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**PERSONALITY TESTING IN ANTARCTIC EXPEDITIONERS;
CROSS CULTURAL COMPARISONS AND
EVIDENCE FOR GENERALIZABILITY**

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ABSTRACT

This paper compares baseline personality testing of 3 groups of Antarctic research personnel from Australia (N=58), Great Britain (N=141), and Norway (N=34) as assessed by the Helmreich Personal Characteristics Inventory (PCI). These data are also compared to two non-Antarctic populations consisting of students from the University of Texas and from the University of Bergen in Norway. **Results:** For the 3 national Antarctic groups, no significant differences were found on any of the nine scales measured on the PCI. When the combined Antarctic samples were compared with scores from the 2 student populations, the Antarctic population was found to score lower on Negative Instrumentality, Competitiveness and Verbal Aggressiveness. No significant differences were found between the US and Norwegian student samples. **Conclusions:** The 3 Antarctic samples were found to be similar to each other on the traits measured by the PCI, despite the fact they are all from different countries. They also scored lower on traits that have been described as undesirable for confined living when compared to students from the U.S. and Norway. These findings suggest that the Antarctic expeditioner population has a characteristic personality trait profile, irrespective of national origin. These data also support previous research that suggests selection criteria based on scores from the PCI are not likely to favor or disfavor candidates from specific nations.

INTRODUCTION

This paper compares baseline personality testing of Antarctic expeditionary personnel from three different national programs of Antarctic research. In addition to looking at the degree of similarity or difference between these three groups, we also examine the question of whether these groups differ in a systematic manner from non-Antarctic personnel. Consideration is also given to methodological concerns involved in assessing personality across cultures.

Antarctica has been described as a natural laboratory for studying human behaviour in confinement and isolation¹⁻³ In addition, the harsh environment, extreme isolation, and similarity of social organization have lead many to suggest that the human experience in Antarctic is an ideal analogue for the study of human behaviour in spaceflight.³⁻⁶ In support of these research objectives, this study examines baseline personality trait assessments of Antarctic personnel from three nations – Australia, Great Britain and Norway.

Personality traits and clusters of traits have been found to be predictive of individual and team performance in a number of high risk and extreme environments, including aviation^{7:8}, space⁹, as well as the Antarctic.¹⁰ Recent studies have also suggested that those who volunteer for work in polar environments can be characterized by specific trait profiles that can be demonstrated on standardized testing measures.¹¹

The multinational nature of Antarctic research creates both valuable opportunities and methodological confounds for psychological researchers. The fact that many nations have conducted research on the Antarctic continent,

and that many have conducted psychological research on these personnel means that the current literature on human performance in Antarctic includes data obtained from peoples of diverse cultures and ethnic groups. To some extent, this diversity reflects the increasingly international nature of the current space program, most notably the International Space Station (ISS) with its multinational membership, multinational mission control, and its diverse, multinational crews.

In recent years, however, cross-cultural psychological research has demonstrated a number of concerns in conducting psychological studies on such varied populations¹². Problems of language, differing tendencies towards acquiescence in test taking, and differences in scale usage can all lead to systematic deviations in testing between different cultures¹³⁻¹⁵. Given the possibility of systematic cultural differences in scale usage on measures of personality, there are theoretical and realistic concerns regarding the use of such measures for the purpose of selection in multinational or culturally diverse settings. Direct comparison of test scores without consideration of these differences may lead to biased interpretation of those test scores. While research findings have supported certain universal aspects to human personality, many authors caution that there is also evidence that true psychological differences may exist between individuals from different cultures¹⁶. Some authors have proposed that these differences account for the failure of several major psychological studies to replicate in cultures other than those in which such research was originally conducted¹².

We feel that it is important to address such issues of comparability in Antarctic populations on several levels. First, we are interested in assessing whether Antarctic personnel who come from different nations are essentially similar to one another or whether significant national differences exist. Secondly, we wish to explore whether there is any indication of national variation in test-taking that may account for apparent differences (or alternatively suggest similarities when there are, in fact, real

differences) between populations under study. Finally, we are interested in exploring the notion that these individuals represent a systematically different population when compared to "normative," non-Antarctic populations. While it is not feasible to pursue a complete analysis of these issues within the confines of one study, we feel it is at least important to begin addressing such issues in our research. A clearer understanding of these issues will increase the confidence with which psychological findings can be generalized between countries and environmental domains, and identify instances where such generalizations may need to be tempered where significant population differences are shown to exist.

