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Person-environment fit: Needs and challenges in Antarctica

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Abstract

Thousands of individuals are deployed to Antarctica every year to support scientific research. Understanding how they cope in such an unusual location can reveal the factors and dynamic processes of human adaptation inherent in the more general category of Isolated and Confined Environments (ICEs). Drawing from an organisational psychology approach that considers the interaction between an individual's and an environment's characteristics, the present research applies the Person-Environment fit (P-E fit) theory to ICEs. This approach assumes that matching characteristics of an individual with relevant aspects of an environment allows one to predict overall adjustment to that environment. Focussing on the fit of two defining characteristics of those environments (isolation and confinement) with social needs and personality traits, the present research investigated a new theoretical model aimed at better understanding and predicting one's overall adjustment to deployment, as measured by job satisfaction, job performance, sleep disturbance, cognitive impairment, and mood ratio (positive/negative). Two studies were conducted to test this model. Study 1 utilised data from wintering personnel ("winter-overs"; n = 14) at Antarctic stations operated by five different National Antarctic Programmes. Data were collected throughout each participant's period of deployment in Antarctica. Study 2 used former winter-overs (n = 59). Deployments for this group covered a range of almost 60 years, in 16 different Antarctic stations that were operated by eight different National Antarctic Programmes. Results across both studies consistently found one's fit with isolation to be positively related to one's job satisfaction, cognitive performance and mood. No reliable relationship with sleep quality was found. By contrast, results failed to find any consistent relationship between one's fit with the lack of privacy and the same outcome variables. The results suggest that it is possible to predict one's fit with the isolation from one's need for affiliation but not from one's need for intimacy. It is suggested that one's fit with the lack of privacy on station can be predicted from one's need for intimacy but not from one's actual need for privacy. Moderation of these relationships via privacy regulation strategies is discussed, such strategies being behaviours one would adopt in order to achieve one's desired privacy (e.g., social withdrawing). Finally, the impact of limitations of the studies and the implications of the results for theory and for practices in other ICEs are discussed.

Keywords: Person-Environment fit (P-E fit), Isolation and Confined Environment (ICE), Psychology, Antarctica, Adaptation

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Table of Contents

Abstract	i
Acknowledgements	ii
Table of Contents	iii
List of Tables	vi
List of Figures	vii
Chapter 1 : Introduction.....	1
1.1 Isolated and Confined Environments (ICEs).....	5
1.2 Aims and objectives of the present study.....	6
Chapter 2 : Literature review	7
2.1 Isolation	7
2.1.1 Social needs.....	9
2.2 Confinement	13
2.2.1 Social needs.....	16
2.3 Winter-over syndrome.....	16
2.3.1 Mood.....	17
2.3.2 Sleep.....	17
2.3.3 Cognition.....	18
2.3.4 Potential causes	18
2.4 Symptoms over time.....	19
2.5 Positive repercussions of an ICE experience.....	20
2.6 What matters in Antarctica?.....	22
2.6.1 The individual.....	23
2.6.2 Person-Environment fit.....	24
2.6.3 Paradoxical environment.....	27
2.7 Scarcity.....	28
2.8 Personality	29
2.8.1 Agreeableness and extraversion as moderators	31
2.9 Research Objectives.....	33
Chapter 3 : Study 1	36
3.1 Method	36
3.1.1 Participants	36
<i>Recruitment</i>	36
<i>Sample</i>	37
3.1.2 Measures and procedure.....	38
3.1.3 Pre-winter-over survey	38
<i>Demographics</i>	38
<i>Personality traits</i>	38
<i>Need for social contacts (affiliation and intimacy)</i>	39

	<i>Need for privacy</i>	39
3.1.4	Monthly survey	40
	<i>Job Satisfaction</i>	40
	<i>Sleep Disturbance</i>	41
	<i>Mood Ratio</i>	41
	<i>Cognitive Impairment</i>	41
	<i>Loneliness</i>	41
	<i>Privacy Fit</i>	42
	<i>Privacy Regulation</i>	42
	<i>Job performance</i>	42
3.2	Results.....	44
	<i>Measures' reliability</i>	45
3.2.2	Analysis.....	46
3.2.3	Predicting P-E fits	47
3.2.4	P-E fits predicting outcome variables	49
3.2.5	Privacy Regulation.....	50
3.2.6	Other notable findings	53
3.3	Discussion.....	54
3.3.1	P-E fits predicting outcome variables	56
	<i>Isolation P-E fit</i>	56
	<i>Privacy P-E fit</i>	56
3.3.2	Predicting P-E fit.....	57
	<i>Isolation P-E fit</i>	57
	<i>Privacy P-E fit</i>	57
3.3.3	Strengths and weaknesses of Study 1.....	58
Chapter 4 : Study 2		60
4.1	Method	60
4.1.1	Participants	60
	<i>Recruitment</i>	60
	<i>Sample</i>	61
4.1.2	Measures.....	62
4.2	Results.....	63
4.2.1	Analysis.....	63
	<i>Measures' reliability</i>	63
4.2.2	Model testing	64
	<i>Model fit</i>	64
4.2.3	Privacy regulation	66
4.3	Discussion.....	68
4.3.1	P-E fits predicting outcomes variables.....	69
	<i>Isolation P-E fit</i>	69
	<i>Privacy P-E fit</i>	69
Chapter 5 : General Discussion		71
5.1	Results Summary: Contrasting Study 1 and Study 2.....	71
5.1.1	Isolation - outcomes.....	72
5.1.2	Privacy - outcomes.....	72
5.1.3	Isolation – predictors	74
5.1.4	Privacy – predictors.....	74
5.1.5	Privacy regulation	75
5.2	Theoretical contribution	77
5.2.1	Importance of isolation.....	78

5.2.2	Conceptualisation of privacy.....	78
5.2.3	Conclusions about P-E fit	80
5.2.4	Channelling hypothesis	81
5.3	Implications of the method	82
5.3.1	Sample.....	82
5.3.2	Language	83
5.3.3	Self-report	83
5.4	Practical implications of the results.....	84
5.4.1	Consequences for the individual.....	84
5.4.2	Consequences for the team	85
5.4.3	Consequences for the significant others.....	85
5.4.4	Consequences for the organisation	86
5.5	Future recommendations	87
5.5.1	Group dynamics	87
5.5.2	Privacy regulation	88
5.6	Conclusion.....	88
References		90
Appendix A Study 1		102
A.1	Email to the National Antarctic Programme.....	102
A.2	Information sheet	103
A.3	Email to prospective participants	105
A.4	Email for the pre-winter-over survey	107
A.5	First online survey (prior to winter-over)	108
A.6	Email for the monthly survey.....	113
A.7	Monthly online survey	114
A.8	Human Ethic Committee letter of approval.....	119
A.9	Monte Carlo simulation 1	120
A.10	Monte Carlo simulation 2	121
Appendix B Study 2.....		122
B.1	Email to Antarctic-related organisations, clubs and associations	122
B.2	Complete advertisement for Study 2.....	124
B.3	Short advertisement for Study 2.....	125
B.4	Human Ethic Committee letter of approval.....	126

List of Tables

Table 1. List of manned Antarctic stations during the 2016 winter with their operating country, count and percentage of winter-overs. Information obtained from COMNAP (2016).	.3
Table 2. Direction of relationships between different predictors and dependent variables and the effect moderators have on those relationships.	32
Table 3. Number of participants (n) who filled in their survey after each month spent in Antarctica.	44
Table 4. Internal consistency for the scales used before the winter-over.	45
Table 5. Internal consistency for scales used as repeated measures. Cronbach’s alphas are given for each month	46
Table 6. Mean internal consistency for scales used as repeated measures (mean of the 12 months).	46
Table 7. Descriptive statistics of the variables measured before the winter-over (Need for Affiliation, Need for Intimacy, Need for Privacy, Agreeableness and Extraversion) and the two measures of P-E fit (Loneliness and Privacy Fit).	48
Table 8. Back-transformed Spearman correlations after a Fisher’s z transformation between Loneliness and Privacy Fit, and their respective predictors	48
Table 9. Descriptive statistics of Job Satisfaction, Sleep Disturbance and Mood Ratio.	49
Table 10. Back-transformed Spearman correlations after a Fisher’s z transformation between Loneliness and the relevant outcome variables	50
Table 11. Back-transformed Spearman correlations after a Fisher’s z transformation between the Privacy Fit and the relevant outcome variables	50
Table 12. Descriptive statistics regarding locations mentioned when feeling like having more privacy.	51
Table 13. Descriptive statistics regarding activities mentioned when feeling like having more privacy.	52
Table 14. Number of participants per Antarctic station and the country of their associated National Antarctic Programme	62
Table 15. Number of full entries and missing values for each variable, as well as the percentage those missing values represent of the total number of participants	63
Table 16. Internal consistency for each scale, their total number of items and the number of respondents	64
Table 17. <i>Path analysis model fit indices</i>	65
Table 18. Standardised regression coefficients from the path analysis	65
Table 19. Descriptive statistics regarding locations mentioned when feeling like having more privacy.	66
Table 20. Descriptive statistics regarding locations mentioned when feeling like having more privacy.	67

List of Figures

<i>Figure 1.</i> Location of the 40 Antarctic stations manned during the 2016 winter. Map adapted from Alexrk2 based on information from COMNAP (2016).	4
<i>Figure 2.</i> Social penetration model, adapted from Altman and Taylor (1973)	11
<i>Figure 3.</i> Focus point (in grey) of three P-E fit approaches; atomistic, molecular and molar.	26
<i>Figure 4.</i> Model depicting P-E fits (isolation and privacy P-E fit) as its core, bridging social needs (needs for affiliation, intimacy and privacy) and their moderators (agreeableness, extraversion and privacy regulation) to outcomes variables (job satisfaction, job performance, sleep disturbance, cognitive impairment and mood ratio). Dashed lines represent negative relationships.	35
<i>Figure 5.</i> Mean and standard deviation of <i>Job Satisfaction</i> score per month spent in Antarctica...53	53
<i>Figure 6.</i> Mean and standard deviation of <i>Sleep Disturbance</i> score per month spent in Antarctica.....	53
<i>Figure 7.</i> Mean and standard deviation of <i>Cognitive Impairment</i> score per month spent in Antarctica.....	53
<i>Figure 8.</i> Mean and standard deviation of <i>Loneliness</i> score per month spent in Antarctica.	53
<i>Figure 9.</i> Mean and standard deviation of <i>Mood Ratio</i> per month spent in Antarctica.....	54
<i>Figure 10.</i> Mean and standard deviation of <i>Privacy Fit</i> score per month spent in Antarctica.	54
<i>Figure 11.</i> The proposed model, with standardised estimates from the path analysis.....	64
<i>Figure 12.</i> Theoretical model predicting relevant factors of adaptation to ICEs.	71
<i>Figure 13.</i> Three possible relationships between P-E fit (Environmental affordance minus Person's need) and strain. Model adapted from Caplan (1987).	79
<i>Figure 14.</i> Distribution of 1,000 overall correlations obtained by averaging each month's correlations (grey) and 1,000 correlations obtained by correlating each month's averages (black). Data based on simulated data with a true correlation of .50.	120

Chapter 1: Introduction

Historically, humans have always been prone to travel and explore new lands. Migration was already a significant aspect of the hunter-gatherers who left the African continent to cross deserts and mountains during the first expansion of modern humans, about 55,000 years ago (Liu, Prugnolle, Manica, & Balloux, 2006). Despite the emergence of agriculture and, with it, the beginning of settled communities, humans kept walking, riding, and sailing towards the unknown. As they cleared the haze of the unknown by filling the gaps on world maps, the remaining places left to be discovered were always the most remote and inaccessible. By using increasingly complex technology, people could start exploring environments that were otherwise unreachable. In this pursuit, humans have survived temperatures as low as -80°C (European Space Agency, 2013), have travelled to a depth near 11,000 metres under the sea (Rubin, 2010) and 400,000 km from Earth (Wall, 2016). These extreme environments require specific logistics, particularly regarding shelters. It would not be possible to extensively explore polar regions without specialised tents, buildings, and vehicles, the deep sea without submarines, or space without spacecraft and space stations. Despite their unique features, these habitats share a common purpose; protecting people from environments that can often be life-threatening. Exiting these habitats could be extremely hazardous, if not instantly fatal. Modern sojourners to these environments can be restricted, therefore, to live for prolonged lengths of time in confining structures far from civilisation.

Because these temporary homes, termed Isolated and Confined Environments (ICEs), display such extreme and unusual features, the impact on their residents has become of interest in the medical, behavioural, and social sciences. Indeed, the success of these missions also depends on the ability of the residents to fully adapt to their momentary new homes. Although the research in this thesis focuses on Antarctic stations, the elements of Antarctic stations that are being considered here are common to all ICEs. Thus, even though the concept of ICE and Antarctic stations are not interchangeable, the conclusions of the present research are argued to apply to any other ICEs.

There were 78 active stations and three temporary closed stations in Antarctic in 2016, operated by 28 countries (or National Antarctic Programmes). Each station accommodated a peak of population ranging from six to about 1,200 people, with a median population of 40 individuals (COMNAP, 2016). The same source informs us that in winter, only 40 stations were manned in 2016, and they were operated by 20 National Antarctic Programmes (see Table 1). Though most permanent stations are coastal, three are inland (see Figure 1). During the winter, those 40 stations accommodated between two and 153 people with a median at 17 people. It is worth noting that those statistics are similar to those of 2017 (COMNAP, 2017). Over the years, stations have evolved as technology improved. Nowadays, in most stations, it is possible to make telephone calls to one's home, and to access the

Internet for email and social media. In summer, stations have a high level of activity. Scientists travel to these places for data collection, either near the station or at deep-field camps, while support personnel arrive to make repairs, replenish station supplies, and support scientific activities. In winter, however, only essential personnel who ensure the running of the station stay. At this period of the year, the constant darkness and harsh weather conditions at many of these stations makes it difficult to transport people to and from the continent so the 'winter-overs' usually stay for the whole winter. This wintering-over crew typically includes support personnel such as mechanics, electricians, chefs, cleaners, science technicians, and medical personnel. They all contribute to ensure the smooth running of the scientific research that takes place throughout the year.

Table 1. List of manned Antarctic stations during the 2016 winter with their operating country, count and percentage of winter-overs. Information obtained from COMNAP (2016).

Operating countries	Stations	Number of winter-overs	Percentage (station)	Total [and percentage] (country)
Argentina	Belgrano II	12	1.3	176 [18.5]
	Carlini	20	2.1	
	Esperanza	55	5.8	
	Marambio	55	5.8	
	Orcadas	14	1.5	
	San Martín	20	2.1	
Australia	Casey	20	2.1	62 [6.5]
	Davis	22	2.3	
	Mawson	20	2.1	
Brazil	Comandante Ferraz	15	1.6	15 [1.6]
Chile	Arturo Prat	9	0.9	105 [11.1]
	Bernardo O'Higgins Riquelme	16	1.7	
	Eduardo Frei Montalva	70	7.4	
	Julio Escudero	2	0.2	
	Lieutenant Rodolfo Marsh	8	0.8	
China	Great Wall	14	1.5	31 [3.3]
	Zhongshan	17	1.8	
France	Dumont D'Urville	26	2.7	26 [2.7]
France & Italy	Concordia	13	1.4	13 [1.4]
Germany	Neumayer III	9	0.9	9 [0.9]
India	Bharati	15	1.6	40 [4.2]
	Maitri	25	2.6	
Japan	Syowa	28	3.0	28 [3.0]
New Zealand	Scott Base	10	1.1	10 [1.1]
Norway	Troll	7	0.7	7 [0.7]
Poland	Arctowski	12	1.3	12 [1.3]
Republic of Korea	Jan Bogo	16	1.7	38 [4.0]
	King Sejong	22	2.3	
Russia	Bellingshausen	25	2.6	88 [9.3]
	Mirny	N/A		
	Novolazarevskaya	30	3.2	
	Progress	20	2.1	
	Vostok	13	1.4	
South Africa	SANAE IV	10	1.1	10 [1.1]
Ukraine	Vernadsky	12	1.3	12 [1.3]
United Kingdom	Halley VI	17	1.8	44 [4.6]
	Rothera	27	2.8	
Uruguay	Artigas	8	0.8	8 [0.8]
USA	Amundsen-Scott South Pole Station	49	5.2	215 [22.7]
	McMurdo	153	16.1	
	Palmer	13	1.4	
Total		949		

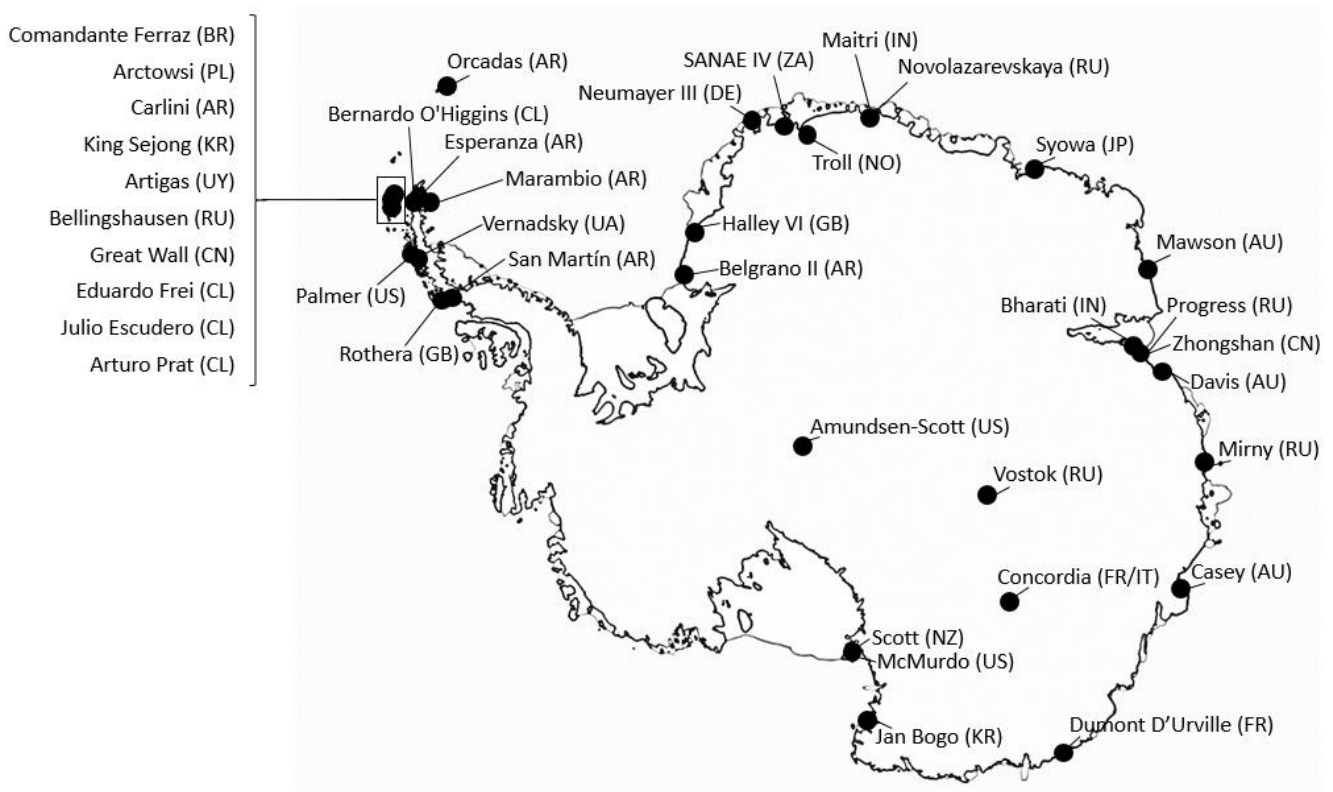


Figure 1. Location of the 40 Antarctic stations manned during the 2016 winter. Map adapted from Alexrk2 based on information from COMNAP (2016).

As seen above, the population residing in Antarctic stations is culturally very diverse. It is an aspect to bear in mind when studying human beings in this environment since, to ensure the best generalisation, the sample should mirror this diversity. We know that certain behaviours, representations or ways of communicating can be culture-specific. For instance, during a spaceflight simulation, which is another ICE, it appeared that communication with ground crew and compliance with given instructions differed from one nationality to another (Sandal, Bye, & van de Vijver, 2011). Another study looking at astronauts' adjustment to their social environment found cultural differences in perception of physical comfort or work pressure from the same environment (Kanas et al., 2000). This is important because a study using only a monoculture sample can hardly be generalised to a broader, multicultural population.

This being said, a given Antarctic station run by an Antarctic National Programme would not necessarily host exclusively winter-overs who are only citizens from that country. It is relatively common to have people of different nationalities sharing a station. However, the individual recruited for wintering-over in a specific station is likely to be familiar, if not with the host culture, at least with their language. So, even though a station can accommodate, to a certain extent, different cultures, the main culture expressed at the station is likely to be that of the National Antarctic Programme. For example, it is likely that the way a Japanese station is being run and organised (e.g., social norms, relationships with the hierarchy) will differ from that of a Chilean station. Therefore, from now on, the

culture of a station refers to the culture of the host country, even though it is acknowledged that individual differences can occur within the station.

1.1 Isolated and Confined Environments (ICEs)

The concept of an ICE encompasses different environments which, by definition, share two characteristics; they are isolated and confined. Isolation is defined as a “*separation from the usual environments, friends, spare-time activities and family*” (Weiss & Moser, 1998, p. 235). While contact via email or telephone is sometimes possible, physical interactions remain extremely difficult, if not impossible. However, it is important to note that when considering groups in ICEs, we are not dealing with a “true” social isolation since social interactions exist within the group (Suedfeld, 1979). Individuals in such an environment are therefore not alone, but might feel lonely due to the distance and limited interactions with the usual social network.

Confinement refers to a limited physical setting which residents can only leave for brief moments, if at all. Indeed, ICEs are usually habitats surrounded by an exterior environment that is threatening for life. This also implies difficulties in case of an emergency evacuation. As a result, residents are forced to work, live and share a limited space with the same individuals.

Commonly studied ICEs include Antarctic stations, spacecraft, and submarines (Gavalas, 2011; ICEBERG, 2012). While places such as a prison or a mountain cottage could fit the definition of an ICE, the work in this thesis will consider only environments in which people stay deliberately and to accomplish a job-related mission. More precisely, similarly to the majority of studies investigating ICEs, the focus of the present study is on Antarctic stations. Indeed, compared to spaceships, Antarctica offers a greater number of potential participants who stay for extended periods of time along with lower costs. Moreover, compared to both submarine and spacecraft environments, Antarctic stations are the most similar to a “standard” home, which means that any psychological or behavioural changes are more likely to be more apparent, given the changes that are part of living and working in the Antarctic. By contrast, a spaceship implies numerous other changes to its inhabitants’ daily life, such as zero gravity, radiation exposure, and frequent contacts with a ground crew that almost constantly monitors. All those elements can potentially impact one’s behaviour or thoughts, thus confounding the effects of isolation and confinement. In addition, unlike a “standard” daily life, being in a submarine or a spaceship requires a sustained work rhythm and physical discomfort. Antarctica seems, then, to be the best natural laboratory to investigate the effects of isolation and confinement on humans.

It is also noteworthy that many studies that have used Antarctica as an ICE might be outdated. For instance, an extensive review of the literature, as part of the present thesis, revealed that amongst 407 articles on polar psychology, more than half were published before 1992, that is before the availability of the internet in Antarctic stations. It is now known that internet access can change the

sense of isolation, group dynamics, and interpersonal interactions (Solignac, 2004). More generally, stations' settings keep changing and technology becomes more and more present in daily life at an Antarctic station. In addition, transport has changed over the years so that now some stations benefit from a winter flight (Winfly). Around mid-August, aircraft bring materials and new crew members to the station. There is, however, a high variability in terms of transport and communication between stations and across time. As a result, older findings about people's psychology and adaptation may be outdated since the environment people have to face has changed substantially. It is, therefore, important to keep investigating the psychology of ICEs in order to find out whether this will replicate previous findings or lead to different conclusions. This is all the more important since the personnel going to Antarctica contribute to crucial research into numerous scientific fields, such as glaciology, atmospheric physics, meteorology and oceanology. Antarctica represents a unique place on Earth to study the planet and environment in order to better understand and respond appropriately to modern issues like global warming. Because the success of these fundamental missions depends on the people undertaking them, updated investigations of their psychology is not only timely, but also essential for science.

1.2 Aims and objectives of the present study

The present study investigates the relationships between interpersonal variables and crucial outcomes for people spending a winter in Antarctica. More precisely, the objectives are to investigate whether one's fit to the social context of a station is positively related to one's job performance, satisfaction and positive/negative affect ratio and negatively related to one's cognitive impairment and sleep disturbance. Moreover, it will investigate the extent to which one's needs for privacy and social contacts, personality and privacy regulation strategies are related to one's fit to the social context of a station. The literature review below will put those objectives in their context and help to specify adequate hypotheses.

Chapter 2: Literature review

2.1 Isolation

“If I were to sum up in two words the things which in polar regions bring about the greatest amount of suffering, I would say humidity and isolation” (Cook, 1909, p. 257).

Isolation is one of the two characteristics that define an ICE. People who elect to work in such extreme environments agree to leave their daily life to experience the remoteness of environments such as Antarctica. However, the separation from friends and families can be a difficult experience. We know that the isolation and the lack of good communication to which one was accustomed make it difficult to understand the problems friends and family encounter (Solignac, 2004). Though telephone calls and email facilitate contact, for most people, these are not the channels through which they usually receive the social support they need. Those limited channels may frustrate some individuals who could suffer from a lack of contact with friends and family. As a result, one might experience a perceived lack of social support that could lead to negative outcomes. For instance, it has been found that satisfaction with support from friends and family was negatively related to depressive symptoms amongst U.S. crews (Palinkas & Browner, 1995; Palinkas, Johnson, & Boster, 2004). Being physically distant from friends and family can thereby lead to a perceived lack of social support from the friends and family back home and this undesirable feeling can be associated with negative outcomes. Outside of Antarctica, Cacioppo et al. (2006) established the causality of this relationship via an experimental study in which loneliness was induced. They found that the feeling of loneliness engenders depressed affect, negative mood and anxiety.

Thinking of friends and family can also be a great source of stress. Such social isolation appeared amongst the major stressors in Antarctica (McCormick, Taylor, Rivolier, & Cazes, 1985). Separation from family and friends was the most frequently mentioned source of stress for two expeditions that spent 17 days in complete isolation in the Arctic (Bishop, Grobler, & Schjøll, 2001). It was also ranked as the main stressor by different Australian crews wintering-over between 1980 and 1982 (Godwin, 1986). Also, Strange and Klein (1973) found that almost all anxious feelings reported by U.S. winter-overs were related to events occurring back home. An inability or difficulty to help with problems and events occurring at home could be one of the reasons for such stress. Indeed, the lack of capacity to help relatives who are in trouble or to take part in special celebrations, and the limited ability to get back home earlier than planned, can be great sources of preoccupation and stress. This is in line with what is known about the general population. We know that when people do not believe they can exert control over environmental events, or have external ‘locus of control’ (Johnson & Sarason, 1978), they tend to be more affected by stressful events (Cascio et al., 2014; Habeeb, 2016; Schmitz, Neumann, & Oppermann, 2000). Finally, Cravalho (1996, p. 633) mentions the case of a man who reported, amongst

other events, a death in his family while he was in Antarctica, and described his winter-over experience as *“the closest he had come to going crazy”*. Isolation can thus be a stressful experience that puts a strain on the individual. This adds up to other stress-inducing characteristics of such an unusual experience. For instance, it has been argued that leisure activities, social participation at the station or the workload could be sources of significant stress for the winter-overs (Decamps & Rosnet, 2005). However, those factors are beyond the scope of the present research.

It is important to adapt to isolation in order to successfully complete a mission in an ICE. This is particularly true with regards to isolation from one's normal social network. Solignac (2004) found that individuals who cope well with separation from their friends and family tend to also adapt well to the station in general. Isolation from usual social networks can not only impact one's mood but it can also impair one's adaptation to the new isolated situation, threatening the fulfilment of one's assignment. Thinking of relatives back home while being unable to intervene if anything were to happen to them can divert one from one's work. For instance, at least one field accident has been attributed to the distraction caused by the first mail delivery from an Antarctica expeditioners' family (Taylor & McCormick, 1987). Palinkas (2002) reported the case of two men who had to be sent back home before the end of their mission when preoccupations with their family prevented them from efficiently carrying out their assignment. When talking about the *isolation* aspect of ICEs, it is thus important to bear in mind that it is not only a geographical description, otherwise known as 'remoteness', it is also intrinsically linked with social isolation where one's needs for social contacts might not be fulfilled. Thus, ICEs can lead to a perceived lack of social contact and a feeling of loneliness.

Social isolation has been argued to refer to an objective absence of relationships, and has been considered as the opposite pole of social participation (Gierveld & Van Tilburg, 2006). However, from a similar social isolation, two individuals might not feel equally lonely. That is because loneliness has to do with *“the manner in which the person perceives, experiences, and evaluates his or her isolation”* (de Jong Gierveld, 1998, p. 74). This highlights the fact that the experience of isolation is not a systematic consequence of a physical isolation. One might be two-day walk away from civilisation and yet not feel isolated, while someone else could feel isolated in a big city surrounded by individuals. Similarly, the experience of isolation does not systematically leads to feeling lonely, nor it is a necessary condition as some individual can enjoy being isolated. So, even though both isolation and loneliness have often been used as synonyms in the literature, it is more accurate to consider loneliness as a negative consequence, though not systematic, of a feeling of isolation. For this reason, when researchers mention isolation as being detrimental, they are actually more specifically referring to the induced loneliness usually experienced as a result of the sense of isolation. This confusion of terms is sometimes simplified in the specialised literature by experts who use interchangeably 'subjective social isolation' and 'loneliness' (de Jong-Gierveld, 1987). In the present thesis, isolation refers to the general feeling of having insufficient relationships where *“the number of existing relationships is smaller than*

is considered desirable or admissible, as well as situations where the intimacy one wishes for has not been realised" (de Jong Gierveld, 1998, pp. 73-74). Loneliness is considered here as one of the negative affective consequences of such a mismatch between what one needs (or wishes for) and one's perceived reality. Those consequences include a sense of emptiness or missing people. So, even though 'objective' isolation only refers to a physical state that can be enjoyed by some, here it is only looked at as a facilitator to feeling lonely.

In addition to the negative affect engendered by isolation, it has been experimentally shown that people who feel lonely take longer to fall asleep, sleep less efficiently, and wake more frequently during the night (Cacioppo et al., 2000). This latter result has also been found in a more recent off-continent study that found lonely people to have low quality sleep and to report more daytime dysfunction (Hawkley, Preacher, & Cacioppo, 2010). If loneliness impairs sleep quality, it can also affect daily functioning. For instance, the cognitive functions - such as reasoning, memory, perception - of lonely people can be degraded. It has been found that feeling lonely impairs performance on cognitive tasks assessing, amongst other measures, one's attention, language, information processing speed and abstract reasoning (Ellwardt, Aartsen, Deeg, & Steverink, 2013). As early as 1898, as part of the very first crew to winter-over in Antarctica, Cook (1909, p. 385) noted that one's "*brain has for a long time been unsteady as a result of the unbroken daylight and hopeless isolation*". It is possible that loneliness' effect on sleep quality and cognitive functioning is mediated or moderated by other factors. For instance, it is conceivable that loneliness might induce stress or negative mood, which then affect one's sleep and cognitive functioning. It is also likely that the lack of sleep may affect one's cognitive abilities.

It seems then that the social isolation imposed by ICEs can lead to a lack of satisfying social contacts and can be a source of stress. Moreover, research has found that not having enough social interactions of quality can lead to sleep disturbance, cognitive impairment, and can generate negative affect.

2.1.1 Social needs

Social relationships have been found to be crucial for humans' well-being (Cohen & Wills, 1985) and health (Holt-Lunstad, Smith, & Layton, 2010; Uchino, 2006). For instance, it has been found that amongst elderly people, feeling isolated was positively related to mortality (Steptoe, Shankar, Demakakos, & Wardle, 2013). It has been suggested that social support can act as a buffer, protecting an individual from the adverse effects of stress (Cohen & Wills, 1985). But this beneficial effect of social relationships can also be explained by *social capital theory*. The main idea of social capital theory is that individuals in one's social network, and their good intention toward one, are valuable resources (Adler & Kwon, 2002). Those resources can be anything that one is provided with and that one benefits from (e.g., advice, gifts, information, access to an area or a job and social support). Woolcock and Narayan (2000, p. 226) sum it up by saying that "*the basic idea of social capital is that a person's family,*

friends, and associates constitute an important asset, one that can be called on in a crisis, enjoyed for its own sake, and leveraged for material gain". Because some of those assets, or resources, contribute to our well-being and health, it is only natural that we all have a certain need for connecting with others. Because our needs are diverse, it is unlikely that one individual could fulfil all of our needs. In the same way, it is unlikely that a social network limited to similar individuals with which one have a similar relationship can be fully satisfying. For this reason, it is suggested that a need for social contacts can be broken down into different constituent categories.

Regarding isolation, two social needs appear relevant: the need for affiliation and the need for intimacy. The need for affiliation is about "*establishing relationships to rather unfamiliar people and acquaintances*" (Schönbrodt & Gerstenberg, 2012, p. 4). It has also been defined as "*the urge to form connections and make contact with other people*" (Vaughan & Hogg, 2014, p. 503). On the other hand, the need for intimacy is concerned with "*being close to others, having positive profound interactions, and practicing self-disclosure and warm mutual exchange*" (Schönbrodt & Gerstenberg, 2012, p. 4). McAdams (1980) said that, as opposed to a high need for affiliation, someone with a high need for intimacy is not

characterized as an active procurer of friendships or a person who strives for convivial activity. Rather, he or she may be especially sensitive and receptive to the possibilities or experiencing the goal state in day-to-day living. In a sense, the emphasis is upon being, not doing. (p. 431)

Some authors have also suggested that intimacy is a function of mutual self-disclosure (Laurenceau, Barrett, & Pietromonaco, 1998). Here, a highly intimate relationship is characterised by a high degree of self-disclosure. Finally, Patterson (1982) described intimacy as

a bipolar dimension reflecting the degree of union with or openness toward another person. Practically, increased intimacy is the result of greater liking or love for another or greater interest in or commitment to such a person. (p. 235)

In other words, affiliation has more to do with the quantity of relationships (getting along with many people) and intimacy is characterised by the depth of relationships (being close to some people).

When considering needs for affiliation and intimacy, a complementary approach to the social capital model is the *social penetration theory* of Altman and Taylor (1973). Those authors proposed a conceptualisation of interpersonal behaviour (see Figure 2).

