

Who dares to join a parabolic flight?

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ABSTRACT

Parabolic flights represent an important tool in space research to investigate zero gravity on airplanes. Research on these flights often target psychological and biological processes in humans to investigate if and how we can adapt to this unique environment. This research is costly, hard to conduct and clearly heavily relies on humans participating in experiments in this (unnatural) situation.

The present study investigated N =66 participants and N =66 matched control persons to study if participants in such experimental flights differ in terms of their personality traits from non-parabonauts. The main finding of this study demonstrates that parabonauts score significantly lower on harm avoidance, a trait closely linked to being anxious. As anxious humans differ from non-anxious humans in their biology, the present observations need to be taken into account when aiming at the generalizability of psychobiological research findings conducted in zero gravity on parabolic flights.

1. Introduction

Parabolic flights are an important research tool to investigate zero gravity without traveling to outer space. Research can be conducted on airplanes flying these parabolas, which also targets the question how the human body including the human brain reacts to this unique experience of being weightless and the straining phases of hypergravity (please see also Fig. 1 illustrating one typical parabola of a parabolic flight). As parabolic flights are clearly a stressful experience [1,2], we wonder if a certain kind of personality type is associated with joining as a participant of a parabolic flight (= parabonauts).

Personality refers to rather stable characteristics of persons manifesting in individual differences in affective, cognitive and behavioral tendencies towards a wide range of different situations [3]. Investigating the parabonaut's personality represents an important research question because a distinct personality type of humans joining parabolic flight might have a profound influence on the generalizability of scientific results gathered on such flights. Of note, biologically oriented personality research has demonstrated that both the structure and the functionality of the human brain differs according to different personalities (e.g. [4–7]). Moreover, the same has been observed for peripheral hormonal activity [8], which clearly is linked to the

processes of the central nervous system. As a growing body of studies aims to investigate psychobiological functions on parabolic flights, it is of tremendous importance to understand if a certain kind of personality type (hence being characterized by a different biological make-up) tends to join more often such a research endeavor.

Much research has been already conducted about humans looking out for extreme situations. Most of “earthly” extreme pleasures such as risky driving [9], rock climbing at Mount Everest [10], parachuting/base jumping [11] or following other extreme sports have been researched in terms of personality [12]. It has been demonstrated that persons eager to search these extreme situations often can be characterized as scoring low on harm avoidance and high on sensation seeking [11,13,14]. Links to the Five Factor Model of Personality have also been established [15]. In the latter study, participants with tendencies towards risky sports were characterized by higher extraversion and openness. On the other hand they had lower scores on neuroticism and conscientiousness.

These classic terms from personality psychology (e.g. novelty seeking, harm avoidance and sensation seeking) stem from different personality theories. The trait novelty seeking describes persons who can be characterized by “exploring unfamiliar places and situations” [16], being impulsive and disorderly. Harm avoidant persons are

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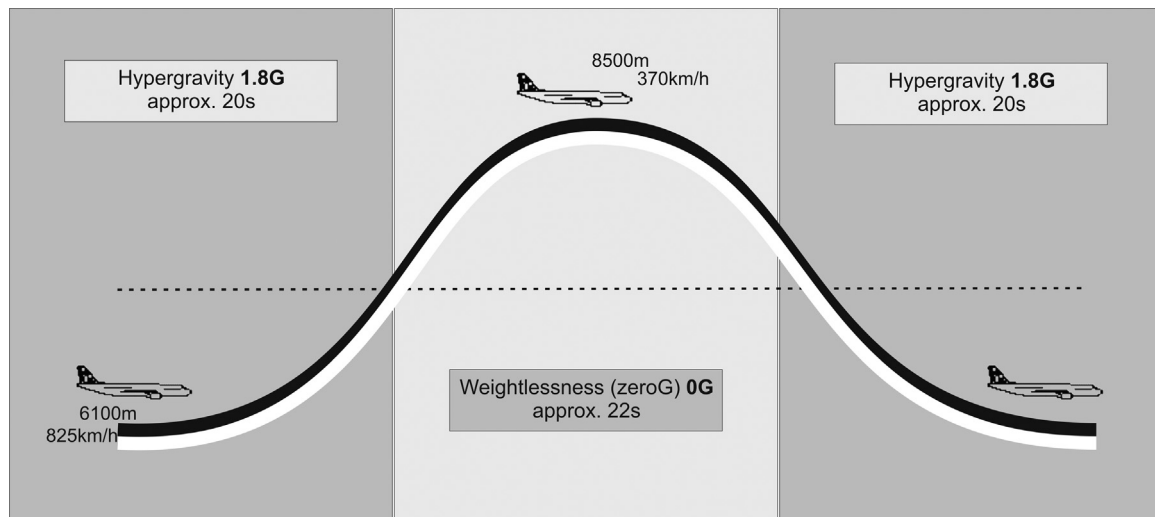