METHODS

Samples

The data for this study came from five separate populations. For personnel traveling down to Antarctica, subjects included members of separate Australian, British and Norwegian Antarctic expeditions. These subjects were given similar versions of a multi-axial testing battery prior to their departure as elements of essentially unrelated investigations into performance, coping and behaviour in Antarctica. For a normative comparison, undergraduates at both The University of Texas at Austin in the United States and The University of Bergen in Norway were tested using a similar version of the same battery. The validity of using students from these two countries will be discussed in detail in the *discussion* section of this paper.

For the Australian Antarctic sample, a total of 58 individuals (48 male, 10 female) volunteered to complete the assessment battery as part of a larger study into human performance at Australian Antarctic research stations (J. Wood, Principal Investigator). All participants were scheduled to participate in winter-over expeditions at one of 3 Antarctic or 1 sub-Antarctic research stations during the 2000-2001 season.

The British Antarctic sample consists of a total of 141 individuals (124 male, 17 female) who volunteered to spend the entire summer or winter at Antarctic research stations. The baseline data were collected prior to the final selection of personnel and was part of an extensive investigation (Erikson & Ursin) aimed to examine psychological predictors for coping in Antarctica.

The Norwegian Antarctic sample consists of several groups of personnel (total N=34, 26 male, 8 female) participating in an expedition performed for the Norwegian Polar Institute where groups of scientists were to operate in different Antarctic environments for a duration of 2 or 3 months.

Students at the University of Texas at Austin in the United States and at The University of Bergen in Norway completed the testing battery in partial fulfillment of undergraduate research participation requirements. A total of 446 students (244 male, 202 female) completed this testing at The University of Texas, while a total of 66 students (13 male, 53 female) completed the instrument at the University of Bergen.

Instruments

To assess traits in these populations, various versions of the Personal Characteristics Inventory (PCI) were used. The PCI is a multi-axial personality trait assessment battery that has been used extensively in aviation, space and space analogue populations. In the present study, several different versions of the PCI were used. All participants completed pencil and paper versions of the battery. The core of the PCI consists of 11 scales that generally assess levels of various aspects of the broad traits of instrumentality and expressivity. These scales have been taken from three pre-existing assessment instruments – the Extended Personal Attributes Questionnaire (EPAQ)¹⁷, the Work and Family Orientation Questionnaire (WOFO)¹⁸, and the Jenkins Activity Survey (JAS).¹⁹ These scales and their definitions are listed in Table 1.

Two versions of the PCI are used in this study. One version consists solely of those scales

detailed in Table 1, and was used with the British and Norwegian samples. This version has 73 items and takes approximately 15 minutes to

Personal Attributes Questionnaire (PAQ)

- 1.M *Instrumentality*: Refers to overall goal seeking and achievement motivation.
- 2.F *Expressivity*: A measure of interpersonal orientation, sensitivity and concern.
- 3.MF *Bipolar Instrumentality - Expressivity*: Contains items that differentiate persons with an instrumental orientation from persons with an interpersonal orientation.
- 4.NEGFVA *Verbal Aggression*: Traits associated with a type of critical, verbal negativity.
- 5.NEGFC *Negative Communion*: Traits associated with a lack of instrumentality (e.g., weak, shy, submissive, etc.).
- 6.NEGM *Negative Instrumentality*: Traits associated with a negative form of goal seeking, such as being arrogant, dictatorial, etc.

Work and Family Orientation Questionnaire (WOFO)

- 1.MAST *Mastery*: A more focused measure of achievement motivation reflecting a need to undertake and master new and challenging activities.
- 2.WORK *Work Orientation*: Reflects a desire to work hard.
- 3.COMP *Competitiveness*: Reflects a desire to succeed in competitive interpersonal situations.

