

Chapter 7

## Flying with Strangers: Postmission Reflections of Multinational Space Crews

*Peter Suedfeld*<sup>1</sup>

Department of Psychology  
University of British Columbia

*Kasia E. Wilk*

Youth Forensic Psychiatric Services Research and Evaluation Department  
Ministry of Children and Family Development

*Lindi Cassel*

Department of Occupational Therapy  
Providence Health Care

### A B S T R A C T

After the Space Age began as part of the national rivalry between the USSR and the United States, space exploration gradually took on a multinational character as both countries included astronauts from their respective allies, and eventually from each other, in their missions. This trend became institutionalized in the Shuttle-Mir program and in the construction of the International Space Station (ISS). The latter is the first truly international, as opposed to multinational, space capsule, in that it does not belong to and was not built by one country. In previous cases, one national space agency was always the host and crewmembers from other nations were perceived and treated as guests. This “guest” status, which usually

---

1. This research was made possible by Contract No. 9F007-033006 with the Canadian Space Agency and is part of the project Long-term Effects After Prolonged Spaceflight (LEAPS). A briefer version of the chapter was presented at the meeting of the American Psychological Association in San Francisco, CA, in August 2007. Correspondence should be addressed to Peter Suedfeld, Department of Psychology, University of British Columbia, Vancouver, BC V6T 1Z4, Canada, or [psuedfeld@psych.ubc.ca](mailto:psuedfeld@psych.ubc.ca).

went with being a minority among a majority from the “host” nation, led to considerable dissatisfaction and frustration.

This chapter examines the archived reminiscences of both majority and minority astronauts and cosmonauts, relying primarily on the method of Thematic Content Analysis (TCA). TCA is a set of techniques whereby trained scorers identify and quantify specific variables in narratives. In this study, TCA procedures were used to analyze how majority-minority status and other variables (e.g., gender, mission duration, and Space Age era) affected satisfaction, feelings about crewmates and home agencies, personal values, ways of coping with problems, and other psychosocial reactions of the mission participants. The study drew upon astronauts’ and cosmonauts’ memoirs, autobiographies, media interviews, and oral history interviews as the databases on which TCA scoring was performed.

## NATIONALISTIC EMBODIMENTS OF A UNIVERSAL HUMAN DRIVE

The exploration of space may be attributed to two driving forces. One is an innate drive shared by many species but perhaps best exemplified by humanity: the urge to seek novelty, to enlarge the sphere of the known as we advance into the hitherto unknown, and to expand the habitat of humankind.<sup>2</sup> Long before technology made real space voyages possible, fictional explorations can be traced to the myth of Daedalus and Icarus and its counterparts in other traditions, to the writings of Cyrano de Bergerac, and eventually to the imaginations of Jules Verne and the multitude of early-20th-century science fiction writers.

The second motivator, which determined just when in our species’ history space travel would move from fiction to reality, was international rivalry. Primitive military rocketry began centuries ago, accelerated and took the first large steps toward space during World War II, and was increasingly well supported and brought to eventual fruition as the “space race” component of the Cold War.

---

2. M. Holquist, “The Philosophical Bases of Soviet Space Exploration,” *The Key Reporter* 51, no. 2 (winter 1985–86): 2–4.

The first decades of human spaceflight were a series of competitions between the Soviet Union and the United States: who would be the first to launch an orbiting spacecraft, a piloted spacecraft, a space crew, a Moon rocket, a space station . . . . Flights were scheduled to preempt media publicity from the competition. Temporary victory veered from one bloc to the other, with each claiming—or at least implying—that being momentarily ahead in the race was proof of the superiority of its political and economic system, just as Olympic gold medals were (and are) risibly interpreted as markers of national quality.

In such a setting, it followed logically that cooperation between the two leading space nations would be unlikely. The original space travelers were exemplars of the virtues each country extolled: they were military pilots, the cream of that already hand-picked crop, who were used to flying experimental and operational aircraft at the very edge of new technology, individuals of demonstrated courage, coolness, and ability. The world was shown that they were all physically fit, psychologically stable, good husbands and fathers, modest, humorous, and loyal. They were patriotic citizens and, depending on which program they were in, strong supporters of either communism or democratic capitalism. Although these portraits omitted a number of what would have been more realistic, if less rosy, individual differences among these pioneers, both space agencies continued to paint such idealized pictures, and the spacemen did their best not to smear the paint (although later in the Space Age, revisionists have tried to rub off some of its luster by emphasizing the internal politics of the agencies, alleging arbitrary and biased decisions being made concerning the assignment of astronauts, and so on).<sup>3</sup> More recently, selection procedures have changed to reflect the expanded sources and duties of astronauts, to include civilians, nonpilots, women, and a variety of (mostly, but not entirely, technical and scientific) professionals; but there is a perception that some kinds of bias still exist—e.g., in favor of astronauts from the military.<sup>4</sup>

It is worth remembering that the combination of the universal urge to explore and the particularistic urge to use exploration to exalt one's nation is neither new nor unique to space explorers. For centuries, it has been a prominent reason why

---

3. B. Burrough, *Dragonfly: NASA and the Crisis Aboard Mir* (New York: HarperCollins, 1998).

4. M. Mullane, *Riding Rockets: The Outrageous Tales of a Space Shuttle Astronaut* (New York: Scribner, 2006).

terrestrial expeditions were funded and also a strong component of many expeditioners' motivation.<sup>5</sup>

## GUEST ROOMS IN SPACE

In 1975, the two rivals cooperated to design a docking module that allowed spacecraft from each (Apollo and Soyuz) to join in space. Later, both superpowers began to offer room and board in their space capsules to citizens of their respective international blocs. The Soviet *Interkosmos* program made room for cosmonauts from various Eastern Bloc countries, as well as from France, Syria, and India; American crews have shared their spacecraft with colleagues from Canada, Western Europe, Australia, Japan, India, Israel, Brazil, and Saudi Arabia.

This trend was reinforced by the establishment of space agencies in countries that could select and train astronauts but had no independent crewed space vehicles. The most active among these are Canada, Germany, France (and eventually the European Union [EU]), and Japan. The People's Republic of China has since gone beyond such strategies to develop its own launch vehicles and begin an independent program of piloted spaceflight. Eventually, multinationality became routine, as did the inclusion of women and the broadening of selection to allow for the participation of people who were not military, not test pilots, and often not even pilots. The new participants were from a range of disciplines: engineers, scientists, physicians, politicians, and, most recently, private individuals who bought a brief stay on the ISS.

This major increase in the diversity of space voyagers sharpens a distinction that began when the USSR and the United States first added foreign crewmembers. Differences, sometimes invidious, were not only between nationalities per se, but also between the "host" crew of Americans or Soviets/Russians and the "visitors." At first, the inclusion of international crewmembers was primarily a propaganda move. It had relatively little beneficial effect on the missions themselves and angered the established astronaut and cosmonaut corps by reducing the flight

---

5. J. R. L. Anderson, *The Ulysses Factor: The Exploring Instinct in Man* (New York: Harcourt Brace Jovanovich, 1970).

opportunities of their members.<sup>6</sup> Until the construction of the ISS, every capsule that carried human beings into space was either American or Soviet/Russian. Was it possible that mixed-nationality crews aboard felt equally at home and comfortable, or was a host-guest distinction unavoidable? Would the latter be strengthened by the fact that some of the “home” team inhabited the vehicle for a much longer period than did the foreign visitors? Could the distinction be eliminated, or at least minimized, by appropriate training and crew composition? And what did the answers to these questions imply for truly international efforts, such as building and working on the ISS, and perhaps the eventual exploration of space beyond low-Earth orbit and the Moon? This chapter presents data that address some, though not all, of these questions.

There has been considerable evidence that psychosocial stressors are among the most important impediments to optimal crew morale and performance.<sup>7</sup> Positive reactions during and after spaceflight were relatively ignored as psychologists focused on problems that needed to be avoided or solved. After a somewhat slow start toward balancing the situation, attention to positive aspects has expanded in the past few years to look at eustress (positive stress), personal growth, excitement, enjoyment, feelings of satisfaction, camaraderie, and changes in values.<sup>8</sup>

---

6. T. Furniss and D. J. Shayler, with M. D. Shayler, *Praxis Manned Spaceflight Log, 1961–2006* (Chichester, U.K.: Springer Praxis, 2007); Mullane, *Riding Rockets*.

