.

Cultural Differences in Work and Mission Success in Antarctic Space Analogues: How Can Anthropology Contribute to Human Spaceflight Research?

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Abstract

Cultural diversity has long been identified in space psychology as a key factor influencing crew cohesion, performance and well-being during long-duration missions. Yet most studies see culture as a background variable, measured through standardised indicators and behavioural outcomes. This paper argues that anthropology can deepen these approaches by documenting how cultural frameworks are produced and lived in everyday mission life. Using Antarctic stations as a space analogue, it draws on a comparative ethnographic study of French and Japanese crews: fifteen months of participant observation at the French Dumont d'Urville station, combined with semi-structured interviews with winter-over personnel from the Franco-Italian Concordia station and the Japanese Shōwa station. The results show that cultural differences operate not only between national groups but also within seemingly homogeneous crews, shaped by professional background, generation and social origin. At Dumont d'Urville, crew members hold divergent understandings of what counts as legitimate work, acceptable risk or mental health care, and technicians and scientists operate from different value systems about what matters in Antarctica. Whether such an internal line divides a mission depends less on its existence than on how memberships intersect: where they overlap, subgroups remain permeable; where a single line prevails, it hardens into a clan. The French-Japanese comparison makes these divides starker. French and Japanese crews define success itself differently, French teams judging a winter-over by group cohesion and relational well-being, Japanese crews by the completion of the planned scientific and technical programme. Both, however, share a common effort to maintain the balance of the collective, which they sustain through distinct means: an economy of the gift of time and of debt, contrasting repertoires for expressing and avoiding conflict, and a shared sequence of repair whose outcome depends on the continuity of communication rather than on the absence of tension. These frameworks largely remain implicit, experienced as self-evident or attributed to individual personalities. By making visible these cultural and moral foundations this paper argues that anthropology can support more culturally reflexive selection, preparation and psychosocial countermeasures for international long-duration crews.

Keywords: Antarctica; space analogue; anthropology; cultural difference; mission success; long-duration spaceflight

1. Introduction

On the European Space Agency (ESA) website, in the "Science & Exploration" category, few articles discuss the "White Mars" that is Antarctica. About a hundred research stations, fewer than half of which stay open in winter, are scattered across a continent twice the size of Europe. The French-Italian station Concordia sits on Dome C, a plateau at some 3,200 m of altitude, with a crew cut off from the world and winter temperatures that can fall to −80 °C. "In other words, Concordia is perfect"[*], the site notes, implying that the Antarctic station is ideal for studying space, both from the outside, by observing the Universe through the clear sky and thin atmosphere, and from the inside, by using Concordia as a space analogue to study the human factor.

Long-duration crewed space missions expose their crews to psychological and behavioural constraints. The management of, and adaptation to, prolonged isolation, confinement and danger conditions the well-being of astronauts as much as the safety and success of missions [1]. Space agencies and the scientific community have long relied on terrestrial environments with comparable properties, grouped under the term isolated, confined and extreme (ICE) environments [2, 3, 4]. Antarctic stations are among the most widely used analogues: their remoteness, the hostility of the environment, sensory monotony and the impossibility of rapid evacuation are said to make them the closest thing to space on Earth [5]. Beyond these similarities, the appeal of such analogues is also practical, as they allow the study of larger populations than those in orbit, for example [6].

This comparison has limits, however, and these limits apply to psychology, medicine and psychiatry as much as to anthropology. Space, whether in near-Earth orbit or beyond, and Antarctica are two very different environments, and the White Continent cannot reproduce the full set of extra-planetary conditions such as microgravity or increased exposure to cosmic radiation. Analogues are always partial and situated, valid for some parameters but not for others. This article does not seek to minimise the uniqueness of space (nor that of Antarctica), and we are aware of the need to avoid excessive generalisation [7]. Moreover, the assumption that observations from one national programme would hold indiscriminately for others and for human spaceflight is weakened by the fact that the cultural background of crews is itself associated with different modes of psychosocial adaptation [8].