Jenkins Activity Scale (JAS)

- 1.ACHSTRV *Achievement Strivings*: Traits associated with taking work seriously and working hard.
 - 2.II *Impatience/Irritability*: Reflects a sense of time urgency and impatience associated with a high degree of irritability.
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Table 1 - Scales and their definitions for the Personal Characteristics Inventory (PCI).

complete. A second version, one with an extended number of experimental scales, was used with the Australian and Texas samples. This extended version was originally developed during studies of astronaut performance that were conducted between 1989 and 1995, and includes additional scales designed to assess a broad range of traits, including empathy, dominance and the Big Five, among others. This version of the PCI has 273 items and takes 40 to 60 minutes to complete. These additional scales will not be analyzed in this study. Additionally, the extended version of the PCI has slightly modified versions of the two JAS scales. The modifications of these scales are such that we have opted not to compare

data from these two scales (*Achievement Striving* and *Impatience/Irritability*) in the present study.

This instrument has been used extensively in studies of personality and performance on numerous groups, including airline pilots⁸, astronauts⁹, submarine crews²⁰, scientists¹⁸, military personnel²¹, as well as previous polar expeditioners.^{10;22} The success of the PCI in predicting performance in many of these populations was the primary reason for its selection for the present study.

Procedures

For the Australian Antarctic sample, participants completed a 261-item version of the extended PCI during their week of pre-departure field training in central Tasmania. Participation was voluntary and responses were kept confidential. Participants were fully informed of any risks and of their option to not participate should they so choose. All protocols were approved by institutional review committees of the participating agencies. Subjects in the British Antarctic sample represented volunteers for either summer or over-winter station duties. As described previously, the PCI was administered before final selection took place. This population received the standard 73 item version of the PCI, consisting solely of the 11 scales from the EPAQ, WOFO and JAS. All participants completed the test voluntarily. The Norwegian Antarctic subjects also completed the standard 73-item version of the PCI prior to departure for a 3 month stay at an Antarctic research station.

At The University of Texas at Austin, students completed the extended 261-item version of the extended PCI in partial fulfillment of undergraduate requirements. Participation was voluntary, with alternatives available for those who did not wish to participate. Testing protocols were approved by the institutional ethics review committee at the University of Texas at Austin. Students at the University of Bergen completed the same 73-item version of the PCI that was administered to the British and Norwegian Antarctic samples. Participation in this data collection was voluntary for the students. Testing

protocols were approved by the institutional ethics review committee at the University of Bergen.

RESULTS

Data for this study were analyzed using the Statistical Package for the Social Sciences (SPSS) version 11.0. for Windows²³. An alpha of 0.05 was chosen as the accepted significance level for analyses, and this level was reduced accordingly in consideration of the number of comparisons made within these data.

The scales of the PCI that have proven useful in predicting performance in applied settings have their roots in the gender and trait research of Spence and Helmreich¹⁸. Accordingly, sex differences on most, if not all of the scales of the PCI should be expected, and studying the differences between genders is not the focus of these analyses. The increased variance (or noise) produced by combining genders could well obscure significant, though modest differences between same gender subjects from different national groups. For this reason, we have elected to analyze males and females within these samples separately. Indeed, it has been argued that such an approach is rational, sample size permitting.²⁴

Demographics

A demographic summary of the numbers of subjects by nation and by gender are given in Table 2

Group	Male	Female	Total
Australian Antarctic	48	10	58
British Antarctic	124	17	141
Norwegian Antarctic	26	8	34
U. of Texas students	244	202	446
U. of Bergen students	13	53	66

Table 2 – Demographics of the samples under study

Scale comparisons for the 3 Antarctic groups

For male subjects in the three Antarctic samples (Australian (N=48), British (N=124) and Norwegian (N=26)), analyses of variance (ANOVA) demonstrated no significant differences between national groups on any of the 9 scales of the PCI (*Masculinity*, *Expressivity*, *Bipolar*

Instrumentality-Expressivity, Verbal Aggression, Negative Communion, Negative Instrumentality, Mastery, Work Orientation, and Competitiveness). As mentioned in the previous section, the traits of *Achievement Striving* and *Impatience/Irritability* were not compared due to differences in these scales on versions of the PCI used by investigators.

Similarly, for female subjects in the three Antarctic samples (Australian (N=10), British (N=17) and Norwegian (N= 8)), ANOVA also demonstrated no significant differences between national groups on any of the 9 traits. Again, *Achievement Striving* and *Impatience/Irritability* scores were not included in these analyses.