7. N. Kanas and D. Manzey, *Space Psychology and Psychiatry* (Dordrecht, Netherlands: Kluwer, 2003); Space Studies Board, *A Strategy for Research in Space Biology and Medicine in the New Century* (Washington, DC: National Research Council, 1998); J. Stuster, *Bold Endeavors: Lessons from Space and Polar Exploration* (Annapolis, MD: Naval Institute Press, 1996); P. Suedfeld, “Applying Positive Psychology in the Study of Extreme Environments,” *Journal of Human Performance in Extreme Environments* 6 (2001): 21–25; P. Suedfeld, “Space Memoirs: Value Hierarchies Before and After Missions—A Pilot Study,” *Acta Astronautica* 58 (2006): 583–586.

8. Suedfeld, “Applying Positive Psychology”: 21–25; E. C. Ihle, J. B. Ritscher, and N. Kanas, “Positive Psychological Outcomes of Spaceflight: An Empirical Study,” *Aviation, Space, and Environmental Medicine* 77 (2006): 93–102; A. D. Kelly and N. Kanas, “Communication Between Space Crews and Ground Personnel: A Survey of Astronauts and Cosmonauts,” *Aviation, Space, and Environmental Medicine* 9 (1993): 795–800; P. Suedfeld, “Invulnerability, Coping, Salutogenesis, Integration: Four Phases of Space Psychology,” *Aviation, Space, and Environmental Medicine* 76 (2005): B61–B66; Suedfeld, “Space Memoirs”: 583–586; P. Suedfeld and G. D. Steel, “The Environmental Psychology of Capsule Habitats,” *Annual Review of Psychology* 51 (2000): 227–253.

It has been pointed out that “mixed” crews are mixed in many different ways. Intercultural issues can arise, and have arisen, not only between space voyagers of different nationalities, but also between those of different space agencies, sexes, and educational and professional backgrounds. Crewmembers who came to space with a military test pilot background and those with an academic science background may have problems understanding each other’s jargon and worldview (to say nothing of those of teachers and politicians). The same, to an even greater extent, is likely to be true in international crews that are not perfectly bilingual.<sup>9</sup> However, the current chapter focuses on only one kind of diversity, that based on nationality.

Whether the possible benefits of increased diversity in crew composition (such as reducing boredom, celebrating unaccustomed holidays, and becoming acquainted with new and useful approaches to interpersonal and operational problems) will outweigh the additional stresses that it generates, or vice versa, needs to be assessed through empirical data. To date, there have been three sources of relevant information. One advantage that they all share, which sets them off from simulation and analog studies, is their high external validity: the information is produced by real participants in real space operations. This is the only kind of information that will be considered here.

The most colorful and memorable, but least generalizable and scientifically rigorous, source is the collection of anecdotes that has been generated by the space voyagers and others involved in the programs. Self-report studies using surveys and interviews have provided both qualitative and some quantitative information, usually from a relatively small number of crewmembers during a mission and occasionally from larger samples of ground staff personnel. Thematic content analyses applied to interviews, memoirs, and similar archival materials provide another form of quantitative analysis applied to qualitative materials. This is the method used in the current chapter.

---

9. Kelly and Kanas, “Communication Between Space Crews and Ground Personnel”: 795–800; P. Kumar, “Intercultural Interactions Among Long-Duration Spaceflight Crew (LDSF)” (paper presented at the International Astronautical Congress, Hyderabad, India, September 2007).

## “MY HOUSE” OR JOINT TENANCY?

### Anecdotal Evidence

As in much of space psychology, and more generally in the psychology of all extreme and unusual environments, the first bits of knowledge came from the anecdotes told and written down by participants. These stories have tended to emphasize the dramatic, and therefore mostly unpleasant, interactions between crewmembers of different demographic (including national/cultural) categories. It should be noted that most of them are “common currency” in the space community; the references given are only examples of several sources in which these stories have appeared.

The kind of diversity with which this paper is concerned, that is, differences in national origin, has been the topic of many anecdotal reports. Some of the best known involve visitors to Soviet capsules. When the first *Interkosmos* cosmonaut, Vladimir Remek of Czechoslovakia, returned from space (Soyuz 28, 1978), the joke went around that he was suffering from “red hand syndrome”: every time he reached for a switch or other control, a Russian crewmate would slap his hand and tell him not to touch it.<sup>10</sup>

Four years later, Jean-Loup Chrétien, a French air force officer and the first of a series of French cosmonauts, was likewise forbidden to touch anything during his crew training with two Russians; he not-so-subtly communicated his frustration (and annoyed his crew commander) by bringing a pillow and going to sleep during one training session. After the inhospitable commander was replaced and Chrétien reached the *Salyut* space station for a one-week visit, his expertise, good nature, and sophisticated equipment impressed the Russians—but one of them later expressed his relief at going back to black bread and borscht after a menu of canned French delicacies, including compote of pigeon with dates and dried raisins, duck with artichokes, boeuf bourguignon, and more.<sup>11</sup> Chrétien, in turn, criticized the excessive workload imposed on the crew.<sup>12</sup>

---

10. V. Lebedev, 1990, cited in R. Zimmerman, *Leaving Earth: Space Stations, Rival Superpowers, and the Quest for Interplanetary Travel* (Washington, DC: Joseph Henry Press, 2003), p. 134.

11. V. Lebedev, *Diary of a Cosmonaut: 211 Days in Space* (New York: Bantam Books, 1990; original publication, 1983); “Surprise! Astronauts Eat in Orbit,” *Space Today Online*, <http://www.spacetoday.org/SpcShtls/AstronautsEat.html> (accessed 14 March 2008).

12. R. D. Hall, D. J. Shayler, and B. Vis, *Russia’s Cosmonauts: Inside the Yuri Gagarin Training Center* (Chichester, U.K.: Springer Praxis, 2005), pp. 235–236.

The long-duration deployments to the *Salyut* and *Mir* space stations included the presence of mixed crews, and the Shuttle-*Mir* mission series was in fact designed for such crews. Each of the latter missions was constructed around an American-Russian team flying to *Mir* aboard a Space Shuttle orbiter and remaining on the station (with occasional crew changes and short-term visitors) for between four and seven months.

The reluctance of Russian hosts to admit their guests to full coworker status persisted during this collaborative program. In 1995, Norman Thagard was the first American to be a long-term crewmember on the *Mir* space station. Despite his status as a full resident, rather than a short-term visitor like Remek and Chrétien, Thagard, like them, felt that he was left out of important and interesting activities on the aging and deteriorating spacecraft. He wound up doing crossword puzzles while his crewmates did the work. Shannon Lucid, who spent six seemingly happy months on *Mir* in 1996, was left “in command” of the station while her two Russian colleagues performed EVAs; however, the control switches were taped down, and she was told not to touch anything.<sup>13</sup> In an oral history interview, one NASA psychologist said, “We were never able, I don’t think, to have the American be on par with the Russian crew members . . .”<sup>14</sup> The problem may not be restricted to the astronauts. Thagard and other Shuttle-*Mir* astronauts indicated that more vigorous support from NASA ground personnel in Mission Control in Russia might have ameliorated these problems—but those personnel in turn felt themselves to be tense, unhappy, underutilized, and somewhat ignored by their own Russian counterparts.<sup>15</sup>

---

13. S. Lucid, “Six Months on *Mir*,” *Scientific American* (May 1988): 46–55; Zimmerman, *Leaving Earth*.

14. Al Holland, interview by Rebecca Wright, Frank Tarazona, and Summer Bergen, 13 August 1998, published through “Shuttle-*Mir* Oral History Project,” Johnson Space Center History Portal, available at [http://www.jsc.nasa.gov/history/oral\\_histories/participants.htm](http://www.jsc.nasa.gov/history/oral_histories/participants.htm) (accessed 7 June 2010).