[*] https://www.esa.int/ESA_Multimedia/Images/2018/10/Perfection

The study of human behaviour in these extreme environments remains largely dominated by the psychological and biomedical sciences. Culture has indeed been identified there as a significant factor influencing the stress and adaptation of those living in such settings [9, 10], but it is most often captured as a variable through standardised indicators. Anthropology has remained marginal on the continent, for reasons we return to in the theory section, where long-term ethnographies remain rare and recent [11, 12]. This article examines how an anthropological approach can enrich the study of humans in space, drawing on the concrete case of Antarctica as an analogue.

2. Material and methods

Anthropology is a comparative discipline, always held in balance between the in-depth understanding of one particular group and its perspective at a wider scale, drawn from the work of other anthropologists who have written other ethnographies. Antarctic stations are highly heterogeneous, both in their environment (the Antarctic Peninsula or the interior of the continent) and in their organisation (crew size, nationalities, modes of operation): comparing winter-over missions therefore requires both an in-depth knowledge of overwintering itself and a coordinated, multi-sited research design. To our knowledge, few other ethnographies of the stations exist. We have thus favoured an ethnographic approach centred on one station, the French base Dumont d'Urville, complemented by a comparative component based on interviews with personnel who wintered at the French-Italian station Concordia and within the Japanese expeditions (JARE). This choice gives access not only to what happens in crew life, but also to the way members interpret and justify their practices.

The main data come from fifteen months of ethnographic fieldwork at Dumont d'Urville, from November 2019 to January 2021. As a member of the TA70 expedition and one of the two ornithologists on the team, I conducted an ethnographic study as part of my doctoral research. This project, distinct from my position as a biologist, was made explicit throughout the recruitment process, and maintaining this transparency in the field was a central principle of the method. The material rests above all on participant observation. Interactions with the crew were recorded in a field notebook, with the explicit consent of those concerned and a constant concern to preserve their anonymity, despite the constraints of such a small group. No audio or video recordings were made: all data come from daily observation, detailed notes and answers obtained

from station personnel. Most of my time nonetheless remained devoted to my work as a biologist and to the continuity of the scientific programmes during the winter. This fieldwork has been described in more detail in earlier work [13].

Settled in a place I could not leave, I adopted a reflexive stance to hold my position among the twenty-four members of TA70. This continuous reflexivity concerned both my place within the collective and my choices in writing and my own interests. As a woman in a mostly male expedition, my gender also shaped my position and my view of station life.

The first comparative component concerns Concordia station. I first met the crew leaving the 2020 winter-over, who were returning to the continent via Dumont d'Urville, and I then continued to exchange with Concordia winterers over the years, through other winterers or at collective events (SCAR conferences, midwinter celebrations, weddings, and so on). This component draws on some thirty semi-structured interviews.

The second comparative component concerns the Japanese expeditions. It rests on some twenty semi-structured interviews with members of former Japanese expeditions (JARE), several of whom wintered at Shōwa station. These interviews were conducted during five months of fieldwork carried out in Japan in 2025 and 2026, as part of postdoctoral work on the notion of sustainability in the Japanese space sector, which allowed me to meet many people who had also taken part in Antarctic expeditions.

To this is added, more in the background, interviews and encounters with Australian, German and American winterers, which provide a few small points of comparison here and there.

We acknowledge the asymmetry of the data between the different countries, with, on the one hand, a fifteen-month immersion and, on the other, material on Concordia and Shōwa stations that rests on semi-structured interviews and repeated exchanges. The main case nonetheless provides the ethnographic depth, and the two comparative components provide the points of contrast that set this depth in perspective. The overwintering experience is not homogeneous: it varies not only from one station to another, but also, within a single station and depending on the profiles of the people present, from one mission to the next. We therefore do not seek to establish generalisable regularities, nor to build a systematic comparative model of national cultures in an extreme environment.

3. Theory

Antarctic anthropology is a recent undertaking, for several reasons. As the only continent without a resident or indigenous population, it long deprived the discipline of its main object of study, the human being [11]. To the recent history of human presence are added other obstacles: access filtered by national programmes, harsh competition for the few places in a setting with limited room, and a field window often reduced to a few summer weeks, which makes long-term ethnography almost impracticable, and this only when stations are willing to open their doors to the social sciences and humanities, far less present than the exact sciences.