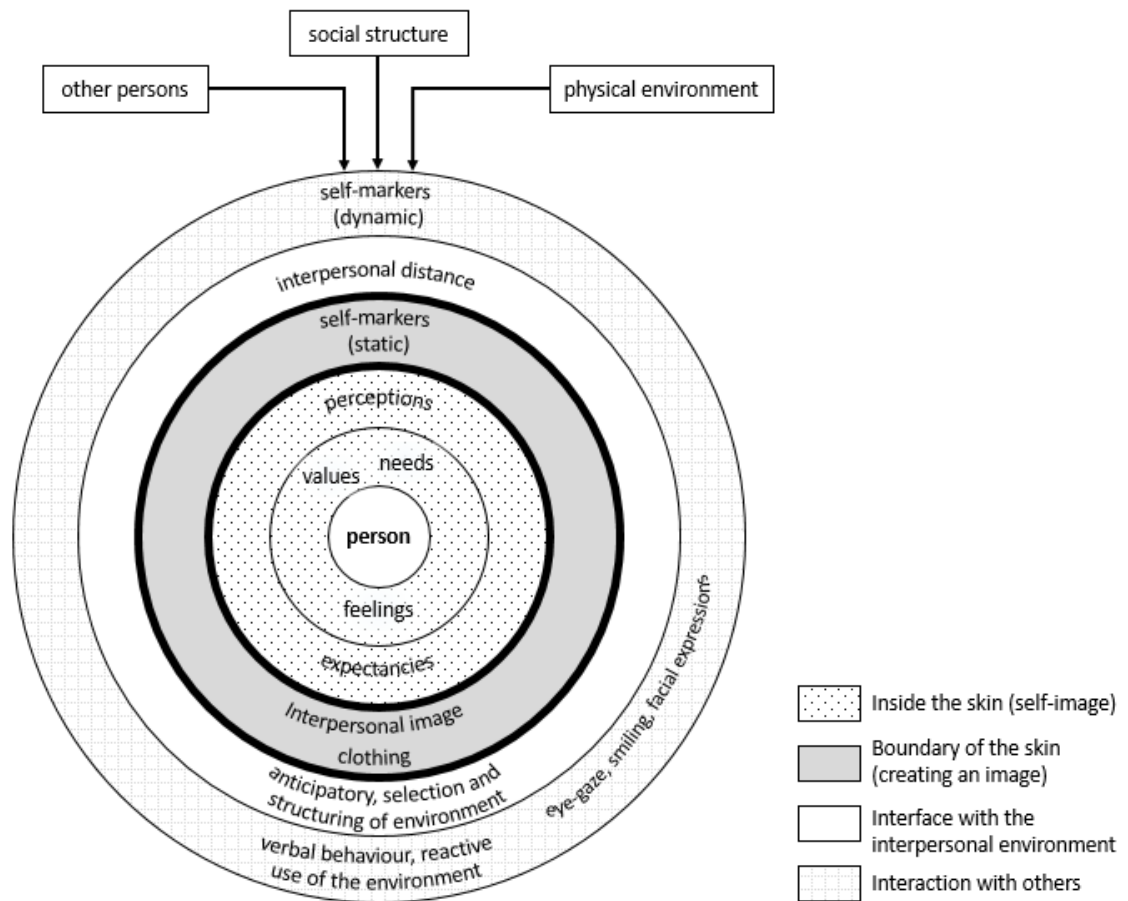


Figure 2. Social penetration model, adapted from Altman and Taylor (1973)

The basic idea is that several “layers” surround each individual. At the innermost layer are our values, needs and feelings, the most private aspect of self that we do not tend to easily share or disclose at a first encounter. The people we share those intimate aspects with are close friends and relatives. The next layer represents our interpretation of situations and our intentions on how to respond to them. This layer, along with the first one, are considered to be *inside the skin*, in the sense that they are not directly observable by another person. Then, the *boundary of the skin* is the very first layer that is seen during a first encounter and encompasses *static self-markers* which are nonverbal information about oneself. Self-markers include clothes, posture, facial expressions and so forth. The *interface with the interpersonal environment* layer represents features that are apparent during a social interaction. It includes *anticipatory selection and structuring of environments* which refer to modifying the environment to create a certain setting in anticipation of an interaction (e.g., arranging chairs before a meeting, tidying a room and adjusting the light). Finally, the outermost layer is where the actual social interaction happens. It includes *verbal behaviour*, *dynamic self-markers* (e.g., facial expression, eye-gazing and body movements) and *reactive use of the environment*, which refers to using physical features in the interaction (e.g., using an object and establishing a territory).

Characteristics closer to the core radiate stronger in the sense that they have a greater impact on the outer layers than those have on them. For instance, one's values and perceptions are likely to influence the way one will dress and interact with someone, while one's clothes are not as likely to shape one's inner values. For this reason, based on what is accessible to anyone (on the boundary of the skin and out), one can only infer someone else's self-image (or characteristics inside the skin).

In regard to social capital theory, one might think that disclosing personal information to many individuals, to let as many as possible close to the core, can only be a good idea. Indeed, really close individuals with whom one has bonded can offer a great range of resources, from superficial advice anyone could provide to personal social support that requires one to be familiar with someone else's values and intimate characteristics. Having many close friends would allow one to have both the need for affiliation and need for intimacy fulfilled by the same individuals. However, a limiting factor to letting people become intimate is the cost it represents. Adler and Kwon (2002) argue that building and maintaining social capital requires important investments, and comes at a cost. Not only does it take time to create a close bond with someone but, also, there is a tacit principle of reciprocity (Coleman, 1990). This suggests that it may be easy to reciprocate a superficial contribution but it could become resource-consuming to reciprocate in close relationships. For this reason, one might want to have only a few very close friends and have more superficial acquaintances to find a good cost-benefit balance. In addition, one might want one's values and feelings to be known only by a few people. Thus, the number of individuals we let in each layer of the social penetration model is proportional to the diameter of the ring.

With a high need for affiliation, one needs to form superficial relationships with many people in order to control the overall cost to oneself. Because those relationships do not need to be deep, one can disclose very limited information about oneself and let people have access only to the outer skin layers. In order to be fulfilled, though, the need for affiliation requires a setting in which one would have enough people with whom one could potentially interact. By contrast, to fulfil a high need for intimacy one has to feel close to someone else and has to share more about one's self-image. So, in order to be fulfilled, the need for intimacy requires a setting in which one feels comfortable to share intimate information, even if it is just with one other person.

In an ICE, the social *affordance* (what the environment provides) can be perceived as low. Because the environment provides little variety for individuals to interact with, it is harder to relate and interact with as many people as one was used to in one's more mundane social setting. If one needs to socialise with many different people, an Antarctic station will offer little opportunity to do so. Because the pool of people one can interact with is limited, it gives fewer chances to find a like-minded person with whom one may truly bond. In addition, while the other crew members might not be enough to fulfil one's need for affiliation, the medium of communication with significant others back home might also reduce the quality of those latter's social support. The quality of a relationship can be degraded in

different ways in Antarctica. It has been reported that some future winter-overs decide with their family not to disclose bad news during the winter, so as not to alarm or worry each other (Solignac, 2004). It is also known that, in our societies, people prefer face-to-face, as opposed to email or telephone, to communicate with individuals they feel close to if they have the opportunity to do so (Baym, Zhang, & Lin, 2004). This might be because communication via emails might not allow to convey all the subtlety of a face-to-face communication. As a result, a degraded communication with significant others could lead one not to fully benefit from the opportunity to communicate with their friends and family back home. This is supported by a study revealing that though the availability of such support remains constant over time, the satisfaction with the social support diminishes (Palinkas, Johnson, & Boster, 2004). Because family and friends usually fulfil one's need for intimacy, a degraded relationship or perceived support might greatly affect a person with a high need for intimacy. This is important because satisfaction with social support was found to be negatively related with depressive symptoms while in Antarctica (Palinkas & Browner, 1995). For the reasons mentioned above, it is expected that the needs for affiliation and intimacy are harder to fulfil in an isolated environment.

It is expected that an individual with high needs for affiliation and intimacy might be more frustrated in an ICE and, therefore, suffer greater negative consequences. This is supported by findings showing that when reporting little relatedness, people with higher needs for affiliation and intimacy present greater social cynicism (measured in this study with statements such as "People dislike others who succeed in life.", "It is rare to see a happy ending in real life" or "People deeply in love are usually blind") (Hofer, Busch, Raihala, Poláčková Šolcová, & Tavel, 2017). For these reasons, it is expected that higher needs for affiliation and intimacy, as opposed to lower needs, would be detrimental to individuals who are going to an ICE.

2.2 Confinement

"L'individu se sent prisonnier du groupe dans la mesure où chaque instant de la vie quotidienne est communautaire, tout acte se faisant sous le regard des autres."

[The individual feels like a prisoner of the group inasmuch as each instant of daily life is communal, each action being done under the gaze of others].

(Rosnet, Cazes, & Bachelard, 1998, p. 740, cited in Giret, 2006)

While, historically, some ICEs were designed to host only one individual (e.g., first manned spaceships), modern scientific or military missions in ICEs tend to include a crew of different specialists covering all aspects of the complex logistics that are required. When speaking of the *confinement* dimension of ICE, one should bear in mind that it usually implies sharing this limited space with other people. As ICEs allow a limited range of options for physical privacy, one has greater difficulties

escaping from the social context that is imposed by this specific setting and, thus, the constant presence of colleagues can have adverse effects. Privacy has been defined as “*a boundary control process whereby people sometimes make themselves open and accessible to others and sometimes close themselves off from others*” (Altman, 1977, p. 67). Privacy is therefore the control one has over the type and amount of information disclosed about oneself to others. We understand easily that in an ICE, where it is difficult if not impossible to escape the habitat and where personal space is restricted to a small room in the best cases, the control one has over the information they can retain for themselves is limited. A lack of privacy can emerge from, but not as an automatic consequence of a sense of crowding (Marshy, 1999), where one is surrounded by more people and has less opportunity to control information flow than one might find desirable.

Crowding has long been shown to generate stress and hostility (Evans, 1979). Indeed, such a situation can lead to a perceived lack of privacy, which is reported as the second most important source of stress by Australian winter-overs from 1980 to 1982 (Godwin, 1986). To illustrate this, Cravalho (1996) mentions that a woman complained that even when she wanted to get away from McMurdo, it had to be done with someone else. As noted by Binsted, Kobrick, Griofa, Bishop, and Lapierre (2010), this is not only caused by the lack of visual privacy but also by the limited auditory privacy due to the construction mode of polar stations. As one winter-over reported, in an Antarctica station “*tu entends tout. En fait tu n’as aucune intimité*” [you hear everything. Actually, you have no privacy] (Solignac, 2004, p. 130).

This relationship between crowding/lack of privacy and negative affect has not only been sporadically observed in Antarctica but has also been a topic of research in general society. For instance, a laboratory experiment found that hostility and anxiety are higher when confined in a crowded environment than when the habitat was shared with fewer people (Zeedyk-Ryan & Smith, 1983). In addition, Smith and Haythorn (1972) isolated groups of two or three men for three weeks and found an increase in stress and anxiety compared to baselines measured before and after the isolation period. They also found that both hostility and anxiety increased over the confinement time. This could explain why crowding has often been found to positively correlate with aggression and violence in nightclubs (Macintyre & Homel, 1997), bars (Graham, Bernardis, Osgood, & Wells, 2006), hospital psychiatry units (Ng, Kumar, Ranclaud, & Robinson, 2001) and prisons (Lawrence & Andrews, 2004). Crowding also has been found to disturb sleep (Rona, Li, Gulliford, & Chinn, 1998), to impair performance on complex cognitive tasks (Nagar & Pandey, 1987) and to increase general negative affect (Nagar & Pandey, 1987). For all those reasons, one might want to find strategies to cope with perceived crowding.

As the usual way of regulating social contacts can be difficult to implement in ICEs (e.g., by spending some time alone), people have to find alternative ways to moderate the overwhelming effect of the lack of privacy by adopting new strategies. For instance, it has been found that, under certain

circumstances, crowding reduces aggression and, instead, promotes social withdrawal (Matthews, Paulus, & Baron, 1979). In regards to ICEs, Jenkins and Palmer (2003) have proposed that social withdrawal could be an effective privacy regulation strategy to cope with the constant social environment. The desirability of this strategy has been noted in a historical account, in which Cook (1909) reported:

When men are compelled to see one another's faces, [...] without any outer influence to direct the mind, they are apt to remember only the rough edges which rub up against their own bumps of misconduct. If we could only get away from each other for a few hours at a time, we might learn to see a new side and take a fresh interest in our comrades; but this is not possible. (pp. 290-291)

One winter-over reported that when the crowd got too overwhelming, “some people become antisocial” (Cravalho, 1996, p. 634). Later, a study in a French Antarctic station found that, over time, people tend to keep a greater distance from each other when having meals (Tafforin, 2004). Moreover, the same author found that, in the dining room, people change seats over the winter so that the number of colleagues in their field of vision decreases. This, again, could be a way of regulating social contact in order to restore a sense of privacy. Finally, Cravalho (1996) reported another strategy used by a crew member; as he was getting bad-tempered, he started working nights to limit social interactions. In their restricted setting, ICEs lead crew members to be constantly in a social environment from which they cannot escape, they force their inhabitants to find new strategies to fulfil their need for privacy.

As privacy in ICEs is often difficult to manage, it can be assumed that one's need for privacy should be negatively correlated with one's adaptation at an Antarctic station. However, as noted above, Antarctic personnel develop innovative strategies in order to fulfil their need. This has also been observed more widely; for example, in cultures in which physical privacy cannot be easily achieved. In such cultures, alternative ways of hiding one's thoughts or behaviours from others have been found. For instance, reducing social contact with others and lying – in order not to disclose personal matters – have been found to be socially acceptable in Mehinacu culture (Altman, 1977). In cultures offering little opportunity for privacy, such strategies seem to keep the society functioning and help people feel adjusted to it. This suggests that it would be possible that someone with a high need for privacy, but who has developed adequate means of privacy regulation, could eventually adapt to an ICE.

In summary, the confinement imposed by ICEs can lead to a perceived lack of privacy and can be a source of stress. Moreover, research has found that not having enough privacy can lead to sleep disturbance, cognitive impairment, and can generate negative affect. However, innovative privacy regulation strategies can help to restore privacy and might thus, attenuate the three adverse effects mentioned above.

2.2.1 Social needs

Two social needs are relevant regarding confinement: the need for privacy and the need for intimacy. It has been argued that intimacy could actually be a type of privacy (Marshall, 1974; Pedersen, 1999; Westin, 1967). Privacy itself has been theorised to have several dimensions but one dimension that yield great consensus amongst researcher is *solitude*. *Solitude* has to do with being physically separated from other individuals and is thought to be “*the most complete state of privacy that individuals can achieve*” (Westin, 1967, p. 31). While some authors consider solitude as being a dimension of privacy (Long & Averill, 2003; Westin, 1967), others consider solitude and privacy as being part of the same construct (Stewart & Cole, 2001). The defining feature of confinement in an ICE is most directly related to a limitation in finding one’s desired solitude. Also, because ICEs can lead to a lack of privacy, finding a time and a place to spend time with one individual in order to bond, without being exposed to others, can be challenging. Since the need for intimacy is less easily fulfilled in an ICE than in more common environments, individuals with a lower need should feel less frustrated in an Antarctic station. In the same way, someone with a high need for privacy will be more easily annoyed by the limited privacy experienced on the ice. For these reasons, it can be expected that higher needs for privacy and intimacy, as opposed to lower needs, would be detrimental to individuals who are going to an ICE.

It is worth noting that while other dimensions of privacy have been identified, they are not deemed equally relevant for an ICE. For instance, Marshall (1974) reports *anonymity* as one dimension, this relates to not being identified in a public area. She also considers *not neighbouring* as a dimension, which specifically relates to urban/residential suburbs. Both dimensions do not translate well to an ICE and are therefore not considered as being critical aspects of privacy in such a setting.

2.3 Winter-over syndrome

As seen above, the literature has found three consequences of isolation and confinement; increase of negative affect (e.g., depression, hostility), poor sleep quality and poor cognitive performance (Strange & Klein, 1973). Not surprisingly, those three symptoms are amongst the most common symptoms observed in Antarctica (Palinkas & Suedfeld, 2008) and have been widely studied. These symptoms have been collectively referred to as the *winter-over syndrome*. They are discussed below and then followed by the suggested causes for them.

2.3.1 Mood

"Physically, mentally, and perhaps morally, then, we are depressed."

(Cook, 1909, p. 291)

The impact of an ICE on one's mood is inherent in the common idiom "cabin fever", which can be defined as a *"combination of irritability, moodiness, boredom, depression, or feeling of dissatisfaction in response to confinement, bad weather, routine, isolation, or lack of stimulation"* (Rosenblatt, Anderson, & Johnson, 1984, p. 44). Field studies support the existence of such emotional reactions when being in an extreme environment. In 1957 and 1958, 55% and 35% (respectively) of U.S. crew members admitted to having felt sad at some point, while 49% and 34% reported to have felt easily annoyed or irritated, respectively (Gunderson, 1966). Those values were even greater in another study, which found 80% reported feeling sad and even more of them reported feeling easily annoyed or irritated (Gunderson, 1968). Amongst the U.S. station McMurdo crew in 1989, 47.6% reported feeling more irritable in Antarctica than usual and 62.1% reported feeling depressed (Palinkas, 1992). The literature indicates that it is rather common to observe a rise of depressive mood and irritability over a winter-over.

2.3.2 Sleep

"either there is a constant inclination to sleep or persistent insomnia"

(Cook, 1909, p. 306)

The impact of an ICE on one's sleep quality has been recorded since the very first winter-over in Antarctica. Cook (1909, p. 292) reported that *"about half of the men complain of headaches and insomnia; many are dizzy and uncomfortable about the head, and others are sleepy at all times, though they sleep nine hours"*. Since then, sleep disturbance while residing in Antarctica has been often observed (Bhattacharyya, Pal, Sharma, & Majumdar, 2008; Chen, Wu, Xiong, et al., 2016; Horiuchi et al., 2013).

Gunderson (1966) reported up to 72% and 51% of winter-overs having sleep disturbance in 1957 and 1958, respectively. Sleep disturbance while in Antarctica has been reported by 64.1% of a 1989 U.S. crew (Palinkas, 1992), 80% of crew members spending the 1992 winter in the Indian station Maitri (Bhargava, Mukerji, & Sachdeva, 2000), and 60% of a New Zealand crew (Taylor, 1974). Gunderson (1968) found a similar value with 74% of U.S. navy personnel reporting difficulty falling asleep. Sleep disturbance usually encompasses both difficulty falling asleep and difficulty staying asleep (Palinkas & Suedfeld, 2008). Those aspects have been more recently studied by Steinach et al. (2016). They used 54 participants wintering-over any year between 2008 and 2014 in a German Antarctic station.

Participants wore, twice a month, an actimeter at the back of each upper arm in order to measure their sleep parameters (e.g., sleep time, sleep efficiency). They found that sleep time and sleep efficiency decreased over the course of the winter while the number of wake events per night increased. It has been assessed amongst a summer crew that the impact of sleep disturbance was similar to four hours of sleep deprivation during five consecutive nights (Pattyn, Mairesse, et al., 2017). It is thus frequent for winter-overs to have their sleep strained by the conditions under which they live in an Antarctic station.

2.3.3 Cognition

“The men were incapable of concentration, and unable to continue prolonged thought.”

(Cook, 1909, p. 303)

The impact of an ICE on cognitive performance had also been pointed out. Indeed, the cognitive impairment that Cook (1909, p. 330) termed *“mental lethargy”* has also been more recently observed in the New Zealand station (White, Taylor, & McCormick, 1983), and in McMurdo Sound in Antarctica (Reed et al., 2001). Palinkas (1992) found that 51.5% of a U.S. wintering-over crew reported difficulty with concentration or memory. The specific environmental characteristics of an Antarctic station have thus been associated with impaired cognitive functions. However, some studies failed to replicate those results (Barkaszi, Takács, Czigler, & Balázs, 2016; Khandelwal, Bhatia, & Mishra, 2017; Yan, Wu, Wang, Zhang, & Saklofske, 2012) or even found increases in cognitive performance across the stay (Paul, Mandal, Ramachandran, & Panwar, 2010b; Premkumar, Sable, Dhanwal, & Dewan, 2012).

2.3.4 Potential causes

The winter-over syndrome has often been attributed to the disrupted circadian cycle that winter-overs experience. Like most mammals, humans are set to function optimally with a regular day-night cycle of 24 hours. However, in Antarctica, winter-overs have to face months of constant daylight followed by months of constant darkness. As a result, the absence of light during a polar winter leads to disturbance in hormones release. For instance, darkness leads to an increased production of melatonin (Nagtegaal, Kerkhof, Smits, & Van Der Meer, 1998; Zeitzer, Dijk, Kronauer, Brown, & Czeisler, 2000), and it has been demonstrated that there is a negative correlation between this hormone level and accuracy when solving cognitive tasks (Pääkkönen et al., 2008). This would explain why, when in prolonged darkness, winter-overs’ performance on cognitive tasks decreases. This relationship has also been observed in Antarctica where the level of melatonin is significantly higher in winter than summer and this difference is greater early in the day (Premkumar et al., 2012). However,

it is worth noting that the same authors found that during the winter mornings, the level of melatonin is positively correlated with performance scores on cognitive tasks. The negative effect of prolonged darkness on people's mood, through the effect it has on hormones, has been called 'Seasonal Affective Disorder' (SAD) (Rosenthal et al., 1984) and is often observed in population living in high latitudes (Booker & Hellekson, 1992; Rosen et al., 1990). However, due to inconsistencies in findings, more research on the role hormones play in adaptation to unusual circadian cycles is needed.

Moreover, during the night, the production of the thyroid hormone T_3 decreases (Campos-Barros et al., 1997; Palinkas et al., 2001). In polar studies, a reduction of T_3 has been shown to be associated with higher level of fatigue, depression and anger, and lower performance in cognitive tasks and reaction time tasks (Pääkkönen et al., 2008; Reed et al., 2001). This consequence of prolonged exposure to darkness in polar regions is termed *polar T_3 syndrome*. However, it should be noted that it has been suggested that thyroid hormone T_3 in lower animals can be influenced by other factors than the level of natural light, such as one's diet (Ahmadi, 2016) or cold temperature (Mustafa & Elgazzar, 2014). Cold temperatures have been suggested to be a factor influencing cognitive performance (Palinkas et al., 2001; Reed et al., 2001). Even though later studies found mixed results, with cold sometimes benefiting and sometimes impairing cognitive performance (Mäkinen et al., 2006; Palinkas et al., 2005).

It is also suggested that the winter-over syndrome might be, at least partially, attributed to both isolation and confinement (Palinkas, 1992, 2002). Given the importance of the factors mentioned above and identified in prior literature, it is not expected that social factors would explain a large amount of variance of sleep quality. However, the direct link between the sense of isolation and lack of privacy imposed by an Antarctic station and the emergence of the overall winter-over syndrome has yet to be tested.

2.4 Symptoms over time

It is one thing to know the consequences of extreme environments on psychological processes, but it would be simplistic to imagine that they appear as soon as one enters and remain stable during the stay before disappearing as soon as one exits.

Carrere (1990) found that adaptation to a U.S. station and its effects on individuals is a dynamic process evolving over time. She found that sporadic events (e.g., parties) and evolution of the environment (e.g., change of weather) made crew members' anxiety, depression, blood pressure and epinephrine fluctuate. Sleep disturbances have also been found to be irregular over a year in an Indian station in Antarctica (Bhargava et al., 2000). The same authors also found satisfaction with work and life to decrease over time. Another study found the number of stressors reported by French winter-overs to drop after mid-winter followed by a peak in the last weeks in Antarctica (Decamps & Rosnet,

2005). They also found somatic complaints (sleep disturbance, functional symptoms) to drop after the first weeks while mood variation and anxiety start increasing. Every aspects of one's reaction to an Antarctic station, such as stress level (Bishop et al., 2001) or depression, insomnia, and hostility (Palinkas, Gunderson, & Burr, 1989b) seem to be subject to fluctuation over time.

An important finding from numerous studies is the temporal aspect of a winter-over and the major impact it has on crew members. If the modulations of each characteristic that is measured seem to present their own evolution, a cluster of symptoms usually follow the same temporal pattern. This pattern had first been described by Bechtel and Berning (1991) in their study of personnel in cold regions. They noticed a sudden increase in marital counselling, accidents and assaults just past the middle of winter. They soon found out that this 'low' systematically appears right after the middle of a known stressful duration. In the same article, they explain that they eventually named this phenomenon the *third-quarter phenomenon*. Because winter-overs are deployed for a set period of time in an environment that is often considered as challenging, the third-quarter phenomenon could well occur in such situations. For this reason, this phenomenon has been addressed by many studies focusing on Antarctic stations (Decamps & Rosnet, 2005; Jenkins & Palmer, 2003; Palinkas, Johnson, Boster, et al., 2004; Steel, 2001; Wilson, 2011). It seems that indeed, after the mid-point of the mission, regardless of the duration of the stay, displeasure and negative mood increase while vigour decreases, as it has been found for instance at a New Zealand station (Steel, 2001). The third-quarter phenomenon has not only been linked with mood but it also has an impact on interpersonal relationships, with French crew members starting to avoid public places and preferring personal areas after mid-winter (Weiss, Feliot-Rippeault, & Gaud, 2007).

All effects of an ICE experience, such as its adverse effects, one's adaptation and privacy regulation seem to be dynamic processes that evolve and fluctuate over time. Thus, it is essential to take into consideration the effect of time on all aspect of a winter-over to fully understand the latent mechanisms that lead to the success, or failure, of a mission.

2.5 Positive repercussions of an ICE experience

The picture portrayed so far of ICEs, and particularly Antarctic stations, depicts them as relatively detrimental for people. Indeed, Bhargava et al. (2000) observed that 64% of Indian crew members are, at some point, dissatisfied with work and life situation at an Antarctic station. But it is noteworthy that if Australian winter-overs report a greater variety of negative experiences, the fewer positive experiences are reported as being more frequent (Wood, Hysong, Lugg, & Harm, 2000). So, despite the bleak picture of ICEs portrayed so far, crew members are usually satisfied with their experience. For instance, amongst the 78 crew members spending the 1977 winter in the U.S. station McMurdo, almost all of them eventually considered the winter-over as one of the best experiences of their lives

and almost half of them would have wintered again (Oliver, 1991). Taylor (1974) found that 12% of a New Zealand crew reported willingness to go back to Antarctica, one month after their return. This latter finding must, however, be considered with caution, as the first two-month period after the return has been referred to as the 'honeymoon' phase, during which former winter-overs experience positive changes (e.g., optimism, valuing one's relationships) (Moult, Norris, Paton, & Ayton, 2015).

However, one has to be prudent when considering retrospective reports. Literature has found that one tends to adopt a more positive view, or 'rosy view', after the event has passed (Mitchell, Thompson, Peterson, & Cronk, 1997). For instance, Wirtz, Kruger, Scollon, and Diener (2003) have found that students reported a greater level of positive affect, and to a lesser degree negative affect, when reflecting on their past spring break compared to what they reported during their holiday. A more positive experience reported afterwards compared to what is actually felt during the event has been found by several other studies (Kemp, Burt, & Furneaux, 2008; Wilson, Meyers, & Gilbert, 2003). This effect might be due to a memory bias. Szpunar, Addis, and Schacter (2012) found that one recalls more details from a positive anticipated event while memory of negative anticipated events fades away more quickly. This 'fading affect bias' (Walker, Skowronski, & Thompson, 2003) simply states that the intensity of recalled affect fades faster for negative affect.

Even accounting for the fading affect bias, it still appears that, despite the different adverse consequences encountered, people experience truly beneficial effects. For instance, amongst members of a six-week British expedition in Greenland, improvement for different skills has been observed, such as for enjoying isolation, managing time efficiently, avoiding depression, controlling emotions, or living in crowded circumstances (Stott & Hall, 2003). Danish people coming back from a one-year expedition to Greenland also report personal growth, such as being more open minded and tolerant (Kjaergaard, Leon, & Fink, 2013). However, people seem to benefit differently from a similar polar experience. Leon, Sandal, Fink, and Ciofani (2011) looked at two men on an expedition to reach the North Pole. They had the same goal, were exposed to the very same environment and were both undergoing this experience in a similar situation. As one might expect, they both similarly benefitted from this experience, by having an increase of the Universalism value (inner harmony, protecting the environment). However, they also each gained a form of personal growth that the other did not gain. One experienced an increase of Self-direction value (independency) while the other one had an increase of Benevolence value (honesty, loyalty). Those changes remained even six months after the end of the expedition (Leon et al., 2011). It is thus clear that individuals can greatly benefit from an experience in an extreme or unusual environment and this benefit can be specific to each person. But benefits are not only in terms of personal growth. Palinkas (1986) found that a group of U.S. winter-overs had fewer hospitalisations than a comparison group within the year following the expedition. Such an approach, focusing on what benefits can emerge from a specific experience, is termed *salutogenic*.

Unfortunately, the positive effects of wintering-over have not been much investigated. As Suedfeld and Steel (2000) have pointed out, most studies usually consider the negative impacts of ICEs on individuals. Zimmer, Cabral, Borges, Coco, and Hameister (2013) found that amongst 44 publications on the effects of an Antarctic stay, about two thirds mentioned positive effects of a stay in an Antarctica station while all studies considered negative outcomes. Such an approach is termed *pathogenic* and usually aims to identify the determinants of adverse effects on winter-overs. However, investigating how to reduce pathologic consequences does not necessarily allow the promotion of good health. It was suggested that, during polar expeditions, both positive and negative experiences can exist simultaneously (Sagar & Pattanayak, 2015). The independence of positive and negative affect had been attested for decades (Diener, 1984) and it is accepted that one does not suppress the other. As a result, preventing people from being dissatisfied does not systematically lead to greater satisfaction. For this reason, it is suggested that an approach looking at both salutogenic and pathogenic determinants and outcomes would lead to a comprehensive understanding and more accurate prediction of adjustment.

One reason for an emphasis on negative aspects might be due to the heavier weight of negative affect compared to positive affect on well-being. Fredrickson and Losada (2005) found that counterbalancing a certain “amount” of negative affect with the same quantity of positive affect is not enough to have flourishing mental health. They found that one needs about three times more positive affect than negative affect to live within an optimal range of human functioning. Thus, as negative affect impacts more heavily on functioning and well-being, one might be tempted to focus only on the adverse effects that happen to winter-overs. However, the relevant information is not the quantity of negative affect as such, but rather the ratio of positive and negative.

In conclusion, it is only by a complete understanding of all effects of ICEs, including both positive and negative effects, that it will be possible to identify those who fit best in Antarctica and, as a result, to accurately screen for the most suitable individuals.

2.6 What matters in Antarctica?

If the consequences of ICEs on people’s mood and behaviour seem gloomy, it does not prevent former winter-overs from recommending the experience and for prospective candidates to keep applying for scientific and military missions. Nevertheless, considering both the negative consequences of isolation and confinement on people, and the cost of such missions, whether they be in Antarctica, space, or the deep sea, one should insure, as far as possible, that the selected personnel will carry out the mission and will draw more positive than negative experiences. This section will review the elements thought to be important for efficient personnel screening.

2.6.1 The individual

When considering prospective participants, the hiring organisation has to bear in mind that the future crew members will need to adapt to an unusual environment that features unique characteristics. Moreover, the logistical and infrastructure costs make the screening process highly important. One wants to make sure that the personnel going to Antarctica will perform efficiently despite the environmental factors. Indeed, employees' performance might be the most important aspect for an employer. The psychological contract, as defined by Rousseau (1989), implies mutual expectations of satisfaction for both parties in any organisation, and that the employer as well as the employee should benefit from the collaboration. If high levels of job performance are the expected outcomes for the employer, reciprocity should lead to high job satisfaction for the employee. For a fruitful collaboration, both outcomes should occur. It is not a coincidence that two different meta-analyses have found a positive correlation ($r = .17$ and $.30$) between job performance and job satisfaction (Iaffaldano & Muchinsky, 1985; Judge, Thoresen, Bono, & Patton, 2001). Significant correlations have also been observed in U.S. stations in Antarctica for scientists (up to $r = .47$) but not for Navy personnel (Doll & Gunderson, 1969). If a station wants to have a productive crew, it has to make sure that crew members will be efficient and satisfied in their work environment.

However, knowing that a good employee is one who is high performing and satisfied in a specific environment, does not help one to predict who will eventually fulfil those conditions. It is to answer this question that numerous studies have investigated relations between individual characteristics of winter-overs and their adaptation in the station. Indeed, it has long been established that a key factor for good performance and satisfaction is adaptation to one's workplace. Some authors even consider job satisfaction and job performance as being indicators of adaptation (Jimmieson, Terry, & Callan, 2004; Sargent & Terry, 1998). Since one's adaptation to a U.S. station in Antarctica and one's performance are positively correlated (Nelson & Gunderson, 1962), screening for those who will adapt best maximises the chance to select those who will perform best.

As mentioned above, performance is related to satisfaction thus, one's adaptation should not only be predictive of one's performance but also of one's satisfaction. This has been found by other studies which have demonstrated positive relationships between job satisfaction and adaptation to Australian stations in Antarctica ($r = .32$ and $.48$ respectively) (Sarris, 2007, 2008).

Since individuals differ in their adaptation to Antarctica, it is of interest to investigate what, in an individual, can predict one's adaptation and, thus, performance and satisfaction. Literature has identified a large number of predictors, stating that a good crew member should be, for instance, disciplined, extraverted, independent, have low need for affection or use an emotional focused coping strategy (Grant et al., 2007; Palinkas, Gunderson, Johnson, & Holland, 2000; Peri, Barbarito, Barattoni, & Abraham, 2000; Sarris, 2007; Smith & Jones, 1962). However, some of those individual characteristics have led to contradictory conclusions. For instance, high extraversion has been

alternatively found to be a desirable (Sarris, 2006) and an undesirable trait (Rosnet, Le Scanff, & Sagal, 2000) in Antarctica. In addition, those studies only consider one aspect of adaptation. To fully understand a situation, the perspective of a person within a specific environment should be adopted. Such an approach takes into consideration both aspects of the context; the individual and the environment and, more precisely, the psychological context (individual) and the interpersonal context (environment) (Wapner & Demick, 2002). Any study investigating adaptation should thus consider both *who* needs to adapt and to *what* environment. Taking both into consideration should allow for a better prediction of one's performance and satisfaction.

2.6.2 Person-Environment fit

The environment itself presents specific characteristics that impact on one's adaptation, performance, and satisfaction. For instance, Kwallek, Woodson, Lewis, and Sales (1997) found that workers' performance varied according to the colour of walls in their office. But, more interestingly, they found that the impact of the colour was different amongst workers. While workers who had a high level of stimulus screening ability performed better with red walls than blue walls, the opposite was observed for those scoring low on stimulus screening ability. Such a study demonstrates that not only individual characteristics are important, nor just the environment, but the interaction of both. Here, one cannot predict employees' performance only using their individual characteristics, stating that low or high "screeners" will perform better in an office. One cannot predict employees' performance only using environmental features, stating that a red or a blue room would lead employees to be more efficient. One has to consider both since both an individual and a given environment are unique, and only looking at their interaction can lead to a comprehensive understanding of the context and to accurate predictions.