15. J. M. Linenger, *Off the Planet: Surviving Five Perilous Months Aboard the Space Station Mir* (New York: McGraw-Hill, 2000); Norman E. Thagard, interview by Rebecca Wright, Paul Rollins, and Carol Butler, 16 September 1998, published through “Shuttle-*Mir* Oral History Project,” Johnson Space Center History Portal, available at [http://www.jsc.nasa.gov/history/oral\\_histories/participants.htm](http://www.jsc.nasa.gov/history/oral_histories/participants.htm) (accessed 5 May 2007); Zimmerman, *Leaving Earth*; N. Kanas, V. Salnitskiy, E. M. Grund, et al., “Interpersonal and Cultural Issues Involving Crews and Ground Personnel During Shuttle/*Mir* Space Missions,” *Aviation, Space, and Environmental Medicine* 71, no. 9 (2000): A11–A16.



Even those astronauts who were given work to do could wind up with menial or routine jobs.<sup>16</sup> David Wolf, a Shuttle-Mir resident astronaut, volunteered to clean “gooey, slimy, ice-cold fluid” from the station’s walls, a job that then devolved on him for 4 to 8 hours per day, almost every day, while his Russian colleagues performed sophisticated technical work. Wolf accepted this with equanimity: “that was the best thing I could come up with to free up their time for what they’re better at and be part of the team.”<sup>17</sup>

The critical attitude toward people perceived to be not-quite-colleagues was not restricted to the Russian space program. Mike Mullane, referring to “part-time astronauts”—one-flight foreign visitors, payload specialists, politicians, and the like—asserts that their training had been cursory and superficial, that some of them exhibited psychological problems, and that “Mission commanders provided their own additional training in the form of the admonishment ‘Don’t touch any shuttle switches!’”<sup>18</sup> Obviously, “part-time astronauts” were seen as less expert and therefore undependable. J. M. Linenger, too, comments negatively on his and colleagues’ attitude toward *American* “part-time astronauts.”<sup>19</sup>

Of course, this should not have applied to people such as Remek, Thagard, and Lucid. They and many others who flew as national minorities were in fact professional astronauts. They were just as well trained as the national majority with whom they flew, and in many cases, they trained together with the majority for a year or more. The comments of majority crewmembers are typically quite positive about their foreign colleagues’ personality and ability to get along with the rest of the crew, but the distrust in their competence within the “home team’s” spacecraft (and/or with the home team’s language) persisted nonetheless.<sup>20</sup>

---

16. N. Kanas, V. P. Salnitskiy, E. M. Grund, V. I. Gushin, D. S. Weiss, O. Kozerenko, A. Sled, and C. R. Marmar, “Social and Cultural Issues During Space Missions,” *Acta Astronautica* 47 (2000): 647–655.

17. David Wolf, interview by Rebecca Wright, Paul Rollins, and Mark Davison, 23 June 1998, “Shuttle-Mir Oral History Project,” Johnson Space Center History Portal, available at [http://www.jsc.nasa.gov/history/oral\\_histories/participants.htm](http://www.jsc.nasa.gov/history/oral_histories/participants.htm) (accessed 7 June 2010).

18. Mullane, *Riding Rockets*.

19. Linenger, *Off the Planet*.

20. N. Thagard, interview with the Panel on Human Behavior, Space Studies Board, National Research Council, Washington, DC, 2 May 1997.

These and similar stories may not be representative of the general experiences of national minorities in a space crew. Many of these individuals' recollections were primarily positive. Nevertheless, the negatively toned anecdotes point out, even if they may overemphasize, problems of which planners should be aware.

To some extent, friction between majority and minority crewmembers may arise from differences in the home cultures of the two most populous groups, Russians (including citizens of the former USSR) and Americans. J. B. Ritscher, in an excellent summary of the relevant cultural differences between these two nations, cites research not only from space but also from aviation and from psychological, sociological, and anthropological studies more generally.<sup>21</sup> According to these studies, Russian culture values collectivism, hierarchical power, distance, and paternalism more than American culture and values individualism, egalitarianism, mastery, autonomy, and uncertainty less. In addition, the USSR was oriented more toward survival and less toward well-being.

On a number of dimensions, including the ones listed above, Russia is discrepant from all of the other nations involved in the International Space Station project. Russian and American approaches to spaceflight differ in significant ways, some of these reflecting the more general cultural differences discussed by Ritscher. Supporting the view that Russian culture is more hierarchical than American culture were perceptions that Russian mission commanders were more authoritarian, Russian communications were more structured and formal (at least in English translation), and Russians were more circumspect in criticizing mission control or the systems on the spacecraft.<sup>22</sup>

Perhaps because of differences in the national economies and the funding of the space agencies, cosmonauts were more likely to feel that they had to try to repair malfunctioning systems, whereas astronauts tended to discard and replace them. Russians consequently were more satisfied with systems that worked adequately rather than demanding that they work perfectly. On a more personal level, cosmonauts (unlike astronauts) are paid a large spaceflight bonus, with deductions based on how many of the preset goals (experiments, repairs, extravehicular activities, etc.) they fail to complete successfully during the mission. As a result, their

---

21. J. B. Ritscher, "Cultural Factors and the International Space Station," *Aviation, Space, and Environmental Medicine* 76 (2005): 135–144.

22. Kumar, "Intercultural Interactions."

foreign colleagues sometimes considered them to be reluctant to do work that was not within the pay-for-action agreement and to do anything that might foil the completion of an agreed-upon paid task.<sup>23</sup>

Although it is certainly likely that cultural “root causes” (especially those stemming from differences between Russian and Western cultures) may underlie some of the frictions between majority and minority crewmembers, the host-guest dichotomy may have caused more problems than cultural or national diversity per se. If so, a completely different picture may emerge within a truly international facility such as the ISS when it becomes fully operational.

There is another possible explanation. Valentin Lebedev, a long-duration *Mir* cosmonaut, recognized a difference between his reactions to foreign and to compatriot visitors. Concerning one of the former, he wrote, “It’s nice to have guests, but they make you tired,” even though most of his comments about his French colleague were positive; commenting on an upcoming visit by fellow Russian cosmonauts, he wrote, “I think it will be easier with this visiting crew; they won’t disturb us as much . . . .”<sup>24</sup> It may be that it is not nationality but familiarity that makes a visitor more welcome, so that more extensive pre-mission training and joint activities might erase or at least diminish the invidious difference.

### Self-Report Studies

Kanas and Manzey summarized the few studies using self-report measures by space voyagers who had flown in foreign company.<sup>25</sup> Although there have been several simulation and analog studies (respectively, group isolation experiments in specially designed settings and field studies in isolated areas such as the polar regions and undersea habitats), data from actual spaceflight are scarce. Participants have reported miscommunications due to both spoken and nonverbal interaction styles, abrasive differences in leadership decision-making, differences in work patterns,

---

23. Ibid.

24. Lebedev, *Diary of a Cosmonaut*, pp. 101 and 189, respectively.

25. Kanas and Manzey, *Space Psychology and Psychiatry*.

different standards of hygiene and food preparation, and personality clashes that may be related to cultural factors.

Kanas and his colleagues have conducted major studies of space crews in flight by administering standard questionnaires that crewmembers can complete on a computer while the mission is going on. One such study, of crewmembers on *Mir* (five Americans and eight Russians) and the ISS (eight and nine, respectively), found that cosmonauts on *Mir* experienced more direction, support from the leader, and self-discovery than astronauts; lower vigor and more tension and anxiety on the ISS; and less job pressure but higher task orientation and managerial control in both places.<sup>26</sup> Americans on the Russian station felt less comfortable and less well supported from the ground than did the “home team.” In contrast, ISS procedures are more U.S.-influenced, which may have made the Russians feel that they were on unfamiliar territory. Another report on the same Shuttle-*Mir* crews found that during the second half of the mission, Russian crewmembers reported decreasing cohesion and work pressure compared to Americans.<sup>27</sup>

A more recent study reported that miscommunications abounded when members of international crews engaged in extravehicular activities, but not when all crewmembers were from the same country, and that besides the obvious language barrier, space fliers generally felt that coming from the same cultural background would also reduce interpersonal friction.<sup>28</sup> Most of those interviewed agreed that on long-duration missions, they would prefer to go with a homogeneous crew from their own culture. In fact, according to Linenger, many U.S. astronauts declined the opportunity to participate in the Shuttle-*Mir* program for reasons that included distrust of Russian technology and post-Cold War hostility toward Russians themselves. Some of those who did agree to join the program were so dissatisfied with the training they got in Russia that they threatened to quit—“a near mutiny.”<sup>29</sup>

---

26. N. Kanas, V. P. Salnitskiy, J. B. Ritscher, V. I. Gushin, D. S. Weiss, S. A. Saylor, O. P. Kozerenko, and C. R. Marmar, “Human Interactions in Space: ISS vs. Shuttle/Mir” (paper IAC-05-A1.5.02, presented at the International Astronautical Congress, Fukuoka, Japan, October 2005).