It therefore took considerable determination for the social sciences and humanities to establish themselves in the Antarctic landscape and within the Scientific Committee on Antarctic Research (SCAR) [14]. They did so in a world that grants singular value to "being" in Antarctica, for going to the White Continent confers legitimacy, and research without fieldwork is, unfortunately still today, judged superficial [15]. This authority of physical presence, inherited from a culture of heroic and long exclusively male exploration (women were kept away from certain field sites until the mid-1990s), ties the legitimacy of knowledge to a trial of the body and of place, where science merges with the physicality of the expedition. This regime of presence sheds light on a paradox useful to our argument: it is, in many respects, easier to build an anthropology of space than of Antarctica.

The social world of space is largely terrestrial and dispersed across more or less accessible sites, such as agencies, control rooms, robotics teams, laboratories, observatories, New Space companies, and so on. Apart from the ISS, field access is not so much the anthropologist's main difficulty (although it remains a challenge, especially with the large institutional agencies) as the multiplicity of perspectives and scales. The two analogue settings, which the introduction distinguished by their environment, also differ socially, and this is a parameter we take into account. As regards the astronaut/winterer comparison, for example, the two are very different, if only in their status. The winterer holds a temporary position on a station, then returns to a profession in France, whether as a biologist or a carpenter, whereas the astronaut belongs to a profession, to a corps selected and trained over years.

It is aware of these asymmetries that this article chooses not to approach anthropology as a discipline for studying the human factor in space through a mix of new anthropological concepts and of psychological and biomedical studies, but rather to draw on "classical" anthropological

concepts. They make it possible to survey what an anthropology of human spaceflight could achieve, and this article reads as an introduction in which the concepts are not developed in depth. Our aim is not to dive into the depths of debt, values or the boundaries between groups, but to give the sciences already established in the space field a glimpse of what anthropology could contribute to that multidisciplinary domain that is the study of humans in space.

4. Results

4.1 One country, one station, several cultures

At Dumont d'Urville (DDU) the crew is French, with few exceptions, yet its members hold different understandings of what counts as "work" or as acceptable risk. These differences follow generation, profession and social origin, and an Antarctic culture that forms in parallel.

The station has a vocabulary that structures the crew. The population divides into summer crew, *campagnards*, and *hivernants* (winterers), a split in language, and in separate dormitories, divide into sub-groups whose named poles are the *scientos* and the *tech*. A distinction between *anciens* (old hands) and *nouveaux* (new one) is added. These categories are not sealed, and many members say they pay them no attention, yet they mark both usage and the organisation of daily life.

The scientist and technician split is not a word alone but two conceptions of what counts as "working". The visibility of work is a central stake, since not every post is performed in view of all: "There were different profiles. The doctor, you do not see his work; some functions you never see working. The one time you see them is at the gym. We are on top of each other, watching whether others work as much. There is a choice: do the strict minimum, or work" (scientist, DDU, 2021). Social origin adds a further line, more silent, that surfaces in the end: "There was a schism in the technical team during my winter. People do not have the same ambitions or the same salary; we did not talk about it, but it came out" (scientist, DDU, 2021).

Generation is the third line, and the one that carries the most divergent views of acceptable risk. Seniority legitimises competence, and the oldest, held by the crew as the keepers of Antarctic knowledge, embody a relation to safety inherited from another era: "These guys are the closest thing to 'polar heroes'. They were here before safety rules on the sea ice. They are old-style leaders; some are glad not to bother with the labour code or safety rules. In Antarctica we have much more freedom of action than in France" (winterer, technical staff, TA70).