Scale comparisons between the combined Antarctic and two student samples

Since no differences were found between the three national Antarctic groups for either the male or female subjects, the three Antarctic samples were pooled into two larger groups consisting of 198 male and 35 female Antarctic personnel of mixed national origins. Scale scores from these two groups (Antarctic male and female) were compared to those of male and female undergraduate students from both the University of Texas and the University of Bergen.

An analysis of variance (ANOVA) was conducted on each of these two data sets. For the **male subjects**, significant differences were found for the following scales:

Negative Instrumentality $F(2,444)=31.9, p=0.000$

Verbal Aggressiveness $F(2,450)=6.64, p=0.001$

Competitiveness $F(2,446)=44.00, p=0.000$

(US males highest on all three scales, Antarctic personnel lowest)

For **female subjects** in these three groups, the same three scales showed significant variability:

Negative Instrumentality $F(2,279)=9.03, p=0.000$

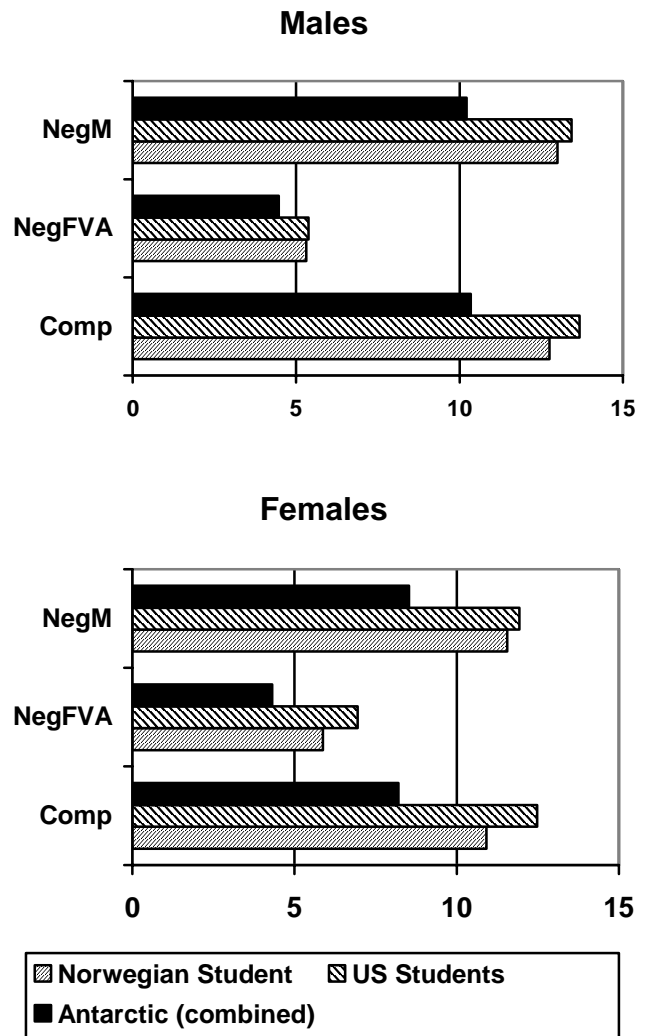
Verbal Aggressiveness $F(2,283)=14.1, p=0.000$

Competitiveness $F(2,285)=19.0, p=0.000$

(US Females higher on all three scales, Antarctic females lowest)

Tukey's test of Highly Significant Differences (HSD) was used post hoc to identify the specific

subgroups for which scale differences were statistically significant. Tukey's HSD was chosen as a post hoc test because of its versatility and its ability to deal with unequal N without being restrictively conservative. Scores for the Antarctic, U.S. student and Norwegian student samples on the scales for which differences were significant are shown below in Graphs 1 and 2.



Graphs 1 and 2. Mean scales scores for Antarctic (combined), US students, and Norwegian students for NegM (Instrumentality), NegFVA (Verbal Aggressiveness), and Comp (Competitiveness). Data are shown for both male (left) and female (right) respondents.

For the male subjects, the differences between the Antarctic and U.S. were significant for all three

scales (NegM, $p=0.000$, NegFVA, $p=0.001$, and COMP, $p=0.000$). The Norwegian student sample was not significantly different from either, presumably due to the rather limited number of subjects for this gender.