27. N. Kanas, V. P. Salnitskiy, D. S. Weiss, E. M. Grund, V. I. Gushin, O. Kozerenko, A. Sled, A. Bosrom, and C. R. Marmar, “Crewmember and Ground Personnel Interactions over Time During Shuttle/Mir Space Missions,” *Aviation, Space, and Environmental Medicine* 72 (2001): 453–461.

28. Kumar, “Intercultural Interactions.”

29. Linenger, *Off the Planet*, p. 45.

## THE CURRENT STUDY: THEMATIC CONTENT ANALYSIS

Content analysis is a research method used in many disciplines to study narratives of interest. For example, anthropologists may content-analyze myths or folktales to identify important issues or beliefs of a culture; literary scholars may find in novels or plays the dominant patterns of social relations in a particular time or place, or hints as to the childhood experiences and personality of an author. Such qualitative or impressionistic methods are frequently used to explore hypotheses derived from a particular theory such as psychoanalysis, Marxism, or postmodernism. The scholar finds examples in the material that are relevant to the theory and uses those examples as evidence, as in Freud's inferences about Leonardo da Vinci's family background, childhood, and personality, based primarily on the analysis of a dream that Leonardo recorded in his diary.<sup>30</sup>

A purely quantitative counterpart is computerized content analysis, in which the occurrence of certain kinds of words or phrases is counted and used to infer either historical or personal characteristics. For example, a frequent appearance of the word "I" may indicate a degree of self-confidence, independence, or narcissism; hostile terminology ("enemy," "threatening," "evil") reveals a bellicose emotional or cultural state: an increase in such words when referring to another person or country may be one indicator of a forthcoming confrontation.<sup>31</sup>

The method used in our study, Thematic Content Analysis (TCA), is different from both the qualitative or impressionistic approaches and purely quantitative computerized ones. In TCA, either all available material or a randomly selected subset is used so that the researcher's theoretical preconceptions cannot bias the selection of material to be analyzed; identifying information is removed as far as possible, as a safeguard against bias in the actual scoring; and the material is scored blindly by a qualified scorer using a detailed scoring manual to further reduce the chances of bias and of idiosyncratic scoring criteria. Generally, at least one other

---

30. S. Freud, *Leonardo da Vinci and a Memory of his Childhood* (New York: Norton, 1961; original publication, 1910).

31. R. C. North, O. R. Holsti, M. G. Zaninovich, and D. A. Zinnes, *Content Analysis: A Handbook with Applications for the Study of International Crisis* (Evanston, IL: Northwestern University Press, 1963).

scorer analyzes a percentage of the same passages to ensure interscorer reliability. Thus, from a qualitative (e.g., narrative) database, quantitative data are generated in a scientifically rigorous way and statistical analyses are made possible.<sup>32</sup>

The issue of accuracy always arises in retrospective materials, usually from two perspectives. One is the exactness of memory; the other is the possibility of impression management. In the current study, precision probably varied as a function of time since the experience (among other variables), which itself varied from very little, as in the *Life* magazine interviews of the first Mercury astronauts, to years in the case of book-length memoirs. In any case, the question of how precisely the narrators remembered events is not of critical importance to this study: we were not interested in compiling a history of their experiences, but rather in the emotions and motives that were associated with the events and that emerged during recall. As for impression management, although this is a likely mediating variable in any self-descriptive human narrative, the TCA scoring criteria are not very transparent, and the material includes a number of cross-checks (e.g., prepared versus spontaneous remarks). Many of the narratives included negative reflections on both other people and the narrator himself (or herself), and stories by several participants in the same event showed substantial differences, so at least the attempt to make oneself (or one's colleagues or one's agency) look good did not swamp all other considerations, and there was no evidence of externally imposed uniformity in the accounts.

## Method

The current study applied TCA scoring methods to a collection of memoirs, interviews, and oral histories originated by 63 astronauts and cosmonauts. The overwhelming majority of U.S. and Soviet/Russian participants were in the categories that NASA considers professional astronauts: pilots and mission specialists. The few exceptions were "spaceflight participants": individuals flown for some goal such as public relations. No "space tourists" (i.e., individuals who were allowed

---

32. C. P. Smith, J. W. Atkinson, and D. C. McClelland, eds. *Motivation and Personality: Handbook of Thematic Content Analysis* (Cambridge: Cambridge University Press, 1992).

to fly for a brief visit to the ISS upon payment of a multi-million-dollar fee) were included; neither were payload specialists, who fly as members of nongovernmental institutions such as corporations or universities to carry out a specific task or experiment. Participants from countries other than the United States and the USSR/Russia were a more mixed group, which included both professional astronauts and others (many of them professional air force officers) who, after their one spaceflight, would have no long-term connection with a space program.

The collections covered the era of human spaceflight from the very first period through the construction of the ISS, but we omitted reports related to missions in which crews of only one nation were involved. Due to the extremely small sample available from ISS veterans, we also omitted those data from our analyses. With the increasing number of crewmembers who have served on the Station, this problem may be on the way to being solved.

Because the source materials of this study varied widely in length, all TCA results reported below are based on number of category mentions per page in the source. Not every subject had references to all of the dependent variables, so *n*'s (sample sizes within each subcategory) varied from measure to measure.

Anecdotes and a numerical content analysis software program were used as secondary data.

### *Independent Variables*

Table 1 shows the breakdown of the subjects by relevant demographic and spaceflight categories, which served as the independent variables. "National origin" refers to the country with which the source was identified in the space program. For example, some "U.S." astronauts were originally immigrants from elsewhere; however, they were selected, trained, and chosen to fly by NASA. "USSR/Russia" includes cosmonauts whose citizenship was Soviet during the existence of the USSR and those who were Russian afterward. The "Other" category includes astronauts who had been recruited and selected by the established space programs of other nations (e.g., Canada or Japan, as well as France, Germany, or other EU nations) and who flew with either the U.S. or the Soviet/Russian space program. *Interkosmos* crewmembers and their equivalents flying with NASA are also classified as "Other."

**Table 1.** Number of subjects by category.

| National Origin | Sex  |        | Flew as  |          | Flew with |             |
|-----------------|------|--------|----------|----------|-----------|-------------|
|                 | Male | Female | Minority | Majority | U.S.      | USSR/Russia |
| U.S.            | 16   | 10     | 7        | 19       | 20        | 6           |
| USSR/Russia     | 14   | 0      | 4        | 10       | 6         | 8           |
| Other*          | 19   | 4      | 23       | —        | 19        | 4           |
| <b>Total</b>    | 49   | 14     | 34       | 29       | 45        | 18          |

\* “Other” refers to crewmembers who are neither American nor Soviet/Russian. All of the subjects in this category flew as a minority with either American or Russian majorities.

In addition to these analyses, others were performed on disaggregations based on mission duration (two weeks or less versus either four or six months or more) and mission phase (portions of the narrative referring to pre-, in-, or postflight periods). In some instances, the *n* within one of these cells was too small for analysis, and those scores are omitted from this report.

### *Dependent Variables*

The scoring categories applied to the materials were as follows:

1. **Value hierarchies:** S. H. Schwartz defined values as having five major aspects. According to him, values
  1. are concepts or beliefs,
  2. pertain to desirable end states of behaviors,
  3. transcend specific situations,
  4. guide selection or evaluation of behavior and events, and
  5. are ordered by relative importance.<sup>33</sup>

Eventually, Schwartz reported that 11 categories of values underlying stable, important life goals (see table 2) had been empirically shown to have cross-cultural generality and high reliability.

---

33. S. H. Schwartz, “Universals in the Content and Structure of Values: Theoretical Advances and Empirical Tests in 20 Countries,” *Advances in Experimental Social Psychology* 25 (1992): 4.