These lines do not form fixed categories, and this is a central result: one axis can divide one mission and stay inert in another. One winter saw a “generation shock”, with groupings by age and a chief rationing alcohol (scientist, DDU, 2007); another saw no generational split: “We had no age separation. Of course we partied among the young, but we had so many sub-groups that we had activities with the others too. The more sub-groups you are in, the more you mix” (technician, DDU, 2020). What separates the two is not the presence of age differences but the number of transversal sub-groups that recompose the collective. Divisions at DDU work as permeable sub-groups that multiply ties through mixing, not as clans that isolate: the more memberships cross, the less a single line hardens into a border.

A mission of one nationality is already plural, and this internal plurality suffices to produce divergent value systems about what, in Antarctica, counts and deserves. If one nationality is already plural, what becomes of crew life when a station joins two?

This is the case of Concordia, the one Antarctic station built and run by two nations. Each winter gathers about a dozen people at rough parity between French and Italians, plus a research doctor from ESA, often of another nationality. DDU’s internal axes operate at Concordia. Generational complementarity recurs: “We were four technicians: two old, two young. The old brake the young, the young are full of drive; to the drive of some answers the experience of others. The saying is: listen to the old and follow the young” (mechanic, Concordia, 2017). The double division of the station is national (French and Italian) and professional (science and maintenance), and it returns in every discussion, to stress the problems it creates or to note that “in my winter it was not like that”. Gender is a further line, with national sub-groups more marked among men than among women, and with recurrent complaints from women about the conduct of Italian men toward them.

Concordia tests the idea of “close” cultures. Two concrete traits show it. The first is language: though the station is French and Italian, the shared working language is English, so two European cultures reputed as neighbours use a third, neutral language that belongs to neither group. The second is the table: the cook does not build one unified cuisine but keeps the two national repertoires side by side, preparing for one feast a French dish and an Italian dish for the two tables. Proximity does not dissolve the border; it displaces it and keeps it at work. The same mechanic states the ambivalence: for his mission national difference had little weight, “there were rows, but a row is communication; it went well”, yet he adds that “the saying that it goes

wrong one time in two is rather true", and that "there would be difficulties from cultural differences if DDU were French and Italian". Proximity lowers friction without erasing it; it demands work whose intensity varies from mission to mission, on top of "being twelve, stuck in a tin can, at altitude and without daylight". At Concordia internal and national differences are entangled: age and job divide within each national group, nationality separates the two groups, and these planes interfere. The question becomes what happens to these frames when the comparison holds not two close cultures but two that everything sets apart, the Japanese case.

4.3 Defining success: a French and Japanese comparison

Neither group uses the word "success" without prompting. For French winterers, success attaches to the notion of a "good expedition" (*bonne mission*): one that fulfils the scientific and technical duties set for the winter, but that above all maintains a social balance, so that every member can have a "good winter". "We do not think in terms of success or failure; it makes little sense. It is a life experience; it can be more or less hard, but it cannot be a failure" (scientist winterer, TA69). This sociality is the base from which the other dimensions of the mission follow: "If we are a good expedition, if people communicate well and there are no clans, then it is much easier to work, to help each other and to finish what we have to do" (technician winterer, TA70).

For Japanese winterers the word 成功 (*seikō*, "success") is as rare, even when the question used it. They speak of safety, of accomplishing the mission, and of producing scientific observation results. Where the French base is communication and good relations, the Japanese base is safety. The term 無事 (*buji*), which translates as safety or security, carries a further sense of peace of mind and calm. Safety in this sense makes the production of results possible, an order of priority that both the winterers' accounts and the institutional formulations of JARE confirm.

To reduce Japanese success to safety and French success to good relations would be a caricature. At DDU safety is central as well, on an ambivalent mode: seen as necessary, it is felt as a constraint on individual freedom. Responsibilising members is judged more effective than plain prohibition: "As soon as a station leader is too strict or bans all risk, the crew goes badly. People resist and take far more risks in secret. You must responsibilise the crew, have them trust you, and turn a blind eye to small breaches. When we say no, they understand it is not taken lightly, and they accept it." Japanese interlocutors value relational qualities, humour and social

adaptability in turn. Success rests not on unique, general values but on cultural configurations, where shared dimensions (safety, sociality, accomplishment) hold different rankings.

