon: Temporal fluctuations in mood and morale have long been observed in various types of ICEs (e.g., polar, undersea, space simulation environments, etc.; see Connor and colleagues' review [10]. Based on these observations, Bechtel and Berning [8] argued for the existence of a "discomfort period" past the midpoint of isolation and called it the "third-quarter phenomenon". During this period, people are likely to experience the most difficulties in mood, morale and interpersonal issues, which might show some recovery towards the end of isolation. In particular, this period seems to depend on the relative time mark only (always around the third quarter) regardless of the absolute length of the mission.

Connor and colleagues [10] associated this pattern with the "psychological anchor points which help the individual mark his confinement". The prevalent views in today's research also attribute this phenomenon to the psychological segmentation of mission duration [3] and

Correspondence Author: Xianghe Zhu, Faculty of Psychology, Beijing Normal University, Beijing, China 100875.

the tendency to contemplate the time remaining before the mission ends [6]. It's likely that when people are half-way through their mission, they realize that a period of isolation and confinement equal to the first half in length still awaits and therefore experience a significant increase in negative affect [6].

This third-quarter effect has been viewed as a notion of a critical period of adaptation [7]. This notion is significant because if there's a predicable period when significant difficulties or changes are likely to occur, it helps us take preventative measures and countermeasures to reduce impacts and facilitate adaptation [11]. To date, evidence is mixed regarding the existence of this phenomenon. Findings obtained from actual and simulation space studies, Antarctic expeditions and other ICE missions are reviewed.

Space and Simulation Environments: Crew members on space missions live and work under extreme isolation and confinement [5]. Some studies conducted in space simulation experiments suggest that the period past the midpoint of the mission is when some significant changes are likely to occur. For instance, researchers analyzed communications between crews and mission control personnel in two simulation studies for 135 and 90 days respectively [12]. During the second half of both mission, as the role of monotony became salient, crew members showed a greater need for information about the outside world and messages they sent became more emotive and phatic and less work-related in their communications [12]. Supporting evidence also comes from the Mars500 simulation experiment conducted in Moscow. Six multinational participants were assessed on their mood states using the Profile of Mood States (POMS) [13]. Scores for both Total Mood Disturbance (TMD, for negative mood states) and Vigor-Activity (V, for positive mood states) revealed a temporal pattern. The highest TMD and the lowest V scores were observed on day 366, around the third-quarter, both with some recovery to the baseline level towards the fourth-quarter [14]. This, along with other findings from the Mars 500 project, seems to support a critical period between the mid-point and the end of the mission, especially in terms of behavioral health [9].

However, supporting evidence is lacking in actual space missions. In the psychological studies conducted in the Russian Mir Space Station and the International Space Station (ISS), no changing pattern consistent with the third-quarter effect was observed [5, 15]. For instance, the crew members (13 in the Mir and 17 in the ISS) on missions of 4-7 months rated their mood and group climate weekly, based on questions from reliable and validated instruments. Results showed no significant variations in mood or perceived social climate during the four quarters of the missions in either studies. Consistent findings were obtained from crew members isolated in Lunar Palace 1, an analogous space station in China, for 80 days [16]. Using the same assessment instruments, researchers did not found supporting evidence for the third-quarter phenomenon [16].

The Polar Environment: The polar environment is a much studied exemplar of the ICE [4]. Due to its commonalities with the space environment, the polar environment has been recognized as a space analog environment and research findings can be informative of human adaptation in space [17]. In a study on Antarctic winterers in Scott Base, a drop in arousal/vigor and increase in displeasure/negative mood was reported during the third quarter of the stay [18]. Increase in tension/anxiety was also observed in winterers in two American Antarctic stations past the halfway of their missions [19]. However, a group of winterers in the Concordia station reported progressive increase in total stress throughout the mission, a pattern not supporting the third quarter effect [1]. Again, the inconsistency in evidence is noted by many researchers [6, 7].

Other ICEs: In addition to actual/simulated space and polar environments, temporal fluctuations in adaptation responses have been observed in environments such as offshore oil drill facilities, submarines and undersea saturation chambers, where workers also face isolation, confinement and harsh physical environments. For instance, negative moods of 75 Chinese offshore oil workers was found to follow the third-quarter pattern during an entire 28-day working period, which peaked around 19^{th} - 20^{th} day [20]. In assessing 6 saturation divers during a 32-day mission, researchers [21] found a local peak in hostility accompanied by a drop in perceived well-being during the third-quarter, but those were just among the many points where critical changes occurred. More findings from environments such as the submarine mission and fallout-shelter simulation is reviewed by Connors and colleagues [10], in which a lack of consistent findings is shown.

Factors and Coping Strategies: Based on this brief review, we can conclude that evidence has been mixed regarding the existence of a third-quarter phenomenon.

In generally, the tendency seems to be that more supporting evidence is found from the Antarctic environment than from the space and other types of ICEs, although no consistency is found within any one type.

The lack of consistent findings across settings raises interesting questions. Several factors that might contribute to such an inconsistency have been noted by researchers [5-7, 15, 16] with respect to assessment methodologies, selection and training processes, support and management and characteristics of the missions. First, the lack of unified instruments for assessing adaptation in the ICE has long been a major problem that hinders comparison [22]. Differences also exist in the frequency or intervals of assessment. Take a 12-month Antarctic winter-over mission for example. In some studies, assessment is made once per month, while in other studies it is made at longer intervals. Second, strictly selected and well-trained astronauts might simply be better at coping with stress than polar or submarine crews [5]. Third, the intense support astronauts get from psychological professionals and the support personnel is incomparable [5].

A final and probably most important factor lies in the differential structure of the missions and the stressors in them. It was suggested that the "excitement of being in space" probably helped blunt negative feelings of the astronauts, which might not be the case for workers in other ICEs who do not experience the same exhilaration [5]. Another point was made by Sandal and colleagues [6, 23] who suggested that boredom and monotony of the mission might be a critical factor. It was argued that a model like emphasizes critical phases or stages in adaptation is probably more appropriate for groups on a prolonged ICE mission where boredom and monotony are the main stressors. In this way, the inconsistent findings might be explained by the different stages of a spaceflight mission with different tasks, a variation which is lacking in an Antarctic winter-over mission especially during the winter. In Bechtel and Berning [8], original thought, they hypothesized that the third quarter phenomenon might be a "general characteristic" of finite-time isolation and stress. We should add or specify that a mission probably need to be monotonous in nature with minimum changes in work and activities for the third-quarter phenomenon to become prominent.

One implication for coping strategies is obvious: we can modify and create situations to break monotony by arranging different tasks and activities to prevent or overcome severe changes in mood and morale [16]. For instance, in the Mars 500 study, although adaptation difficulties increased past the mid-point, novel tasks during the Mars landing period (occurred around the mid-point) seemed to play a role in boosting motivation and attenuate the negative effects [14]. The issue of monotony might be less of a problem for astronauts, who usually have a tight and specific work schedule. But in future missions where more prolonged stays, less effective support from the Earth and more autonomy might be expected, phasic changes in adaptation might become more prominent [15]. In this case, crew members would certainly benefit more from the knowledge and abilities to manage their own psychological well-being.

CONCLUSIONS

Changes in adaptation to the ICE might not be predicted by a single factor such as time or environment solely, but are influenced by a combination of many interacting factors such as selection and training, support and management, mission type and characteristics and individual differences one's relationships with the environment.

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