For the female subjects, there was no difference between U.S. and Norwegian university students. For NegM, the Antarctic population was significantly different from both U.S. students ($p=0.000$) and Norwegian students ($p=0.005$). For NegFVA, only the U.S. sample is significantly different from the Antarctic sample ($p=0.000$). For COMP, again the Antarctic sample is significantly different from both U.S. students ($p=0.000$) and Norwegian students ($p=0.005$).

Analysis of response bias

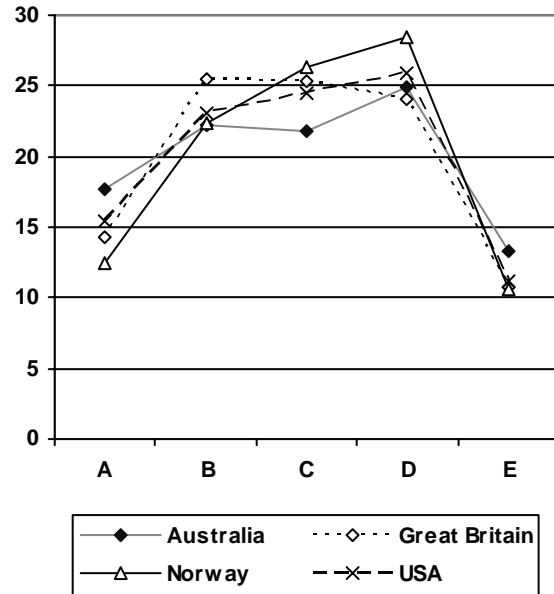
In addition to comparing scale scores from the PCI, we were also interested in possible test-taking differences between these national groups. Previous research has suggested that populations and cultures may differ in their use of these scales, and this may in turn affect comparability between groups taking the same test.^{25;26} Genders were combined for these analyses since previous research has suggested that gender is not a factor in response style.²⁵ For all questions on the PCI, respondents were asked to choose A, B, C, D, or E as responses on a graded 5-point Likert scale. Part I of the PCI consists of two statements separated by a 5-point Likert scale, ranging from A on the extreme left to E on the extreme right. Subjects are asked to indicate where on the continuum they feel they fall on the scale. A sample of this type of question is shown below:

Not at all competitive A....B....C....D....E Very competitive

Part II of the PCI consists of a number of statements to which the subject is asked to respond on a 5-point Likert scale. This scale is reproduced below:

A	B	C	D	E
Strongly Agree	Slightly Agree	Neither Agree Nor Disagree	Slightly Disagree	Strongly Disagree

The frequency with which the four national groups (Australians, British, Norwegian and American) chose each of the lettered responses in parts I and II of the PCI (Combined) is shown in Graph 3.



Graph 3. Frequency of response choices (percentages) for Parts I and II combined.

Acquiescence bias The acquiescence bias refers to the tendency for some individuals to agree with a survey item, regardless of the specific content of that item.^{25;27} Since Part I of the PCI does not consist of agree/disagree items, that section of the battery was not analyzed for evidence of an acquiescence bias. Part II of the battery does have the potential for such a bias, however. To assess this possible response set, A, B, C, D, E responses were converted to 1, 2, 3, 4, 5 scores for each individual. A mean response was then calculated for individuals over all of their individual item responses. The lower the mean response scores, the greater the tendency for an individual to agree with the statements posed in Part II of the battery. After the mean score is calculated for each individual, it is possible to compare mean scores based on national groupings. Note that for this analysis, Norwegian Antarctic and Norwegian students are combined. A t-test of the means for these two groups revealed no significant difference between

the students and Antarctic expeditioners from that country, strongly suggesting that combining the scores was an appropriate manipulation. National mean Likert response values are shown for each national grouping in Table 7.

	Australia	Great Britain	Norway	USA
Mean response	2.44	2.39	2.41	2.22
St. dev.	0.129	0.358	0.355	0.356

Table 7. Mean Likert response for the four national groups (Part II of the PCI only).

An ANOVA of the mean scores factored by country was significant, $F(3, 737) = 16.28$, $p = 0.000$. Tukey's HSD post hoc demonstrated the US mean (2.22) was significantly lower than all other groups. All other groups did not differ significantly from each other.