One such theoretical approach is called *Person-Environment (P-E) fit*. Using this concept in the workplace, Kulik, Oldham, and Hackman (1987, p. 278) defined P-E fit as "*the fit between the characteristics of jobs and the abilities and needs of jobholders*". Thus, one might not only consider prospective crew members' characteristics such as personality traits and needs in order to predict their performance in an ICE, but also the unique and defining features of those unusual environments, namely isolation and confinement. It would be advisable also to consider their interaction; the needs and personality of individuals and the characteristics of the environment.

In Antarctica, biographical data such as life history and status characteristics (Gunderson, 1966) or age and family background (Nelson, 1962) are usually poor predictors of one's performance (Gunderson, 1966; Palinkas, Gunderson, & Burr, 1989a). This is, perhaps, one of the reasons that polar psychology has shifted its focus toward other types of predictors. Though stations have changed over time, it is unlikely that such measures would have become more relevant over time. As Palinkas,

Keeton, Shea, and Leveton (2010) have shown, across 120 Antarctic studies, no demographic characteristics have been found to be strong predictors of performance, while 20% of significant personality traits are considered strong predictors. Personality traits can sometimes predict performance, satisfaction, or different aspects of adaptation, such as social compatibility, task motivation, and so forth, but only within a limited range. For instance, a meta-analysis found personality traits to have an average correlation of $r = .11$ with performance (Barrick & Mount, 1991). Alternatively, adaptation to Antarctic life has been found to be a better predictor, with correlations ranging from $r = .54$ and $.60$ for U.S. winter-overs (Nelson & Gunderson, 1962). As mentioned before, performance and satisfaction are correlated. The P-E fit should thus also be a better predictor for job satisfaction than the individual's characteristics alone. A meta-analysis has found P-E fit at work to correlate at $r = .56$ with job satisfaction (Kristof-Brown, Zimmerman, & Johnson, 2005).

The study described in this paragraph is, as far as the present literature review has revealed, the only one that used an explicit P-E fit approach in Antarctica (Sarris, 2006, 2007, 2008; Sarris & Kirby, 2005, 2007). For that study, 115 people who went to an Australian Antarctic station (Mawson, Davis, Casey and Macquarie Island) between 1950 and 2000 were recruited. More than a hundred of them wintered-over at least once and 12 only spent a summer. The sample comprised 14 women and 103 men. It had been found that personality factors were not predictive of satisfaction except for extraversion for which a correlation of $r = .20$ had been found (Sarris, 2006). However, when considering both elements; the winter-over's and the Antarctic station's characteristics, predictability became more accurate. A positive relationship had been found between subjective P-E fit with the Antarctic station culture and satisfaction with being a member of the expedition (Sarris, 2008) as well as with job satisfaction (Sarris, 2006; Sarris & Kirby, 2005).

However, it is noteworthy that data collection in this study was based on former winter-overs' recollection of their experience. It is thus possible that the overall evaluation can impact on more detailed evaluations of the same object. This is called the *halo effect* and it has been shown to also apply to memory (Pizarro, Laney, Morris, & Loftus, 2006). Here, it is possible that former winter-overs have an overall memory of satisfaction and that this positive recollection influences other aspects such as the fitness in the station. Field studies should thus be carried out to test these previous findings.

The literature seems to suggest that having a comprehensive approach, considering both individuals and the environment within which they have to adapt, would allow better prediction for performance and satisfaction. Thus, it is advisable to use a P-E fit approach in order to have a comprehensive understanding of a good screening process to select winter-overs. More specifically, it is expected that the fit between one's need for social contacts (e.g., affiliation and intimacy) and the affordance in an ICE would play a significant role. A person with a high need for social contact would receive little affordance, due to the isolation, and a misfit would likely happen. As a result, one might feel isolated or even lonely. By contrast, someone with a low need for social contact would not suffer

as much from the same small affordance. In the same way that isolation might lead to loneliness, confinement might lead to a sense of crowding. For this reason, it is expected that one's need for intimacy and privacy would be frustrated in a confined environment where little opportunity to experience privacy is offered. As a result, someone with a high need for intimacy or privacy would experience a misfit.

P-E fit, being a very general and somewhat abstract concept, has led to debates on how to operationalise it. Edwards, Cable, Williamson, Lambert, and Shipp (2006) propose three approaches, which are illustrated in Figure 3:

- Atomistic: an atomistic approach consists of considering the relevant characteristics of the environment and the person separately and then comparing or mirroring them.
- Molecular: a molecular approach consists of directly looking at the extent to which the relevant characteristics differ between the environment and the person.
- Molar: a molar approach consists of directly looking at the extent to which the relevant characteristics of the environment and the person match.

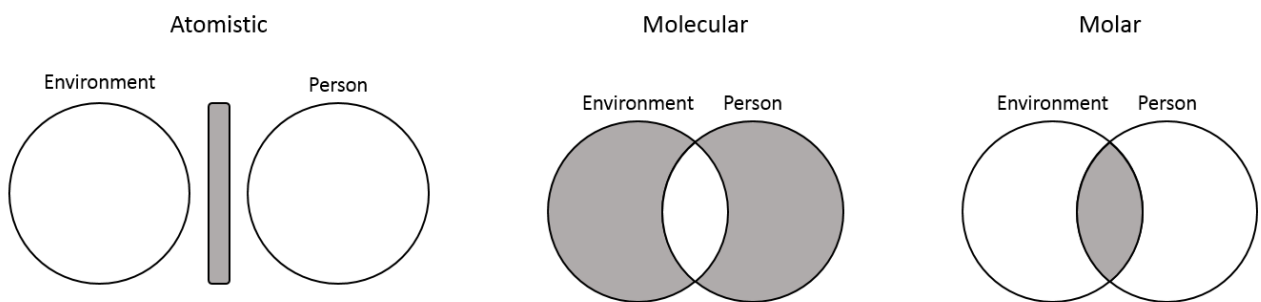


Figure 3. Focus point (in grey) of three P-E fit approaches; atomistic, molecular and molar.

An *atomistic* approach would typically use an objective measure of affordance. Let's suppose that one is interested in measuring the fit between the need for fresh fruits and an Antarctic station's affordance of fresh fruits. In this situation, one could ask future winter-overs how many pieces of fresh fruit they need daily. Then, one would count the number of pieces of fresh fruit available for each winter-over on a daily basis. Finally, one would calculate the difference between the two; the smaller the difference, the higher the fit. Unfortunately, when computing the difference oneself, one might miss out variables that could greatly impact on the relevance of the aforementioned fit score. For instance, the dry air of the station might make people crave more fresh fruit than usual, making an apparently good score too optimistic. On the other hand, because of the excitement of being in such an unusual place, people may neglect food and not crave fruit as much as anticipated, making an apparently bad score more negative than it actually is. Because a fit depends not only on the characteristics of the person and the environments as measured once in time but also on other factors, computing an artificial score from two measures might not be reflective of the fit experienced by the

individual. It is worth noting that one study applying P-E fit to Antarctic stations used both an atomistic and a molar measure (Sarris & Kirby, 2005). They found the molar measure to have additional correlations (with willingness to recommend) and stronger correlations (with job satisfaction and group cohesion) than the atomistic measure. For these reasons, the subjective fit directly reported by the individuals themselves will be used in the present studies.

A *molecular* approach is concerned with the perceived discrepancy between the person and the environment on the relevant characteristic, usually focusing on whether participants receive too much or too few of the resources they need. Following the previous example, it would be asked of participants the extent to which their need for fresh fruit is frustrated by the environment. Because this approach focuses on the discrepancy (or misfit), the fit is implied as being the inverse of the discrepancy. However, some fits are not as simple and linear as this. A great deal of discrepancy might exist along with a relatively high level of fit. In a similar manner, an apparently small discrepancy could be sufficient to be experienced as a misfit by the individual. As a result, it really comes down to the fit itself and it can hardly be inferred from the discrepancy.

A *molar* approach focuses on how well people perceive their needs as being fulfilled by the environment. With the same example as above, participants would be asked about the extent to which their need for fresh fruit is satisfied at the station. Here, the assessment of the perceived fit is done using a direct measure. The individual will automatically, and probably unconsciously, consider all the factors that come into play and will report the fit value that was meant to be measured, as experienced by the individual.

2.6.3 Paradoxical environment

The two main dimensions of an ICE - isolation and confinement – have been described above but two seemingly contradictory implications have been reached.

- By the isolation they impose, ICEs may lead to perceived loneliness, defined as having fewer social interactions than desired
- By the confinement they impose, ICEs may lead to a sense of crowding and lack of privacy, defined as having more social interactions than desired

This apparent paradox is, however, also observed in field studies. Despite the fact that winter-overs are confined in a limited space with the same people they have to live with during a year and that, in such a context, privacy is hard to attain, more than half of winter-overs report to have felt lonely at some point (Gunderson, 1966). Moreover, in a literature review, Zimmer et al. (2013) have found that both isolation and lack of privacy have been identified as problematic in ICE studies. Another study revealed this paradox amongst Indian winter-overs (Paul, Mandal, Ramachandran, & Panwar, 2010a). They found that "*On one hand, there was a greater need to associate with others but with less intimacy.*

Inversely, personnel wanted others to establish close relationships with them but with low need for interaction." (Paul et al., 2010a, p. 713). Winter-overs seem then to seek closer relationships (sociotropism) along with fewer interactions, thus more time spent alone, or more solitude (solitropism). This appears as a paradox only if one considers the need for solitude and the need for social contacts as being two extremes of one scale, one individual being more prone to seek either social interactions or solitude depending on one's position on the scale. However, Leary, Herbst, and McCrary (2003) have found that sociotropism and solitropism are two different constructs, each having its own scale. They demonstrated that it is possible to have high, or low, need for both social contacts and solitude. What winter-overs apparently express is that both needs are not fulfilled in Antarctica. Their need for social contacts, usually satisfied by friends or family, is made difficult to fulfil due to the isolation while their need for privacy is frustrated by the confinement and the constant presence of others. But to understand fully how one single environment can frustrate those two needs, another perspective should be taken, a perspective provided by the theory of scarcity.

2.7 Scarcity

The theory of scarcity, developed by Mullainathan and Shafir (2014), describes the consequences of any scarce object on one's attitude, behaviour, and performance. It assumes that when anything lacks (e.g., financial or social resources, security), it may have two predictable consequences: focus dividend and tunnelling. *Focus dividend* states that one will be focused on what one lacks and this will lead one to be better, wiser, or more efficient for anything related to it. *Tunnelling* states that since one's attention is on what lacks, one might neglect the rest. That is to say, a result of one's attention being captured by a specific object is that one might neglect the rest, and this can have detrimental consequences. As an example, if someone has financial problems, that person might use his or her money in an optimal way, sparing, spending only for necessary items, looking for sales, making the most out of this limited resource (focus dividend) but this preoccupation for financial problems might be a distraction while at work, decreasing one's productivity for an assigned task as a result (tunnelling).

To explain the phenomenon of tunnelling, the authors use the concept of bandwidth that comprises two components: 1) cognitive capacity, which reflects fluid intelligence and 2) executive control, which encompasses planning, attention, initiating and inhibiting actions, and controlling impulses. A fully accessible bandwidth allows one to accomplish complex cognitive tasks, to control one's behaviour and to monitor one's emotions. However, scarcity reduces one's bandwidth by focusing cognitive resources toward what is lacking and thus impairs one's performance on everything else, thereby creating the effect of *tunnelling*.

ICEs are environments that normally offer only limited resources for their residents. These personnel are living in environments entirely designed by an organisation, in which most aspects of daily life are controlled, and from which one cannot easily escape. The options to choose from are extremely restricted in ICEs (e.g., what meals to eat, what sports to practice, geographical places to go to). It is not surprising that in such restrictive environments, the effect of tunnelling is found to be great with lower performance of winter-overs on cognitive tasks, and being more affected by negative emotions. Some winter-overs are so focused on the absence of their families and friends that it distracts them enough to lead to field accidents (Taylor & McCormick, 1987). Others invest so much time writing emails to their relatives and friends to fill the gap that separates them that they distance themselves from the other station members, thus jeopardising their adaptation (Solignac, 2004). Regarding the adverse effects of the introduction of access to the internet, one French winter-over reported: *“C’était très bien à une équipe et puis ils ont voulu l’améliorer, mais ça a amélioré c’est vrai la relation par rapport à la France, mais ça casse un groupe. Enfin, ça casse l’ambiance d’un groupe.”* [It was really good to a team and then, they wanted to improve but, it's true it has enhanced connection with France but, it breaks a group. Well, it spoils the atmosphere within a group.] (Solignac, 2004, p. 125). Others can become so focused on their family that they neglect their assignment and are eventually sent back home (Palinkas, 2002).

But if ICEs are characterised by scarcity, two of the most stressful aspects that are defined by scarcity are isolation and confinement. As seen above, isolation can lead to a perceived lack of social interaction, and potentially to a sense of solitude. Concurrently, confinement can lead to a perceived lack of privacy, and potentially to a sense of crowding. Solitude and crowding being the results of the dissatisfaction of two different and distinctive constructs; need for social contacts (sociotropism) and need for privacy (solitropism).

2.8 Personality

If all people have needs for privacy, intimacy and affiliation, the way individuals express them can differ markedly. For a given environment, two individuals with the same need for affiliation might not have their need equally fulfilled. If one is extraverted and happens to be a pleasant person, they will easily bond with people they come across while someone else, more introverted, might not. This is because one's personality influences one's behaviour and, as a result, acts as a moderator between one's needs and the extent to which one fulfils them. Needs set one's goals and motives but reaching them depends on some personal characteristics; namely, personality traits. The proposition that personality traits channel our needs and motives towards certain behaviours is called the *channelling hypothesis* (Winter, John, Stewart, Klohnen, & Duncan, 1998). These authors found an interaction between extraversion and the motive of affiliation in the way they predict behaviour. Extraverted

participants showed a positive relationship between the motive of affiliation and social behaviour such as volunteering and combining family and work roles. On the other hand, introverted participants showed a negative relationship between the same variables. Because traits shape the way needs are expressed, neither personality traits nor the needs or motives taken alone would be enough to accurately predict behaviour. However, both together can better predict one's behaviour.

In the present study, however, the focus will not be on one's behaviour but rather on one's fit with the environment. It has been established that a P-E fit reflects the match of one's need and the environment's affordance. However, if the environment does not fully satisfy one's need, one can either change the environment or adopt adaptive strategies. Either way, those reactions to a discrepancy, or misfit, are behavioural and can, as a result, reduce the misfit. But because behaviour, as defined by Winter et al. (1998), is a function of motive and personality, and motives derive from needs, the P-E fit can be seen as a function of one's needs, personality and the environmental affordance. The needs would therefore not directly predict one's P-E fit but would be moderated by one's personality, as suggested by the channelling hypothesis.

An ICE is characterised by features that fundamentally relate to a social environment; isolation refers to the difficulties of connecting with a certain social network while being confined with other individuals leads to a sense of crowding. For this reason, personality traits that directly relate to interpersonal relationships should play an important role in one's adaptation. One of the main personality theories recognises five main traits characterising one's personality. Those five personality traits are openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. Originally identified by Fiske (1949) (though with other labels), these traits are supposed to encompass a wide array of personality aspects. Because each trait is so comprehensive, they have been collectively called the 'Big Five' (Goldberg, 1981).

Several studies have linked personality traits with different biographical characteristics. In their 45 year-long longitudinal study, Soldz and Vaillant (1999) found that both extraversion and agreeableness correlate with social support which encompasses dimensions such as quality of relationship with children, partner, friend and involvement in activities with nonfamily members. When it comes to choosing an occupation categorised as social, only extraversion and agreeableness are significant predictors (Judge, Higgins, Thoresen, & Barrick, 1999). In addition, Lopes, Salovey, Côté, Beers, and Petty (2005) found that only those two traits correlate with peer nomination on social characteristics. More specifically, they found that agreeableness correlates with peer nomination on sensitivity, prosocial emotional management, mood and liking, while extraversion correlates with interpersonal competence, dominance and assertiveness. Finally, Lopes et al. (2004) found that only agreeableness correlates with a peer-evaluation of interpersonal competence and only extraversion correlates with a vast array of interpersonal characteristics. While agreeableness is concerned with how pleasant, sympathetic and affectionate one is, extraversion represents how outgoing, energetic or talkative

someone is. It thus comes as no surprise that those two traits are consistently found to correlate with social-related characteristics. Based on those findings, it appears obvious than out of the five Big Five traits, agreeableness and extraversion are the two traits that are the most relevant when investigating social adaptation. For this reason, those two traits will be considered as moderators of the relationships between one's needs and one's social adjustment.

2.8.1 Agreeableness and extraversion as moderators

It has been established that personality traits can act as moderators between one's need and one's behaviour or the extent to which a goal is reached. It is thus important to establish how some personality traits can influence the relationships between the one's needs and those needs' fulfilment. Those moderations are reviewed and explained below and summarised in Table 2.

Individuals with a high need for affiliation would want to interact with many people they encounter, but because an ICE offers only a small and limited number of possible encounters, those individuals might not be a good fit and might feel lonely. This negative relationship between the need for affiliation and isolation P-E fit can be moderated by extraversion and agreeableness. Scoring high on both personality traits means that interactions with others is facilitated by a social predisposition. Thus, a high score on each personality trait should decrease the relationship between one's need for affiliation and one's isolation P-E fit. For example, if both John and Jane score high on the need for affiliation, they might still experience a different level of isolation P-E fit once in an ICE. If John is extraverted and agreeable, he will not only reach out to the other crew members and actively socialise but, by being pleasant, he will also make others willing to interact with him. In such a situation, though John wishes for more interactions, his need for affiliation would still be partially fulfilled. On the other hand, Jane who is introverted and not agreeable, is more likely to stay on her own despite her need for interactions. Because of her not being agreeable, the other crew members might limit their interaction with her to a minimum. As a result, Jane's need for affiliation will be unfulfilled and her sense of isolation or even loneliness might be much greater than that of John's. In this situation, extraversion and agreeableness decrease the relationship between the need for affiliation on the isolation P-E fit.

When considering the moderation effect of extraversion and agreeableness on the negative relationship between the need for intimacy and the isolation P-E fit, the implications are slightly different. Because an ICE provides less privacy than one might be used to in the comfort of one's home, someone with a high need for intimacy might find little opportunity to strongly bond with one or two individuals. Also, because an ICE offers a limited number of people to interact with, the chance of living with someone we can strongly connect with is also limited. But if one has a high need for intimacy, being agreeable can only help achieve a certain level of intimacy with someone else. For example, if

one is extremely unpleasant, fewer crew members would potentially be willing to spend quality time with one. However, if one has a high need for intimacy but is extraverted, one's natural penchant for socialising will likely put one to the forefront of the local social life, leaving one with little opportunity to withdraw with one or two individuals to develop stronger bonds. In this situation, extraversion increases the relationship of high need for intimacy and isolation P-E fit.

Those moderations should apply similarly to the negative relationship between one's need for intimacy and one's privacy P-E fit (fit between the individual's need for privacy and the environment's affordance). While we would expect, in an ICE, that a high need for intimacy would lower one's privacy P-E fit, agreeableness could decrease this relationship since it would facilitate close bonding with others by making one socially more appealing. On the other hand, extraverted individuals are more likely to seek social situations that include many people and this may preclude opportunity to develop intimate relationships. Finally, the negative relationship between one's need for privacy and one's privacy P-E fit should also be moderated by extraversion and agreeableness. In this case, both would increase this relationship. A highly extraverted and agreeable individual would be highly engaged in social life and would attract other crew members to interact with them, leaving them little time on their own to experience the privacy they need.

Table 2. Direction of relationships between different predictors and dependent variables and the effect moderators have on those relationships.

Predictor	Dependant variable	Relationship	Effect of a high score on <i>Extraversion</i> on the relationship	Effect of a high score on <i>Agreeableness</i> on the relationship
<i>Need for Affiliation</i>	<i>Isolation P-E fit</i>	negative	decrease	decrease
<i>Need for Intimacy</i>	<i>Isolation P-E fit</i>	negative	increase	decrease
<i>Need for Intimacy</i>	<i>Privacy P-E Fit</i>	negative	increase	decrease
<i>Need for Privacy</i>	<i>Privacy P-E Fit</i>	negative	increase	increase

Ultimately, what is critical is that one will be a good match within an environment, and it is important to bear in mind that Antarctic stations are not only defined by their isolation and confinement but also by a wide range of other characteristics. Amongst them, the social environment has been suggested to be a crucial determinant of adjustment (Palinkas, Glogower, Dembert, Hansen, & Smullen, 2004). For instance, if all other crew members score low on agreeableness and extraversion, one extraverted individual might feel more rejected by the cold response faced during their numerous attempt to socialise when compared to an introverted person who would not make as much contact with others. It is obvious that no one individual profile will be a good match with all possible group compositions and dynamics. However, such a fine-tuned prediction of adjustment would require to have information on all other crew members. Given the difficulties of collecting such data, average characteristics are assumed for others.

To conclude, though personality certainly plays a role in one's adjustment to the unusual social environment of an ICE, it might not be a core factor, as assumed by some previous studies. It might affect the way one tries to fulfil one's needs in a given environment. As we have seen, all other things being equal, one specific personality trait (e.g., extraversion) might be a facilitator for one given need (e.g., need for affiliation) and at the same time hinder another need (e.g., need for privacy). Assuming that personality alone would be enough to predict part of one's adjustment would be forgetting that adjustment is multi-dimensional, and that personality acts in different directions when considering different dimensions. In a P-E fit approach focusing on social needs, personality is still relevant but only when considered along with those needs.

2.9 Research Objectives

In the above literature review, it has been identified that good job performance and a high satisfaction are important aspects expected from both parties – the winter-overs and the organisation that deploys them to Antarctica. Those two desired outcomes will be variables investigated in the present study. Part of its aim is to investigate which individual's characteristics are related to job performance and satisfaction in an Antarctic station.

It has been found in the literature that if one's relevant characteristics fit well with the demands and constraints of the environment, one will perform better and be more satisfied than with a lower level of fit. As ICEs are characterised by both isolation and confinement, they intrinsically restrict one's social contacts with family and friends and one's privacy. Therefore, it is predicted that low needs for social contacts (affiliation and intimacy) and privacy are positively related with a good P-E fit. More precisely, one's need for privacy and for intimacy should be related to one's fit with the level of privacy of the station (privacy P-E fit). Also, one's needs for affiliation and intimacy are expected to be related to one's fit to the restriction of social contacts of the station (isolation P-E fit). In addition, it is predicted that both P-E fits (privacy and isolation) are positively related with job satisfaction and job performance in an Antarctic station.

However, the empirical and theoretical literature has suggested that the effect of one's needs on one's behaviour is moderated by one's personality. The present study will therefore consider personality traits that are relevant to an interpersonal context when assessing the link between needs for social contacts and privacy and fitness to the station by positing those personality traits as a moderating variable. Those personality traits are extraversion and agreeableness.

Moreover, it has been shown that innovative privacy regulation strategies can appear in an ICE. It is thus assumed that new strategies can attenuate the adverse effect of a high need for privacy on one's privacy P-E fit. Privacy regulation strategies will be used here as a moderating variable between the need for privacy and P-E fit.

As the winter-over syndrome has been suggested to be, at least partially, due to both isolation and confinement, the present study will investigate the extent to which one's fit can predict the emergence and the intensity of the winter-over syndrome. Thus, both P-E fits should be negatively related to the three symptoms of the winter-over syndrome, namely cognitive impairment, sleep disturbance, and an increase in negative affect. To have a comprehensive account of affect, this factor will be measured relative to positive affect. If, for instance, negative affect doubles and positive affect quadruples, a ratio between both measures would account for the relatively low increase of negative affect compared to the increase of positive affect. Overall, this is thought to allow for a more accurate conclusion about the general feeling and well-being of the winter-overs.

The hypotheses of the present study are as follows:

- One's isolation P-E fit and privacy P-E fit are positively related to each of the following variables; job performance, job satisfaction, positive/negative affect ratio and negatively related to the following variables; cognitive impairment and sleep disturbance.
- One's needs for privacy and for intimacy are negatively related to one's privacy P-E fit, the relationship being moderated by one's extraversion, agreeableness and privacy regulation strategies.
- One's needs for affiliation and for intimacy are negatively related to one's isolation P-E fit, the relationship being moderated by one's extraversion and agreeableness.

The model tested in the present thesis is shown in Figure 4 below.

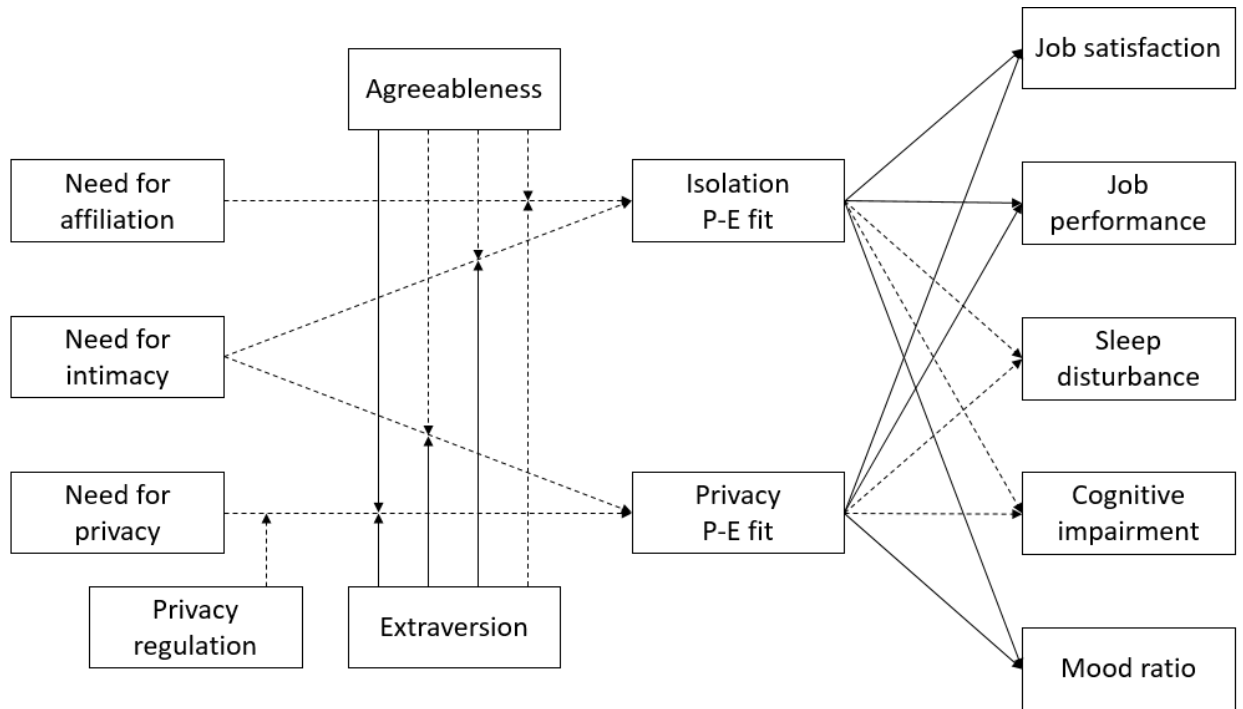


Figure 4. Model depicting P-E fits (isolation and privacy P-E fit) as its core, bridging social needs (needs for affiliation, intimacy and privacy) and their moderators (agreeableness, extraversion and privacy regulation) to outcomes variables (job satisfaction, job performance, sleep disturbance, cognitive impairment and mood ratio). Dashed lines represent negative relationships.

Chapter 3: Study 1

3.1 Method

3.1.1 Participants

Recruitment

Despite the fact that National Antarctic Programmes host winter-overs from all around the world every year, only a few studies have been cross-national in scope. Most studies focus on one station or, more rarely, several stations of the same National Antarctic Programme. This leads one to question the extent to which it is possible to generalise results found at a single station that often hosts a unique culture. This problem of generalisation, found throughout the literature pertaining to the psychology of ICEs, has been raised by several authors (Suedfeld & Weiss, 2000; Tisch, 2005). To overcome this limitation, participants from different stations and different nationalities were recruited. Since the only condition for taking part in the present study was that the potential participant was being deployed for a winter in an Antarctic station, the most convenient and efficient way of reaching potential participants was considered to be through their National Antarctic Programmes.

National Antarctic Programmes

In order to maximise the chance of having a representative sample, 15 National Antarctic Programmes that have at least one permanent station in Antarctica were contacted via emails in 2015. These included: Argentina, Australia, Chile, China, France, Germany, India, Japan, New Zealand, Norway, Russia, South Africa, South Korea, the United Kingdom and the United States.

An email was sent to each National Antarctic Programme (see Appendix A.1), along with an information sheet (see Appendix A.2). If they agreed to collaborate, two options were proposed; they could either send the contact details of their future winter-overs directly to the researchers so that each potential participant could be directly sent the advertisement for the study, or, alternatively, they could directly forward the advertisement (see Appendix A.3) that was attached with the email to potential participants. Also attached was a third file which contained the two surveys (see Appendix A.5 and A.7) so that the contact person in the National Antarctic Programme could know exactly what questions their future winter-overs would be asked.

The Chinese, German, New Zealand and Norwegian National Antarctic Programmes responded positively prior to the beginning of the winter (late 2015 or early 2016) to allow the advertising of the study to their future winter-overs. However, the New Zealand Programme only gave approval in early 2016, once their future winter-overs were already at the station, thus the data for their first months at the station are missing. Those four collaborating National Antarctic Programmes agreed to either

give the researcher the contact details of their future winter-overs or to forward the advertisement of the study (see Appendix A.3) to them.

The other National Antarctic Programmes either failed to reply despite receiving reminders or simply explained they could not be involved in the study for diverse reasons. The main reasons given for non-participation that year was either because the consideration for the research arrived too late in their organisation, they were concerned the study would be too much of a burden for their winter-overs, or they only collaborated with projects initiated from an institute of their country. One country initially expressed interest in participating but eventually ceased contact without explanation.

Future winter-overs

For those participants, who had received the advertisement from their National Antarctic Programme, they directly contacted the researcher in order to receive an email containing the link to the pre-winter-over survey (see Appendix A.4). In addition, a personal code was sent to each of them to be inserted at the beginning of each survey. This personal code, which was re-sent each time the monthly survey link was sent, allowed a link to be made between all the surveys filled in by the same individual.

Despite the absence of response from the U.S. National Antarctic Programme, one of their future winter-overs personally contacted the researcher to take part in the study. This American had come across an interview the researcher had given about the study and that had been published online.

Sample

The four collaborating National Antarctic Programmes altogether deployed 57 future winter-overs to the ice. Out of those 57 potential participants, only 18 (32%) agreed to take part in the study. However, three of them never filled in any survey while one filled in the pre-winter-over survey but dropped out before filling in the first monthly survey.

A total of 14 (26%) of the initial winter-over respondents filled in the pre-winter-over survey and at least one monthly survey. Amongst those 14 participants, there was one in Great Wall Station (China), four at Neumayer Station III (Germany), three at Scott Base (New Zealand), five at Troll Station (Norway) and one at Amundsen-Scott South Pole Station (U.S.). There were a total of 6 females and 8 males. With one male failing to report his age, the average age of the 13 remaining participants was 35.7 years old ($SD = 8.9$), ranging from 24 to 52 years old. Out of the 14 participants, three reported having previously wintered-over at least once, 10 had never wintered-over previously, and one did not respond.

3.1.2 Measures and procedure

While most studies take pre- and post-winter-over measures (Gavalas, 2011), such an approach would not be sensitive enough to capture the variations that occur in one's adjustment during the course of a person's stay. It was felt that a self-report score obtained at the end of the stay was likely to represent an overall appreciation of the experience. Furthermore, such answers could be unduly influenced by the cognitive and affective state at the time of reporting, which might not validly reflect the entire experience throughout the winter. For this reason, and the issue of the 'fading affect bias', discussed in Section 2.5, a more fine-grained approach has been used here. The study consisted of two different surveys. The first was a pre-winter-over survey that participants had to complete at any time prior to their arrival in Antarctica. However, because the New Zealand programme agreed to collaborate one month after their winter-overs arrived in Antarctica, those three participants filled in the pre-winter-over survey while on the ice. Participants received an email (see Appendix A.4) with the link to the survey and their personal password. The online survey had been created using Qualtrics, which is an on-line survey software package.

In order to accommodate non-English speaker participants, both surveys were translated into German and Chinese. The Chinese version had been translated by a Chinese acquaintance while the German version had been translated by a translation agency. Those translations had then been back-translated into English to ensure the accuracy of the translation. Both back-translations were conducted by a translation agency. Minor changes had to be made to the Chinese version in order to fully reflect the concepts expressed in English.

3.1.3 Pre-winter-over survey

The pre-winter-over survey consisted of the following personality and demographic measures (for the full survey see Appendix A.5).

Demographics

Demographic questions were asked about age and gender. This was to allow a description of the sample. Other demographic questions were asked but are not deemed relevant for the present thesis. They pertain to analyses that are unrelated to the model tested here but that will be eventually published.

Personality traits

Personality traits were measured using the Big Five Inventory (BFI) (John & Srivastava, 1999). This questionnaire presents 44 statements (e.g., talkative, reserved, inventive). The participant had to

assess whether each statement describes him or her ranging from “disagree strongly” to “agree strongly” on a 5-point Likert-type response format. Out of those 44 self-evaluations, five personality traits can be measured: openness to experience (creative, interested in many things), conscientiousness (organised, persevering, efficient), extraversion (sociable, express him/herself with confidence), agreeableness (helpful, thoughtful, lenient), and neurotic (easily distressed, easily tormented).

The BFI has an internal consistency of Cronbach's $\alpha = .83$ with a test-retest reliability of $r = .85$ and a convergent validity of $r = .95$ with the Trait Descriptive Adjectives (John & Srivastava, 1999).

These traits have been widely used when investigating the personality of Antarctic crew members (Bishop et al., 2001; Bishop, Kobrick, Battler, & Binsted, 2010; Grant et al., 2007; Leon et al., 2011; Palinkas, Suedfeld, & Steel, 1995; Sarris, 2006, 2007; Steel, Suedfeld, Peri, & Palinkas, 1997). For the present study, only the two traits which directly refer to interpersonal contact were considered; that is to say, extraversion and agreeableness.

Need for social contacts (affiliation and intimacy)

To record the importance of the need for social contact, each participant completed two subscales from the Unified Motives Scales (Schönbrodt & Gerstenberg, 2012): the need for affiliation and need for intimacy scales. While affiliation refers to the importance of having contacts with many other people, intimacy refers to intense contacts with few significant others. Together, they reflect two aspects of social needs. Respondents were asked to evaluate 10 affiliation and 10 intimacy items using a 5-point Likert-type response format.

Schönbrodt and Gerstenberg (2012) found the two scales to have an internal consistency (Cronbach's α) of .91 (affiliation) and .80 (intimacy). As convergent validity, significant correlations with other questionnaires' subscales measuring the same constructs range between $r = .18$ and .89 (affiliation) and $r = .46$ and .70 (intimacy). It is noteworthy that the low convergent validity of .18 mentioned above was found with the Picture Story Exercise (PSE-Q), which is concerned with an aggregate construct of affiliation/intimacy. This may explain the low convergent validity with the measure of affiliation alone. Although one other scale yielded a .52 convergent validity score, the remaining four scales tested yielded convergent validity scores above .70.