Beyond these gaps, several registers are common to the two groups, among them duty and transmission. For the French, one "does one's work» out of duty to fellow winterers and to the labs that hired them, and for "those who follow.» The *passation* is a key moment: each member trains a successor in the job and its tasks, and in a set of informal knowledge, tricks and intangible heritage of the station. Japanese winterers cite transmission, *hikitsugu* (引き継ぐ), as part of the mission's success: "to share Antarctica with future generations," in a glaciologist's words. In both cases technical mastery is recognised, but it ranks below qualities judged more decisive: curiosity, teamwork and the energy spent to make it "work." Both crews insist on "maintaining balance" which Japan names 調和 (*chōwa*, harmony), a motif that crosses the two national cultures and reads as an invariant whose realisations stay specific to each culture.

4.4 Can a concept built for a French station apply to a Japanese one?

From participant observation at DDU and discussions with former Syowa winterers, this search for balance operates at two levels. One is individual (doing one's work while "enjoying" Antarctica, fitting into the group, managing family and life left in France, regulating one's emotions); the other is collective, our focus in this section: holding one's relations to others and navigating between the formal hierarchy (station leader, technical heads) and an informal one.

Collective balance at DDU rests on three interdependent elements we have called "debts." The time debt is the circulation of the gift of time and mutual aid, where a service creates a reciprocal obligation that binds the collective[13]. The moral debt is the obligation to accomplish one's task and master one's job, toward fellow winterers and toward the institutions that sent you [12]. The affective, or social, debt is the energy spent to manage tensions and conflicts, to weigh case by case the benefit and risk for the group of a sanction or a pass, and to hold one's place without excess, for instance without inappropriate conduct linked to problem drinking.

A winterer can "go into debt" on one register without being excluded or isolated. In many cases a technically weak member who does his job "badly" stays integrated, because his warmth and his readiness to help in his free time offset the shortfall. A member with drinking problems who does his job and joins the general mutual aid is not set aside, or set aside at winter's end at most. This does not mean an absence of tension or of correction from the group, but

communication stays open. A member who breaks the group's codes is excluded when communication with the others breaks.

This debt system is not read in isolation. It is legible when tied to the social, psychological and cultural elements of a station, in this case DDU, with its rites, its traditions, its confined and hostile environment, and the psychology of adaptation to isolation. The triptych is not a fact to generalise but a tool to grasp how a mission seeks its balance. The question is whether this tool, built for a French mission, can work for a Japanese one.

Japanese interlocutors agree that the determining factors in a rupture of harmony are not environmental (cold, danger, isolation) but social, tied to the individual's adaptation to "the ordinary." The time debt maps onto their accounts: many report that a colleague "never helped," or that "he thought his work more important than helping," and the recurrent friction of snow clearing after blizzards (present at DDU as well). A meteorologist says: "We understand that some have priority tasks; everyone understands that. Friction comes from those who make their tasks look like priorities because they do not want to shovel." A time economy appears too.

The moral debt maps onto a second pattern: a rupture of harmony when the chain of responsibility is short-circuited, with a minority making peer arrangements to bypass authority. "The Japanese hierarchy is very vertical; I like Antarctica because it is more horizontal, but there is still a hierarchy," a physicist explains; "tension came when people said 'no problem, I can handle this myself,' without going through authority." Many accounts recall that the expedition acts under the chief's command and that each must follow his instructions and rules. Whether conforming to this hierarchy belongs to the moral debt (a duty to the institution and its rules) or to the affective and social debt is hard to settle without fieldwork on site, and this indeterminacy is a result in itself: it marks a zone where the frame must be redefined for a Japanese station. The third debt, affective and social, concerns the management of tensions, whose Japanese form is the object of the next section. The tool does not transpose without change, but it shows what the two crews share, a time economy, and where they diverge, the place and the content of hierarchy. Comparison through a tool produces differentiation.