Fig. 1. The figure depicts a typical parabola consisting of two phases with hypergravity lasting approximately 20 s with a phase of weightlessness in between lasting approximately 22 s.

anxious and they worry about future outcomes. In addition, they are easily fatigued. Both novelty seeking and harm avoidance are temperament traits from Cloninger's Biosocial Theory of Personality dividing personality in temperament and character, whereas temperament can be observed from early on in infancy and should therefore be influenced more by genetics. In contrast the character part of personality is more shaped by the environment manifesting itself in stable patterns in adolescents and adulthood [17]. Cloninger's Biosocial Theory of Personality comprises four temperaments called novelty seeking, harm avoidance, reward dependence and persistence. On the side of the character traits Cloninger names self-directedness, cooperativeness and self-transcendence.

The term sensation seeking has been coined by Zuckerman [18] and describes persons who are characterized by being thrill and adventure seekers, easily being bored and impulsive. Cloninger and Zuckerman [19] searched for overlaps between their personality theories and observed that persons scoring high on novelty seeking are also more impulsive in terms of sensation seeking, and those scoring high on harm avoidance are less impulsive.

Recently, a first study has been published on the personality structure of parabonauts. This interesting study demonstrated that participants of a parabolic flight are characterized by being more extraverted and conscientious and less neurotic [20]. These personality traits stem from a lexical model of personality describing human personality in terms of five global personality traits [21]. Extravert persons tend to be outgoing, lively and good at socializing; conscientious persons are punctual and diligent. Neurotics tend to be anxious and moody. Again overlaps between the Five Factor Model of Personality and the already discussed concepts of Cloninger and Zuckerman have been demonstrated. Among others there are clear links between Neuroticism and Harm Avoidance and between Extraversion and Novelty Seeking (e.g. [22]).

It needs to be mentioned that Collado et al. [20] compared their sample of parabonauts with a norm sample. Although this is a valid approach to investigate and characterize the parabonauts, this research design comes with costs. When using norms from a manual, it is not clear if these persons could imagine being part of a parabolic flight (or even had this unique experience). Therefore, we conducted the present study, where we tried to replicate the findings of Collado et al. [20] by using a short inventory measuring the Big Five of Personality [23] and assessing personality in more detail with the Temperament and Character Inventory by Cloninger et al. [17]. Finally, we aimed to assess sensation seeking in the control group to investigate if those participants stating to be willing to join a parabolic flight would score higher on sensation seeking. With respect to the other personality

dimensions (and in line with the earlier findings from different research areas dealing with personality in extreme situations), we expected parabonauts to score higher on novelty seeking and lower on harm avoidance. Following the results from Collado et al. [20], we expected the parabonauts to score higher on extraversion and conscientiousness as well as lower on neuroticism.

2. Methods

2.1. Participants

The group of parabonauts consisted of $n = 66$ persons (18 females, 48 males; age = 39.65 (SD = 9.32)) flying on parabolic flight campaigns. On each campaign the participants of our study experienced $n = 31$ parabolas on their respective flights. Participants flying on the campaign were selected from a university setting. Personality tests were administered after participating in the parabolic flight (mean time in days since flight has passed until filling in the questionnaires = 1172.02; SD = 1047.61; median = 669; information is missing from $n = 3$ persons). To get an idea of a parabolic flight and its setting, please see Fig. 1 and the additional Fig. 2 depicting researchers CM and SS in zero gravity between experiments.

The control group consisted of $n = 66$ age and gender matched persons (18 females, 48 males; age = 39.42 (SD = 9.79)) that have not taking part in a parabolic flight. These controls were invited according to the rule to find a 'near-perfect' match to the group of parabonauts with respect to age and gender.

All participants filled in a short measure of the Five Factor Model of Personality called Big Five Inventory (BFI-10) [23] (German version included in the same paper) and the Temperament and Character Inventory [17] (TCI, German version by Richter [24] et al.). The control persons also filled in the Sensation Seeking Scale-V (SSS-V) by Zuckerman [25] (German version by Beauducel et al. [26]). Moreover, control persons watched a short video describing parabolic flights. After watching this video they had to answer questions on the willingness to participate in such a flight and on motion sickness. This item set is described in the result section. The study was approved by the local ethic committee of Ulm University, Ulm, Germany.

2.2. Questionnaires

As mentioned, all participants answered a short measure of the Five Factor Model of Personality and the TCI (note that $n = 2$ participants in the group of parabonauts did not fill in the TCI, therefore degrees of freedom vary a bit in the result section). The short measure of the Five

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