It should be noted that this questionnaire is only informative of the need for social interactions and not about one's need for privacy. Indeed, a low score on the two scales does not mean that one does not like being with people, only that one does not need much social contact in one's daily life.

Need for privacy

In order to measure the need for privacy, the Preference for Solitude Scale (Burger, 1995) was used. This questionnaire proposes 12 pairs of statements (e.g., *Time spent alone is often productive for me*

vs *Time spent alone is often time wasted for me*) from which respondents choose the one that describes them the best. Burger (1995) has shown the questionnaire to have an internal consistency (Kuder-Richardson formula 20) ranging from .70 to .73, a test-retest correlation of $r = .72$, a moderate divergent validity from *extraversion* ($r = -.36$) and a moderate convergent validity with *loneliness* ($r = .42$).

Though the Preference for Solitude Scale measures the inclination one has toward solitude, Long and Averill (2003) and Westin (2003) report that solitude is a type of privacy. Westin (1967, p. 31) even considers solitude as “*the most complete state of privacy that individuals can achieve*”. Other researchers have similarly regarded the two concepts as being part of the same construct (Stewart & Cole, 2001). Hence, it is used in this study to indirectly measure a need for privacy. A high preference for solitude should reflect a high need for privacy.

Along with the measures mentioned above, measures regarding the motivation for going to Antarctica were collected. These data are intended for a separate study and, therefore, will not be considered later in this thesis.

3.1.4 Monthly survey

The second survey was completed online on a monthly basis by the winter-overs throughout their stay in Antarctica. It comprised questions directly related to the participants’ experiences at their respective stations for the previous 30 days. Each month, each participant received an email (see Appendix A.6) with the link to the same survey and their personal password. The link redirected them to an online survey created on Qualtrics. One week later, if a participant had not completed the survey, the same email would be sent again with the word “reminder” added as the subject of the email. The monthly survey had the following measures detailed in the sections below (for the full survey, see Appendix A.7).

Job Satisfaction

Job satisfaction was measured through the Brief Index of Affective Job Satisfaction (BIAJS) (Thompson & Phua, 2012). This questionnaire asks one to assess, on a 5-point Likert-type scale, how strongly one agrees with four statements (e.g., *Most days I am enthusiastic about my job*). This questionnaire has an internal consistency (Cronbach’s α) of .85, with a test-retest correlation of $r = .57$, and has been tested for cross-national and cross-population equivalence (Thompson & Phua, 2012). The same authors also found a convergent validity of $r = .74$ with another valid measure of job satisfaction, and a predictive validity with *age* ($r = .18$), *job tenure* ($r = .19$), *subjective well-being* ($r = .51$) and *organisational identity* ($r = .49$).

Sleep Disturbance

Sleep quality was assessed via three items that have already been used in an Antarctic context (Doll & Gunderson, 1971; Palinkas et al., 1989a). For the three of them (*difficulties falling asleep or staying asleep; waking up at night; and feeling tired during the day*), the participant had to indicate the frequency they experienced them in the past thirty days answering on a 5-point Likert-type response format. The choice to replace the original four response options by five was made to unify the scales of response on all items in the whole questionnaire.

Mood Ratio

Positive and negative moods are not simply two ends of a continuum but rather two independent constructs (Agho, Price, & Mueller, 1992). Both positive and negative affect can reach high or low levels independently of each other. It is for instance possible to feel a high level of positive and negative affect at the same time (e.g., a man who fully enjoys his experience at the station but knows he is missing his daughter's birthday) or feeling little of both affects. Because the ratio of both types of affect is important, it is important for the participant to report each affect while bearing the other one in mind. For this reason, the same format of response as the Evaluative Space Grid (ESG) by Larsen, Norris, McGraw, Hawkey, and Cacioppo (2009) was used. This single-item measure consists of a 5x5 grid with the x-axis representing positive affect and the y-axis representing negative affect. Each scale proposes five options (not at all; slightly; moderately; quite a bit; extremely). The participants were asked to indicate, by choosing one square, the extent to which they felt positive and negative affect during the last 30 days. This measure allows calculation of a ratio between negative and positive affect. Because it has been suggested that negative affect has a weighting of about three times more than positive affect in one's overall well-being (Fredrickson & Losada, 2005), the ratio calculated will divide positive affect score by three times the negative affect score and will be labelled *Mood Ratio*.

Cognitive Impairment

Cognitive impairment was assessed via four items covering four different cognitive functions, namely memory, attention, language, and thinking. The items were as follows: *Over the last 30 days, how often have you experienced: 1) being forgetful 2) difficulties to focus 3) difficulties to find your words or express what you meant 4) feeling confused*. The participant answered using a 5-point Likert-type response format. One overall score was calculated by averaging the four answers.

Loneliness

To measure the isolation P-E fit, participants filled in an adapted version of the 6-item De Jong Gierveld Loneliness Scale (Gierveld & Van Tilburg, 2006). It presents six statements (e.g., *There are*

enough people I feel close to) for which participants assess the extent to which they describe them from 'yes!' to 'no!' on a 5-point Likert-type response format.

The same authors found an internal consistency (Cronbach's α) ranging from .70 to .76, and a congruent validity with the original test ranging from $r = .93$ to .95. The scale mixes items relating to what has been defined in Section 2.1 as isolation (e.g., *There are many people I can trust completely*) and loneliness (e.g., *I experience a general sense of emptiness*). The scale measured, therefore, a 'non-fit' with the social environment where one's needs and desires regarding social interactions are left unsatisfied. This means that a low score on *Loneliness* reflects good P-E fit. From now on, the variable will be referred to as *Loneliness*.

Privacy Fit

In order to assess the privacy P-E fit – the extent to which one's need for privacy is fulfilled – the concept of privacy was first defined as follows: *Privacy could be defined as the claim of an individual to determine what information about himself or herself should be known by others. Not having enough privacy might occur when someone is too much exposed to others, when others have access to one's information that one would rather not share, or when one wishes to be away from people for a while but cannot fulfil this need.* Participants were then asked: *with this in mind, and for the last 30 days at the station, how do you agree with the following statement?* The statement was: *I had enough privacy.* Participants had to answer using a 5-point Likert-type scale ranging from 'strongly agree' to 'strongly disagree'.

Privacy Regulation

In order to know whether participants adopted certain strategies to regulate their privacy, an open question was asked: *If you feel like having more privacy, how do you fulfil this need? List all strategies used in the previous month. Be as precise as possible, try to include, if it applies, activities you choose, where you go, the way you interact with others, at what moment. For each strategy, indicate the frequency it has been used over the last month.*

For each strategy mentioned, the participant indicated on a 5-point Likert-type response format (once a month, once a week, twice or three times a week, once a day, more than once a day) the frequency of the use. This open question gathered qualitative and quantitative data about one's privacy regulation strategies given the restriction provided by the environment.

Job performance

To assess one's job performance in Antarctica, peer-evaluation has often been used. Such measures can show high degrees of agreement amongst peers of $r = .66$ (Nelson & Gunderson, 1962), and it is considered as a valid measure of job performance in ICEs (Gunderson & Nelson, 1963) and in more

mundane workplaces (Arvey & Murphy, 1998; Furnham & Stringfield, 1998). One of the most used methods for measuring participants' performance has been to ask each winter-over: *With whom would you like to return to the Antarctic?* This peer-ranking has been estimated to be the best index of performance and also the most intelligible for the respondents (Gunderson & Nelson, 1966) and peer-evaluation has been used by several researchers in Antarctica (Biersner & Hogan, 1984; Gunderson, 1974; Nelson & Gunderson, 1962; Palinkas, Gunderson, Johnson, & Holland, 1998; Palinkas et al., 2000; Taylor & McCormick, 1985). However, this peer-nomination measure is not weighted according to the number and frequency of contacts one has with others. If one crew member (e.g., the cook) has daily contacts with every other crew member, he or she will be more likely to appear frequently on winter-overs' lists. On the other hand, if one crew member (e.g., a scientist) does not encounter many other winter-overs, he or she will be less likely to be nominated by many people.

In addition, the item does not specify the criteria one should use to choose amongst those one would like to winter-over with again. It is possible that one male scientist will be nominated by many because he is a nice person, even though he would perform poorly at his job. In such a situation, the measure is not informative of the scientist's job performance but, rather, his popularity. It is important to note that winter-overs experience their interpersonal relations on two different levels. As they are all in Antarctica to perform their own job and work together for the success of their mission, they can be considered as colleagues. But they also share their daily life together, eating, relaxing, and sleeping in the same building. Thus, they are also co-habitants (in some parlances, "flatmates" or "roomies"). With a general item simply asking with whom one wishes to winter-over again, there is no possible control over what one has in mind when thinking about a fellow crew member. Does he or she think about the other as a co-worker or a flatmate? These roles – normally quite distinct in more mundane settings – are less so in an Antarctic station, and such overlaps affect the interpretation of this item.

Roles have been shown to be important in ratings of other personnel in Antarctica. Gunderson (1974) found that personnel from different occupations used different implicit processes when assessing their peers. It had been found that overall adjustment to Antarctic stations could be broken down into three dimensions (or behaviour areas) (Gunderson, 1966). These dimensions, which are generally known as the "three abilities", are *emotional stability* (calm, even tempered, accept authority), *task motivation* (industrious, proficient) and *social compatibility* (friendly, cheerful, popular)(Gunderson, 1974) . In recent years, some of those terms have been alternatively referred to as task performance, task ability and sociability (Butters, 2017; Chen, Wu, Li, Zhang, & Xu, 2016; Pattyn, Hicks, & Marquis, 2017; Suedfeld & Steel, 2000). In the same publication, he found interpersonal characteristics were more important in scientists' evaluation of their peers than for military personnel, while the opposite was true with work-related criteria and confidence in the organisation.

Yet, for the purposes of the present research, what needs to be assessed is only the extent to which one considers his or her co-workers as performing well. Therefore, an adapted version of this item was

used in the present studies: *If you had to organise the next winter-over, whom would you select to be part of the next crew? Based solely on their job performance, rank your colleagues at the station from the most preferred to the least preferred. Please, provide only a ranking of people whom you know well enough to judge their job performance. For each person mentioned, use the scale to indicate how well you know them. Note: You are not asked to rank your colleagues for their likeability or popularity, but only on their job performance.* The participant answered by entering names in the appropriate fields. In addition, the participants assessed how close they are to the evaluated people by answering the following question: *Compared to most people at the station, I know this person...* on a 5-point Likert-type response format ('not at all; not so much; like most other people; well; very well'). The level of acquaintance can be used to weight one's evaluation of someone else.

This method was approved by the Lincoln University Human Ethic Committee (see Appendix A.8).

3.2 Results

Once all winter-overs had left Antarctica, the data were downloaded from Qualtrics and the scores for each variable were computed. Since the interest is not in the effect of objective time (e.g., how people feel in May) but rather in relative time (e.g., how people feel during their second month at the station), and because not every participant arrived in Antarctica at the same time, each winter-over's timeframe was aligned to start with their respective arrival month. As discussed in Section 2.3.4, the increasing darkness of the austral autumn and the complete darkness of winter can affect winter-overs. Because not all participants' first month is the same, no specific time of the year can be attributed to each month. As a result, if the average of one variable shows a variation over time, this variation is not likely to be due to the natural light conditions or a specific moment of the year but more likely to human reaction to the environment after a certain time spent there.

Because some participants failed to fill in their monthly survey despite the reminder, almost all months had missing data. The number of responses for each month can be seen in Table 3.

Table 3. Number of participants (n) who filled in their survey after each month spent in Antarctica

	months												
	1	2	3	4	5	6	7	8	9	10	11	12	13
n	7	13	10	12	12	12	12	14	12	11	10	9	2

Only two participants filled in a survey after 13 months of stay. Therefore, only the first 12 months of each participant were taken into consideration for analyses. Out of the 14 participants, one Chinese and one US-American participant were the only winter-overs at their respective station to take part in the study. As a result, the peer-nomination method to assess job performance did not occur. Other participants repeatedly commented that they found it too difficult to assess their colleagues. This was

because either they did not feel comfortable about rating them, they found it hard to assess colleagues they hardly see at work, they found it too difficult to separate their colleagues' personality from their work ability, or some combination of these reasons. Therefore, the numerous missing data on that measure led to it being dropped from the analyses, which left no measure of *Job Performance*.

Measures' reliability

The internal consistency of the scales used in this first study are present in Table 4, Table 5 and Table 6 below. Because one participant filled in the pre-winter-over questionnaire but none of the monthly surveys, the sample size varies from 14 to 15. While most of the measures are already validated scales, they have usually been validated for a given language or for different languages separately. Because the present sample is an aggregate of data from surveys in three different languages (Chinese, English and German) and surveys were filled in by some participants in a language that is not their first language, the internal consistency of all measures is given below.

Table 4. Internal consistency for the scales used before the winter-over

variable	# of items	Cronbach's α
Need for Affiliation	10	.456
Need for Intimacy	10	.826
Need for Privacy	12	.440
Extraversion	8	.640
Agreeableness	9	.725

Note: all n = 15

With Cronbach's α above the threshold of .70, *Agreeableness* and the *Need for Intimacy* have good internal consistency. However, *Extraversion* appears as just acceptable while the *Need for Affiliation* and *Need for Privacy* do not present an acceptable internal consistency. It is worth noting that those scales had been validated in English and/or German. They were, however, translated in order to have an English, German and Chinese version of each. Those scales have not necessarily been validated in those languages. In addition, Norwegian participants have filled in the surveys in English which, though being fluently spoken, is not their first language. Finally, it is possible that the concept of 'affiliation' and 'privacy' might be culturally sensitive, creating divergence in the way participants, of different cultures, understood the items and responded to them.

Table 5. Internal consistency for scales used as repeated measures. Cronbach's alphas are given for each month

Variable	# of items	Cronbach's α per month											
		1	2	3	4	5	6	7	8	9	10	11	12
Loneliness	6	.797	.488	.702	.672	.704	.798	.832	.774	.796	.885	.705	.844
Job Satisfaction	4	.932	.919	.953	.956	.768	.840	.869	.843	.696	.944	.955	.894
Sleep Disturbance	3	.850	.584	.687	.786	.859	.879	.788	.806	.871	.866	.948	.900
Cognitive Impairment	4	.692	.793	.837	.867	.716	.900	.954	.936	.961	.964	.933	.792

Some reliability scores seem to fluctuate greatly over time. It could be that the attention paid to some items is not equal throughout the winter, suggesting that participants are less accurate in answering the same item at different times of their stay. In addition, it could be that some dimensions of the measured constructs fluctuate differently over time. For instance, it is possible that within the cognitive impairment measurement, participants reported no change of their ability to focus but a decrease of their ability to find words to express themselves.

Table 6. Mean internal consistency for scales used as repeated measures (mean of the 12 months)

Variable	# of items	Cronbach's α	
		Mean	Standard deviation
Loneliness	6	.750	.105
Job Satisfaction	4	.881	.082
Sleep Disturbance	3	.819	.100
Cognitive Impairment	4	.862	.096

With mean Cronbach's α above .70, the internal consistency of all four measures (*Loneliness*, *Job Satisfaction*, *Sleep Disturbance* and *Cognitive Impairment*) is deemed good.

3.2.2 Analysis

Two distinct methods could have been used to analyse the data with regard to the hypotheses. First, *averaging correlations* consists of calculating, for each month, the correlations of two variables of interest. This method results in 12 correlations (one per month) that are averaged to have one value reflecting the overall relationship between the two variables across time. The second method consists of *correlating averages*. Here, for each month, the average values of two variables of interest are calculated. This method results in 12 averages per variable (one per month) that can then be correlated across the 12 months. It has been demonstrated that averaging correlations is more reliable and less biased than correlating averages (Bittner, Dunlap, & Jones, 1982; Dunlap, Jones, & Bittner, 1983). For

this reason, the data in this study were analysed using the averaging correlations method.¹ However, while averaging correlations appears to be the best option, it has been found that averaging raw correlations produces greater bias than averaging Fisher' z-transformed correlations (Silver & Dunlap, 1987). The advantage of the latter method appears to be even greater when the sample size is small (Corey, Dunlap, & Burke, 1998)².

For each month, the Spearman correlation between two variables of interest was calculated. The non-parametric Spearman correlations were chosen over the parametric Pearson correlations because the small sample size made it difficult to test for the normality of the data, which is assumed by Pearson correlations. For each pair of variables of interest, 12 Spearman correlations (one per month) were obtained. Once the 12 Spearman correlations between two variables of interest were computed, they were converted using the Fisher's z transformation. The average and standard deviation of those z scores were then obtained. Both the average and the standard deviation have been back-transformed to be expressed as correlation coefficients, thus making it easier to assess the effect size. That average was then tested against zero using a t-test to find out if the averaged correlation is significant.

Because the testing of the model required 18 individual correlations, a Bonferroni correction was required to reduce the chance of a Type I error (false positive). As a result, the level of significance is divided by 18, and all the p-values presented in section 3.2.3 and 3.2.4 should be compared to a p-value of .003125 for determining significance at the $p < .05$ level.

3.2.3 Predicting P-E fits

Due to the small sample size, it was not possible to test for the moderation effect of *Agreeableness* and *Extraversion* on the relationship between the three needs and the two measures of P-E fit. Hence, the two personality traits were taken as simple predictors of *Loneliness* and *Privacy Fit*. Both personality traits were expected to have a negative relationship with both *Loneliness* and *Privacy Fit*. Also, because the measure of *Privacy Regulation* was an open-ended question and not a quantitative measure, only a descriptive analysis has been conducted. First, the extent to which both P-E fits (*Loneliness* and *Privacy Fit*) were predicted by the pre-winter-over measures was examined. Table 7 shows the descriptive statistics of those predictors.

¹ A Monte Carlo simulation was conducted and demonstrated that specifically for the present data format, averaging correlations is also the best method for the specific data in the present study (see Appendix A.9).

² A Monte Carlo simulation was conducted and demonstrated that the average of Fisher's z back-transformed correlations was more accurate than the average of raw correlations (see Appendix A.10).

Table 7. Descriptive statistics of the variables measured before the winter-over (Need for Affiliation, Need for Intimacy, Need for Privacy, Agreeableness and Extraversion) and the two measures of P-E fit (Loneliness and Privacy Fit)

	Mean	Standard deviation	Minimum	Maximum	Scale
Need for Affiliation	2.91	0.36	2.20	3.40	1-5
Need for Intimacy	2.76	0.69	1.50	3.90	1-5
Need for Privacy	6.71	1.82	3.00	9.00	0-12
Agreeableness	3.85	0.52	3.11	4.89	1-5
Extraversion	3.20	0.48	2.38	3.88	1-5
Loneliness	2.20	0.50	1.29	3.35	1-5
Privacy Fit	4.16	0.58	2.82	4.86	1-5

Note: all n = 14

On the three scales measuring the needs (for affiliation, intimacy and privacy) and *Extraversion*, the participants' mean scores appear as expected by being relatively central. *Need for Privacy* presents a much greater standard deviation when compared to the other measures. This could be the result of the concept of 'privacy' differing greatly in meaning and importance depending on one's culture. However, regarding their P-E fit measures, the participants tend to be closer to the lower part of the scale on *Loneliness* and closer to the upper part of the scale on *Privacy Fit*. Regarding *Agreeableness*, the participants' means tended to be nearer the high end of the scale. Table 8 shows the correlations between the two measures of P-E fit and their respective predictors.

Table 8. Back-transformed Spearman correlations after a Fisher's z transformation between Loneliness and Privacy Fit, and their respective predictors

		Need for Affiliation	Need for Intimacy	Need for Privacy	Agreeableness	Extraversion
Loneliness	r_s	.252	.052		-.228	.278
	r_s^2	.064	.003		.052	.077
	t value	4.85	0.67		3.52	7.45
	p-value (1-tailed)	< .001	.258		.002	< .001
Privacy Fit	r_s		-.319	-.129	-.008	-.223
	r_s^2		.102	.017	<.001	.050
	t value		3.57	2.25	0.10	2.86
	p-value (1-tailed)		.002	.023	.461	.008

Note: all df = 11. Corrected α = .003125 for determining significance at the $p < .05$ level

As expected, *Loneliness* positively correlated with the *Need for Affiliation* and negatively correlated with *Agreeableness*. However, *Loneliness* and the *Need for Intimacy* were not significantly correlated. Moreover, *Loneliness* was positively correlated with *Extraversion* while a negative relationship was expected. As predicted, the *Privacy Fit* did negatively correlate with the *Need for Intimacy*. However, there was no significant correlation between *Privacy Fit* and *Need for Privacy*, *Agreeableness*, and *Extraversion*. It is noteworthy that, though some expected relationship appear significant, their effect sizes are low.

3.2.4 P-E fits predicting outcome variables

The second step of the analysis consisted of looking at the relationship between the two P-E fit measures and outcome variables relevant for winter-overs, namely *Job Satisfaction*, *Sleep Disturbance*, *Cognitive Impairment* and *Mood Ratio*. Table 9 shows the descriptive statistics for those variables. To obtain the average of any given variables presented here, a mean was calculated for each participant based on the score they obtained each month. Then, a mean of those 14 means has been calculated.

Table 9. Descriptive statistics of Job Satisfaction, Sleep Disturbance and Mood Ratio

	Mean	Standard deviation	Minimum	Maximum	Scale
Job Satisfaction	4.00	0.56	2.89	4.97	1-5
Sleep Disturbance	2.54	0.86	1.12	4.14	1-5
Cognitive Impairment	2.15	0.72	1.04	3.50	1-5
Mood Ratio	0.73	0.35	0.41	1.67	0.07-1.67

Note: all n = 14

It is notable that, on average, the participants' satisfaction with their job tends towards the upper part of the scale while *Sleep Disturbance* and *Cognitive Impairment* are closer to the lower end of the scale. Table 10 shows the correlations between *Loneliness* and the outcome measures.

Table 10. Back-transformed Spearman correlations after a Fisher's z transformation between Loneliness and the relevant outcome variables

Correlations between <i>Loneliness</i> and				
	Job Satisfaction	Sleep Disturbance	Cognitive Impairment	Mood Ratio
r_s	-.487	.219	.486	-.468
r_s^2	.237	.048	.236	.219
t value	10.13	2.40	4.75	6.52
p-value (1-tailed)	< .001	.018	< .001	< .001

Note: all df = 11. Corrected α = .003125 for determining significance at the $p < .05$ level

As predicted, *Loneliness* positively correlated with *Cognitive Impairment* and negatively with *Job Satisfaction* and *Mood Ratio*. Their associated effect sizes, however, appear as low. Also, no significant correlation was found between *Loneliness* and *Sleep Disturbance*.

Table 11 presents the correlations between *Privacy Fit* and the outcome measures.

Table 11. Back-transformed Spearman correlations after a Fisher's z transformation between the Privacy Fit and the relevant outcome variables

Correlations between <i>Privacy Fit</i> and				
	Job Satisfaction	Sleep Disturbance	Cognitive Impairment	Mood Ratio
r_s	.190	.404	.208	-.040
r_s^2	.036	.163	.043	.002
t value	2.81	4.44	2.75	.469
p-value (1-tailed)	.009	< .001	.009	.324

Note: all df = 11. Corrected α = .003125 for determining significance at the $p < .05$ level

Contrary to expectation, a significant positive correlation has been found between *Privacy Fit* and *Sleep Disturbance* with a small effect size. No significant correlation was found between *Privacy Fit* and *Job Satisfaction*, *Cognitive Impairment*, and *Mood Ratio*.

3.2.5 Privacy Regulation

Because little is known about the types of strategies people adopt when needing more privacy in an ICE, no existing scale could have been used to quantify each individual's approach to restoring one's privacy. As a result, open-ended questions were asked and, though the answers format prevents them

from being tested in the model, a description of the general types of response is given below. An initial analysis revealed two dimensions in the responses; location and activity. For this reason, each response has been described on those two dimensions. Locations are listed in Table 12 while activities are listed in Table 13.

Because participants reported, for each regulation strategy, how many times a month they used such a strategy, the mean and standard deviation of those reported occurrences are also reported here. However, while three response options give a clear number of occurrences for a month (*once a month* (1); *once a week* (4) and *once a day* (30)), two others were less precise. It has been decided that the answer ‘2-3 times’ a week would be considered as a value of 2.5 per week, therefore coded as 10 a month. Finally, the response option of ‘>1 a day’ was considered as twice a day and was given the value of 60 times a month.

Table 12. Descriptive statistics regarding locations mentioned when feeling like having more privacy

Location	# of participants ¹	%	Mean frequency by participant ²	Standard deviation	Mean occurrence per month ³	Standard deviation
Outside the station	11	91.7	3.3	3.20	15.8	14.9
Private room	10	83.3	5.8	4.18	20.5	17.5
Working facility	6	50.0	2.3	3.32	25.2	21.1
Gym	6	50.0	1.3	1.96	21.3	15.7
Other station ⁴	1	8.3	0.5	1.73	4.0	0.0
Greenhouse ⁵	1	8.3	0.1	0.29	4	-
Quiet area	1	8.3	0.1	0.29	30	-

Note: n = 12

¹ number of participants who reported each location at least once

² mean of number of times each location is mentioned per participants

³ mean number of times per month each location is used when feeling like having more privacy

⁴ some winter-overs at Scott Base reported going to the neighbouring station (McMurdo station)

⁵ it is worth noting that not all stations have a greenhouse, making this location only available for some participants

While *Outside the station* is the location reported by the greatest number of participants, going to one’s *Private room* is the most frequently reported location. Though both *Working facility* and *Gym* are reported by half of the participants, *Working facility* is more frequently reported. Finally, *Other station*, *Greenhouse* and *Quiet area* are each reported by only one participant.

In terms of occurrence of the use of each location for privacy, the *Working facility* ranks first, followed by *Gym* and *Private room*. These are followed by *Outside the station* and, to a lesser degree, *Other station*, and *Greenhouse*. Though *Quiet area* has the highest average occurrence, it was reported only once by one participant, preventing its “average” from being meaningfully compared to those of the other locations.

Table 13. Descriptive statistics regarding activities mentioned when feeling like having more privacy

Activity	# of participants ¹	%	Mean frequency by participant ²	Standard deviation	Mean occurrence per month ³	Standard deviation
Walk	7	58.3	2.7	3.37	14.3	15.2
Read	6	50.0	2.3	3.67	33.0	18.8
Practice sport	4	33.3	1.6	2.68	14.6	10.1
Watch TV	3	25.0	1.7	3.14	8.9	2.4
Listen to music	3	25.0	1.3	3.44	27.1	7.3
Contact family/friends	3	25.0	1.1	2.64	23.7	15.6
Work	3	25.0	0.5	0.90	42.5	19.8
Shut the door	2	16.7	0.7	2.02	38.8	18.9
Creative activity ⁴	2	16.7	0.6	2.02	7.0	3.1
Listen to audio books	1	8.3	0.9	3.18	30	0.0
Go to McMurdo ⁵	1	8.3	0.5	1.73	4.0	0.0
Adjust work/wake time ⁶	1	8.3	0.1	0.29	30.0	-
Go to bed	1	8.3	0.1	0.29	30.0	-
Eat meals alone	1	8.3	0.1	0.29	4.0	-
Support each other	1	8.3	0.1	0.29	-	-
Talk to colleagues	1	8.3	0.1	0.29	30.0	-

Note: n = 12

¹ number of participants who reported each activity at least once

² mean of number of times each activity is mentioned per participants

³ mean number of times per month each activity is used when feeling like having more privacy

⁴ includes drawing, knitting, painting and sewing

⁵ reported by a participant at Scott Base, about 3 km from the neighbouring McMurdo station

⁶ refers to adjusting one's sleep/wake cycle or working schedule in order to avoid the presence of others

Walking is the activity reported at the highest frequency and by most of participants when they need more privacy. Also common and frequently reported are *Read* and *Practice sport*. The activities *Watch TV*, *Listen to music* and *Contact family/friends* are each reported by three participants which is more frequently than *Work*. *Shut the door* and *Creative activity*, both reported by two participants. Finally, *Listen to audio books*, *Go to McMurdo*, *Adjust work/wake time*, *Go to bed*, *Eat meals alone*, *Support each other* and *Talk to colleagues* are each reported by only one participant.

Amongst the activities mentioned by at least two participants, *Work* is the most frequently used activity to have some privacy. Ranking second and third are *Shut the door* and *Read*. Then comes *Listen to music*, *Contact family/friends*, *Practice sport*, *Walk*, *Watch TV* and *Creative activity*. Though *Adjust work/wake time*, *Go to bed* and *Talk to colleagues* were each reported as being used once a day, they have each been reported only once and by only one participant. *Eat meals alone* was reported once by one participant and reported as being used once a week. Finally, *Support each other* was not given any frequency of occurrence by the participant who reported it.

3.2.6 Other notable findings

Although not the direct focus of the hypotheses, the study did yield some interesting results that are worth mentioning. These are described in this section.

We know that adaptation to Antarctic stations is a dynamic process and evidence has shown a variation of important measures (e.g., mood) over time. Because fit measures (*Loneliness* and *Privacy Fit*) and outcome variables (*Job Satisfaction*, *Sleep Disturbance*, *Cognitive Impairment* and *Mood Ratio*) have been measured every month, it is possible to examine them for trends over time. Below are the graphs representing the variations in means over the months spent in Antarctica. The number of participants per month was presented in Table 3.

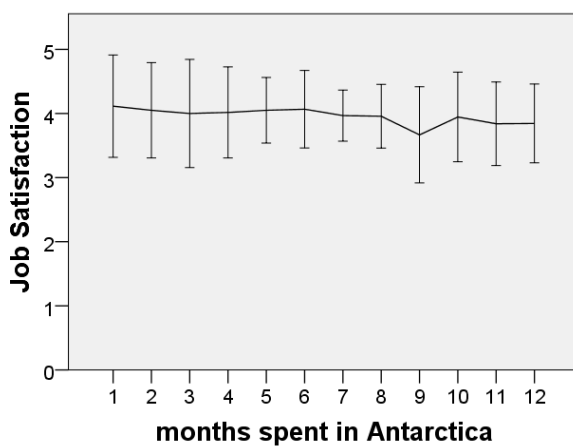


Figure 5. Mean and standard deviation of *Job Satisfaction* score per month spent in Antarctica.

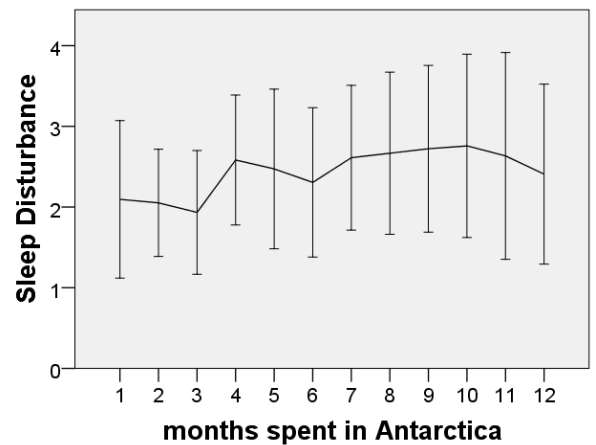


Figure 6. Mean and standard deviation of *Sleep Disturbance* score per month spent in Antarctica.

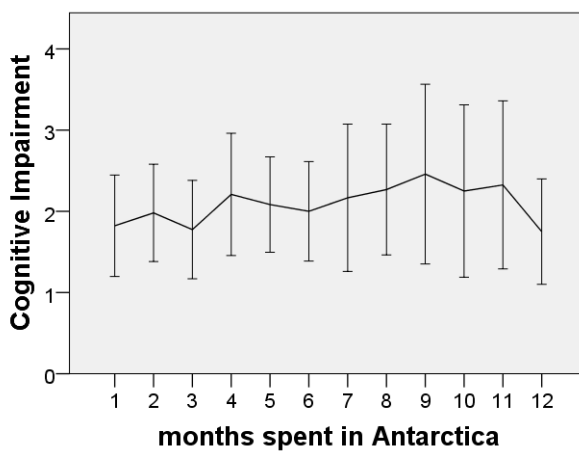


Figure 7. Mean and standard deviation of *Cognitive Impairment* score per month spent in Antarctica.

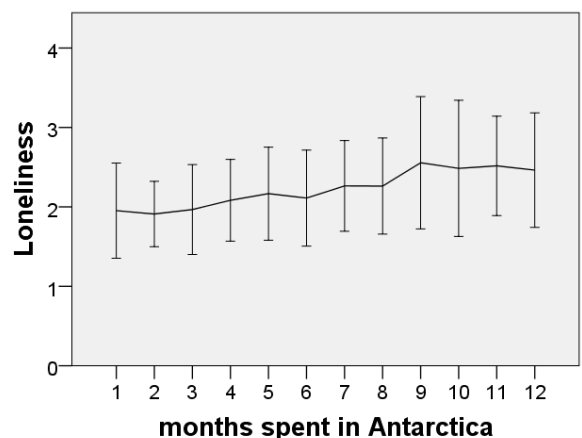


Figure 8. Mean and standard deviation of *Loneliness* score per month spent in Antarctica.

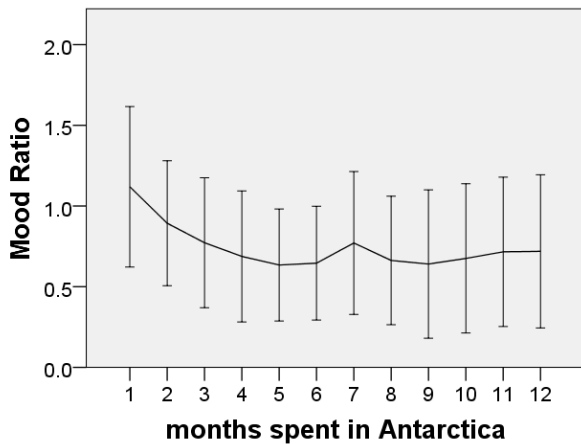


Figure 9. Mean and standard deviation of Mood Ratio per month spent in Antarctica.

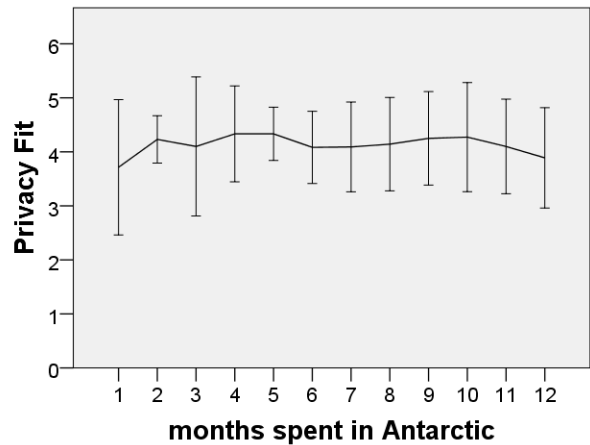


Figure 10. Mean and standard deviation of Privacy Fit score per month spent in Antarctica.