**Table 2.** Value categories and definitions (alphabetical order).\*

| <b>Value</b>          | <b>Brief Definition</b>   |
|-----------------------|---|
| <b>Achievement</b>    | Personal success through demonstrated competence according to social standards                    |
| <b>Benevolence</b>    | Concern for close others in everyday interaction  |
| <b>Conformity</b>     | Inhibition of socially disruptive acts, impulses, or inclinations                                 |
| <b>Hedonism</b>       | Pleasure in satisfying organismic needs   |
| <b>Power</b>          | Social prestige/status, control over people and resources   |
| <b>Security</b>       | Safety, harmony, stability of society, relationships, and self                                    |
| <b>Self-Direction</b> | Independent thought and action: choosing, creating, exploring                                     |
| <b>Spirituality</b>   | Meaning and harmony by transcending everyday reality  |
| <b>Stimulation</b>    | Excitement, novelty, challenge  |
| <b>Tradition</b>      | Respect for one's cultural/religious customs and ideas  |
| <b>Universalism</b>   | Understanding, appreciation, tolerance, and protection of the welfare of all people and of nature |

\* Adapted from Schwartz, "Universals in the Content and Structure of Values": 5–12.

One way to group the values is to distinguish between those that serve individual interests and those that serve collective interests: Achievement, Hedonism, and Self-Direction versus Conformity, Security, and Tradition. The emphasis on individual versus collective cultural values is generally thought to separate American and Soviet cultures; a comparison between the two groups of values across the fliers representing the two national space agencies can be an interesting way to check on this widespread view.

The value scores reported in the current paper reflect the number of times the source person mentioned experiencing, advancing, or identifying with values in that category per page or section of text in the source material.

2. **Social relations** (two subcategories):

- a. **Affiliative Trust/Mistrust:** positive, trusting relationships versus cynicism and negativity toward others.<sup>34</sup>
- b. **Intimacy:** Positive Intimacy is a measure of readiness or preference for warm, close, and communicative interaction with others.<sup>35</sup> In the current study, we supplemented this by scoring Negative Intimacy as well: negative affect in relationships, negative dialogue, rejection of commitment or concern for others, interpersonal disharmony, nonreciprocated friendliness, and escape from or avoidance of intimacy.

Each social relations measure was scored whenever the source mentioned that emotion in relation to the following:

- his or her crewmates,
- his or her own space agency,
- the space agency in charge of the mission,
- his or her own family, and
- people in general.

3. **Coping strategies:** A standard set of coping categories was used to analyze the source materials.<sup>36</sup> These include both problem-oriented and emotion-oriented strategies. “Supernatural Protection” was added in our previous studies of Holocaust survivors and was retained in the current analysis.<sup>37</sup> This is not a coping strategy per se, but rather an expression of the individual’s invocation of spirituality, religion, mysticism, or fatalism in dealing with problems (see table 3). The category was scored each time the narrative mentioned that the source had used that strategy in attempting to solve a problem.

4. **LIWC computer analysis:** In addition, material that was accessed through the Internet (oral histories and some interviews) was separately computer-analyzed by

---

34. J. R. McKay, “Affiliative Trust-Mistrust,” in *Motivation and Personality: Handbook of Thematic Content Analysis*, ed. Smith, Atkinson, and McClelland, pp. 254–265.

35. D. P. McAdams, “Scoring Manual for the Intimacy Motive,” *Psychological Documents*, vol. 2613 (San Rafael, CA: Select Press, 1984).

36. S. Folkman, R. S. Lazarus, C. Dunkel-Schetter, A. DeLongis, and R. Gruen, “Dynamics of a Stressful Encounter: Cognitive Appraisal, Coping, and Encounter Outcomes,” *Journal of Personality and Social Psychology* 50 (1986): 992–1003.

37. P. Suedfeld, R. Krell, R. Wiebe, and G. D. Steel, “Coping Strategies in the Narratives of Holocaust Survivors,” *Anxiety, Stress, & Coping* 10 (1997): 153–179.

**Table 3.** Coping categories and definitions.

|     | <b>Coping Category</b>            | <b>Definition</b>   |
|-----|-----------------------------------|---|
| 1.  | <b>Confrontation</b>              | Effort to resolve situation through assertive or aggressive interaction with another person   |
| 2.  | <b>Distancing</b>                 | Effort to detach oneself emotionally from the situation   |
| 3.  | <b>Self-Control</b>               | Effort to regulate one's own feelings or actions  |
| 4.  | <b>Accept Responsibility</b>      | Acknowledging that one has a role in the problem  |
| 5.  | <b>Escape/Avoidance</b>           | Efforts to escape or avoid the problem physically   |
| 6.  | <b>Planful Problem-Solving</b>    | Deliberate (rational, cognitively oriented) effort to change or escape the situation  |
| 7.  | <b>Positive Reappraisal</b>       | Effort to see a positive meaning in the situation   |
| 8.  | <b>Seeking Social Support</b>     | Effort to obtain sympathy, help, information, or emotional support from another person or persons                                   |
| 9.  | <b>Endurance/Obedience/Effort</b> | Trying to persevere, survive, submit, or comply with demands  |
| 10. | <b>Compartmentalization</b>       | Encapsulating the problem psychologically so as to isolate it from other aspects of life  |
| 11. | <b>Denial</b>                     | Ignoring the problem, not believing in its reality  |
| 12. | <b>Supernatural Protection</b>    | Invocation of religious or superstitious practices; efforts to gain such protection (e.g., prayer, amulets); reliance on luck, fate |

Linguistic Inquiry and Word Count (LIWC).<sup>38</sup> LIWC is a word-count software application that identifies a variety of affective/emotional, cognitive, sensory/perceptual, and social processes, as well as references to personal space and orientation, motion, work, leisure, financial and metaphysical issues, and physical states. Because computer analysis is subject to many problems such as ignoring context and being restricted to those words and phrases that had been entered in the software dictionary, this was considered a secondary methodology in the current study.

---

38. J. W. Pennebaker, M. E. Francis, and R. J. Booth, *Linguistic Inquiry and Word Count (LIWC): LIWC 2001* (Mahwah, NJ: Erlbaum, 2001).

## Results

We want to emphasize that the findings reported here concentrate on the impact of status as a member of the national majority or a minority within a space crew. Main effect differences as a function of minority-majority status based on characteristics other than nationality (e.g., gender, occupation, or job category on a space mission) are not reported.

In the findings described below, all cited differences were significant at  $p = .05$  or better unless otherwise specified.

### *Value Hierarchies*

1. **Preflight differences:** In references to their life before the mission, the 18 majority sources for whom we had complete data referred significantly more often to Achievement than did the 19 minorities.
2. **In-flight differences:** For the period of flight, internal analyses showed significant majority-minority differences on Achievement and Spirituality, with majority crewmembers higher on both.

Achievement and Conformity also showed interactions with nationality. Across all categories, Russians mentioned Achievement the most often. Americans ranked the highest on both values when flying in minority status, but Russians ranked highest when they were in the majority (see figure 1). With regard to Conformity, Americans were high when they were in the minority but low in the majority; Russians were the opposite (see figure 2).

Minorities and majorities also differed significantly as a function of flight duration. When discussing in-flight periods lasting over four months, minorities emphasized Security more than majorities: the reverse was true for short (less than two weeks) missions.

Of the 18 minority astronauts who made references to values while they were in space, 8 flew with predominantly American crews and 10 with Russian crews. Those who flew with the Americans showed significantly less Hedonism, Self-Direction, Conformity, and Security than those who flew with the Russians. Comparing minorities and majorities flying in American or Russian crews, we found an interaction: non-Americans flying with NASA mentioned Universalism more frequently than

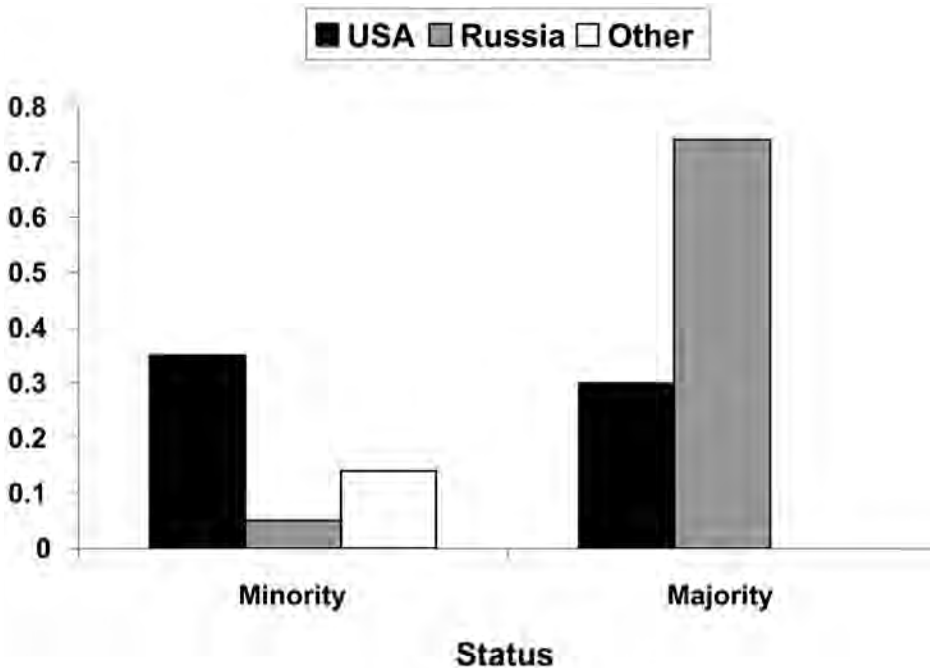


Figure 1. Differences in Achievement value during spaceflight.