4.4 Avoiding and resolving tensions

Japanese accounts foreground avoidance. "We Japanese are good at avoiding conflict. We have many expressions for it, such as 空気を読む (*kūki wo yomu*, 'read the air'). So we avoid

having a conflict to solve. When it happens, we apologise and try to put it in perspective. With the internet it is easier to contact relatives to complain; there is no point complaining inside the station," says a former winterer in astrophysics. Avoidance is a recurrent theme: avoid the conflict, and avoid the person once the conflict is present. The futility of "complaining" returns, as with a former telecommunications engineer: "Grumbling after work does not fix the work problem. Complaining to others has only a negative effect on cohesion."

For the French, grumbling is the reverse, as a former carpenter at DDU puts it: "Grumbling frees you. Something annoys me, I grumble, and it annoys me less." Both DDU and Syowa share a will to prevent tension, with the same relation to balance: "You take it on yourself in Antarctica, much more than in France. I did not think I could be so patient" (technician winterer, TA70). Once tension appears, the group tries to absorb it. At DDU, mediators step in: a colleague, a friend, a winterer known for "that role," or the station leader. Reintegration of those who broke the balance follows. It is not unlimited: a member seen as "problematic," who multiplies tensions despite warnings, is set aside, by silence or by being ignored. This exclusion by silence meets the Japanese avoidance of the person after conflict: the withdrawal of communication is, in both, the last mechanism. Japanese accounts foreground avoidance and apology and do not report the mediator role described at DDU, where avoidance seems to hold that place.

The danger is not the quarrel but the rupture of communication: "It is not the arguments that are the problem. There will always be more or less affinity, and always tensions in a group; that is part of the game. With people well chosen through psychological tests, winterers end up calming down, explaining themselves, apologising. The problem is when tension is so strong that people no longer dare to talk, for fear of making it all implode. One winterer told me that by the end of winter he no longer dared meet the eyes of a winterer he disliked, afraid the eye contact alone would make him implode and throw a punch. When it concerns two people it is not too serious; when it touches the whole group, that is a real problem" (former winterer, summer campaigner, SC 2019/2020).

The same stages appear at Concordia. The invariant is to maintain the collective's balance; the variable is the "what" and the "how": what counts as a fault, as a tension, and how one avoids or repairs the imbalance. Meal segregation is not read by the winterers as polarising. Both national groups place high value on meals and food as moments of talk. A "soft" segregation,

“one that moves,” as a former mechanic and station leader at Concordia explains, lets them “regroup around one language, rest from English and from the Italians [laughs]. It prevents group tensions, and it does not stop us mixing more on feast nights or on Sundays.” The language barrier limits communication and draws exasperation toward the institutions from both sides: “Why do the French and Italians send people who do not speak English?!” The fatigue of working in another language, the “lost in translation” in what counts as the closest analogue to space, and the translation of emotions feed tensions. French and Italian winterers agree that keeping the balance of the station and the crew, a balance built on different modalities from one mission to another, is the key to avoiding conflict.

5. Discussion

We would like to open this discussion with the limits and cautions of this study. Comparing three stations brings into play three national cultures that are not homogeneous, but also dozens of professional cultures, practices that change over time (the arrival of telecommunications), and a strong heterogeneity of individual profiles and of missions whose composition changes every year. To this is added the asymmetry of our material: a long immersion on one side, interviews on the other.

“Culture” is not a fixed explanatory label, so we must be careful not to essentialise our observations, or even what the actors say about themselves. Japan is a clear example, since it exerts a certain fascination on the West that is a source of bias, even for a trained anthropologist, while the discourse on Japanese singularity is itself sustained by Japanese people, often unconsciously. The idea of “collectivist” Japanese, contrasted with individualist Americans, has for instance been widely questioned, and it warns us against cultural stereotypes [16].

Research on the human factors of spaceflight has built, over half a century, a considerable body of knowledge on the dynamics we describe in the results. It has shown, among other things, that tensions shift from the crew towards ground control, and that cultural, professional and linguistic heterogeneity is a source of friction [15, 16]. These studies capture polar or space groups through standardised instruments validated across hundreds of studies, applied to a setting that places people under stress. Anthropology, for its part, is comparative and empirical, and while it attends to what people say, its object of study is mainly the implicit and the lived: the thinking taken for granted, hidden behind cultural norms. The two approaches are

complementary, and they allow anthropology to give a social and cultural frame, a context, to studies in psychology and the medical sciences. Our discussion therefore sets out to unfold our results with anthropological concepts and analyses.