It is noteworthy that, overall, *Sleep Disturbance* (see Figure 6), *Cognitive Impairment* (see Figure 7) and *Loneliness* (see Figure 8) seem to increase over time while *Mood Ratio* (see Figure 9) decreases in the first months and then stabilises. By contrast, *Job Satisfaction* (see Figure 5) and *Privacy Fit* (see Figure 10) remain relatively stable over time. However, none of the variables seem to follow the third-quarter phenomenon, where an increase of negative outcomes and decrease of positive outcome would be expected during the third-quarter of the stay. However, because not all participants stayed the same time in Antarctica, and all their timeframes were aligned on their first month, the third-quarter of each participant's stay cannot be identified on those figures.

3.3 Discussion

Previous studies investigating social and psychological adjustment to ICEs, and more specifically in Antarctica, have often focussed on personality. The dominant approach was to measure personality traits, as well as using demographic information, to predict how well a person would adjust to life in an Antarctic station. However, despite a wealth of research spanning decades, no obvious characteristics have emerged with strong predictive power. More importantly, due to the nature of the paradigm used, it is difficult to know the extent to which those results can generalise to other ICEs. In addition, if one finds that extraversion predicts adjustment, there is no clear explanation as to what features of the environment makes an extraverted orientation better suited to life there. As a result, as alterations are made to the physical space and provision of comfort and facilities (e.g., introduction of access to the internet, change of the furniture, diet, etc.), there is the need to constantly make sure that this correlation still exists.

For those reasons, the present study proposed a new approach for the variables of interest; i.e., considering an Antarctic station as a workplace and taking into consideration the defining characteristics of this environment. Rather than trying to directly link some personal characteristics to

some outcome variables, the present approach first created a model based on an organisational psychology theory; the Person-Environment fit (P-E fit). This approach considers the interaction between the individual and the environment as the core of the prediction with individual characteristics predicting the interaction and the interaction itself predicting the outcome variables. Here, the individual and the environment are considered as one coherent unit of analysis. The only research having used this theoretical approach in an Antarctic station was published by Sarris (2006, 2007); Sarris and Kirby (2005, 2007). Specifically, they looked at the fit between a person's values and the station's values. These fits were strongly related to other measures of adjustment such as overall satisfaction and group cohesion, making it a promising approach.

In the present study, instead of considering the station's values, the focus was on the socio-physical characteristics that make an ICE challenging. An ICE is defined by its isolation and confinement, and those characteristics are the two main aspects that have been regarded as being the most challenging by winter-overs (Godwin, 1986; McCormick et al., 1985). Those aspects have also been mentioned more recently as being crucial in the role they play in triggering undesirable outcomes (Mehta & Chugh, 2011; Pattyn, Mairesse, et al., 2017). For this reason, isolation and confinement became the core of the proposed theoretical model. The fit between one's need for affiliation and intimacy, and the perceived isolation, and the fit between one's need for privacy and intimacy, and the perceived lack of privacy was assessed. The P-E fit theory predicts that the degree to which the needs fit with the relevant socio-physical features of the ICE will be related to how well an individual will adjust to the environment. Adjustment in Antarctica is characterised by many aspects. The winter-over syndrome being a commonly observed set of negative symptoms (negative mood, sleep disturbance and cognitive impairment), aspects of adjustment associated with it have been included in the study just described. With the decision to adopt an organisational psychology approach, measures that would traditionally be used in a workplace setting were also included; namely, job satisfaction and job performance.

However, the peer-nomination method used to assess job performance was unsuccessful. First, as already mentioned, two participants were the only personnel at their respective stations to take part in the study. As a result, none of their fellow crew members provided a measure of their job performance. Amongst the other participants, some explicitly refused to nominate any of their fellow crew members. Some explained that it was difficult to objectively assess their colleagues' performance without being biased by their personality. This could also reflect a tendency to avoid explicit judgement of others in a confined environment where maintaining a certain group cohesiveness might be a priority and where an individual who is perceived as a threat to the group harmony might be ostracised. Paty, Rosnet, and Bachelard (2005) showed that minor conflicts or rumours are made more salient and take bigger proportion due to the close proximity and where any silence or absence from a social event is a communication to the rest of the crew. However, the idea that crew members are

aware of this and would choose not to report any explicit judgments of others is speculation. More research would be needed to investigate the effect of confinement on individuals' willingness to express judgements.

3.3.1 P-E fits predicting outcome variables

Isolation P-E fit

Findings from the first study support the hypothesis that the fit between one's need for social contact and an environment's lack of opportunities for social contacts predicts, to a certain extent, one's adjustment to this same environment. More specifically, someone who has a low need for social contact would be a better fit in an isolated workplace like an Antarctic station that offers limited contacts with friends and family. As a result, that person would experience better cognitive ability, better mood and higher job satisfaction, as opposed to someone with a high need for social contact. This is in line with the idea that when one struggles to adjust to an environment, it has negative consequences, the most common consequences in Antarctica being the winter-over syndrome. The results support the idea that when one's characteristics match environmental attributes, residing in such an environment is easier. However, the study failed to suggest a relationship between one's isolation P-E fit and one's sleep quality. This may be because of environmental factors such as constant darkness or the low temperatures greatly impacting on one's sleep. Compared to those factors, the social adjustment is only a small contributor and more fine-tuned measures or a greater sample would be required to actually observe it.

Privacy P-E fit

Privacy fit was expected to predict *Job Satisfaction* and the symptoms of the winter-over syndrome. However, it only positively correlated with *Sleep Disturbance* while this relationship was expected to be negative. This surprising result suggests that one who is a good fit with the level of privacy offered by an ICE would have greater sleep disturbance. One explanation for this could be that people who feel like they already have enough privacy (high score on *Privacy Fit*) do not adopt strategies to ensure a certain level of privacy (e.g., closing the bedroom's door) and might create an environment that is not ideal for a restorative sleep. By contrast, someone who does not have enough privacy might adopt a behaviour that insures more privacy (e.g., not falling asleep in a social area) and, as a result, would create better sleep conditions.

In addition, a relationship between Privacy P-E Fit and job satisfaction, cognitive impairment, and mood failed to be supported. Those unexpected findings could originate from an incorrect assumption regarding the measure used in the study. While a low score on the *Loneliness* scale reflected a positive state regarding the lack of social contact, and a high score was an explicit expression of maladjustment

with that same restriction, the same bipolarity of the *Privacy Fit* scale is not as clear. With the question being '*do you have enough privacy?*', it is clear that a low score reflects a negative experience of privacy. However, a high score would not necessarily be an indicator of a positive experience. One could have, for example, too much privacy and wish that one would come across more people on a daily basis. Here, the sense of isolation would be so strong that one would rather have less privacy in order to be surrounded by more individuals. This double-interpretation of a high privacy fit score could explain the unexpected results. This problem is further addressed in Section 5.2.2. A better measure could include a bipolar scale with the optimum level of privacy in the middle. Because winter-overs have reported the lack of privacy as being an undesirable feature of an ICE, it should still be considered as relevant, but, for future research, it may be advisable to use a scale that would allow measurement of the wider range of privacy desirability.

3.3.2 Predicting P-E fit

Isolation P-E fit

It is one thing to know that a person's social fit is related to other relevant outcomes of interest, but it is essential to be able to predict such fit before someone is deployed. In this regard, the study provides support for the proposed model. It is suggested that isolation P-E fit, which combines one's social needs and the social affordance, can be predicted with one's need for affiliation, agreeableness and extraversion. Since the need for affiliation is the need for creating superficial contacts with surrounding people, it is a natural predictor of this fit. Even though social related personality traits could not have been tested as moderators, they seem to have a direct relationship with social fit. There are thus ways to predict, during the recruitment process, who will have a good social fit in an ICE. This finding needs to be considered cautiously, however. The effect sizes for those three correlations were fairly small, suggesting that the relationship that ties those variables together is weak. In addition, the need for intimacy was not found to be related to the isolation P-E fit. This could be because the need for intimacy is concerned with the quality and closeness of relationships. Given that an ICE forces people to live in small communities, it can still provide the opportunity to be close to some people but more generally frustrates the need to interact with many different people (need for affiliation). It could be that, despite the limited number of people with whom one could potentially closely bond, one still manages to find individuals suitable to fulfilling this need.

Privacy P-E fit

The data also support the idea that it is possible to predict a person's privacy fit using scales measuring the need for intimacy. Here, it is assumed that someone with a high need for intimacy might be frustrated in an environment that offers little opportunity for privacy, as it might be more difficult

to develop deeper relationships without the opportunity to get away from the rest of the group and have intimate conversations and other, similar behaviours. However, neither the need for privacy, agreeableness nor extraversion seem to predict one's privacy P-E fit. Once again, this surprising result may be explained by the way *Privacy Fit* was measured. As discussed above, the measure did not allow a distinction between those participants who had just the right level of privacy and those who had too much privacy. A discussion on the results regarding the privacy regulation strategies is given in Section 5.1.5.

3.3.3 Strengths and weaknesses of Study 1

The strength of the P-E fit approach is that it allows for a more in-depth understanding of human adaptation to specific environments. With a traditional approach consisting of measuring one's personality and demographics and correlating them with on-site outcomes, the findings are limited to the specific environment used in the study. For instance, if one found a positive correlation between extraversion and adaptation to the Japanese station of Showa in 1982, it is difficult to know the extent to which one could recommend hiring extraverted individuals for a Norwegian station in 2017, or an extraverted international crew for a long-term space flight. Such a finding would require constant updating to check its relevance in a station after the introduction of the Internet, the change of the colour of walls, or newly introduced private bathrooms. This is because one does not know what, in the 1982 Showa station, made extraverted winter-overs adapt better. On the other hand, as found in the present study, if one's fit with the environment is related to the most concerning outcomes, knowing how an environment is different should be enough to know how one's fit will be. Typically, if one station introduces the Internet, it should be enough to assess the extent to which this impacts on the perception of isolation and privacy to know the extent to which a fit with those aspects will be important. If it is reported that contacting significant others and seeing them through Skype on a regular basis highlighted the perceived distance between them, it will be even more important to recruit people who have a low need for affiliation.

Another strength of the present study is its sample. Though a sample size of 14 is small, the participants were in five different stations. The five stations were part of different National Antarctic Programmes and in each of them a different language was spoken and a different culture was expressed. This makes the results even more generalisable to the culturally diverse crews working in Antarctica. As opposed to the vast majority of studies in polar psychology, which usually focus on one station or several stations within the same National Antarctic Programme, the present results are based on people from around the world. One can thus be confident that these findings are not specific to a given nationality. In addition, because five stations were involved, one also knows that the findings are not specific to the features of one specific station but, more likely, reflect a general human

adaptation to Antarctic stations. However, one has to be cautious when generalising this first study to different cultures. This would be assuming that the participants are representative of their own culture which, given the small representation of each station, is unlikely.

However, one limitation of this study is that the results are based on data gathered in 2016. Present Antarctic stations are different from the ones in the 1950's and most probably different from what they will be in 2050. Since the predictors to ICEs are meant to be part of a general theoretical model, the model should be equally valid if tested 20 years ago or 20 years from now. For this reason, it was decided to conduct a second study, this time, having former winter-overs as participants.

Chapter 4: Study 2

Antarctic stations have changed over time, in terms of design, technology, materials, level of resources, and facilities, so it is important to base conclusions not only on one study fixed in time but, also, to consider data that inform about the validity of the proposed model over time. While the results of Study 1 were promising, they were limited to reflect the reality of the 2016 winter-over. With the intention to generalise the results as much as possible, it was obvious that the study had to be replicated with a broader and more general sample, with winter-over experience spanning several decades. Study 2 aims at filling this gap. However, collecting longitudinal data over the years would be impractical with the means of the present research. For this reason, it was decided to collect data from past years, recruiting former winter-overs.

However, because Study 2's participants are former winter-overs, and their data are based on recollection, it poses an obvious problem when it comes to testing one part of the model. The individual's needs and personality traits are meant to be measured before the winter-over experience. Yet, it is known that personality traits can change over time (Roberts, Walton, & Viechtbauer, 2006). Also, life experience can change one's social needs. For instance, it has been found that after a 6-week expedition in Greenland, expeditioners reported higher ability to enjoy isolation, control emotions and live in crowded circumstances (Stott & Hall, 2003). Thus, one's need for affiliation could appear higher before a winter-over, as they would later learn to appreciate the isolation. We understand that the social needs and personality traits, as measured today, can hardly retroactively "predict" one's fit in an Antarctic station 50 years ago. Because of the nature of the data collected in Study 2, the first part of the model regarding the needs and personality and their relation to the fits is not expected to be well tested here. However, for the sake of consistency, as much of the whole model as possible is being tested.

4.1 Method

4.1.1 Participants

Recruitment

In order to recruit former winter-overs, an email message (see Appendix B.1) was sent to different organisations, clubs, and societies associated with Antarctica. Attached to this email was a complete advertisement for the study (see Appendix B.2) and a short advertisement (see Appendix B.3), both giving a link to the online Qualtrics survey. Six organisations either declined to forward the messages to their members, redirected the researcher toward what they felt was a more appropriate organisation, or simply never replied. Six other groups, however, agreed to advertise the study to their

members (Australian National Antarctic Research Expeditions (ANARE) club, the British Antarctic Survey Club, the UK Polar Network, the Association of Polar Early Career Scientists (APECS) and the Facebook groups 'I've been to Antarctica' and 'Old Antarctic explorers'). It was expected that amongst their members there would be some who would have wintered-over at least once in Antarctica. In addition, the study was advertised by word of mouth and forwarded by individuals on social media such as Facebook and Twitter. Because only one link to the survey has been used across different media, it is impossible to know how each participant has been informed of the study. Participants coming through one medium might be markedly different from members of another organisation. For instance, participants coming from APECS would likely be younger and more international than participants recruited via the 'Old Antarctic explorers' Facebook page. The description of the demographic indicates in which way the sample might be skewed.

Sample

Of the 66 individuals who started the survey, seven participants (all males) did not provide any information about their experience in Antarctica. These have been excluded from the analysis. Out of the 59 remaining participants, a further 7 failed to respond to some items. However, because they still provided relevant information about some of their experience, they were included in the data set. For this reason, the number of participants in the following analyses range from 52 to 59.

There were 15 females and 44 males in the final data set. Fifty-six provided information that allowed the calculation of a mean age (56.3 years; $SD = 14.2$; ranging from 23 to 81 years old). This group had an average age of 33.4 years ($SD = 9.4$; minimum = 19 years; maximum = 59 years) at the time of their last winter-over deployment. Fifty-seven participants indicated the location of their last station. These encompassed 16 different stations from 8 different National Antarctic Programmes (Australia, France, Germany, India, New Zealand, United Kingdom, United States and Uruguay), with year of winter-over ranging from 1957 to 2016. The number of participants per station is shown in Table 14.

Table 14. Number of participants per Antarctic station and the country of their associated National Antarctic Programme

Country	Station	N
	Casey	1
Australia	Davis	7
	Wilkes ¹	1
France	Dumont D'Urville	2
Germany	Neumayer III	1
India	Maitri	1
New Zealand	Scott Base	2
United Kingdom	King Edward Point ²	1
	Rothera	1
	Amundsen-Scott	11
	Byrd ¹	1
United States	McMurdo	21
	Palmer	3
	Plateau ¹	1
	Siple ¹	1
Uruguay	Artigas	1
	<i>Unspecified</i>	2
TOTAL		59

¹ no longer operational as for 2016-2017

² located on South Georgia Island, north of the 60th parallel south, not included in COMNAP's (2016) stations list and the map on Figure 1.

4.1.2 Measures

The two surveys used in Study 1 (see Sections 3.1.3 and 3.1.4 and Appendices A.5 and A.7) were combined into a single form for this study, and questions were modified appropriately to refer to past experiences. Participants were asked to fill in the demographic, personality, needs and motivations questions, as well as questions regarding to their experience in the Antarctic. However, for the latter questions, the instructions that were, in Study 1, as follows: 'Over the last 30 days' were changed into 'during your last winter-over'. Since there were no repeated measures for Study 2, participants were asked to answer the questions relatively to their overall experience of their last winter-over. Thus, questions concerning sleep or cognitive impairment, job satisfaction, isolation and privacy were asked only once.

The only exception to this was the question asking participants to report their mood. The participants were asked to recall their mood for each quarter of their stay and, finally, their mood for their overall experience. They were instructed that if they found it difficult to break down their mood into the four quarter of their stay, they could go directly to the question concerning their overall mood. Also, since it was impossible to ask for peer-evaluation of job performance, this measure was omitted.

This method was approved by the Lincoln University Human Ethic Committee (see Appendix B.4)

4.2 Results

4.2.1 Analysis

In order to test the model, a path analysis was conducted using SPSS AMOS 24.0.0. Because not all surveys had been completely filled in, Table 15 shows the number of missing values for each variable.

Table 15. Number of full entries and missing values for each variable, as well as the percentage those missing values represent of the total number of participants

Variable	# of full entries	Missing count	Missing percent
Need for Affiliation	57	2	3.4
Need for Intimacy	57	2	3.4
Need for Privacy	56	3	5.1
Agreeableness	55	4	6.8
Extraversion	55	4	6.8
Loneliness	59	0	0
Privacy Fit	57	2	3.4
Job Satisfaction	59	0	0
Sleep Disturbance	59	0	0
Cognitive Impairment	59	0	0
Mood Ratio	56	3	5.1

Note: total n = 59

Because the percentage of missing value for each variables is relatively low, means and intercepts have been estimated when needed without too much risk of biasing the results. However, because of the small sample size, it is acknowledged that the path analysis is underpowered and, therefore, caution is advised when interpreting the results. In addition, because of the small sample size, and the resulting few participants representing each decade, it was not possible to control for the year or decade of the last winter-over experience. Even though it might be that the time at which one last wintered-over might have an effect on the results, it will not be tested in the present study.

Measures' reliability

The internal consistency values of the scales used in this second study are presented in Table 16, below.

Table 16. Internal consistency for each scale, their total number of items and the number of respondents

Variable	Number of items	N	Cronbach's α
Need for Affiliation	10	54	.867
Need for Intimacy	10	54	.831
Need for Privacy	12	56	.750
Extraversion	8	51	.723
Agreeableness	9	54	.709
Loneliness	6	59	.755
Job Satisfaction	4	60	.750
Sleep Disturbance	3	59	.844
Cognitive Impairment	4	60	.887

All measures have a Cronbach's alpha over .70, and are therefore considered to have a good level of internal consistency.

4.2.2 Model testing

Because the measure of *Privacy Regulation* was an open-ended question and not quantitative, it could not be included in the model tested by the path analysis. The results of the path analysis are presented in Figure 11, below.

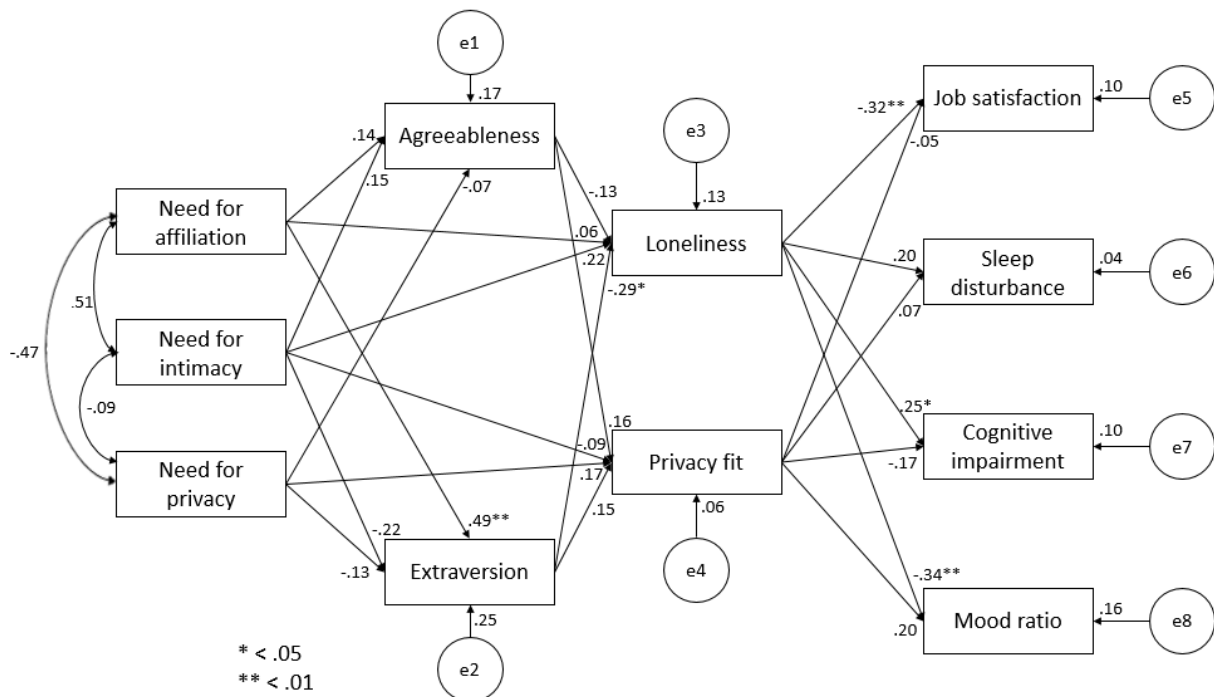


Figure 11. The proposed model, with standardised estimates from the path analysis.

Model fit

The model fit indices are presented in Table 17 below. Because some means and intercepts have been estimated, Goodness of Fit Index (GFI) and Standardised Root Means Square Residual (SRMR) were unable to be calculated, and are, therefore, not reported.

Table 17. Path analysis model fit indices

Model fit indices	values	p-value	df	90% CI
Chi square (CMIN)	36.630	.188	30	
Comparative Fit Index (CFI)	.890			
Tucker Lewis Index (TLI)	.757			
Incremental Fit Index (IFI)	.931			
Normed Fit Index (NFI)	.709			
Root Mean Square Error of Approximation(RMSEA)	.061			<.001 - .121

A full listing of all the results is shown in Table 18 below.

Table 18. Standardised regression coefficients from the path analysis

Predictors	Dependent variables	Standardised coefficient	p-value (1-tailed)
Need for Affiliation	Extraversion	.489	.001
Need for Intimacy	Extraversion	-.215	.062
Need for Privacy	Extraversion	-.127	.175
Need for Affiliation	Agreeableness	.141	.210
Need for Intimacy	Agreeableness	.146	.172
Need for Privacy	Agreeableness	-.067	.329
Extraversion	Loneliness	-.291	.022
Extraversion	Privacy Fit	.148	.146
Agreeableness	Loneliness	-.126	.169
Agreeableness	Privacy Fit	.156	.128
Need for Affiliation	Loneliness	.055	.371
Need for Intimacy	Loneliness	.218	.073
Need for Intimacy	Privacy Fit	-.088	.256
Need for Privacy	Privacy Fit	.173	.110
Loneliness	Job Satisfaction	-.315	.006
Loneliness	Sleep Disturbance	.196	.064
Loneliness	Cognitive Impairment	.253	.022
Loneliness	Mood Ratio	-.341	.003
Privacy Fit	Job Satisfaction	-.050	.346
Privacy Fit	Sleep Disturbance	.066	.307
Privacy Fit	Cognitive Impairment	-.173	.086
Privacy Fit	Mood Ratio	.197	.055

Loneliness

As expected, the *Need for Affiliation* is positively correlated with *Extraversion* which, in turn, has a negative relationship with *Loneliness*. However, the *Need for Affiliation* was not found to be reliably related to *Loneliness*, which argues against the hypothesis that there is a moderator effect of *Extraversion* between *Need for Affiliation* and *Loneliness*. Also in contrast to the predictions, *Agreeableness* was not found to be related to either *Need for Affiliation* nor *Loneliness*. On the other hand, *Loneliness* was found to be negatively related to both *Job Satisfaction* and *Mood Ratio* and positively related to *Cognitive Impairment*. These results agreed with the hypothesised relationships.

Privacy Fit

The data failed to support the part of the model related to *Privacy Fit*. None of the expected predictors (*Need for Intimacy*, *Need for Privacy*, *Extraversion* and *Agreeableness*) were found to have a significant relationship with *Privacy Fit*. In addition, no relationship has been found between *Privacy Fit* and the different outcome measures; *Job Satisfaction*, *Sleep Disturbance*, *Cognitive Impairment* and *Mood Ratio*.

4.2.3 Privacy regulation

Though the privacy regulation measure could not have been included in the path analysis, a summary of the regulations is presented below. In order to analyse what participants do when they feel like having more privacy, the same coding system used in Study 1 (see Section 3.2.5) has been used here. The responses have been coded on two dimensions; location (see Table 19) and activity (see Table 20).

Table 19. Descriptive statistics regarding locations mentioned when feeling like having more privacy

Location	# of participants ¹	% of participants	Mean occurrence per month ²	Standard deviation
Outside the station	24	53.3	9.4	12.7
Private room	16	35.6	16.6	19.0
Working facility	12	26.7	18.9	19.3
Leisure room ³	8	17.8	12	11.7
Greenhouse ⁴	1	2.2	1.0	-
Restricted area	1	2.2	60.0	-
Bathroom	1	2.2	4.0	-
Other station	1	2.2	4.0	-

Note: n = 45

¹ number of participants who reported each location at least once

² mean number of times per month each location is used when feeling like having more privacy

³ includes library, gym, photography darkroom, reading room and music room

⁴ it is worth noting that not all stations have a greenhouse, making this location only available for some participants

The majority of participants reported going *Outside the station* when feeling like having more privacy. Going to one's *Private room* or a *Working facility* are also commonly reported, with more than one quarter of participants reporting them. Then, *Leisure room* is reported by about 18% of participants. Finally, *Greenhouse*, *Restricted area*, *Bathroom* and *Other station* were each mentioned by only one participant.

In term of frequency, amongst the locations chosen by at least two participants when one feels like having more privacy, *Working facility* and *Private room* rank first and second respectively. Then comes *Leisure room* and *Outside the station*. Finally, *Greenhouse*, *Restricted area*, *Bathroom* and *Other station* have each been mentioned by only one participant, making their "average" difficult to compare to more frequently reported locations.

Table 20. Descriptive statistics regarding locations mentioned when feeling like having more privacy

Activity	# of participants ¹	% of participants	Mean occurrence per month ²	Standard deviation
Walk	17	37.8	14.1	18.8
Work	10	22.2	11.1	16.0
Read	8	17.8	17.6	19.0
Watch TV	8	17.8	10.7	9.3
Get isolated bedroom ³	5	11.1	35.7	21.4
Avoid others	4	8.9	31.0	22.9
Shut the door	4	8.9	19.5	27.1
Practice sport	4	8.9	13.5	11.4
Adjust work/wake time ⁴	3	6.7	6.0	3.5
Creative activity ⁵	3	6.7	12.0	12.3
Drink	2	4.4	4.0	0.0
Eat meals alone	2	4.4	15.5	20.5
Avoid social events	2	4.4	1.0	0.0
Shovel snow	2	4.4	20.0	14.1
Study	2	4.4	20.0	14.1
Contact friends/family	2	4.4	17.0	18.4
Listen to music	2	4.4	10.0	-
Avoid eye contact	1	2.2	60.0	-
Spend time with penguins	1	2.2	1.0	-
Camping	1	2.2	1.0	-
Ignore phone calls/emails	1	2.2	4.0	-
Masturbate	1	2.2	1.0	-
Meditate	1	2.2	30.0	-
Talk with colleagues	1	2.2	4.0	-
Use bathroom	1	2.2	60.0	-
Run husky team	1	2.2	10.0	-
Encounter no privacy issue	3	6.7	30.0	-
No way of having privacy	2	4.4	-	-
No particular strategy	2	4.4	-	-
Unclassifiable ⁶	2	4.4	30.0	0.0

Note: n = 45

¹ number of participants who reported each activity at least once

² mean number of times per month each activity is used when feeling like having more privacy

³ get isolated bedroom includes choosing a bedroom that is far for other accommodations and making one's bedroom in another part of the station

⁴ refers to adjusting one's sleep/wake cycle or working schedule in order to avoid the presence of others

⁵ creative activity includes writing, drawing, knitting and developing photographs

⁶ the unclassifiable category encompasses entries that either did not answer the question or that are unintelligible

Going for a *Walk* was by far the most common activity participants engaged in when they felt like they wanted more privacy. This was followed by *Work*, *Read* and *Watch TV*. Other activities worth mentioning include *Get isolated bedroom*, *Avoid others*, *Shut the door*, *Practice sport*, *Adjust work/wake time* and *Creative activity*. Other activities are mentioned by two or fewer participants. It is worth noting that two participants reported not adopting any particular strategy, two mentioned

that it was simply impossible to have any privacy and finally, three reported that they did not experience a lack of privacy.

Considering activities mentioned by at least two participants, *Get isolated bedroom* and *Avoid others* are each reported as being used at least once a day. *Shovel snow* and *Study* are also frequently occurring activities. *Shut the door*, *Read*, *Contact friends/family*, *Eat meals alone* and *Walk* are each reported being used about twice a month by those participants who chose such activities as ways of dealing with the lack of privacy. *Practice sport*, *Creative activity*, *Work*, *Watch TV* and *Listen to music* are used about twice or three times a month. Finally, *Adjust work/wake time*, *Drink* and *Avoid social events* are reported as occurring relatively infrequently. The remaining activities were reported by one person each, and may be idiosyncratic.

4.3 Discussion

The theoretical model proposed in this thesis is sought to be a general model detailing variables that are influential in one's adjustment to an ICE. It is meant to be valid across cultures and broad demographic measures. Theoretically, the model is also independent from any era. It should apply equally to people who winter-over today, and those who wintered-over forty years ago or will experience an ICE in fifty years' time. If those theoretical assumptions are true, the model should stand against a sample of a variety of cultures and winter-over experiences from different decades. The aim of Study 2 was to provide data that would encompass the evolution of Antarctic stations over decades and offer a sample of wide cultural representation.

Study 2 measured participants' current need for affiliation and then asked them to remember their feeling of loneliness in the past. This limited empirical testing to portions of the entire model proposed in this thesis. The needs and personality traits measures as predictors of the two measures of fit cannot be properly tested using the data of Study 2. Although personality traits are very stable aspects of a person, it is possible for life experiences to have an impact on them. It is possible that participants in Study 2 now report a certain need for affiliation, privacy and intimacy that would have been different if the variables had been measured before their last deployment. Since the data for those measures have still been collected, and in the interest of a coherent approach of the model throughout the thesis, all variables had still been included in the analysis. With no surprise, most of the predictor variables have not been found to predict any of the measures of fit. Only *Extraversion* has been found to have a significant positive relationship with *Need for Affiliation* and a negative relationship with *Loneliness*. This suggests a mediation rather than a moderation of extraversion between the need for affiliation and isolation P-E fit. It suggests that individuals with a high need for affiliation tend to be more extraverted and have a better isolation P-E fit in an ICE. But because one's extraversion or need for affiliation might have changed since one's last winter-over, this result is not informative about how

those variables can predict a future winter-over's experience. A discussion on the results regarding the privacy regulation strategies is given in Section 5.1.5.

4.3.1 P-E fits predicting outcomes variables

Isolation P-E fit

Study 2 provides support for a relationship between the isolation P-E fit and all but one aspect of adjustment (sleep disturbance). Since *Loneliness* related to crucial indices of adaptation, it suggests that one's fit with the isolation feature of an environment could be a core aspect of one's adjustment. However, the study failed to find support for a relationship between sleep quality and isolation P-E fit. One reason for this result could be that one's memory regarding sleep quality is less reliable than it is for the other variables. We know that the accuracy of memories can be influenced by the affect attached to the recalled event. For example, emotional events are better recalled than neutral events (Payne, Chambers, & Kensinger, 2012). It is logical that when asked to remember the affect or mood experienced back in Antarctica, participants easily recall the emotional memories even though this recollection is likely to be biased toward positive affect due to the fading affect bias (Walker et al., 2003) discussed in Section 2.5. We know that job satisfaction is related to affective experience in the workplace (Fisher, 2000; Weiss, Nicholas, & Daus, 1999), and so it is reasonable to consider that job satisfaction also benefits from that emotional facilitation in encoding. In the same way, if cognition is impaired, it will be particularly noticeable when in the context of work. The difficulty to focus or feelings of confusion are likely to hinder work and be frustrating. This would generate negative emotions and participants would likely remember those negative memories years later. On the other hand, though sleep difficulties are likely to generate negative emotions as well, this will occur when people are at rest, trying to fall asleep. It is known that in such states of sleepiness, the brain does not work at its full potential and memory is impaired (Harrison & Horne, 2000). In such situations, the memory of sleep difficulties will be less accurate than the memory of other emotion-related events occurring when one is fully awake and not sleepy. To conclude, despite isolation P-E fit failing to predict one's sleep difficulties, it was, as expected, related to several other important outcome variables.

Privacy P-E fit

However, as opposed to the model's prediction, Study 2 failed to suggest a relationship between one's privacy P-E fit and the winter-over syndrome symptoms as well as job satisfaction. While it was expected that the measure of *Privacy Fit* would be positively related to *Job Satisfaction* and *Mood Ratio* and negatively related to *Sleep Disturbance* and *Cognitive Impairment*, no relationship has been found. The most likely reason for such a result is that the measure, more specifically the scale, used in the present study was not appropriate for the construct it was meant to assess. As discussed in Section

5.2.2, it is argued that the scale did not allow participants to report a sense of 'too much' privacy. The limitations of Study 2 are discussed in Chapter 5 below.

Chapter 5: General Discussion

The discussion will first summarise the results from the two studies presented in this thesis, in regard to the proposed theoretical model shown in Figure 12, below. It will then discuss the theoretical contributions of the research, and the implications of the method used in the present studies for the interpretation of the results. Finally, the implications of the results will be discussed, including recommendations for future research.