Neutral bias Another potential bias is in the tendency for some individuals to choose "C", or the middle of the Likert scale. This is termed "neutral bias", and this bias has also been shown to vary significantly with national culture. To test for this tendency, we calculated the percentage of time that an individual chose "C" on the 5-point scale. Mean values, factored by country, are shown below in Table 8.

	Australia	Great Britain	Norway	USA
% choosing "C"	21.9	25.4	26.3	24.4
St. Dev.	10.2	10	8.5	9.5

Table 8. Percent of time individuals choose "C" for the four national groups.

These differences were modestly significant, with an overall ANOVA giving an $F(3, 740) = 2.95$, $p = 0.032$. The Australian mean was significantly lower than that of Norwegians ($p = 0.028$).

Extreme response bias A third source of national bias is the tendency to choose extreme over more modest responses when answering on a Likert scale. This is termed the "extreme response" bias, and again has been shown to exhibit patterns of national variation.^{25:28} To test for this bias, we calculated the percentage of

time that an individual chose either "A" or "E" when choosing either "A," "B," "D," or "E" as a response. These values are shown in Table 9.

	Australia	Great Britain	Norway	USA
Percent "A" or "E"	38.1	32.6	30.3	34.5
St. Dev.	20.1	16.9	13.45	15.46

Table 9. Percent of time individuals choose "A" or "E" for the four national groups

Again, an ANOVA suggested that these means varied significantly, though modestly – $F(3, 740) = 3.56$, $p = 0.014$. Post hoc tests confirmed that the Norwegian mean was significantly lower than that of Australians.

DISCUSSION

Cross cultural testing considerations

Before discussing the specific test results, we feel it is important to address several methodological issues given the cross-cultural nature of these data. Three of the groups under study in this paper are from countries where English is the dominant language. Obviously, the English version of the PCI was used with subjects in the Australian, British, and U.S. populations, and as can be best determined, all subjects in these populations were able to complete the test without difficulty due to language.

Construct validity has been identified as an important issue in cross cultural research (ref - Chinese cultural connection). Fundamental psychological principles may not be considered valid ones when applied to cultures other than those in which those concepts originate. The scales of the PCI were developed and validated on U.S. subjects, and have been demonstrated to be both reliable and highly predictive of human performance in this population.^{8:18} Given the common language and the common socio-cultural origins of the United States, Australia and Great Britain, we are confident in assuming that the constructs assessed by the PCI are stable across these populations. Previous research has also demonstrated the reliability of the PCI in predicting human performance in Norwegian subjects¹⁰, and suggests that these constructs can

be considered to be valid ones in this population as well.

Likert Scale Usage

There is considerable evidence to suggest that the manner in which individuals' response to Likert scaled questions varies systematically between ethnic and cultural groups. These styles of responses, referred to as "response sets"²⁹ may be described as patterns of answering that are not related to the question content, but are characteristic of the respondent. There are at least three types of bias that have been identified to vary according to national tendencies in cross cultural research. The first, yea-saying, or acquiescence is characterized by a tendency to agree with questions regardless of item content. A second form of bias is the "neutral bias", or the tendency to choose the middle of a Likert scale rather than agree or disagree with an item. The third bias is termed the "extreme response" bias, and is defined as the tendency to choose the extreme ends of the Likert scale and to avoid using the more modest response options.

In comparing the mean Likert score for Part II of the PCI (Part I does not involve agreement or disagreement with items), the results of our analysis suggest the U.S. students in our sample had a significantly higher tendency to agree with test items.

When comparing tendencies towards the neutral bias, the Norwegian subjects were the most likely to choose neutral responses and the Australian subjects were the least likely. With regard to using more extreme responses ("A" or "E" over "B" or "D"), the Australian subjects were the most likely to show this tendency and the Norwegians the least.

Another consideration which we have not addressed in these analyses is the response set resulting from the tendency of some individuals to create a favorable impression on instruments such as the PCI. Our research would benefit from further investigation of the effects of response desirability on the scoring characteristics of the PCI.