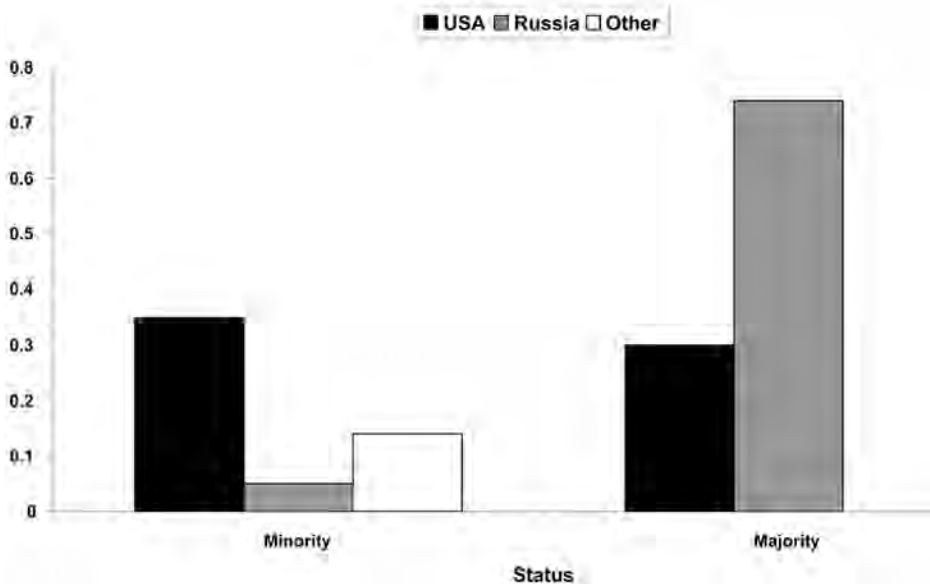


Figure 2. Differences in Conformity value during spaceflight.

**Table 4.** Phase- and status-related changes (mean value scores).

| Value          | Status   | Mission Phase |           |            |
|----------------|----------|---------------|-----------|------------|
|                |          | Preflight     | In-flight | Postflight |
| Power          | Majority | .08           | .06       | .23        |
|                | Minority | .11           | .05       | .29        |
| Achievement    | Majority | .76           | .47       | .47        |
|                | Minority | .46           | .21       | .29        |
| Self-Direction | Majority | .26           | .17       | .23        |
|                | Minority | .31           | .10       | .21        |

did their American colleagues; minorities flying with *Interkosmos* mentioned it less frequently than Russians in their own spacecraft.

#### Value Change

In general, all value references decrease when the source is discussing the period of his or her flight and mostly move back toward or above preflight baselines in descriptions of the postflight period. There were three significant phase-related value changes among the 17 minority and 15 majority crewmembers for whom we had complete data across the three mission phases (see table 4).

For minority sources only, significant changes over the three phases were found: increasing references to Spirituality and Hedonism between the in-flight and post-flight phases, as well as decreasing references to Stimulation and Conformity over the three phases (see figure 3). For majorities, none of the changes was significant.

There were no significant interactions of gender and status or nationality and status with regard to value change over time, nor were there significant national differences in individual- versus collective-oriented values.

#### Social Relations

There were four separate, although correlated, measures within this category: Trust, Mistrust, Positive Intimacy, and Negative Intimacy.

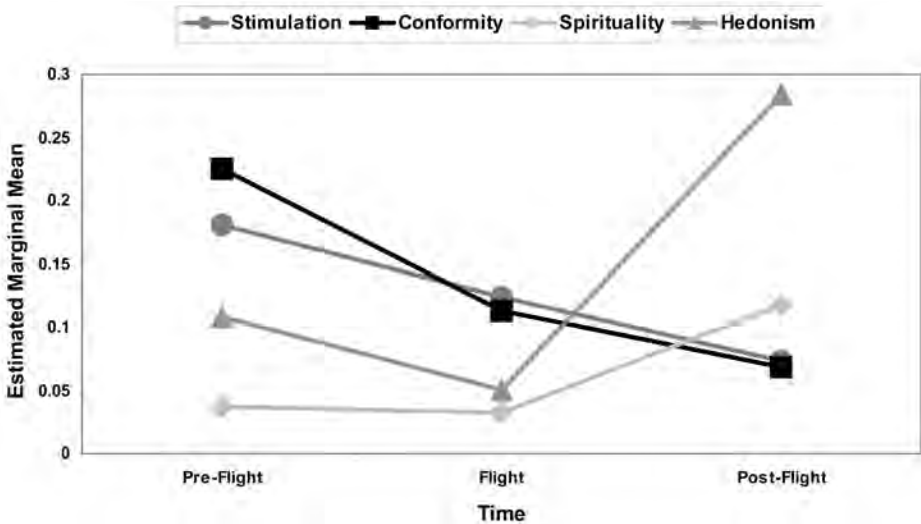


Figure 3. Minority value changes by mission phase.

1. **Majorities versus minorities:** Minority or majority status made a significant difference in the social relations references: minorities were more mistrustful and more negative about intimacy than majorities. There were no reliable overall differences and no interaction effects on the basis of gender or the nationality of crewmates. References to relations between the source and his or her family members were more positive in both subcategories when the source flew with a foreign majority. Minority astronauts showed more Negative Intimacy references toward their own space agency and showed more Mistrust toward the foreign home agency of their majority colleagues.

There were no majority-minority differences in either positive or negative orientation toward astronauts' fellow crewmembers; these comments were predominantly positive (high Trust and Positive Intimacy). The same was true of references to other people in general. Minorities who flew in Russian spacecraft mentioned both positive and negative social relations (Trust and Mistrust, Positive and Negative Intimacy) more frequently than those who flew with American majorities, although only the difference in Trust reached the  $p = .05$  level of significance.

2. **Mission duration:** Regardless of status, long-duration crewmembers made more references to Mistrust than those on shorter missions. Majorities had higher