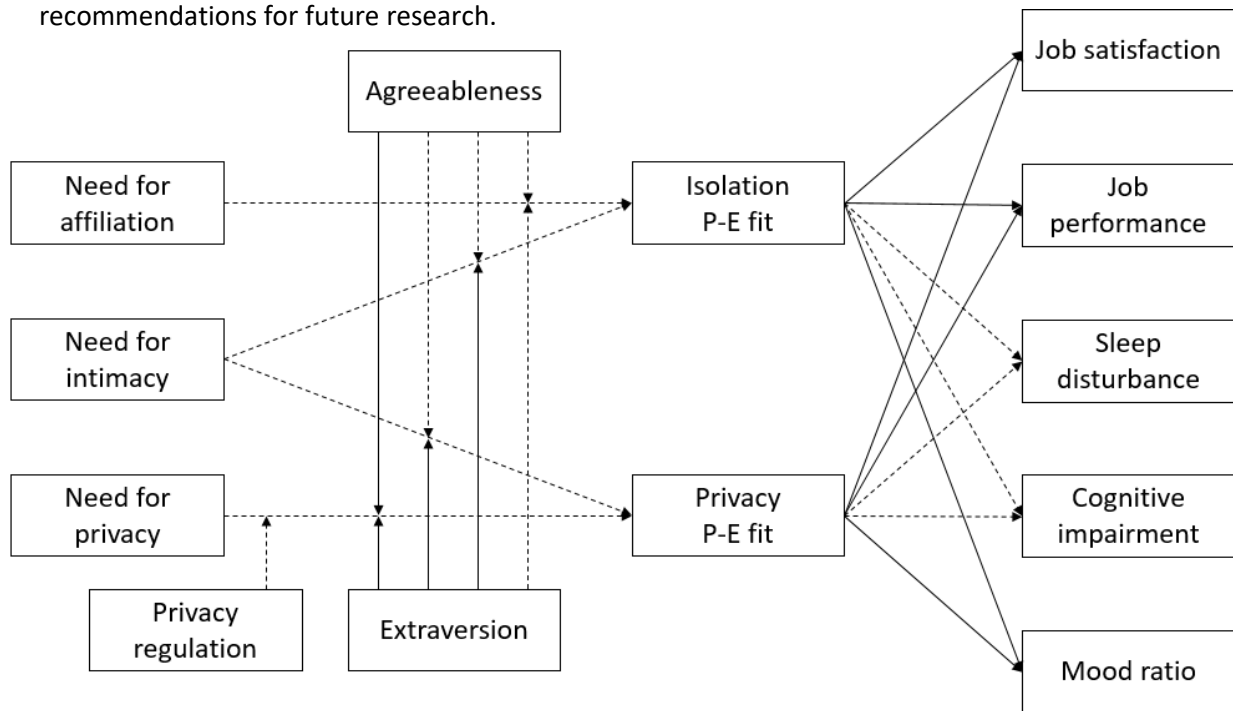


Figure 12. Theoretical model predicting relevant factors of adaptation to ICEs.

The core of the present model is based on the concept of Person-Environment fit (P-E fit). Here, it was proposed that the extent to which one is a good fit with the aspects of isolation and lack of privacy in an ICE is related to different outcomes; specifically, the winter-over syndrome (sleep disturbance, cognitive impairment and increase of negative mood), job performance, and job satisfaction. It was thought that fit, in this instance, could be predicted with measures of one's social needs (needs for affiliation, intimacy and privacy), and that this relationship would be moderated by two personality traits (agreeableness and extraversion) and strategies people use to regulate their privacy.

5.1 Results Summary: Contrasting Study 1 and Study 2

While the model predicted that privacy regulation moderates the relationship between the need for privacy and privacy P-E fit, the data collected regarding privacy regulation could not be included in the model analysis. Also, because of the amount of missing data for job performance in Study 1, this portion of the model was excluded from the analysis. Finally, the nature of Study 2 did not allow peer-

evaluation of respondents on job performance. All other components of the model were subjected to appropriate statistical analyses.

5.1.1 Isolation - outcomes

While winter-overs have reported that being separated from their friends and family was a major stressor during their time on the ice (Bishop et al., 2001; Godwin, 1986), few studies have looked closely at the relationship between isolation and indicators of adjustment. In both Study 1 and Study 2, it has been consistently found that *Loneliness* is negatively related to *Job Satisfaction* and *Mood Ratio*, and positively related to *Cognitive Impairment*. Although the study designs precluded statements about causality, the findings support the idea that perceived isolation, inasmuch as it is one condition for loneliness, is crucial to the nature of a winter-over experience. The results also support previous propositions suggesting that isolation could be partially responsible for the winter-over syndrome (Palinkas, 1992, 2002). However, contrary to expectation, in neither Study 1 nor Study 2 was *Loneliness* found to be related to *Sleep Disturbance*.

5.1.2 Privacy - outcomes

By contrast, while a lack of privacy had been reported by winter-overs as being a major stressor (Godwin, 1986), Study 1 and Study 2 failed to provide conclusive results. Study 1 did find a significant positive correlation between *Privacy Fit* and *Sleep Disturbance* but this finding was not supported by Study 2 which yielded no significant results in regard to privacy. This could be because the data in Study 2 were based on recollection. The memory of the sense of privacy was possibly supplanted by the memory of isolation which may have been more prominent. This may have happened for two reasons.

Antarctic stations are more often depicted as isolated places rather than as confined environments. For example, when advertising for station leader (Australian Antarctic Division, 2013b), medical practitioner (Australian Antarctic Division, 2015a), chef (Australian Antarctic Division, 2013a) or telecommunication (Australian Antarctic Division, 2015b) positions, the Australian Antarctic Division warns about the isolation and remoteness of the advertised workplace as being challenging but with no mention of the confinement and possible lack of privacy. In addition, because feeling lonely might be more expected than feeling crowded, it could be that it is an easier topic to discuss with the fellow winter-overs. No one would be surprised if one shares their difficulties about being separated from their loved ones, but it might be more delicate to discuss problems regarding the excessive proximity experienced with the colleagues. This means that the experience of staying at an Antarctic station is more strongly associated with isolation than confinement. The *spreading activation* model of memory developed by Collins and Loftus (1975) states that the more closely related concepts are, the more one will be activated when the other comes to mind. So, both the general representation of Antarctic

stations as being typically seen as isolated places rather than confined environments, and the relative ease of sharing feelings about isolation as opposed to confinement, might explain why the isolation would be better remembered. Every time former winter-overs would talk about their experience, they might more easily share memories related to the isolation and fewer about the confinement. Over time, the memory of the isolation would be strengthened as opposed to the memory of the lack of privacy they experienced.

We also know that memory can be extremely malleable. For instance, priming individuals with suggested autobiographical events can lead them to affirm that they did experience them, even though they never did (Braun-LaTour, LaTour, Pickrell, & Loftus, 2004; Braun, Ellis, & Loftus, 2002). Simply swapping an indefinite article with a definite article in a question can lead people to believe that, in a given context, they noticed some objects that were not actually there (Loftus & Zanni, 1975). As a result of such influence on one's memory, it is likely that what participants of Study 2 recall has changed over time, and the most common stories, related to the most commonly expected features (isolation), may overshadow a more nuanced and complex experience. When filling in the survey, the participants, especially those who wintered-over some decades ago, might have had better recollection of their feeling of isolation than of their feeling of confinement. This could explain why Study 2 failed to replicate the results observed in Study 1 regarding *Privacy Fit* and *Sleep Disturbance*, while it replicated perfectly the relation between *Loneliness* and the outcome variables.

A complementary explanation concerns the seeming paradox between feeling isolated and crowded at the same time. In an ICE, one is both isolated and confined at the same time. By imposing a limited space in which to live, confinement forces a certain density on the winter-overs. This density, in conjunction with the difficulty to get away from fellow crew members, can be perceived as being greater than is desirable in the ideal living condition. In such conditions, one will feel crowded and might wish to have more privacy from those with whom one has little intimacy. At the same time, one can feel socially isolated from the rest of the world, and especially one's friends and family with whom one shares a closer relationship. However, feeling like escaping the presence of others and feeling like being closer to others might sound incompatible. We know that perceived inconsistencies with one's attitudes (e.g., in favour of both approaching and avoiding) can lead to psychological discomfort, generally described as a state of *cognitive dissonance* (Festinger, 1962). We like to think of ourselves as having beliefs, values and behaviours that are all consistent with one another to perceive ourselves as one coherent individual. If an inconsistency occurs, we might rationalise it in order to reduce this discomfort (Elliot & Devine, 1994). In the case of a winter-over experiencing both a desire to get away from people and a desire to be closer to people at the same time, this might induce a cognitive dissonance that could be solved by overlooking one of the two contradictory desires. In this instance, because the isolation feature of Antarctica is made salient by advertisements and is likely more easily discussed with fellow winter-overs, one might overlook the problem of lack of privacy.

An alternative reason for the poor support to the part of the model relative to privacy could come from the way *Privacy Fit* has been measured. It has been argued that the measure did not allow participants to report a 'too much' privacy (see Section 3.3.2). This explanation is discussed in Discussion 1 and below in Section 5.2.2.

5.1.3 Isolation – predictors

While Study 1 found that one's score of *Loneliness* can be, to a certain extent, predicted by measuring one's *Need for Affiliation* before deployment to the station, Study 2 failed to reproduce this result. The discrepancy between the results found in Study 1 and Study 2 regarding the prediction of the measures of fit could source from the nature of Study 2. Indeed, in Study 2, participants' personality traits and needs were measured as for the time they filled in the survey while the answer to questions relative to their winter-over experience are based on recollection. As argued in the Discussion of Study 2 in Section 4.3, personality traits and needs might change over time and are, therefore, not expected to retroactively predict one's fit and adjustment variables to an Antarctic station. For this reason, the nature of Study 2 does not allow a good testing of the part of the model relating to the needs and personality traits. It is also important to note that though Study 1 revealed a significant relationship between one's need for affiliation and their adjustment to the isolation, this relationship had only a small effect size, suggesting that other determinants might play a bigger role in predicting one's adjustment.

5.1.4 Privacy – predictors

Due to Study 2 being based on recollection, it is difficult to interpret the results involving needs and personality measured today regarding the reported privacy related to an experience set decades ago. Because one's personality and needs measured today would not necessarily be the same as one's before the last winter-over, the data might not be the best suited to test the part of the model relative to those variables. This may explain why Study 2 did not reveal any correlation between the *Need for Intimacy* and *Need for Privacy* and *Privacy Fit*. By contrast, Study 1 did find negative relationships between the *Need for Intimacy* and *Privacy Fit*. This suggests that privacy fit can be predicted by measuring the need for intimacy prior to deployment but that the need for intimacy might change over time.

One reason why no relationship has been found between the *Need for Privacy* and *Privacy Fit* could come from the absence of the moderator variable *Privacy Regulation*. It was predicted that those with a high need for privacy could still have their need fulfilled, in an environment that provides limited privacy, by adopting certain strategies. Such strategies could range from staying in one's own room, leaving the station, avoiding eye contact or verbal interaction, and ignoring phone calls and emails.

However, someone with a high need for privacy but who lacks such strategies was predicted to experience a lack of privacy. Though those strategies were thought to moderate the effect of *Need for Privacy* on *Privacy Fit*, they might actually act as mediators. This would mean that the need for privacy has no direct relation with privacy P-E fit but, instead, predicts the use of strategies and those strategies predict Privacy P-E fit.

5.1.5 Privacy regulation

Because little is known about the specific strategies people adopt to regulate privacy in ICEs, the survey used in the present research was open-ended. For this reason, the data from this question have been analysed using descriptive techniques. It was found, in both Study 1 and Study 2, that, when needing more privacy, the most often reported location participants chose was outside the station. By physically going away from the station, one isolates oneself and uses this isolation to overcome the lack of privacy experienced inside the station. It is noteworthy that participants of Study 2 have last wintered-over anywhere between 1957 and 2016. Because stations have changed over time in terms of logistics, organisation and composition of crews, we can imagine that the regulation strategies one can adopt might have changed over time. For instance, before the introduction of the Internet, communicating with one's family and friends was difficult, rare and brief. In addition, with increased awareness of health and safety and subsequent regulations, it is likely to be more difficult to go outside on one's own nowadays than it was decades ago. The second preferred place to regulate privacy is one's private room. Finally, ranked alternatively third and fourth in both studies are 'working facility' and 'leisure room' (e.g., gym and library).

Other locations reported by only a few participants include the greenhouse and a nearby station. It is noteworthy that in Study 1, though more participants reported going outside the station than going to one's private room, the latter is reported by each participant more often than the former. This means that though more individuals go outside to regulate their privacy, each individual goes to one's private room more often to fulfil the same need. It can be understood that the outdoors is a place that most people will, at some point, go when in need of more privacy but going to one's room is a more frequent choice, probably due to the ease of access and the warmer temperature. Similarly, while working facilities and the gym are both reported by half of Study 1's participants, working facilities are reported more frequently than the gym.

When looking at the frequencies for each location, locations and activities that were reported by only one participant were considered as idiosyncratic. Because the present research aims to better understand general adaptation mechanisms and privacy regulation, only the most frequently reported strategies are discussed here. Regarding the location, both studies found that working facilities ranks first. Working facilities seem to be used about five times a week. It is likely that winter-overs do not

choose go to working facilities specifically to restore their privacy but, rather, they use the opportunity of having a workspace to enjoy the privacy it provides them with. The second most frequently used location is one's private room. Such a place is reportedly used about four times a week as a private area. Leisure rooms, such as gyms and libraries, are reportedly used slightly less than four times a week to fulfil one's need for privacy. Such places have been designed for winter-overs to spend their free time. The results show that winter-overs do use those rooms as intended, although facilities such as the gym appear to fulfil other purposes (e.g., solitude or privacy), as well. Finally, it seems that winter-overs go outside of the station about three times a week. Though this is the most commonly reported location one chooses when needing more privacy, it is not the most frequently used. The effort required to exit the station (e.g., donning clothing, letting someone else know where one is going) as well as adverse weather conditions might explain why this favourite location is not used more often.

In terms of activities used to regulate one's privacy, in both studies walking is most commonly reported, and reading is in the top three. In both studies, a certain proportion of participants report working and watching TV as ways of having more privacy. Such activities as watching TV, reading or listening to music can be used to shelter one from social interactions (Ito, Okabe, & Anderson, 2009). We know for instance that individuals with headphones on are perceived as being less likely to engage in social interactions (Garner, 2014). Interestingly, Burns and Sawyer (2010) found that people being addressed by a stranger while listening to music react differently depending on how that stranger is perceived. They found that people are more likely to remove their earbuds if the stranger interests them. Such behaviours provide implicit communication regarding one's willingness to interact. The use of such activities to gain more privacy or to deal with the negative affect of a lack of privacy have also been supported by other studies (Boal-Palheiros & Hargreaves, 2001; Kaya & Weber, 2003). For these reasons, the use of personal cassette recorders for private listening had been advised in another ICE; a spaceship (Harrison, Caldwell, & Struthers, 1988).

It is noteworthy that trying to have an isolated sleeping area is the most frequently reported activity in Study 2 but is not mentioned at all in Study 1. This might come from the fact that participants of Study 2 wintered-over in different decades and it may have been easier, decades ago, to change room or create one's own room in an emergency kitchen, as one participant reported. Today's concern for health and safety is likely to have brought more rigid rules, leaving winter-overs with fewer opportunities to change the organisation of the station. Both studies found that shutting a room's door was performed about once a day in order to have more privacy. Both studies also found that winter-overs read between four to seven days a week to help fulfil their need for privacy. This activity usually requires one to find a quiet area, and it also sends the implicit message to other winter-overs that one does not wish to be disturbed. This 'cocooning' behaviour helps establish a private bubble that disengages one from their physical environment and, as a result, from potential social interactions (Ito et al., 2009).

In Study 1, participants reported contacting their friends and family between five and six times a week on average. In Study 2, the average was four times a week. This difference could be explained, again, by the fact that Study 2 includes participants who wintered-over decades ago, when possibilities for contacting friends and relatives were either limited or non-existent. The results reveal that opportunity given to winter-overs to contact their friends and family are frequently used. Finally, both studies suggest that winter-overs go for a walk slightly more than three times a week. This activity allows one to physically isolate oneself while practicing a physical activity. One limitation is the interpretation made of the reported frequency of each strategy. Because the participants were asked to indicate “the frequency [each strategy] has been used”, participants might have understood it in two different ways. Some participants might understand it as the frequency they have used the reported strategy specifically when needing more privacy. In this condition, reporting a strategy as having been used every day would mean that it has been consciously used every day to provide more privacy. For instance, if one goes outside every day for work but goes for a walk only once a week to enjoy some privacy, one would report going outside as being a weekly activity. By contrast, the item could be understood as asking the frequency such a strategy is used, regardless of its purpose. In this condition, reporting a strategy as having been used every day would simply mean that such an activity is performed or such a location is frequented on a daily basis, regardless of whether one needs more privacy. For instance, if one goes outside every day for work but goes for a walk only once a week to enjoy some privacy, one would report going outside as being a daily activity. Such a double-interpretation makes understanding the data potentially confusing and caution is advised.

However, despite such a limitation, the present data give a valuable insight into the privacy-related behaviour adopted by winter-overs. This gives a basis on which to work to further investigate privacy regulations and how they interact with other variables of adaptation. Though privacy regulation strategies have received little attention in the field of polar psychology, it is suggested that they play a central role in one’s adjustment to the social environment of an Antarctic station. Understanding such adaptive (or maladaptive) behaviours can also allow a more comprehensive understanding of human’s adjustment to ICEs.

5.2 Theoretical contribution

The present research considered the two defining characteristics of an ICE, namely isolation and confinement with a P-E fit approach. The results suggest implications for the importance of such an approach and the conceptualisation of the phenomena of interest.

5.2.1 Importance of isolation

In the present studies, a P-E fit approach has been used to develop a model predicting adjustment to a rather unusual work environment; namely, an ICE. Taking into consideration both workers' and the workplace's characteristics, as well as their interaction, provided a better understanding of job satisfaction and overall adaptation to the workplace. However, concluding that all indicators of the winter-over syndrome are related to isolation would be too strong. Any effect of social factors on sleep quality, for example, may be overwhelmed – or, at least, strongly influenced – by the circadian cycle disruption occurring in high and low latitudes. Since the lack of natural light has been found to be a factor contributing to sleep problems (Francis et al., 2008), the model could benefit from the inclusion of measures of natural light exposure. Irrespective, isolation is thought to be a central factor when considering one's adjustment to an ICE.

Nevertheless, it appears that feeling lonely is strongly related to other negative moods and to cognitive performance. This is especially relevant in modern Western societies where social isolation appears to be on the rise. It has been observed, for example, that during the last two decades in the U.S., the mean size of individuals' social networks has shrunk (McPherson, Smith-Lovin, & Brashears, 2006). In addition, in the U.K., the proportion of people living alone has doubled from 1971 to 2009 (Office for National Statistics, 2009). While social isolation becomes increasingly prevalent, its consequences, as well as risk factors, are still under investigation. In a way, ICEs can offer a simplified environment for observing social isolation and, as a result, a great opportunity to more clearly understand this phenomenon. It is also interesting to note that, though the introduction of the Internet in Antarctica was thought to alleviate the sense of isolation, it has been reported to potentially increase this feeling (Solignac, 2004). The same author has reported that some individuals were spending so much time online that they distanced themselves from other station crew members. Communicating with people on the other side of the world might also make one aware of what one is missing, or make one aware of issues that one cannot act on due to the physical distance. This is reminiscent of modern day life throughout the world, where we tend to be all interconnected and highly active in this virtual socialisation but, yet, the prevalence of loneliness increases.

5.2.2 Conceptualisation of privacy

As Caplan (1987) states, there are three possible curves representing the relationship between the P-E fit and strain, as shown in Figure 13. While it is reasonable to assume that the more the environment provides for one's needs, the less strain will be felt, what happens when the affordance exceeds the need is not so obvious. Curve A represents the situation where there is an optimal 'quantity' of affordance and that any excess would be detrimental. For instance, employees might have an ideal workload in mind; a lighter workload would make them bored while a heavier workload would

be too stressful. Curve *B* characterises a circumstance in which an excess of affordance is neither detrimental nor beneficial. For instance, if some employees complain about the long queue to use a vending machine, increasing the number of machines would satisfy the employees until each employee has its own. From that moment on, increasing the number of vending machines will neither increase nor decrease satisfaction. Finally, Curve *C* represents the situation where any additional affordance is beneficial. For example, employees might wish for a certain wage with which they would be satisfied, but offering them an even higher pay might make them even more satisfied.

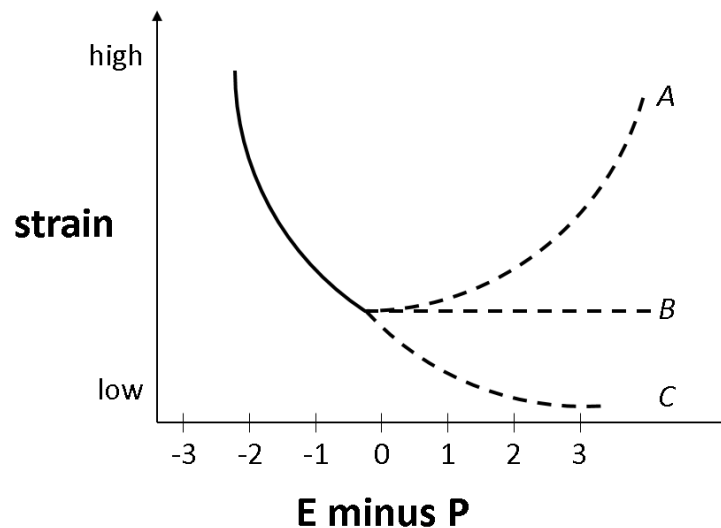


Figure 13. Three possible relationships between P-E fit (Environmental affordance minus Person's need) and strain. Model adapted from Caplan (1987).

In the present studies, it has been assumed that the relationship between privacy P-E fit and strain would follow Curve *B*. However, Altman (1977) suggested that privacy follows Curve *A*; each of us has, at any given time, a desired level of privacy and a deviation from that level, in either direction, would be unsatisfactory. If, as suggested, privacy fit follows Curve *A*, the measure used in the present studies could not distinguish one individual who had just the optimal privacy from one who has too much privacy. In a solitary confinement for instance, though one is not experiencing any kind of crowding, one also cannot disclose any information to anyone. According to Altman (1977), if having too little privacy generates a sense of crowding, having too much privacy creates a sense of isolation.

Following this reasoning, privacy could be conceptualised as a continuum reflecting how much information one can, or has to, disclose to others. One end represents forced disclosure that can happen in a crowded environment that offers little opportunity to escape. The other end is when disclosure is prevented or made impossible and this is when a sense of isolation can occur. Because such a model would exclude the co-occurrence of feeling crowded and feeling isolated at the same time, it is important to consider that such a continuum would exist for different social groups around us. For instance, one can feel crowded in a station because one is forced to disclose information to one's *crew members* by continuously living with them over a year. At the same time, one can feel

isolated because one does not have enough occasions to disclose to one's *family and friends*. In this example, one has simultaneously two continuums, one for one's crew members and one for one's friends and family, each inducing an opposite feeling.

As a result, participants scoring high on the privacy fit measure could actually be indicating (or attempting to indicate) that they felt isolated. This can happen if one's feeling of isolation regarding one's family and friends overwhelms one's feeling of crowding and lack of privacy. In such a situation, being asked to answer one general question regarding privacy might not give the opportunity to report the complexity of how one feels. Such a lack of sensitivity in the measure could explain why privacy fit has not been consistently found to be related with any other measure.

It is also possible that the sense of privacy plays little-to-no role in the overall adjustment one makes to an ICE. In such a case, the results would reflect a true lack of association between the sense of privacy and measures of adjustment. This would mean that, although winter-overs report a lack of privacy as being an important problem, it does not actually affect their overall adaptation to the environment. If this is true, a fit between one's privacy and the environment's affordance for control over information disclosure is not a relevant predictor of adaptation in the context of ICEs. Superficially, this seems unlikely, given the high frequency with which perceived privacy-limiting features have been reported as a potential problem. However, there might be a discrepancy between what individuals report as being problematic and what actually affects them; that is to say, a distinction needs to be made between what people say they *desire* and what people actually *need*. While privacy might be desirable, it might not be needed – at least, not to the extent reported in the popular media and in the scientific research literature. Thus, the lack of it may not inexorably lead to dissatisfaction.

5.2.3 Conclusions about P-E fit

The use of P-E fit as a main framework for the present thesis aimed to investigate human adaptation to ICEs through application of an organisational psychology approach. Because the number of studies in polar psychology is, relative to other fields, limited, little theory has emerged from it. However, people going to an Antarctic station to perform a job could be regarded just as any other employees who have to adjust to their workplace. It is therefore reasonable to use an organisational psychology theory as a mean of understanding adjustment in such an unusual setting. Though Sarris (2007, 2008) was the first researcher to bring a P-E fit approach to the Antarctic, the present studies are the first to combine it with the social aspects of an ICE that have been found to be crucial, namely isolation and confinement. The present studies support an approach that focuses not only on the individual but one that also considers individuals *in* their environment. Such a focus may generate more comprehensive explanations that, ultimately, lead to a greater understanding of human adaptation.

Considering Antarctica as an exceptional place for people to work may lead some researchers to believe that knowledge from 'regular' workplaces cannot be applied there, or vice versa. This could induce a sense of exploring an entirely uncharted field of study in which little is known and where theory can only build upon what has been previously found in the same context. However, integrating Antarctic stations in the broader environment category of workplaces allows investigation to develop from well-known theories. As a result, one can draw knowledge from different fields of research and build upon it. The present thesis' research was built upon previous research that identified relationships between a range of variables to produce a more complex model. The results suggest that more complex and comprehensive models can improve our knowledge of psychology in ICEs by yielding a better understanding of how predictive variables relate to outcome variables. This is especially true for a field of research that still has a comparatively small number of studies. Broadening the scope of the research to investigate the underlying human adaptation mechanisms involves mixing theoretical perspectives. The model presented in this thesis drew from an approach which has been often used in organisational psychology (namely, via the concept of P-E fit) while integrating personality traits following the channelling hypothesis. It is suggested that integrating physiological measures, such as the effect of natural light on hormones and its impact on sleep quality into a biopsychosocial model could greatly improve the current model. In general, the greater the inclusion of relevant aspects of the environment and its interaction with individuals, the more precise the model is likely to be.

5.2.4 Channelling hypothesis

Individuals vary on a multitude of characteristics. Equally, environmental features can also greatly vary. While it was expected that personality traits would moderate the P-E fit, as defined by the relationship between one's needs and what the environment offered, this has not been supported by the present research. It appears that the moderating role of personality traits is not that straightforward; at least, not with respect to extraversion and agreeableness in an ICE. It could be that only certain personality traits are relevant for a given relationship and that those traits are not always the ones that seem the most obvious.

It could also be that the relationship between personality, needs, and behaviour is more complex than previously stated by Winter et al. (1998). The way they interact might differ from one situation to another. It could also be that for some individuals, a specific need would be so strong that it, on its own, predicts one's behaviour, with the effect of personality being insignificant. This would mean that the way those personal characteristics interplay would depend on situational factors and individual characteristics. Further investigation of this theory is required to better understand its environmental limitations.

5.3 Implications of the method

The operationalisation of the theoretical predictions always limits one's research to the specific settings one's study is conducted in. The following subsections examine the notable strengths and weaknesses of the present research.

5.3.1 Sample

Across both studies, there was a total of 73 participants from 21 different Antarctic stations, operated by 10 different National Programmes with winter-over experience spanning over almost 60 years. This gives a diverse sample and allows for greater generalisation of the results compared to many previous studies conducted in this field. Other large studies, with sample size of 657 (Palinkas et al., 2000), 110 (Gunderson, 1966) or 103 participants (Sarris, 2007), used participants from only one National Antarctic Programme. It is worth noting that though using a sample from only one National Antarctic Programme seems to be the norm, some studies have included a number of programmes (COMNAP, 2016). The discrepancy between the National Antarctic Programmes represented by the sample and the population of winter-overs might pose a problem as the concept of space, privacy, crowding and isolation might greatly differ from one culture to another. Hall (1966) described the culturally different conceptions of space, privacy or crowding between countries such as Japan, Germany, France and the United Kingdom. Nowadays, even globalisation has not homogenised the world population since differences in need for privacy can even be observed between cultures within the same country, such as Iran (Gharaei, Rafieian, & Jalalkamali, 2012). For this reason, it is difficult to generalise the results of Study 2 alone to the population.

So, while Study 1 was biased toward German and Norwegian participants, Study 2 was biased toward English speakers. It is notable, though, that most of the results have been replicated from one study to the other. This strongly suggests that the results might not be as culture-specific as one might think, though both cultures are still European. Despite the presence of participants from China, France, India and Uruguay, those nationalities, and others, were under-represented in the present studies. Further research that includes a greater diversity and more representative proportions of nationalities is needed to further validate the present model.

Finally, a self-selection bias might have played a significant role in the present studies. It is likely that individuals with a high need for privacy are generally less likely to be willing to take part in studies, especially in a setting like an Antarctic station where they could easily be identified. Because the need for privacy and the way people cope with the lack of it was of interest for the present research, it is possible that the sample did not cover the full range of privacy need, and subsequent adjustment and behaviour, that is present in Antarctic stations. Also, by recruiting former winter-over, it is possible

that Study 2 only drew individuals who had a good experience in Antarctica. The study having been advertised through clubs and organisations related to Antarctica, it is possible that individuals who had negative experience never joined such groups and were less likely to be exposed to the advertisement. This highlights the limitations of generalising such small samples to the greater population.

5.3.2 Language

The survey used in Study 1 was translated into Chinese and German to accommodate those participants. Other respondents had to fill in the survey in English, despite it not being their first language; for example, as was the case for the Norwegian participants. This was due to limited resources to conduct the study and, for the Norwegian participants, an expected high level of fluency in English. This was supported by the EF English Proficiency Index which ranked Norway at fourth place of the most English fluent countries in the world in 2016 (excluding most English speaking countries) (EF English Proficiency Index, n.d.). All this meant that a Bokmål version of the survey was unnecessary. For those participants, and those of Study 2 whose first language was also not English, filling in a survey in an acquired language might present some biases and extra challenges in terms of interpretation. As already noted, it is known that the concepts of space or the perception of crowding are culturally sensitive (Hall, 1966).

Different ways to achieve a good translation have been suggested by McGorry (2000). She suggests that *back-translation* might be one of the best approaches and this is the procedure that was used in Study 1. However, she also points out the issue regarding literal translation. For instance, there are occasions when a phrase could be translated literally in another language but may not make much sense but still be accurately back-translated. To overcome such issues, a more complex approach has been suggested that involves recording observers and the use of expert committees (Beaton, Bombardier, Guillemin, & Ferraz, 2000). This, however, is a procedure that requires more resources than many researchers may possess.

5.3.3 Self-report

Because all measures of adjustment were self-report, including measures of sleep and cognitive impairment, it raises the question as to what extent individuals can have enough self-awareness when it comes to such constructs. The present studies relies exclusively on self-report measures, which assumes that people have enough insight to accurately report on those variables. However, it could be that one who has impaired cognitive abilities does not realise that his or her capacities are diminished. As a result, a report that their cognitive functions are as usual would not reflect reality. Though this discrepancy could be interesting to investigate, particularly in conjunction with objective measures of sleep quality and cognitive functioning, the present research was concerned with individual's

perception of their experience. Even though one's poor sleep quality could affect one's daily functioning and mood without the person being aware of it, the present studies only looked at one's perception of his or her sleep quality. This is a limitation, in that it is possible for some people to perceive themselves as perfectly adapted to an Antarctic station and not realise that their daily functioning greatly suffers from a misfit in this environment, leading to poor performance. For this reason, future studies could benefit from more direct and objective measures of such constructs.

5.4 Practical implications of the results

Though Antarctic stations are probably the most studied ICEs, it is surprising that few studies have included both the elements of isolation and confinement in their measurements. Even though both elements are key aspects defining an ICE, they have received little attention despite their importance (Bishop et al., 2001; Godwin, 1986). This makes the present research even more valuable as it gives a complex insight into the role of both isolation and confinement in one's adjustment.

5.4.1 Consequences for the individual

Study 1 and Study 2 both suggest that the more people feel lonely in an ICE, the less satisfied with their work experience they are. The studies also support the idea that loneliness is negatively related to mood ratio. This is in line with physiological research on isolation that found social isolation to be related with higher level of cortisol (Matias, Nicolson, & Freire, 2011), which is known to increase irritability and depression, as well as cognitive impairment and sleep disturbance. Altogether, the present studies suggest that the extent to which one feels lonely in an ICE could be a good indicator of how well one adjusts. This is important because those who enrol for such positions might be highly motivated and enthusiastic about being part of an expedition and experiencing life in the confined habitat in which they will have to live. But if the environment presents challenges they unsuccessfully struggle to overcome, their stay might become an unpleasant experience and can greatly affect them. It has been argued that depressed affect is amongst the most common symptoms in people in polar environments (Palinkas & Suedfeld, 2008). It appears that time in deployment plays a part in one's affective state. For example, it has been found that scores of negative mood tend to be higher during the second half of the deployment (Steel, 2001). We also know that depressive states, while in an Antarctic station, tend to increase over time (Palinkas, Cravalho, & Browner, 1995). Such a rise has been associated with a higher chance of presenting a DSM-IV diagnosis (such as sleep-related disorders, personality disorders or substance-related disorders) (Palinkas, Glogower, et al., 2004). Therefore, the personnel selection process can be critical for a team safety and the mission success since failing to identify unsuited candidates might result in serious on-site consequences.

5.4.2 Consequences for the team

The consequences of isolation, and its related maladjustment factors, do not only affect the person who directly suffers from it but can also affect fellow crew members. For instance, it is known that one's depressive state and irritability can reduce group harmony (Gunderson, 1968), and that the performance and satisfaction of each crew member is, in turn, influenced by group dynamics and an individual's interaction with others (Palinkas, 2003; Sarris & Kirby, 2005). One individual failing to adjust well can have a negative effect on a whole team. For example, in an unpublished interview conducted by Jaksic, one former winter-over reported the case of a nurse whose *"challenge was that no one was getting sick"* and got depressed as a result of the boredom. He remembers that all crew members were affected by this situation and, as he stated, tried to *"reach out"* to her. He concluded by saying *"if one of us is struggling, we tend to struggle all of us"*. While the present research has identified some extent to which loneliness can be detrimental for an individual, it is strongly suggested that it can make a negative impact on the crew as a whole.

5.4.3 Consequences for the significant others

Going to an Antarctic station might not only be challenging for the individuals who are being deployed but also for their friends and family. For the whole duration of the stay, romantic partners staying back home experience more distress than their deployed partners (Norris, Paton, & Ayton, 2008; Taylor & McCormick, 1987). Also, from the winter-over's point of view, keeping friends and relatives reassured might be at their own expense. Some winter-overs have reported not disclosing negative aspects of their experience to their family (Solignac, 2004) and, as a result, have to deal with those negative affects without the support from their family. This might explain why Palinkas, Johnson, and Boster (2004) found that even though the availability of friends and family remained constant over the time spent in Antarctica, satisfaction with the social support they provided decreased significantly. If one is struggling with one's experience in Antarctica but does not share the details of this struggle with their friends and family, the support group will be of little help since they would not even know that certain aspects of the experience are problematic. This is in line with the *'buffering hypothesis'* (Cohen & Wills, 1985) that states that social networks can act as a buffer protecting individuals from the adverse effect of stressful events (Cassel, 1976; Cobb, 1976). This protective effect of social support has since then been observed in a wide variety of stressful events; acculturation experience (Finch & Vega, 2003), stressful job (Abu Al Rub, 2004), road traffic accident (Holeva, TARRIER, & Wells, 2001) or health issues (Lackner et al., 2010).