Our results show that at Dumont d'Urville, as in the Japanese accounts, cooperation circulates in the form of debts [13]. Doing a favour, giving one's time, spending one's energy to defuse a tension: each of these acts calls for a return and binds the collective through a threefold obligation, to give, to receive and to reciprocate [17]. A failure to reciprocate does not have the same consequences depending on the individual's place in the social structure of the group and on the context, particularly in extreme environments, where tolerance for "faults" is greater in order to preserve the group's balance [12]. This gradation of reciprocity partly explains why an individual can "go into debt" on one register without being excluded, since indebtedness alone is not enough. Leaving the circuit of reciprocity, that is, the rupture of the relationship, is more likely to bring about exclusion [20].

The growing interdependence of long-duration space missions and mutual support are identified there as responses to the risks involved [21]. The body of research on cooperation often approaches it as something to be optimised. Our results first show cooperation as an order of obligations, by analysing who owes what, what counts as reciprocity (simple, mediated, undifferentiated or immediate [13]), and at what threshold indebtedness can cause a major imbalance within the mission. As distance increases crew autonomy and reduces recourse to ground control [21], it is this internal economy of debt, more than external supervision, that governs ordinary cooperation.

This system of reciprocity and obligation, as we have briefly described it, is not universal, however, and it is better to establish it than to assume it [22]. Among the Japanese Antarctic crews, we find a grammar of obligation. On (恩), the debt contracted when receiving a benefit, and giri (義理), the obligation to respond to it and to take part in exchanges, describe a lasting reciprocity charged with affect [23]. As with the concepts of reciprocity developed in the Western anthropological literature, the debt here is asymmetric and perpetual. This system of exchange is not meant to close, but to maintain social ties. In the accounts of the Japanese crews, however, the reciprocity reported tends towards a collective form. This collective form is also found at DDU, but less clearly and to a lesser degree than the settling of an individual debt. This is a

cultural difference to grasp in order to study cooperation in space crews, just as what one defines as the success of a mission also bears on that cooperation.

Our results show that the success of a mission is almost never named as such, and that what the actors establish as its components is not ranked in the same way. Among the French winterers at DDU and Concordia, sociability and relational balance encompass the rest and make work possible, whereas among the Japanese winterers it is rather the notion of safety. Two missions may thus share the same ingredients of success (completing the research programmes, a good atmosphere in the team, preventing accidents) but rank them differently.

Research on space crews holds a view slightly closer to the Japanese than to the French, with a definition of success as a result. A successful mission is one without loss of crew or equipment and without loss of objectives [24], and performance is treated as a behaviour that can be predicted and optimised [25]. Yet an indicator of success or performance, even framed in neutral terms, is always culturally constructed and carries an order of priorities. What makes the "good worker" or the "good crew" is built, in part, in the eyes of the group, where the value a person accumulates through their acts extends their place in the collective [26]. Our data show this, "we are on top of one another, watching whether the others work", and it is this visibility that converts effort into recognition. The affective debt analysed above finds here its positive side: to give to the group is also to make oneself valuable in its eyes.

This recognition has a content, and that content is what the collective holds to be worth doing [27]. "Productivity" is therefore never a measure without quality: each time, it designates a certain shared sense of what is worthwhile. When a French mission judges that a winter in which people "lived well together" cannot be a failure, and a Japanese mission places the completion of the observation programme among its duties towards those who will follow, what is expressed is not two levels of performance but two definitions of what counts as success, or conversely as failure, marked by the presence of tensions or the group's inability to resolve them.