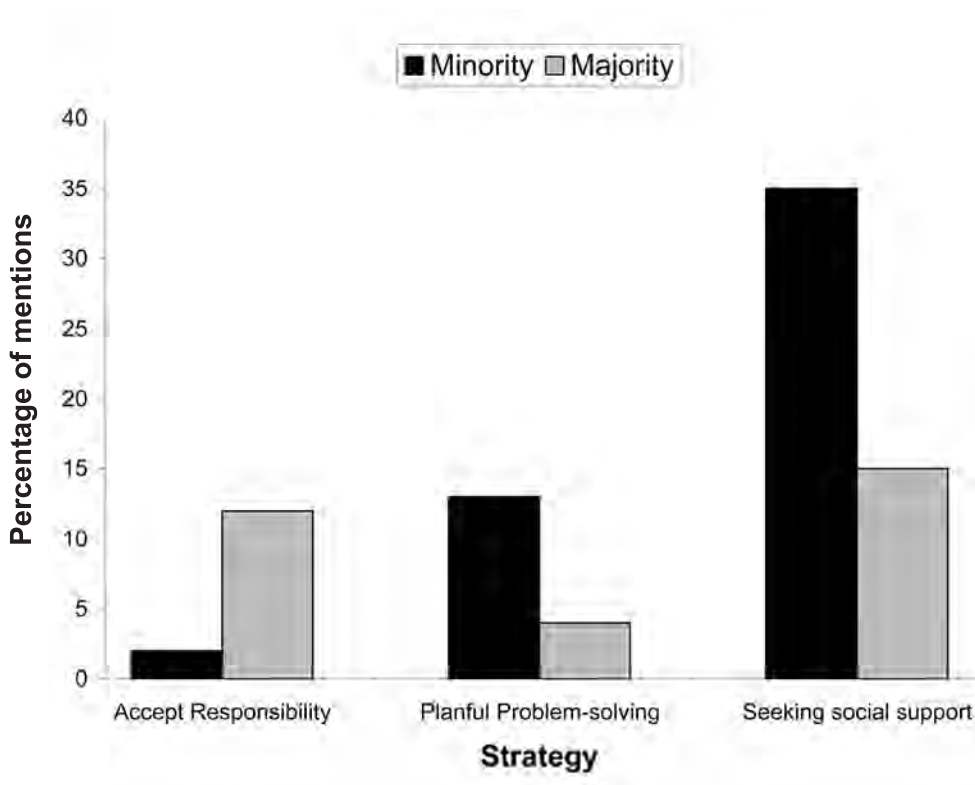


Figure 4. Coping strategies by minority-majority status.

Mistrust and higher Negative Intimacy scores than minorities when discussing short missions, but minorities on long missions were more negative than their hosts.

3. **Mission phase:** Disaggregating minority and majority crewmembers, we found that both decreased in Trust from the pre- to the postflight portion of their narrative, but the drop was marginally ( $p = .08$ ) steeper among minorities. On Mistrust, majorities remained stable while minorities showed a dramatic increase, especially from the in-flight to the postflight stages. There was also a marginal ( $p = .07$ ) interaction effect on Negative Intimacy, with minorities showing a steep increase (again, especially from in- to postflight), while majorities started out much higher in the preflight stage and remained stable at that level.



### *Coping Strategies*

Coping data were collected from 56 astronauts and cosmonauts. There were no significant overall differences for own nationality, gender, or nationality of crew colleagues, and there were no significant baseline (preflight) differences. Over all mission phases and nationalities, there were three statistically significant majority-minority differences (see figure 4).

The remainder of the coping strategy analyses concentrated on descriptions of the mission phase where coping was most crucial—that is, during the flight. There was a significant majority-minority main effect for 3 of the 12 categories. Majority crewmembers were higher than minorities on Accepting Responsibility and lower on Planful Problem-Solving and Seeking Social Support.

Mission duration had significant effects on five coping strategies during flight, in each case with long-duration (four months or more) fliers higher than the short (two weeks or less). The strategies affected were Confrontation, Escape/Avoidance, Denial (all  $p = .01$ ), Accepting Responsibility ( $p = .05$ ), and Supernatural Protection ( $p = .06$ ).

Still during the flight phase, duration also figured in four interactions with majority-minority status. In each case, the difference appeared in the long-duration group only: Accepting Responsibility, Denial, and Escape/Avoidance ( $p = .07$ ), with majority fliers the highest on all three measures, and Supernatural Protection ( $p = .06$ ), with minority crewmembers the highest.

### *LIWC*

Analysis by nationality showed higher word count scores for Russians than Americans on references to affect in general, positive emotions, and optimism. Americans scored higher on references to social interaction. Word count differences as a function of majority-minority status showed that minorities used fewer words and phrases referring to social interaction, community, other individuals, and human beings as a group.

There were no significant differences on such LIWC categories as anxiety, anger, or sadness and no differences as a function of gender or mission duration.

## DISCUSSION

### **Flying with Strangers: The Influence of Minority-Majority Status**

It seems clear that space voyagers who fly in a crew composed mostly of people from their own country have a different experience from those who are a minority flying with a mostly foreign crew. However, contrary to some assumptions that minority status would be generally aversive, the data show a mixed picture. For example, among minority participants, the value of Stimulation and Conformity decreases between the preflight and in-flight phases; this decrease presumably indicates that both boredom and the desire to submerge one's own culturally learned characteristics become less of a challenge over time. Simultaneously, Spirituality increases, indicating a growing internal recognition of transcendental values that is often found among astronauts and is apparently not thwarted—and may in fact be enhanced—by being the “odd person out” in the crew.<sup>39</sup> Hedonism also increases, implying a heightened concern with pleasure.

Being in the minority was associated with fewer references to social interaction, community, other specific individuals, and human beings in general. This datum emerged from the computerized frequency analysis and is difficult to interpret because LIWC merely counts words and phrases; it does not differentiate on the basis of context. More interesting is the fact that minority status also led to more positive comments about one's family, perhaps to compensate for some degree of social isolation; apparently, absence made the heart grow fonder (which was not found for majority crewmembers). One's own home organization evoked more negative references, confirming the complaints of inadequate preparation and support that characterize some anecdotal comments. The agency in charge of the mission—that is, a space agency foreign to the minority flier—was viewed with increasing mistrust as the mission unfolded, perhaps with the recognition that its rules and procedures were alien and sometimes uncomfortable.

However, there was no evidence that bad feelings prevailed toward the majority crewmates, again despite conclusions sometimes drawn from selected anecdotal reports. In fact, the data showed a generally trustful and friendly attitude,

---

39. P. Suedfeld, “Space Memoirs: Value Hierarchies Before and After Missions—A Pilot Study,” *Acta Astronautica* 58 (2006): 583–586.

compatible with such reports as that of Shannon Lucid, a long-duration *Mir* resident with two Russian crewmates: “Yes, we really had a good time together. We really enjoyed being there together. Yuri and Yuri were absolutely fantastic to work with. I mean, I could not have picked better people to spend a long period of time with. We just lived every day as it came. We enjoyed every day. We enjoyed working together and joking around together. It was just a very good experience, I think, for all of us.”<sup>40</sup>

It should be noted that, in the same way, the majority crewmembers expressed trust and friendship toward their foreign colleagues—once again contradicting the negative picture drawn from selective quoting of particular complaints. However, comparisons of comments concerning the in-flight phase with those concerning the postflight phase showed that these positive feelings did decline on both sides (and especially among minorities), and both majority and minority veterans of long-duration missions showed more Mistrust and Negative Intimacy than those who flew shorter missions. Growing interpersonal stress as a function of isolation and confinement with the same small group for over four months was thus confirmed by our data.

We expected to find changes in values, as in previous research.<sup>41</sup> Among the most interesting changes was the drop in references to Power and Self-Direction, for both groups but especially for the minority, as the narratives moved from the pre- to the in-flight portion, followed by increases after the flight. The highly regimented aspects of the launch and the flight itself probably explain the general finding, and the somewhat tenuous and isolated role we have seen for many minority crewmembers, from which they were freed after the mission, explains their more dramatic changes. Minorities’ position within the crew may also be implied by their higher scores on coping by Seeking Social Support and lower scores on Accepting Responsibility—which in many cases they were not permitted to do. However, they also used Planful Problem-Solving more frequently than their majority counterparts,

---

40. Shannon Lucid, interview by Mark Davison, Rebecca Wright, and Paul Rollins, 17 June 1998, published through “Shuttle-Mir Oral History Project,” Johnson Space Center History Portal, available at [http://www.jsc.nasa.gov/history/oral\\_histories/participants.htm](http://www.jsc.nasa.gov/history/oral_histories/participants.htm) (accessed 7 June 2010).

41. Suedfeld, “Space Memoirs”: 583–586.

perhaps because they had to face not only the problems of spaceflight, but also the problem of gaining full social equality.