Both the apparent tendency of the U.S. respondents to "acquiesce" in comparison to the other groups, and the more modest Likert response style of the Norwegian respondents compared to the Australians have the potential to affect scale scores on tests constructed in the same manner as the PCI. The concern is that these influences are the result simply of culturally specific response sets and distort true measures of psychological constructs. While, it is possible to transform the original data to attempt to correct for these effects, such manipulations have been described by some as compromising, even when done appropriately.²⁷ Although we would not consider applying such manipulations given the limited size of these data sets and the lack of corroborating findings in similar populations, it is appropriate to caution that some of our findings may be mildly suspect given the doubts raised by these findings. More studies and larger numbers of respondents are needed to determine the most appropriate means to deal with these uncertainties.

PCI Scale comparisons

In the ANOVA of the 9 PCI scales among the three national Antarctic groups, no significant differences were found. This finding was consistent for both the male and female subgroups in the Antarctic population. To some extent, these analyses are limited by the relatively low Ns, particularly of the Australian and Norwegian Antarctic groups. Our interpretation of these results is that they support the supposition that there are common personality trait profiles among those who choose to venture to Antarctica.

These findings are consistent with results from an extensive study among candidates for the European astronaut selection in 1990.³⁰ These results suggested that, at least within Western culture, responses to the PCI are relatively unaffected by variations in national cultural background. Moreover, it might indicate that definition of psychological selection criteria based on scores from PCI is not likely to favor or disfavor candidates from specific nations.

To test the hypothesis that the Antarctic population was characterized by certain personality traits, we compared data from the combined Antarctic sample to “normative” undergraduate students at both The University of Texas at Austin and The University of Bergen in Norway. Male and female students in the U.S. and Norway scored significantly higher on *Negative Instrumentality*, *Verbal Aggressiveness* and *Competitiveness*. These traits could well be considered as undesirable for close quarter living and interpersonal harmony. One possible explanation for this difference is that individuals possessing these traits are less likely to be attracted to service on Antarctic expeditions or are otherwise somehow selected out. Since the selection process applied to some of these groups was limited, self selection would seem the most likely explanation. These findings are highly suggestive that the Antarctic population, irrespective of national origin, has a characteristic profile of specific personality traits, and that in a sense they define their own unique population. Such findings have been suggested in other studies¹¹, and our research supports those conclusions. Certainly, however, it is important to point out that within each of these populations there is still tremendous intra-group variability.

Choosing students as a “normative” population may be questioned by some, and there are both positive and negative arguments for doing so. The ease with which data can be collected in this population makes it a common source of research subjects in psychological research. Since the University of Texas population was the original population in which the PCI was developed, the psychometric characteristics of this group are well known to the authors. Also, given the importance of using Antarctic populations as analogues for the astronaut population, it seemed reasonable and important to include a U.S. sample in the analysis – given the prominent role of that country’s astronauts in spaceflight. Our research would benefit from using comparison data from other cultures as well, including Japanese, Russian, and other European nations. Using data from Norwegian

students also seemed like a good idea. If only U.S. data were compared to the Antarctic samples, it would be less clear whether we are looking at national differences, or ones due to Antarctic/non-Antarctic differences. The apparent similarity between the U.S. and the Norwegian students was somewhat unexpected, but again seems to attest to the cross cultural utility of the PCI – at least in Western populations. It is important to acknowledge, of course, that some of the differences between the Antarctic subjects and the U.S. and Norwegian students may be due to age or some other characteristic of the student population. Regardless, we find the differences between these two groups (Antarctic and non-Antarctic) to be intriguing. Future studies should include other comparative populations to explore these issues further.

There are other limitations to the current study. The limited number of subjects poses problems for statistical analysis. We hope to include larger numbers of subjects in future analyses for that reason. We have also not considered the impact of homogenous subgroups within our test samples. Much of the work with the PCI has included considerations of subgroups of personnel with similar personality characteristics. Future studies would benefit from a more through analysis of these populations with respect to these factors. Another limitation in the present study may be due to the nature of the scales measured with the PCI. Although the scales have been identified as being particularly relevant to behaviour and performance in complex settings, there are other measures, including more global ones (such as the Big 5) that may also be relevant to defining population differences in these groups. Also, due to space limitations, we have not examined gender differences and the interaction of gender with nationality. We hope to address these factors in future publications.

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