As we have seen, tensions and conflicts are not synonymous with a "bad mission". A crew drawn entirely from one country is crossed by boundaries that are first and foremost categories of ascription. One places oneself, and is placed, in the box of winterer, scientist or technician, old hand or newcomer, and this mutual assignment shapes interaction [27]. In multinational crews such as Concordia, it is not so much "culture" that draws the distinction between French and Italian as the boundary itself, a boundary that persists despite the constant interaction of the two

groups. Two cultures reputed to be close actively maintain this boundary rather than dissolve it, sometimes against their will (with English imposed as the common language) and sometimes deliberately, by seating themselves at opposite ends of the table during meals.

This boundary carries value orientations, because it is symbolically constructed. Groups thus lay claim to "their" view of success, of mutual aid or of acceptable risk. The boundary does not have the same force according to the context and the social specificities of each mission: one and the same axis can divide one mission and have "no effect" in another. It can be flexible, allowing a multiplication of subgroups that "mixes" the crew, or rigid, favouring the emergence of clans [12]. The first is seen as positive by all the winterers interviewed, the second as negative.

This mechanism is found in space crews as well, though under different names, such as "team cohesion" [26, 27]. In a small crew, the formation of a clique isolates those left out of it, whereas in a larger crew, belonging to several overlapping component teams improves integration instead. And where one crew sees its subgroups re-form according to the activity, another sees a subgrouping harden for the whole mission.

These boundaries set the scene. What remains is what happens when a tension erupts. Our results bring out a sequence: the tension rises, intermediaries step in (a colleague, a friend, the person known for "having that role", and, as a last resort, the station leader), and the member who broke the balance is either reintegrated or set aside. This is the form of the social drama described by Turner: breach, crisis, redressive action ranging from informal mediation to authority, then reintegration or schism. The decisive result lies elsewhere, however. The danger is not the quarrel but the breakdown of communication. A disagreement that is voiced stays within the game; it is when those involved "no longer even dare to look at each other" that the tie breaks. Here, the end of the rituals of face: exclusion through silence and avoidance of the person are not an intensification of the conflict but the withdrawal of the exchange that used to contain it [30]. The repertoires of this reparative work are culturally distinct, keeping silent and "reading the air" (空気を読む, *kūki wo yomu*) on one side, "grumbling" to relieve oneself on the other, two opposite ways of holding one and the same relationship together.

This difference of repertoires matters all the more as distance transforms the conditions of repair. When the communication delay forces a crew to settle its tensions on its own, without the ground relay that today serves as an intermediary [24], the group's internal repertoire becomes the only recourse, and a resolution procedure thought to be neutral may be experienced by one

member as the normal path to appeasement and by another as an intrusion. In the same way, what an outside observer records as a “loss of cohesion” may not be an incompatibility between individuals but a boundary that has hardened, a faultline that has become active. The distinction is not a minor one: it separates a problem that would be attributed to persons from a process that lies in the structure of belonging.

6. Conclusion

This work has shown that cultural differences, in Antarctic stations taken as an analogue, operate as much within crews as between national groups. A mission of a single nationality is already plural, crossed by divisions of trade, generation and social origin, and whether an axis divides or not depends less on its existence than on the way memberships intersect: where they overlap, subgroups remain permeable; where a single line prevails, it hardens. Against this background, what “counts”, legitimate work, acceptable risk, success itself, is not given but evaluated, and the same components are ranked differently from one culture to another. The two settings nonetheless share a common imperative, to maintain the balance of the collective, which they achieve through distinct means: an economy of debt and reciprocity, opposite repertoires for expressing and avoiding conflict, and a single sequence of repair whose outcome rests on the continuity of communication more than on the absence of tension. These frameworks, finally, remain largely implicit, experienced as self-evident or attributed to individuals.

This is where the contribution of an anthropological approach lies. By making visible the cultural and moral foundations that standardised instruments, treating culture as a background variable, let slip, ethnography sheds light on dynamics that are decisive for the selection, preparation and psychosocial support of long-duration international crews: one and the same criterion of “success”, one and the same protocol for resolving tensions, can be experienced differently by different members, and what might be read as a loss of cohesion or an incompatibility of personalities may stem from a boundary that has become active. Mobilised here by way of introduction, classical anthropological concepts thus open a terrain, situated and non-essentialist, that a more specialised anthropology of human spaceflight will be able to deepen.

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