Majority crewmembers' characterization of their pre-mission life was marked by more references to Achievement than that of the minority members; striving to become an astronaut may be a more vivid achievement goal for those hopefuls whose country has its own spaceflight capability (all majority subjects were from either the United States or the USSR/Russia). Achievement scores in general were high, compared to those for other values, as one would expect from a group with the high levels of achievement that spacefarers had reached even before becoming astronauts or cosmonauts.<sup>42</sup>

We speculate that for most astronauts and cosmonauts, Achievement is a high-level background variable that tends to be taken for granted, not a primary concern, except at particular periods; preparing to become an astronaut and then to embark on a space mission may be such periods. This hypothesis is supported by the finding of overall decreases in Achievement references between the preflight phase and both subsequent phases as the successful mission and return reduce concern about the person's ability to function at the desired level. In fact, space agencies may want to provide Achievement opportunities for postflight astronauts to help them regain their interest in this value, as an astronaut for whom Achievement has become drastically less important than before may suffer serious adverse consequences in adjustment, health, and performance.<sup>43</sup>

### **Status and Nationality**

The often-cited cultural differences—especially between the two major spacefaring nations, the United States and the USSR/Russia—seemed to make no difference as to how positive and trusting relations among crewmembers were. Neither were they reflected in overall comparisons of the individual-oriented versus group-oriented values. However, Russian cosmonauts were higher in mentions of Achievement than were American or other astronauts.

---

42. P. Suedfeld and T. Weiszbeck, "The Impact of Outer Space on Inner Space," *Aviation, Space, and Environmental Medicine* 75, no. 7, supplement (2004): C6–C9.

43. Suedfeld and Weiszbeck, "The Impact of Outer Space on Inner Space": C6–C9.

In some of our data, nationality did interact with the majority or minority status of the crewmember. For example, it is intriguing to see Russians mentioning Achievement-related values especially often when they were in the majority during a space mission, but much less frequently when they were in the minority, whereas Americans did not change much as a function of their status. Achievement for the cosmonauts seems to be more closely linked to social approval from their compatriots than it is for astronauts, perhaps stemming from the collectivist-individualist difference.

Astronauts and cosmonauts varied in references to Conformity, but in opposite directions: the former were slightly higher when they were in the minority, and the latter were much higher when they were in the majority. It may be that Americans felt somewhat easier about being different from their compatriots but felt constrained to fit into their foreign crewmates' expectations. Russians, to the contrary, confirmed traditional mores when they formed the majority but were freer with dissent or individualism when flying alone with foreigners.

### **Status and Flight Duration**

Discussing the spaceflight experience itself, majorities on short-duration missions referred to issues of Security more than minorities, perhaps because they were the hosts responsible for the safety of the capsule and the mission, and they may have felt responsible for the welfare of their guests as well as themselves. However, as missions lengthened, the pattern was reversed; the hosts may have come to feel more secure while the guests became more concerned, possibly because of problems that only the former knew how to solve (e.g., the gradual mechanical deterioration of *Mir*) or possibly because the latter were being prevented from full engagement in meaningful work dealing with those problems.

References to coping strategies in narratives of short flights showed no differences as a function of status. Long missions, however, evoked a majority-minority difference, with the majority higher on mentions of Accepting Responsibility, Denial, and Escape/Avoidance. It may be that these went together: as one accepted more responsibility for solving problems, it may also have become more important to use emotion-oriented means of coping to reduce psychological stress. Minorities mentioned Supernatural Protection more frequently, confirming their increased mention of spiritual values.

Minorities participating in short flights may have appreciated the experience so much that they let personal disharmony pass without comment, while the majority felt less compunction about mentioning interpersonal problems with the salient "other." In long flights, the guest may have both experienced more abrasiveness and become less reluctant to describe it later; the hosts may have become habituated to the strangeness of the visitor or (note the increased mentions of Escape/Avoidance and Denial, mentioned above) withdrawn from unpleasant interactions either physically or psychologically, or both.

### **Status and Host Nationality**

Minority members also reacted differently depending on which nation constituted the majority. Minorities who flew in predominantly American crews cited pleasure and enjoyment, security, autonomy, and (paradoxically) conformity less frequently than those who flew with Russians and also made fewer valenced (positive and negative) references in either direction to social relationships. Whether these differences were the result of the minority member's changing to fit in with the majority (implying that the Russian colleagues themselves were more expressive than American crews, as is also indicated by the LIWC results) or of asserting their own cultural distinctiveness is impossible to tell.

Minorities who flew with *Interkosmos* expressed a feeling of global concern for Earth (universalism) less frequently than their Russian hosts, while the reverse was true for minorities who flew with NASA. However, this is a misleading datum: the two groups of minority fliers did not differ from each other; it was the hosts who differed, with higher scores among the Russian than the American majorities. Whether this is a function of the generally greater emotional expressivity of the Russians or is specific to the topic is not revealed by our data.

## **C O N C L U S I O N**

It appears that any problems related to mixed-nationality space crews may be more a function of the fact that space capsules have belonged to, and were predominantly operated according to the traditions and standard operating procedures of,

one space agency. As a result, the minority “guest” tends to feel left out, unfamiliar with important matters that come naturally to his crewmates, and also feels neglected and let down by his own home organization. This may be an even more pressing problem for minorities who can fly only in that status—that is, all nationalities except Russians, Americans, and (perhaps soon) Chinese. The development and use of truly international missions, including international vehicles and common procedures, is a necessary countermeasure.

One possible way to reduce misunderstanding, miscommunication, and cultural friction would be for all mission participants, both space crews and ground staff, to have in situ language training and familiarization in each other’s countries. When astronauts were being prepared for the Shuttle-Mir missions, they underwent extensive Russian language training and spent considerable time in Russia, both training and socializing with their future crewmates. Apparently it was not considered necessary for the cosmonauts in the crew to have equal exposure to American culture and folkways: cosmonauts did not have prolonged deployments to Houston to become linguistically and culturally adapted. This omission may have been economical in terms of money and time, but it was shortsighted in terms of smoothing performance and interpersonal relations in space, and the lack of similar provisions for mission controllers and staff exacerbated the problems.

We did not look at cultural or personal differences based on characteristics other than nationality, although they have also been thought of as causes of increased stress. However, there is no a priori reason to suspect that they would be any more important in that role than nationality itself, given its pervasive nature: it underlies language, values, history, traditions, child-rearing approaches, political ideologies, concepts of human nature and the individual-society relationship, and so on. We have found, as have other researchers, that differences within each national group are greater than differences across groups; but the latter differences in any case were few except as they interacted with majority-minority (or host-guest) status.

As has been expected, based on anecdotes but without much empirical grounding, long-duration missions (four months or more) reveal more abrasiveness and dissatisfaction.<sup>44</sup> Our data show that these negative tendencies also include more

---

44. See, for example, Lebedev, *Diary of a Cosmonaut*, or Lebedev, cited in Zimmerman, *Leaving Earth*, p. 134.

divergence in values and concerns, and on the part of the majority, emotion-oriented coping that does not really solve problems effectively. How this would develop further on voyages lasting several years is unknown, but is certainly something that space agencies need to think about.

Individual changes in astronaut personality—in values and social orientation—may be evanescent, persistent, or permanent. They may be particularly problematic for people who fly as minorities, especially on long missions. If they last into the postflight life of the crewmember, they may affect his or her family relationships, career progress, and physical and mental health. Again, it behooves the home organization to conduct nonthreatening and supportive post-return help where needed, both for astronauts and for their families.

## POSTSCRIPT

Much of the research concerning international crews has been based on the prospect that such crews will continue to be the norm, as they have been on the International Space Station. Some commentators have asserted that a project as massive and complex as the trip to Mars would have to be an international technical, scientific, and financial effort (although that does not necessarily imply a multinational crew). Politically, it seems that cooperation and collaboration have become the permanent hallmark of space exploration.

As this chapter was being written, the old space race was showing signs of reviving. NASA's three-stage plans, sparked by President George W. Bush, had turned the world's space agencies in new directions. Human return to the Moon, a Moon base, and the voyage to Mars, seemed to have been adopted as goals by all of the major space agencies. But by the same token, several agencies announced a hope that *their* astronauts would be among those who took these giant steps. Some countries (e.g., Canada) accepted that this would happen on an international vehicle, but others (e.g., Russia and China) indicated plans to go on their own. At that time, the Administrator of NASA deplored the possibility of Chinese "taikonauts" reaching the Moon before Americans return to it—an echo of the early years, when competition was the name of the game.

The Obama administration's 2010 decisions concerning the near future of NASA's human space exploration program—canceling the construction of new



space vehicles, delaying if not abandoning a return to the Moon, delaying a voyage to Mars, and introducing the novel possibility of using an asteroid as the next new destination—may have put the United States on the sidelines in any such renewed space race. The impact of these changes for the future of multinational space crews remains to be seen.