Significant others are especially important for winter-overs as an Antarctic station presents another challenge; crowding. As defined by Stokols (1972, p. 276), crowding is the *"disparity between the amount of space demanded, or considered to be adequate, by the individual, and the amount of space*

available to him.". Because most Antarctic stations offer little opportunity to get away from the people one is living with, especially during winter, the sense of crowding or the lack of privacy are reported as major stressors by winter-overs (Godwin, 1986). It is known that social support can effectively counteract the effect of crowding on stress (Evans, Palsane, Lepore, & Martin, 1989). Because crowding generates unwanted social interactions, a logical strategy would be to withdraw from social contacts. Though such a strategy has been suggested as an efficient way to reduce stress (Evans, Rhee, Forbes, Allen, & Lepore, 2000), it also isolates the individual from others. As a result, one would not benefit as much from the potential social support that could be found around them. It has been empirically found that people who live in crowded environments not only display more social withdrawal, but also tend to ignore social support when it is offered (Evans & Lepore, 1993). Interestingly, even though the same participants sought less, and rejected more, any offered support, they considered the confederate who was offering support as being less supportive compared to participants who lived in uncrowded environments.

This can shed light on the findings observed in Antarctica. Palinkas, Johnson, and Boster (2004), for example, found that even though winter-overs regarded their friends and family to be equally available across their stay, the support they provided was perceived as being less satisfying over time. It is also interesting to note that family and friends can make the winter-over experience worse. For instance, in Study 1, one participant explained his bad mood by the fact that his girlfriend left him. In two unpublished interviews conducted by Jaksic in 2017, two participants explained how they had to deal with the death of their father while being in Antarctica. It is obvious that not only the distance itself but the news communicated in either way, the lack of social support and the impossibility to physically act when a problem occurs involving one's loved ones can be detrimental for both parties.

5.4.4 Consequences for the organisation

Congruent with the model presented in this thesis, the present studies suggest that isolation could be a key element in adjusting to ICEs. Those who suffer from the isolation would have impaired cognitive abilities, impacting on their job performance. This is important because training and deploying crew members to an ICE is often costly and time-consuming. If the selection criteria do not allow predictions of how one will cope with the isolation, not only that employee will suffer some consequences but the organisation itself will have wasted some resources that would have been maximised with another employee. The organisation also takes the risk to have their whole on-site team being dragged down by the one individual who fails to fit. Finally, if one's misfit becomes critical and an emergency evacuation is required, this would lead to further resource loss and cost for the National Antarctic Programme.

In addition, it was shown that while people can use a variety of strategies to regulate their privacy, walking outside was by far the preferred option. This indicates that most winter-overs, at some point, feel the need to escape from the confined habitat where fulfilling one's privacy might be difficult. This must be taken into consideration by organisations dealing with ICEs and should prompt more research on how to better alleviate the weight of confinement. Though it is not suggested that National Antarctic Programmes do a poor job at selecting their personnel, evidence shows that there is definitely room for improvement. In conclusion, understanding that the direct consequence of the isolation can impact on the winter-over syndrome and job satisfaction could lead to more accurate recruitment criteria and personnel management.

5.5 Future recommendations

The following subsections proposes key aspects of human adaptation to ICEs that are worth considering in the future as a consequence of the findings of the present studies.

5.5.1 Group dynamics

Some participants pointed out that group dynamics were an important factor that was not covered by the questions asked. Interpersonal tensions have been identified as important stressors in polar expeditions (Palinkas & Suedfeld, 2008). In addition, it has been found that perceived group cohesiveness is positively related with job satisfaction (Sarris & Kirby, 2005). However, as one participant of Study 1 reports: *“Die ist NICHT der entscheidende Faktor sondern wie jemand im Team funktioniert, welche Arbeitsleistung die Gruppe erbringt und wie die Gruppe funktioniert.”* [It [one's job performance] is NOT the decisive factor but rather how someone functions in the team, what output the group yields and how the group works.]. Therefore, although studies focusing on the individuals' experience are valuable, it is recommended that the specific impact that group functioning has on the individuals in ICEs be investigated.

However, such studies are hindered by methodological and logistical problems relative to the difficulties of accessing, recruiting, and engaging a whole winter-over crew's participation over the time of their deployment. When focusing on individuals, it is often justifiable to base conclusions on just a few individuals from each crew. However, when investigating groups, a researcher needs to have access to a whole team; preferably, several of them. Because of the socio-metric nature of such studies, one crew member refusing to take part in the study could jeopardise the validity of the data gathered, which would then not reflect the whole picture of the group dynamics. In addition, sample size can be a limiting factor when it comes to quantitative studies. If one crew of nine members takes part in a study, the unit of research is nine with an individual approach but is of only one if the focus is on the group. Such a constraint makes data analyses and generalisation much harder. Some studies

have managed to identify relevant factors within groups, such as group size (Doll & Gunderson, 1971; Johnson, Boster, & Palinkas, 2003), group composition (Gunderson, 1974), group harmony (Peri et al., 2000), group cohesion (Sarris & Kirby, 2005), groupthink (Paty et al., 2005; Sandal, Leon, & Palinkas, 2006) or the ability to adjust to the group (Nelson & Gunderson, 1962). The importance of shifting from individual to group had already been pointed out by Macpherson (1977) but, since then, research has not paid as much attention to it as it did to individuals. It is not enough to know that, for instance, interpersonal sensitivity is a desirable characteristic of people going to an ICE (Sandal, Endresen, Vaernes, & Ursin, 1999). We also have to understand how such characteristics play out in interaction with others. Despite the logistic difficulties, it is recommended that further research be done on group composition and dynamics in ICEs in order to broaden our understanding of human adjustment to unusual environments.

5.5.2 Privacy regulation

The present research shed light on the strategies winter-overs adopt when feeling like having more privacy. While we know that the lack of privacy is an important factor (Binsted et al., 2010; Godwin, 1986), few studies have made this feature a central focus of their investigation. The present research provided an insight into how winter-overs try to achieve their desired level of privacy. It is recommended that this knowledge be used in future studies to investigate, in greater detail, the role those different strategies play in the adjustment process. To better understand this process, future studies should measure privacy P-E fit while considering the effect of “too much” privacy. While not enough privacy would lead to a sense of crowding, too much privacy would lead to a sense of isolation. The present thesis suggests that such a continuum exists for different individuals and social groups. For this reason, it is recommended that future studies assess one’s sense of privacy in regard to at least other crew members and family and friends back home.

5.6 Conclusion

The present research aimed to test a model built upon different theoretical approaches that defines the relationships between variables deemed central to human adaptation to ICEs. The year-long data collection that combined repeated measures of in situ data with cross-sectional retrospective data gives the present research a unique insight into adjustment to unusual social settings. This is important because sending crews to perform a job in an ICE (e.g., submarine, spaceship, Antarctic station) can be extremely costly in many ways; financially, socially, and in time. It is, therefore, of utmost importance that the crew members are well-suited for such unusual environments. The present thesis suggests that the defining characteristics of an ICE play a role in one’s adjustment. It also suggests that commonly observed symptoms directly relate to the match between one’s social needs and the

environment's affordances. The present research demonstrated that mixing different theoretical approaches can expand our understanding of psychology in unusual places and, ultimately, could benefit human wellbeing in such environments.

References

- Abu Al Rub, R. F. (2004). Job stress, job performance, and social support among hospital nurses. *Journal of Nursing Scholarship*, 36(1), 73-78.
- Adler, P. S., & Kwon, S.-W. (2002). Social capital: Prospects for a new concept. *Academy of Management Review*, 27(1), 17-40.
- Agho, A. O., Price, J. L., & Mueller, C. W. (1992). Discriminant validity of measures of job satisfaction, positive affectivity and negative affectivity. *Journal of Occupational and Organizational Psychology*, 65(3), 185-195.
- Ahmadi, M. (2016). The effect of different levels of rapeseed meal with and without enzyme on the performance and the serum level of Triiodothyronine (T3), Thyroxine (T4) and Thyroid Stimulating Hormone (TSH) in broiler chickens. *Iranian Journal of Applied Animal Science*, 6(1).
- Alexrk2. (2010, February 21). *Location map Antarctica, Azimuthal equidistant projection*. Retrieved 03/10/2017, from https://upload.wikimedia.org/wikipedia/commons/archive/c/c7/20110503161440%21Antarctica_location_map.svg
- Altman, I. (1977). Privacy regulation: Culturally universal or culturally specific? *Journal of Social Issues*, 33(3), 66-84.
- Altman, I., & Taylor, D. A. (1973). *Social penetration: The development of interpersonal relationships*. New York: Holt, Rinehart & Winston.
- Arvey, R. D., & Murphy, K. R. (1998). Performance evaluation in work settings. *Annual Review of Psychology*, 49(1), 141-168.
- Australian Antarctic Division. (2013a, March 19). *Chef*. Retrieved 15/05/2017, from <http://www.antarctica.gov.au/living-and-working/experiences/chef>
- Australian Antarctic Division. (2013b, March 18). *Station leader*. Retrieved 15/05/2017, from <http://www.antarctica.gov.au/living-and-working/experiences/station-leader>
- Australian Antarctic Division. (2015a, October 26). *Antarctic medical practitioner (AMP)*. Retrieved 15/05/2017, from <http://www.antarctica.gov.au/living-and-working/experiences/antarctic-medical-practitioner-amp>
- Australian Antarctic Division. (2015b, February 13). *Communications operator and supervising communications technical officer*. Retrieved 15/05/2017, from <http://www.antarctica.gov.au/living-and-working/experiences/telecommunications>
- Barkaszi, I., Takács, E., Czigler, I., & Balázs, L. (2016). Extreme environment effects on cognitive functions: A longitudinal study in high altitude in Antarctica. *Frontiers in Human Neuroscience*, 10.
- Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, 44(1), 1-26.
- Baym, N. K., Zhang, Y. B., & Lin, M.-C. (2004). Social interactions across media: Interpersonal communication on the internet, telephone and face-to-face. *New Media & Society*, 6(3), 299-318.
- Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, 25(24), 3186-3191.
- Bechtel, R. B., & Berning, A. (1991). The third-quarter phenomenon: Do people experience discomfort after stress has passed? In A. A. Harrison, Y. A. Clearwater & C. P. McKay (Eds.), *From Antarctica to Outer Space* (pp. 261-265). New York: Springer-Verlag. doi:10.1007/978-1-4612-3012-0_24
- Bhargava, R., Mukerji, S., & Sachdeva, U. (2000). Psychological impact of the Antarctic winter on Indian expeditioners. *Environment and Behavior*, 32(1), 111-127.
- Bhattacharyya, M., Pal, M. S., Sharma, Y. K., & Majumdar, D. (2008). Changes in sleep patterns during prolonged stays in Antarctica. *International Journal of Biometeorology*, 52(8), 869-879.
- Biersner, R. J., & Hogan, R. (1984). Personality correlates of adjustment in isolated work groups. *Journal of Research in Personality*, 18(4), 491-496.

- Binsted, K., Kobrick, R. L., Griofa, M. Ó., Bishop, S., & Lapierre, J. (2010). Human factors research as part of a Mars exploration analogue mission on Devon Island. *Planetary and Space Science*, 58(7), 994-1006.
- Bishop, S. L., Grobler, L. C., & Schjøll, O. (2001). Relationship of psychological and physiological parameters during an Arctic ski expedition. *Acta Astronautica*, 49(3), 261-270.
- Bishop, S. L., Kobrick, R., Battler, M., & Binsted, K. (2010). FMARS 2007: Stress and coping in an arctic Mars simulation. *Acta Astronautica*, 66(9), 1353-1367.
- Bittner, J. A. C., Dunlap, W. P., & Jones, M. B. (1982). Averaged cross-correlations with differentially-stable variables: Fewer subjects required with repeated measures. *Sage Publications Sage CA: Los Angeles, CA*. Symposium conducted at the meeting of the Proceedings of the Human Factors Society Annual Meeting
- Boal-Palheiros, G. M., & Hargreaves, D. J. (2001). Listening to music at home and at school. *British Journal of Music Education*, 18(2), 103-118.
- Booker, J. M., & Hellekson, C. J. (1992). Prevalence of seasonal affective disorder in Alaska. *American Journal of Psychiatry*, 149(9), 1176-1182.
- Braun-LaTour, K. A., LaTour, M. S., Pickrell, J. E., & Loftus, E. F. (2004). How and when advertising can influence memory for consumer experience. *Journal of Advertising*, 33(4), 7-25.
- Braun, K. A., Ellis, R., & Loftus, E. F. (2002). Make my memory: How advertising can change our memories of the past. *Psychology & Marketing*, 19(1), 1-23.
- Burger, J. M. (1995). Individual differences in preference for solitude. *Journal of Research in Personality*, 29(1), 85-108.
- Burns, J. E., & Sawyer, P. R. (2010). The portable music player as a defense mechanism. *Journal of Radio & Audio Media*, 17(1), 96-108.
- Butters, Z. (2017). *Polar psychology and the implications for Antarctic health and safety*. Canterbury University. Christchurch, New Zealand.
- Cacioppo, J. T., Ernst, J. M., Burleson, M. H., McClintock, M. K., Malarkey, W. B., Hawkley, L. C., . . . Hugdahl, K. (2000). Lonely traits and concomitant physiological processes: the MacArthur social neuroscience studies. *International Journal of Psychophysiology*, 35(2), 143-154.
- Cacioppo, J. T., Hawkley, L. C., Ernst, J. M., Burleson, M., Berntson, G. G., Nouriani, B., & Spiegel, D. (2006). Loneliness within a nomological net: An evolutionary perspective. *Journal of Research in Personality*, 40(6), 1054-1085.
- Campos-Barros, A., Musa, A., Flechner, A., Hassenius, C., Gaio, U., Meinhold, H., & Baumgartner, A. (1997). Evidence for circadian variations of thyroid hormone concentrations and type II 5'-iodothyronine deiodinase activity in the rat central nervous system. *Journal of Neurochemistry*, 68(2), 795-803.
- Caplan, R. D. (1987). Person-environment fit theory and organizations: Commensurate dimensions, time perspectives, and mechanisms. *Journal of Vocational Behavior*, 31(3), 248-267.
- Carrere, S. (1990). *Physiological and psychological patterns of acute and chronic stress during winter isolation in Antarctica*. Unpublished doctoral dissertation. University of California, Irvine.
- Cascio, M. I., Magnano, P., Elastico, S., Costantino, V., Zapparrata, V., & Battiato, A. (2014). The relationship among self-efficacy beliefs, external locus of control and work stress in public setting schoolteachers. *Open Journal of Social Sciences*, 2(11), 149.
- Cassel, J. (1976). The contribution of the social environment to host resistance. *American Journal of Epidemiology*, 104(2), 107-123.
- Chen, N., Wu, Q., Li, H., Zhang, T., & Xu, C. (2016). Different adaptations of Chinese winter-over expeditioners during prolonged Antarctic and sub-Antarctic residence. *International Journal of Biometeorology*, 60(5), 737-747.
- Chen, N., Wu, Q., Xiong, Y., Chen, G., Song, D., & Xu, C. (2016). Circadian rhythm and sleep during prolonged Antarctic residence at Chinese Zhongshan station. *Wilderness & Environmental Medicine*, 27(4), 458-467.
- Cobb, S. (1976). Social support as a moderator of life stress. *Psychosomatic Medicine*, 38(5), 300-314.
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98(2), 310.

- Coleman, J. (1990). *Foundations of Social Theory*. Cambridge, Massachusetts, and London, England: The Belknap Press of Harvard University Press.
- Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, 82(6), 407.
- COMNAP. (2016). Main Antarctic facilities operated by National Antarctic Programs in the Antarctic Treaty Area (South of 60° latitude South). Retrieved 05/09/2017 https://www.comnap.ag/Members/SiteAssets/SitePages/Home/Antarctic_Facilities_List_27July16.xls
- COMNAP. (2017, 2017 March 31). *Antarctic facilities*. Retrieved 02/10/2017, from https://www.google.co.nz/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKewjCuNKGwtDWAhXFJ5QKHTxPabwQFggIMAA&url=https%3A%2F%2Fwww.comnap.ag%2FMembers%2FSiteAssets%2FSitePages%2FHome%2FCOMNAP%2520Antarctic%2520Facilities%2520List%252031%2520March%25202017.xlsx&usq=AOvVaw2nznO-gA1LhRm-XpCE9_5T
- Cook, F. A. (1909). *Through the first Antarctic night, 1898-1899: A narrative of the voyage of the "Belgica" among newly discovered lands and over an unknown sea about the South pole*. New York: Doubleday, Page & Company.
- Corey, D. M., Dunlap, W. P., & Burke, M. J. (1998). Averaging correlations: Expected values and bias in combined Pearson *r*s and Fisher's *z* transformations. *The Journal of General Psychology*, 125(3), 245-261.
- Cravalho, M. A. (1996). Toast on ice: The ethnopsychology of the winter-over experience in Antarctica. *Ethos*, 24(4), 628-656.
- de Jong-Gierveld, J. (1987). Developing and testing a model of loneliness. *Journal of Personality and Social Psychology*, 53(1), 119.
- de Jong Gierveld, J. (1998). A review of loneliness: Concept and definitions, determinants and consequences. *Reviews in Clinical Gerontology*, 8(1), 73-80.
- Decamps, G., & Rosnet, E. (2005). A longitudinal assessment of psychological adaptation during a winter-over in Antarctica. *Environment and Behavior*, 37(3), 418-435. doi:10.1177/0013916504272561
- Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, 95(3), 542-575.
- Doll, R. E., & Gunderson, E. K. E. (1969). Occupational group as a moderator of the job satisfaction - job performance relationship. *Journal of Applied Psychology*, 53(5), 359-361.
- Doll, R. E., & Gunderson, E. K. E. (1971). Group size, occupational status and psychological symptomatology in an extreme environment. *Journal of Clinical Psychology*, 27(2), 196-198.
- Dunlap, W. P., Jones, M. B., & Bittner, A. C. (1983). Average correlations vs. correlated averages. *Bulletin of the Psychonomic Society*, 21(3), 213-216.
- Edwards, J. R., Cable, D. M., Williamson, I. O., Lambert, L. S., & Shipp, A. J. (2006). The phenomenology of fit: Linking the person and environment to the subjective experience of person-environment fit. *Journal of Applied Psychology*, 91(4), 802.
- EF English Proficiency Index. (n.d.). *The world's largest ranking of countries by English skills*. Retrieved 16/10/2017, from <http://www.ef.edu/epi/>
- Elliot, A. J., & Devine, P. G. (1994). On the motivational nature of cognitive dissonance: Dissonance as psychological discomfort. *Journal of Personality and Social Psychology*, 67(3), 382.
- Ellwardt, L., Aartsen, M., Deeg, D., & Steverink, N. (2013). Does loneliness mediate the relation between social support and cognitive functioning in later life? *Social Science & Medicine*, 98, 116-124.
- European Space Agency. (2013, 22 March 2013). *The remotest base on Earth*. Retrieved 12/10/2017, from http://www.esa.int/Our_Activities/Human_Spaceflight/Concordia/The_remotest_base_on_Earth
- Evans, G. W. (1979). Behavioral and physiological consequences of crowding in humans. *Journal of Applied Social Psychology*, 9(1), 27-46.
- Evans, G. W., & Lepore, S. J. (1993). Household crowding and social support: A quasiexperimental analysis. *Journal of Personality and Social Psychology*, 65(2), 308.

- Evans, G. W., Palsane, M. N., Lepore, S. J., & Martin, J. (1989). Residential density and psychological health: The mediating effects of social support. *Journal of Personality and Social Psychology*, 57(6), 994.
- Evans, G. W., Rhee, E., Forbes, C., Allen, K. M., & Lepore, S. J. (2000). The meaning and efficacy of social withdrawal as a strategy for coping with chronic residential crowding. *Journal of Environmental Psychology*, 20(4), 335-342.
- Festinger, L. (1962). *A theory of cognitive dissonance* (Vol. 2): Stanford university press.
- Finch, B. K., & Vega, W. A. (2003). Acculturation stress, social support, and self-rated health among Latinos in California. *Journal of Immigrant Health*, 5(3), 109-117.
- Fisher, C. D. (2000). Mood and emotions while working: Missing pieces of job satisfaction? *Journal of Organizational Behavior*, 185-202.
- Fiske, D. W. (1949). Consistency of the factorial structures of personality ratings from different sources. *The Journal of Abnormal and Social Psychology*, 44(3), 329.
- Francis, G., Bishop, L., Luke, C., Middleton, B., Williams, P., & Arendt, J. (2008). Sleep during the antarctic winter: Preliminary observations on changing the spectral composition of artificial light. *Journal of Sleep Research*, 17, 354-360.
- Fredrickson, B. L., & Losada, M. F. (2005). Positive affect and the complex dynamics of human flourishing. *American Psychologist*, 60(7), 678.
- Furnham, A., & Stringfield, P. (1998). Congruence in job-performance ratings: A study of 360 feedback examining self, manager, peers, and consultant ratings. *Human Relations*, 51(4), 517-530.
- Garner, B. R. (2014). iPod use and the perception of social introversion. *Leisure Studies*, 33(1), 22-31.
- Gavalas, A. (2011). Researching team dynamics, personality and behaviour of team members working on Antarctic research stations: A literature review and suggestions for a future study. *OKS Review*, 1(1), 1-12.
- Gharaei, F. M. N., Rafieian, M., & Jalalkamali, N. (2012). Investigating cross-cultural differences in the privacy regulation and perception of crowding: Northern and Yazdi women in Iran. *Procedia-Social and Behavioral Sciences*, 50, 69-78.
- Gierveld, J. D. J., & Van Tilburg, T. (2006). A 6-item scale for overall, emotional, and social loneliness confirmatory tests on survey data. *Research on Aging*, 28(5), 582-598.
- Giret, É. (2006). La «base» de Kerguelen: Les travaux et les jours. *Ethnologie Française*, 36(3), 443-455.
- Godwin, J. R. (1986). *A preliminary investigation into stress in Australian Antarctic expeditioners*: DTIC Document.
- Goldberg, L. R. (1981). Language and individual differences: The search for universals in personality lexicons. *Review of Personality and Social Psychology*, 2(1), 141-165.
- Graham, K., Bernards, S., Osgood, D. W., & Wells, S. (2006). Bad nights or bad bars? Multi-level analysis of environmental predictors of aggression in late-night large-capacity bars and clubs. *Addiction*, 101(11), 1569-1580.
- Grant, I., Eriksen, H. R., Marquis, P., Orre, I. J., Palinkas, L. A., Suedfeld, P., . . . Ursin, H. (2007). Psychological selection of Antarctic personnel: The 'SOAP' instrument. *Aviation, Space, and Environmental Medicine*, 78, 793-800.
- Gunderson, E. K. E. (1966). *Adaptation to extreme environments: Prediction of performance*: DTIC Document.
- Gunderson, E. K. E. (1968). Mental health problems in Antarctica. *Archives of Environmental Health*, 17(5), 558-564.
- Gunderson, E. K. E. (1974). Psychological studies in Antarctica. *American Geophysical Union. Antarctic research series*, 22, 115-131.
- Gunderson, E. K. E., & Nelson, P. D. (1963). Adaptation of small groups to extreme environments. *Aerospace Medicine*, 34(12), 1111-1115.
- Gunderson, E. K. E., & Nelson, P. D. (1966). Criterion measures for extremely isolated groups. *Personnel Psychology*, 19(1), 67-80.
- Habeeb, K. T. (2016). Perceived locus of control, stress and stress management level in adolescents of Aurangabad city. *Stress*, 3(6).
- Hall, E. T. (1966). *The hidden dimension*. New York: Anchor Books Editions.

- Harrison, A. A., Caldwell, B., & Struthers, N. J. (1988). *Incorporation of privacy elements in Space Station design*: NASA.
- Harrison, Y., & Horne, J. A. (2000). Sleep loss and temporal memory. *The Quarterly Journal of Experimental Psychology: Section A*, 53(1), 271-279.
- Hawkey, L. C., Preacher, K. J., & Cacioppo, J. T. (2010). Loneliness impairs daytime functioning but not sleep duration. *Health Psychology*, 29(2), 124.
- Hofer, J., Busch, H., Raihala, C., Poláčková Šolcová, I., & Tavel, P. (2017). The higher your implicit affiliation-intimacy motive, the more loneliness can turn you into a social cynic: A cross-cultural study. *Journal of Personality*, 85(2), 179-191.
- Holeva, V., TARRIER, N., & Wells, A. (2001). Prevalence and predictors of acute stress disorder and PTSD following road traffic accidents: Thought control strategies and social support. *Behavior Therapy*, 32(1), 65-83.
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, 7(7), e1000316.
- Horiuchi, M., Kanesada, H., Miyata, T., Watanabe, K., Nishimura, A., Kokubo, T., & Kirisako, T. (2013). Ornithine ingestion improved sleep disturbances but was not associated with correction of blood tryptophan ratio in Japanese Antarctica expedition members during summer. *Nutrition Research*, 33(7), 557-564.
- Iaffaldano, M. T., & Muchinsky, P. M. (1985). Job satisfaction and job performance: A meta-analysis. *Psychological Bulletin*, 97(2), 251.
- ICEBERG. (2012). *Space, polar and submarine missions: Analogy and prospective*: CNES workshop report. Retrieved from [www.iceberg.expert/IMG/pdf/iceberg - workshop report 2012.pdf](http://www.iceberg.expert/IMG/pdf/iceberg_-_workshop_report_2012.pdf)
- Ito, M., Okabe, D., & Anderson, K. (2009). Portable objects in three global cities: The personalization of urban places. In R. Ling & S. Campbell (Eds.), *The reconstruction of space and time: mobile communication practices* (pp. 67-87). New Brunswick, New Jersey: Transaction Publishers.
- Jenkins, D., & Palmer, S. (2003). A review of stress, coping and positive adjustment to the challenges of working in Antarctica. *International Journal of Health Promotion and Education*, 41(4), 117-131.
- Jimmieson, N. L., Terry, D. J., & Callan, V. J. (2004). A longitudinal study of employee adaptation to organizational change: The role of change-related information and change-related self-efficacy. *Journal of Occupational Health Psychology*, 9(1), 11.
- John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. *Handbook of personality: Theory and research*, 2(1999), 102-138.
- Johnson, J. C., Boster, J. S., & Palinkas, L. A. (2003). Social roles and the evolution of networks in extreme and isolated environments. *Journal of Mathematical Sociology*, 27(2-3), 89-121.
- Johnson, J. H., & Sarason, I. G. (1978). Life stress, depression and anxiety: Internal-external control as a moderator variable. *Journal of Psychosomatic Research*, 22(3), 205-208.
- Judge, T. A., Higgins, C. A., Thoresen, C. J., & Barrick, M. R. (1999). The big five personality traits, general mental ability, and career success across the life span. *Personnel Psychology*, 52(3), 621-652.
- Judge, T. A., Thoresen, C. J., Bono, J. E., & Patton, G. K. (2001). The job satisfaction–job performance relationship: A qualitative and quantitative review. *Psychological Bulletin*, 127(3), 376.
- Kanas, N., Salnitskiy, V., Grund, E. M., Gushin, V., Weiss, D. S., Kozerenko, O., . . . Marmar, C. R. (2000). Social and cultural issues during Shuttle/Mir space missions. *Acta Astronautica*, 47(2-9), 647-655.
- Kaya, N., & Weber, M. J. (2003). Privacy regulation and college adjustment: A comparison of American and Turkish freshmen living in residence halls. *College Student Journal*, 37(1), 79-93.
- Kemp, S., Burt, C. D., & Furneaux, L. (2008). A test of the peak-end rule with extended autobiographical events. *Memory & Cognition*, 36(1), 132-138.
- Khandelwal, S. K., Bhatia, A., & Mishra, A. K. (2017). Psychological adaptation of Indian expeditioners during prolonged residence in Antarctica. *Indian Journal of Psychiatry*, 59(3), 313.
- Kjaergaard, A., Leon, G. R., & Fink, B. A. (2013). Personal challenges, communication processes, and team effectiveness in military special patrol teams operating in a polar environment. *Environment and Behavior*. doi:10.1177/0013916513512834

- Kristof-Brown, A. L., Zimmerman, R. D., & Johnson, E. C. (2005). Consequences of individuals' fit at work: A meta-analysis of person-job, person-organization, person-group, and person-supervisor fit. *Personnel Psychology, 58*(2), 281-342.
- Kulik, C. T., Oldham, G. R., & Hackman, J. R. (1987). Work design as an approach to person-environment fit. *Journal of Vocational Behavior, 31*(3), 278-296.
- Kwallek, N., Woodson, H., Lewis, C., & Sales, C. (1997). Impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity. *Color Research and Application, 22*(2), 121-132.
- Lackner, J., Brasel, A., Quigley, B. M., Keefer, L., Krasner, S., Powell, C., . . . Sitrin, M. (2010). The ties that bind: Perceived social support, stress, and IBS in severely affected patients. *Neurogastroenterology & Motility, 22*(8), 893-900.
- Larsen, J. T., Norris, C. J., McGraw, A. P., Hawkey, L. C., & Cacioppo, J. T. (2009). The evaluative space grid: A single-item measure of positivity and negativity. *Cognition and Emotion, 23*(3), 453-480.
- Laurenceau, J.-P., Barrett, L. F., & Pietromonaco, P. R. (1998). Intimacy as an interpersonal process: The importance of self-disclosure, partner disclosure, and perceived partner responsiveness in interpersonal exchanges. *Journal of Personality and Social Psychology, 74*(5), 1238.
- Lawrence, C., & Andrews, K. (2004). The influence of perceived prison crowding on male inmates' perception of aggressive events. *Aggressive Behavior, 30*(4), 273-283.
- Leary, M. R., Herbst, K. C., & McCrary, F. (2003). Finding pleasure in solitary activities: Desire for aloneness or disinterest in social contact? *Personality and Individual Differences, 35*(1), 59-68.
- Leon, G. R., Sandal, G. M., Fink, B. A., & Ciofani, P. (2011). Positive experiences and personal growth in a two-man north pole expedition team. *Environment and Behavior, 43*(5), 710-731. doi:10.1177/0013916510375039
- Liu, H., Prugnolle, F., Manica, A., & Balloux, F. (2006). A geographically explicit genetic model of worldwide human-settlement history. *The American Journal of Human Genetics, 79*(2), 230-237.
- Loftus, E. F., & Zanni, G. (1975). Eyewitness testimony: The influence of the wording of a question. *Bulletin of the Psychonomic Society, 5*(1), 86-88.
- Long, C. R., & Averill, J. R. (2003). Solitude: An exploration of benefits of being alone. *Journal for the Theory of Social Behaviour, 33*(1), 21-44.
- Lopes, P. N., Brackett, M. A., Nezlek, J. B., Schütz, A., Sellin, I., & Salovey, P. (2004). Emotional intelligence and social interaction. *Personality and Social Psychology Bulletin, 30*(8), 1018-1034.
- Lopes, P. N., Salovey, P., Côté, S., Beers, M., & Petty, R. E. (2005). Emotion regulation abilities and the quality of social interaction. *Emotion, 5*(1), 113.
- Macintyre, S., & Homel, R. (1997). Danger on the dance floor: A study of interior design, crowding and aggression in nightclubs. *Policing for Prevention: Reducing Crime, Public Intoxication and Injury, 7*, 91-113.
- Macpherson, N. (1977). Adaptation of groups to Antarctic isolation. *Polar Record, 18*(117) p., 581-585.
- Mäkinen, T. M., Palinkas, L. A., Reeves, D. L., Pääkkönen, T., Rintamäki, H., Leppäluoto, J., & Hassi, J. (2006). Effect of repeated exposures to cold on cognitive performance in humans. *Physiology & Behavior, 87*(1), 166-176.
- Marshall, N. J. (1974). Dimensions of privacy preferences. *Multivariate Behavioral Research, 9*(3), 255-271.
- Marshy, M. (1999). Social and psychological effects of overcrowding in Palestinian refugee camps in the West Bank and Gaza - Literature review and preliminary assessment of the problem. *International Development Research Centre, 8*.
- Matias, G. P., Nicolson, N. A., & Freire, T. (2011). Solitude and cortisol: Associations with state and trait affect in daily life. *Biological Psychology, 86*(3), 314-319.
- Matthews, R. W., Paulus, P. B., & Baron, R. A. (1979). Physical aggression after being crowded. *Journal of Nonverbal Behavior, 4*(1), 5-17.
- McAdams, D. P. (1980). A thematic coding system for the intimacy motive. *Journal of Research in Personality, 14*(4), 413-432.

- McCormick, I. A., Taylor, A. J., Rivolier, J., & Cazes, G. (1985). A psychometric study of stress and coping during the International Biomedical Expedition to the Antarctic (IBEA). *Journal of Human Stress, 11*(4), 150-156.
- McGorry, S. Y. (2000). Measurement in a cross-cultural environment: survey translation issues. *Qualitative Market Research: An International Journal, 3*(2), 74-81.
- McPherson, M., Smith-Lovin, L., & Brashears, M. E. (2006). Social isolation in America: Changes in core discussion networks over two decades. *American Sociological Review, 71*(3), 353-375.
- Mehta, M., & Chugh, G. (2011). Achievement motivation and adjustment in members of Indian scientific expedition to Antarctica. *Psychological Studies, 56*, 404-409.
- Mitchell, T. R., Thompson, L., Peterson, E., & Cronk, R. (1997). Temporal adjustments in the evaluation of events: The "rosy view". *Journal of Experimental Social Psychology, 33*(4), 421-448.
- Moult, C., Norris, K., Paton, D., & Ayton, J. (2015). Predicting positive and negative change in expeditioners at 2-months and 12-months post Antarctic employment. *The Polar Journal, 5*(1), 128-145.
- Mullainathan, S., & Shafir, E. (2014). *Scarcity: The new science of having less and how it defines our lives*. New York: Picador.
- Mustafa, S., & Elgazzar, A. (2014). Influence of chronic exposure to cold environment on thyroid gland function in rabbits. *Hormone and Metabolic Research, 46*(08), 546-549.
- Nagar, D., & Pandey, J. (1987). Affect and performance on cognitive task as a function of crowding and noise. *Journal of Applied Social Psychology, 17*(2), 147-157.
- Nagtegaal, J., Kerkhof, G., Smits, M., & Van Der Meer, Y. (1998). Delayed sleep phase syndrome: A placebo-controlled cross-over study on the effects of melatonin administered five hours before the individual dim light melatonin onset. *Journal of Sleep Research, 7*(2), 135-143.
- Nelson, P. D. (1962). *Human adaptation to Antarctic station life*. San Diego, CA, U.S.A.: Naval Medical Neuropsychiatric Research Unit. Retrieved from <http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=AD0286493>
- Nelson, P. D., & Gunderson, E. K. E. (1962). *Analysis of adjustment dimensions in small confined groups*: DTIC Document.
- Ng, B., Kumar, S., Ranclaud, M., & Robinson, E. (2001). Ward crowding and incidents of violence on an acute psychiatric inpatient unit. *Psychiatric Services, 52*(4), 521-525.
- Norris, K., Paton, D., & Ayton, J. (2008). The long cold night: Comparing expeditioner and partner experiences during Antarctic absences Symposium conducted at the meeting of the APS: Australian Psychological Society Annual Conference
- Office for National Statistics. (2009). *Proportion of people living alone doubles since 1971*. Retrieved from <http://webarchive.nationalarchives.gov.uk/20090909172052/http://www.statistics.gov.uk/pdudir/stalone0409.pdf>
- Oliver, D. C. (1991). Psychological effects of isolation and confinement of a winter-over group at McMurdo station, Antarctica. In A. Harrison, Y. A. Clearwater & C. P. McKay (Eds.), *From Antarctica to Outer Space* (pp. 217-227). New York: Springer-Verlag. doi:10.1007/978-1-4612-3012-0_20
- Pääkkönen, T., Leppäluoto, J., Mäkinen, T. M., Rintamäki, H., Ruokonen, A., Hassi, J., & Palinkas, L. A. (2008). Seasonal levels of melatonin, thyroid hormones, mood, and cognition near the Arctic Circle. *Aviation, Space, and Environmental Medicine, 79*(7), 695-699.
- Palinkas, L. A. (1986). Health and performance of Antarctic winter-over personnel: A follow-up study. *Aviation, Space and Environmental Medicine, 57*(10), 954-959.
- Palinkas, L. A. (1992). Going to extremes: The cultural context of stress, illness and coping in Antarctica. *Social Science & Medicine, 35*(5), 651-664.
- Palinkas, L. A. (2002). On the ice: Individual and group adaptation in Antarctica Retrieved from http://www.bec.ucla.edu/papers/Palinkas_On_The_Ice.pdf
- Palinkas, L. A. (2003). The psychology of isolated and confined environments: Understanding human behavior in Antarctica. *American Psychologist, 58*, 353-363.
- Palinkas, L. A., & Browner, D. (1995). Effects of prolonged isolation in extreme environments on stress, coping, and depression. *Journal of Applied Social Psychology, 25*(7), 557-576.

- Palinkas, L. A., Cravalho, M. A., & Browner, D. (1995). Seasonal variation of depressive symptoms in Antarctica. *Acta Psychiatrica Scandinavica*, *91*(6), 423-429.
- Palinkas, L. A., Glogower, F., Dembert, M., Hansen, K., & Smullen, R. (2004). Incidence of psychiatric disorders after extended residence in Antarctica. *International Journal of Circumpolar Health*, *63*(2).
- Palinkas, L. A., Gunderson, E. K. E., & Burr, R. G. (1989a). *Psychophysiological correlates of human adaptation in antarctica*. San Diego, CA, U.S.A.: Naval Health Research Centre. Retrieved from <http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA216679>
- Palinkas, L. A., Gunderson, E. K. E., & Burr, R. G. (1989b). Social, psychological, and environmental influences on health and well-being of Antarctic winter-over personnel. *Antarctica Journal of the US*, *24*, 207-209.
- Palinkas, L. A., Gunderson, E. K. E., Johnson, J. C., & Holland, A. W. (1998). Antarctic Space Analog Program.
- Palinkas, L. A., Gunderson, E. K. E., Johnson, J. C., & Holland, A. W. (2000). Behavior and performance on long-duration spaceflights: Evidence from analogue environments. *Aviation, Space, and Environmental Medicine*, *71*(9,Sect2,Suppl), A29-A36.
- Palinkas, L. A., Johnson, J. C., & Boster, J. S. (2004). Social support and depressed mood in isolated and confined environments. *Acta Astronautica*, *54*(9), 639-647.
- Palinkas, L. A., Johnson, J. C., Boster, J. S., Rakusa-Suszczewski, S., Klopov, V. P., Fu, X. Q., & Sachdeva, U. (2004). Cross-cultural differences in psychosocial adaptation to isolated and confined environments. *Aviation, Space, and Environmental Medicine*, *75*, 973-980.
- Palinkas, L. A., Keeton, K. E., Shea, C., & Leveton, L. B. (2010). *Psychosocial characteristics of optimum performance in Isolated and Confined Environments (ICE)*: NASA.
- Palinkas, L. A., Mäkinen, T. M., Pääkkönen, T., Rintamäki, H., Leppäluoto, J., & Hassi, J. (2005). Influence of seasonally adjusted exposure to cold and darkness on cognitive performance in circumpolar residents. *Scandinavian Journal of Psychology*, *46*(3), 239-246.
- Palinkas, L. A., Reed, H. L., Reedy, K. R., Van Do, N., Case, H. S., & Finney, N. S. (2001). Circannual pattern of hypothalamic–pituitary–thyroid (HPT) function and mood during extended antarctic residence. *Psychoneuroendocrinology*, *26*(4), 421-431.
- Palinkas, L. A., & Suedfeld, P. (2008). Psychological effects of polar expeditions. *Lancet*, *371*, 153-163. doi:10.1016/s0140-6736(07)61056-3
- Palinkas, L. A., Suedfeld, P., & Steel, G. D. (1995). Psychological functioning among members of a small polar expedition. *Aviation, Space, and Environmental Medicine*.
- Patterson, M. L. (1982). A sequential functional model of nonverbal exchange. *Psychological Review*, *89*(3), 231.
- Pattyn, N., Hicks, A., & Marquis, P. (2017). Counter measures to improve quality of life, performance, health, and well-being. In COMNAP (Chair), Symposium conducted at the meeting of the Winter-Over Challenges, Goa, India.
- Pattyn, N., Mairesse, O., Cortoos, A., Marcoen, N., Neyt, X., & Meeusen, R. (2017). Sleep during an Antarctic summer expedition: New light on “polar insomnia”. *Journal of Applied Physiology*, *122*(4), 788-794.
- Paty, B., Rosnet, E., & Bachelard, C. (2005). Mécanismes de la rumeur et de la pensée groupale en groupe restreint: Une utilisation des données recueillies en fin d’hivernage à Dumont d’Urville. *Actes du Congrès International de la Société Française de Psychologie du Sport. Présenté au Congrès International de la Société Française de Psychologie du Sport*.
- Paul, F. J., Mandal, M. K., Ramachandran, K., & Panwar, M. (2010a). Interpersonal behavior in an isolated and confined environment. *Environment and Behavior*, *42*(5), 707-717.
- Paul, J. F. U., Mandal, M. K., Ramachandran, K., & Panwar, M. R. (2010b). Cognitive performance during long-term residence in a polar environment. *Journal of Environmental Psychology*, *30*, 129-132.
- Payne, J. D., Chambers, A. M., & Kensinger, E. A. (2012). Sleep promotes lasting changes in selective memory for emotional scenes. *Frontiers in Integrative Neuroscience*, *6*.
- Pedersen, D. M. (1999). Model for types of privacy by privacy functions. *Journal of Environmental Psychology*, *19*(4), 397-405.

- Peri, A., Barbarito, M., Barattoni, M., & Abraham, A. (2000). The dynamics and the interpersonal and intrapersonal relations within an isolated group in extreme environments. *Small Group Research, 31*, 251-274.
- Pizarro, D. A., Laney, C., Morris, E. K., & Loftus, E. F. (2006). Ripple effects in memory: Judgments of moral blame can distort memory for events. *Memory & Cognition, 34*(3), 550-555.
- Premkumar, M., Sable, T., Dhanwal, D., & Dewan, R. (2012). Circadian levels of serum melatonin and cortisol in relation to changes in mood, sleep, and neurocognitive performance, spanning a year of residence in Antarctica. *Neuroscience Journal, 2013*.
- Reed, H. L., Reedy, K. R., Palinkas, L. A., Van Do, N., Finney, N. S., Case, H. S., . . . Thomas, J. (2001). Impairment in cognitive and exercise performance during prolonged Antarctic residence: Effect of thyroxine supplementation in the polar triiodothyronine syndrome. *The Journal of Clinical Endocrinology & Metabolism, 86*(1), 110-116.
- Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin, 132*(1), 1.
- Rona, R. J., Li, L., Gulliford, M. C., & Chinn, S. (1998). Disturbed sleep: Effects of sociocultural factors and illness. *Archives of Disease in Childhood, 78*(1), 20-25.
- Rosen, L. N., Targum, S. D., Terman, M., Bryant, M. J., Hoffman, H., Kasper, S. F., . . . Rosenthal, N. E. (1990). Prevalence of seasonal affective disorder at four latitudes. *Psychiatry Research, 31*(2), 131-144.
- Rosenblatt, P. C., Anderson, R. M., & Johnson, P. A. (1984). The meaning of "cabin fever". *The Journal of Social Psychology, 123*(1), 43-53.
- Rosenthal, N. E., Sack, D. A., Gillin, J. C., Lewy, A. J., Goodwin, F. K., Davenport, Y., . . . Wehr, T. A. (1984). Seasonal affective disorder: A description of the syndrome and preliminary findings with light therapy. *Archives of General Psychiatry, 41*(1), 72-80.
- Rosnet, E., Le Scanff, C., & Sagal, M.-S. (2000). How Self-Image and Personality Influence Performance in an Isolated Environment. *Environment and Behavior, 32*(1), 18-31. doi:10.1177/00139160021972414
- Rousseau, D. M. (1989). Psychological and implied contracts in organizations. *Employee Responsibilities and Rights Journal, 2*(2), 121-139.
- Rubin, J.-F. (2010, 08/02/2010). *Piccard, Jacques*. Retrieved 12/10/2017, from <http://www.hls-dhs-dss.ch/textes/f/F28906.php>
- Sagar, R., & Pattanayak, R. D. (2015). To the ends of the earth and beyond: Psychological aspects of circumpolar expeditions. *Journal of Mental Health and Human Behaviour, 20*(2), 45.
- Sandal, G. M., Bye, H. H., & van de Vijver, F. J. (2011). Personal values and crew compatibility: Results from a 105 days simulated space mission. *Acta Astronautica, 69*(3), 141-149.
- Sandal, G. M., Endresen, I. M., Vaernes, R., & Ursin, H. (1999). Personality and coping strategies during submarine missions. *Military Psychology, 11*(4), 381.
- Sandal, G. M., Leon, G. R., & Palinkas, L. (2006). Human challenges in polar and space environments. *Reviews in Environmental Science and Biotechnology, 5*, 281-296.
- Sargent, L. D., & Terry, D. J. (1998). The effects of work control and job demands on employee adjustment and work performance. *Journal of Occupational and Organizational Psychology, 71*(3), 219-236.
- Sarris, A. (2006). Personality, culture fit, and job outcomes on Australian Antarctic stations. *Environment and Behavior, 38*, 356-372.
- Sarris, A. (2007). Antarctic culture: 50 years of Antarctic expeditions. *Aviation, Space, and Environmental Medicine, 78*(9), 886-892.
- Sarris, A. (2008). Applying organisational theory to isolated, confined and extreme settings. *The Australian and New Zealand Journal of Organisational Psychology, 1*, 1-6.
- Sarris, A., & Kirby, N. (2005). Antarctica: A study of person-culture fit. *Australian Journal of Psychology, 57*(3), 161-169. doi:10.1080/00049530500125165
- Sarris, A., & Kirby, N. (2007). Behavioral norms and expectations on Antarctic stations. *Environment and Behavior, 39*, 706-723.

- Schmitz, N., Neumann, W., & Oppermann, R. (2000). Stress, burnout and locus of control in German nurses. *International Journal of Nursing Studies*, 37(2), 95-99.
- Schönbrodt, F. D., & Gerstenberg, F. X. (2012). An IRT analysis of motive questionnaires: The unified motive scales. *Journal of Research in Personality*, 46(6), 725-742.
- Silver, N. C., & Dunlap, W. P. (1987). Averaging correlation coefficients: Should Fisher's z transformation be used? *Journal of Applied Psychology*, 72(1), 146.
- Smith, S., & Haythorn, W. W. (1972). Effects of compatibility, crowding, group size, and leadership seniority on stress, anxiety, hostility, and annoyance in isolated groups. *Journal of Personality and Social Psychology*, 22(1), 67.
- Smith, W. M., & Jones, M. B. (1962). Astronauts, Antarctic scientists, and personal autonomy. *Aerospace Medicine*, 33(2), 162-166.
- Soldz, S., & Vaillant, G. E. (1999). The Big Five personality traits and the life course: A 45-year longitudinal study. *Journal of Research in Personality*, 33(2), 208-232.
- Solignac, A. (2004). *Influence des moyens de communication sur l'adaptation en situation d'isolement: Le cas d'un groupe d'hivernants en Terre Adélie* [Influence of communication channels on adjustment in an isolation context: Case of winter-overs in Adélie land]. Université de Reims Champagne-Ardenne.
- Steel, G. D. (2001). Polar moods: Third-quarter phenomena in the Antarctic. *Environment and Behavior*, 33(1), 126-133.
- Steel, G. D., Suedfeld, P., Peri, A., & Palinkas, L. A. (1997). People in high latitudes: The 'Big Five' personality characteristics of the circumpolar sojourner. *Environment and Behavior*, 29(3), 324-347.
- Steinach, M., Kohlberg, E., Maggioni, M. A., Mendt, S., Opatz, O., Stahn, A., & Gunga, H.-C. (2016). Sleep quality changes during overwintering at the German Antarctic stations Neumayer II and III: the gender factor. *PloS one*, 11(2), e0150099.
- Stephoe, A., Shankar, A., Demakakos, P., & Wardle, J. (2013). Social isolation, loneliness, and all-cause mortality in older men and women. *Proceedings of the National Academy of Sciences*, 110(15), 5797-5801.
- Stewart, W. P., & Cole, D. N. (2001). Number of encounters and experience quality in Grand Canyon backcountry: Consistently negative and weak relationships. *Journal of Leisure Research*, 33(1), 106.
- Stokols, D. (1972). On the distinction between density and crowding: Some implications for future research. *Psychological Review*, 79(3), 275.
- Stott, T., & Hall, N. (2003). Changes in aspects of students' self-reported personal, social and technical skills during a six-week wilderness expedition in Arctic Greenland. *Journal of Adventure Education & Outdoor Learning*, 3(2), 159-169.
- Strange, R., & Klein, W. (1973). Emotional and social adjustment of recent US winter-over parties in isolated Antarctic stations. In O. G. Edholm & E. K. E. Gunderson (Eds.), *Polar human biology: Proceedings of the SCAR/IUPS/IUBS Symposium on human biology and medicine in the Antarctic* (pp. 410-416). Chicago: Heinemann.
- Suedfeld, P. (1979). Stressful levels of environmental stimulation. *Stress and Anxiety*, 6, 109-127.
- Suedfeld, P., & Steel, G. D. (2000). The environmental psychology of capsule habitats. *Annual Review of Psychology*, 51(1), 227-253.
- Suedfeld, P., & Weiss, K. (2000). Antarctica natural laboratory and space analogue for psychological research. *Environment and Behavior*, 32(1), 7-17.
- Szpunar, K. K., Addis, D. R., & Schacter, D. L. (2012). Memory for emotional simulations remembering a rosy future. *Psychological Science*, 23(1), 24-29.
- Tafforin, C. (2004). Ethological analysis of a polar team in the French Antarctic station Dumont d'Urville as simulation of space teams for future interplanetary missions. *Acta Astronautica*, 55(1), 51-60.
- Taylor, A. J. W. (1974). The adaptation of New Zealand research personnel in the Antarctic. In O. G. Edholm & E. K. E. Gunderson (Eds.), *Polar human biology: Proceedings of the SCAR/IUPS/IUBS symposium on human biology and medicine in the Antarctic* (pp. 417-429). Chicago: Heinemann.

- Taylor, A. J. W., & McCormick, I. A. (1985). Prediction of performance on the International Biomedical Expedition to the Antarctic (IBEA). *Polar Record*, 22(141), 643-652.
- Taylor, A. J. W., & McCormick, I. A. (1987). Reactions of family partners of Antarctic expeditioners. *Polar Record*, 23(147), 691-700.
- Thompson, E. R., & Phua, F. T. (2012). A brief index of affective job satisfaction. *Group & Organization Management*, 37(3), 275-307.
- Tisch, C. (2005). *Is it really so bad? A review of positive experiences of personnel wintering over in Antarctica*. Literature review. University of Canterbury. Christchurch, New Zealand.
- Uchino, B. N. (2006). Social support and health: A review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine*, 29(4), 377-387.
- Vaughan, G. M., & Hogg, M. A. (2014). *Social psychology: French Forest, N.S.W.*: Pearson Australia.
- Walker, W. R., Skowronski, J. J., & Thompson, C. P. (2003). Life is pleasant--and memory helps to keep it that way! *Review of General Psychology*, 7(2), 203.
- Wall, M. (2016, 5 April 2016). *The most extreme human spaceflight records*. Retrieved 12/10/2017, from <https://www.space.com/11337-human-spaceflight-records-50th-anniversary.html>
- Wapner, S., & Demick, J. (2002). The increasing contexts of context in the study of environment behavior relations. In R. B. Bechtel & A. Churchman (Eds.), *Handbook of environmental psychology* (pp. 3-14). New York: John Wiley & Sons.
- Weiss, H. M., Nicholas, J. P., & Daus, C. S. (1999). An examination of the joint effects of affective experiences and job beliefs on job satisfaction and variations in affective experiences over time. *Organizational Behavior and Human Decision Processes*, 78(1), 1-24.
- Weiss, K., Feliot-Rippeault, M., & Gaud, R. (2007). Uses of places and setting preferences in a French Antarctic station. *Environment and Behavior*, 39, 147-164.
- Weiss, K., & Moser, G. (1998). Interpersonal relationships in isolation and confinement: Long-term bed rest in head-down tilt position. *Acta Astronautica*, 43(3-6), 235-248.
- Westin, A. F. (1967). *Privacy and freedom*. New York: Atheneum.
- Westin, A. F. (2003). Social and political dimensions of privacy. *Journal of Social Issues*, 59(2), 431-453.
- White, K. G., Taylor, A. J., & McCormick, I. A. (1983). A note on the chronometric analysis of cognitive ability: Antarctic effects. *New Zealand Journal of Psychology*, 12(1), 36-40.
- Wilson, D. (2011). *The third-quarter phenomenon in Antarctic personnel*: University of Canterbury.
- Wilson, T. D., Meyers, J., & Gilbert, D. T. (2003). "How happy was I, anyway?" a retrospective impact bias. *Social Cognition*, 21(6), 421-446.
- Winter, D. G., John, O. P., Stewart, A. J., Klohnen, E. C., & Duncan, L. E. (1998). Traits and motives: Toward an integration of two traditions in personality research. *Psychological Review*, 105(2), 230.
- Wirtz, D., Kruger, J., Scollon, C. N., & Diener, E. (2003). What to do on spring break? The role of predicted, on-line, and remembered experience in future choice. *Psychological Science*, 14(5), 520-524.
- Wood, J., Hysong, S. J., Lugg, D. J., & Harm, D. L. (2000). Is it really so bad? A comparison of positive and negative experiences in Antarctic winter stations. *Environment and Behavior*, 32(1), 84-110.
- Woolcock, M., & Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. *The World Bank Research Observer*, 15(2), 225-249.
- Yan, G., Wu, S., Wang, T., Zhang, X., & Saklofske, D. H. (2012). Cognitive effects of long-term residence in the Antarctic environment. *Advances in Polar Science*, 23(3), 170-175.
- Zeedyk-Ryan, J., & Smith, G. F. (1983). The effects of crowding on hostility, anxiety, and desire for social interaction. *The Journal of Social Psychology*, 120(2), 245-252.
- Zeitler, J. M., Dijk, D. J., Kronauer, R. E., Brown, E. N., & Czeisler, C. A. (2000). Sensitivity of the human circadian pacemaker to nocturnal light: melatonin phase resetting and suppression. *The Journal of Physiology*, 526(3), 695-702.
- Zimmer, M., Cabral, J. C. C. R., Borges, F. C., Coco, K. G., & Hameister, B. R. (2013). Psychological changes arising from an Antarctic stay: Systematic overview. *Estudos de Psicologia Campinas*, 30(3), 415-425.

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Appendix A

Study 1

A.1 Email to the National Antarctic Programme

Dear [name],

I am a Ph.D. student at Lincoln University, New Zealand, leading a cross-national study on psychology in Antarctica. I have been redirected to you to discuss my research and a potential collaboration with the future winter-overs at [station name] station (winter 2016).

Please, find attached two documents:

- “[NAP name]_info_sheet” which contains the main information about the study
- “Online_Surveys” which contains the [English version of the] surveys that would be sent to the winter-overs

I remain at your entire disposal if you have any question and I am looking forward to hearing from you.

Best regards,
Cyril Jaksic

A.2 Information sheet

Dear Sir or Madam,

My name is Cyril Jaksic and I am a PhD student at Lincoln University (New Zealand), supervised by Dr Gary Steel. I plan to study psychological and social variables amongst winter-overs during the 2016 austral winter.

Aim

This cross-national study aims to investigate the psychological factors related to adjustment to life in Antarctic stations. Specifically, I am interested in investigating one's social fitness to the station, job satisfaction, job performance, mood, sleep quality and cognitive performance. Indeed, social fitness is thought to be strongly related to one's job performance, as are the other main factors influencing one's daily functioning: sleep quality and mood.

Since we seek to have a culturally representative sample of the Antarctic population, we would like to include [*name(s) of the station(s)*] in the present study.

Method

Data collection will comprise two parts:

- The first part is a **brief online survey** that will be filled in prior to the austral winter and will take approximately 10 minutes to complete.
- The second part will take the form of a **brief monthly online survey** filled in by participants while residing in Antarctica over the winter and will take approximately 5 minutes to complete on each occasion. Please, find below the two questionnaires.

[*While the survey will be translated into 'language'*] You can find the two surveys [*(English version)*] attached along with the present document.

Participation

Since the participants representing your country would be the members of your Antarctic programme, we kindly ask that you allow your support personnel and scientists to take part in our study while on duty at your base(s). If you agree, we would need you to provide us with the names and email addresses of the participants, so that we can approach them directly. Alternatively, you may choose to contact them yourselves rather than passing along their contact details to us. In the event of you choosing to contact them yourselves, we have an information sheet for you to forward to them. Once they have agreed to participate, no other actions would be needed from your organization.

Please bear in mind that participation in the study is **entirely voluntary**. It is very important that personnel feel no pressure to take part in the study.

The participants will be assured that the study is independent from your programme and that their participation, as well as personal data, will not be disclosed to you in order to prevent the perception of any coercion to take part in the study.

This research has been reviewed and approved by the Lincoln University Human Ethics Committee (Lincoln University, New Zealand).

This research is carried out by:

Doctoral student

Cyril Jaksic

Dept. of Tourism, Sport and Society
Lincoln University, Canterbury, New Zealand

Email: [email address]

Tel: [phone number]

Supervisor

Dr. Gary Steel

Senior Lecturer in Social and Environmental Psychology

Email: [email address]

Tel: [phone number]

Associate supervisors

Associate Professor Kevin Moore

Dr. Emma Stewart

Email: [email address]

Email: [email address]

A.3 Email to prospective participants

Dear future winter-over,

You have been identified as a winter-over for the 2016 winter at the [country name] permanent station by your organisation. Every year, Antarctic national programmes cooperate with and support researchers who study social aspects of the winter-over, the present study being one of them.

Your organisation has agreed to allow its Antarctic personnel to participate in this study, and is kindly sending this information sheet to you on behalf of Lincoln University doctoral student, Cyril Jaksic.

Be assured that this research is independent of the national programme that employs you. Your national programme will not be informed of whether or not you agreed to take part in this study. No personal data may be communicated to your employer. Your national programme will only receive copies of any publications made as a consequence of this study.

This PhD study is led by Cyril Jaksic, from Lincoln University, New Zealand. Its aim is to collect psychosocial data over the year in the [country] station to investigate the social context in such an unusual environment. Amongst other consequences, the results should help to refine training processes for future Antarctic expeditions or similar social environments (e.g., on spaceships and submarines).

Your participation in this project will involve:

- Filling in **one brief online questionnaire** prior to the winter-over (approximately 10 minutes)
- Filling in **one brief monthly online questionnaire** (different from the first one) of 5 minutes over the time spent in Antarctica

Note: One question will refer to your colleagues. You will be asked to choose, amongst all your colleagues, those you would select for another winter-over, based on their job performance. This has been found to be one of the most accurate way to measure job performance (in opposition to self-report). Of course, your answer to this question, as well as for all other questions, will remain confidential and your colleagues will not be aware of the evaluation you will make.

The results of the project may be published, but you may be assured of your anonymity in this investigation: while the name of the stations taking part in the study might be disclosed, the identity of any participant will not be made public, nor made known to any person other than the researcher, his/her supervisors and the Human Ethics Committee. No personal data will be published along with identifiable information. The data will be analysed as a whole and no individual data will be disclosed. There will be no mention of any characteristic that might refer to only one of the winter-overs. For example, it will never be said that "one woman..." if there was only one female participant. All data will be stored securely on personal computers at Lincoln University and protected by passwords. To ensure anonymity you will be given a personal code that you will be asked to enter at the beginning of each questionnaire. This will allow us to link together your questionnaires over time while preserving your anonymity.

By filling in the questionnaires you confirm that you have read and agreed with the conditions mentioned above, and that you give your consent to participate in the research. Please note that you can stop participating in the survey at any time. However, any information you would have provided up to that point will become part of our data set.

If you accept to take part in the survey:

- simply forward the email received from your National Programme (containing this pdf) to
- or*
- send an email from the email address you will be using in Antarctica to:

[email address]

and we will send you the survey

Note: please, in your first email, indicate when you are scheduled to arrive in and leave Antarctica. That will enable us to send you the monthly survey for each month of your stay.

Thank you very much for your collaboration.

This research has been reviewed and approved by the Lincoln University Human Ethics Committee (Lincoln University, New Zealand).

Do not hesitate to contact any of the following researchers, they will be pleased to discuss any concerns you have about participation in the project.

This research is carried out by:

Doctoral student

Cyril Jaksic

Dept. of Tourism, Sport and Society
Lincoln University, Canterbury, New Zealand

Email: *[email address]*

Tel: *[phone number]*

Supervisor

Dr. Gary Steel

Senior Lecturer in Social and Environmental Psychology

Email: *[email address]*

Tel: *[phone number]*

Associate supervisors

Associate Professor Kevin Moore

Dr Emma Stewart

Email: *[email address]*

Email: *[email address]*

A.4 Email for the pre-winter-over survey

Dear future winter-over,

Thank you very much for taking part in this study.

This first survey is a general personality assessment and should take approximately 10-15 minutes to complete.

You can access the survey by clicking on the link below:

[link to the survey]

On the first page of the survey, you will be asked to enter a personal password to ensure your anonymity while still being able to link all your surveys together.

Please, enter the following password:

[xxxxxxx]

Please, note that this code is personal and should not be disclosed to anyone.

One month after your arrival, you will receive a monthly survey (about 5 minutes to complete) that will ask specifically about your experience at [base name].

Thank you very much for your participation.

If you have any question or concern, please feel free to contact me.

Cyril

Cyril Jaksic: *[email address]* / *[phone number]*

Dept. of Tourism, Sport and Society

Lincoln University, Canterbury, New Zealand

A.5 First online survey (prior to winter-over)

Thank you for agreeing to take part in this research. We appreciate your help. Before you begin, we would like to provide you with assurances about how your information will be treated.

This questionnaire is anonymous, and you will not be identified as a respondent. Please note that you can stop participating in the study at any time. This means that you can stop answering any of the questionnaires at any time, or withdraw from the study completely at any time. However, any information you have provided up to that point will become part of our data set.

Although this is a very brief survey, you can stop filling in the survey at any time and resume later. However, for better reliability of the data, we ask that you complete the survey all in one sitting, if possible. If you choose to stop filling in the survey and resume later, make sure that none of your colleagues can access your computer and see your responses

The results of the project may be published, but you may be assured of your anonymity in this investigation: while the name of the station might be disclosed, the identity of any participant will not be made public, nor made known to any person other than the researcher, his/her supervisors and the Human Ethics Committee. No personal data will be published along with identifiable information. The data will be analysed as a whole and no individual data will be disclosed.

This research is independent from the national programme that employs you. Your national programme will not be informed whether you agreed to take part in this study or not thus your participation will have no impact on your employment. No personal data will be communicated to your employer.

By clicking the green button at the bottom right, marked as ">>", you confirm that you have read and agreed with the conditions mentioned above.

Thank you very much for your participation.

This research is being held out by Cyril Jaksic, a Ph.D. student at Lincoln University, New Zealand, under the supervision of Dr. Gary Steel. If you have any questions about the research, please feel free to contact either person. Their contact details are below:

Email contacts:
[*email addresses*]

They will be pleased to discuss any concerns you have about participation in the project.

The project has been reviewed and approved by the Lincoln University Human Ethics Committee.

Write the password that has been given to you to take part in this study

The following are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with each statement.

I see myself as someone who...

	Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
Is talkative					
Tends to find fault with others					
Does a thorough job					
Is depressed, blue					
Is original, comes up with new ideas					
Is reserved					
Is helpful and unselfish with others					
Can be somewhat careless					
Is relaxed, handles stress well					
Is curious about many different things					
Is full of energy					
Starts quarrels with others					
Is a reliable worker					
Can be tense					
Is ingenious, a deep thinker					
Generates a lot of enthusiasm					
Has a forgiving nature					
Tends to be disorganized					
Worries a lot					
Has an active imagination					
Tends to be quiet					
Is generally trusting					
Tends to be lazy					
Is emotionally stable, not easily upset					
Is inventive					
Has an assertive personality					
Can be cold and aloof					
Perseveres until the task is finished					
Can be moody					
Values artistic, aesthetic experiences					
Is sometimes shy, inhibited					
Is considerate and kind to almost everyone					
Does things efficiently					
Remains calm in tense situations					
Prefers work that is routine					
Is outgoing, sociable					
Is sometimes rude to others					
Makes plans and follows through with them					
Gets nervous easily					
Likes to reflect play with ideas					
Has few artistic interests					
Likes to cooperate with others					
Is easily distracted					
Is sophisticated in art, music, or literature					

Each item of this questionnaire is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Please be as accurate and honest as you can be, and don't worry about being "consistent" in your responses.

	Strongly disagree	Disagree	Rather disagree	Rather agree	Agree	Strongly agree
I try to be in the company of friends as much as possible.						
I spend a lot of time visiting friends.						
Encounters with other people make me happy.						
Often I would rather be alone than with a group of friends.						
I go out of my way to meet people.						
I choose hobbies that I can share with other people.						
I like to make as many friends as I can.						
I feel a rush of energy when I get to know new people.						
I like to fully immerse myself in a relationship.						
I want to be able to share all the good and negative emotions in a relationship.						
Getting close to someone is the only thing that matters in life.						
My thoughts permanently revolve around my loved ones.						
Finding a soul mate is important for me.						
Sometimes I feel a deep connection and complete unity with another person.						
I don't keep any secrets from the people I love.						

Here you see several goals that can be more or less important for you. Please mark how important each of these goals is for your life, from "not important to me" (1) to "extremely important to me" (6). There are no right or wrong answers – your opinion is all that matters.

	Not important to me	Of little importance to me	Of some importance to me	Important to me	Very important to me	Extremely important to me
Engage in a lot of activities with other people.						
Have a wide circle of friends.						
Have a close, intimate relationship with someone.						
Give sympathy and love to other people.						
Not being separated from the people I really care about.						

For each of the following pairs of statements, select the one that best describes you. In some cases neither statement may describe you well or both may describe you somewhat. In those cases, please select the statement that best describes you or that describes you most often.

1. a. I enjoy being around people.
 b. I enjoy being by myself.
2. a. I try to structure my day so that I always have some time to myself.
 b. I try to structure my day so that I always am doing something with someone.
3. a. One feature I look for in a job is the opportunity to interact with interesting people.
 b. One feature I look for in a job is the opportunity to spend time by myself.
4. a. After spending a few hours surrounded by a lot of people, I usually find myself stimulated and energetic.
 b. After spending a few hours surrounded by a lot of people, I am usually eager to get away by myself.
5. a. Time spent alone is often productive for me.
 b. Time spent alone is often time wasted for me.
6. a. I often have a strong desire to get away by myself.
 b. I rarely have a strong desire to get away by myself.
7. a. I like to vacation in places where there are a lot of people around and a lot of activities going on.
 b. I like to vacation in places where there are few people around and a lot of serenity and quiet.
8. a. When I have to spend several hours alone, I find the time boring and unpleasant.
 b. When I have to spend several hours alone, I find the time productive and pleasant.
9. a. If I were to take a several-hour plane trip, I would like to sit next to someone who was pleasant to talk with.
 b. If I were to take a several-hour plane trip, I would like to spend the time quietly.
10. a. Time spent with other people is often boring and uninteresting.
 b. Time spent alone is often boring and uninteresting.
11. a. I have a strong need to be around other people.
 b. I do not have a strong need to be around other people.
12. a. There are many times when I just have to get away and be by myself.
 b. There are rarely times when I just have to get away and be by myself.

The following information only help us describe the pool of participants for this study.

Which sex are you?

- Male
- Female

What was your age (in years) on your last birthday?

What occupation will you hold during the coming winter-over?

What is your highest qualification (including industrial qualification)?

Are you currently in a relationship?

- Yes
- No

If you answered 'yes' to the previous question, please indicate for how many years you have been in a relationship.

How many children do you have?

How many times have you PREVIOUSLY wintered-over?

If you have any comment regarding this questionnaire or some of your answers, please feel free to comment here.

Thank you for your participant.

Please, click the green button at the bottom right (>>) to submit your questionnaire.

A.6 Email for the monthly survey

Dear winter-over,

It has been now [n] months since you arrived in Antarctica. You receive now the [nth] monthly survey that specifically asks about your experience in Antarctica.

You can access the survey by clicking on the link below:

[*link to the survey*]

On the first page of the survey, you will be asked to enter a personal password to ensure your anonymity while still being able to link all your surveys together.

Please, enter the following password:

[**xxxxxxxx**]

Please, note that this code is personal and should not be disclosed to anyone.

Thank you very much for your participation.

If you have any question or concern, please feel free to contact me.

Cyril

Cyril Jaksic: [*email address*] / [*phone number*]

Dept. of Tourism, Sport and Society

Lincoln University, Canterbury, New Zealand

A.7 Monthly online survey

Thank you for agreeing to take part in this research. We appreciate your help. Before you begin, we would like to provide you with assurances about how your information will be treated.

This questionnaire is anonymous, and you will not be identified as a respondent. Please note that you can stop participating in the study at any time. This means that you can stop answering any of the questionnaires at any time, or withdraw from the study completely at any time. However, any information you have provided up to that point will become part of our data set.

Although this is a very brief survey, you can stop filling in the survey at any time and resume later. However, for better reliability of the data, we ask that you complete the survey all in one sitting, if possible. If you choose to stop filling in the survey and resume later, make sure that none of your colleagues can access your computer and see your responses

The results of the project may be published, but you may be assured of your anonymity in this investigation: while the name of the station might be disclosed, the identity of any participant will not be made public, nor made known to any person other than the researcher, his/her supervisors and the Human Ethics Committee. No personal data will be published along with identifiable information. The data will be analysed as a whole and no individual data will be disclosed.

This research is independent from the national programme that employs you. Your national programme will not be informed whether you agreed to take part in this study or not thus your participation will have no impact on your employment. No personal data will be communicated to your employer.

By clicking the green button at the bottom right, marked as ">>", you confirm that you have read and agreed with the conditions mentioned above.

Thank you very much for your participation.

This research is being held out by Cyril Jaksic, a Ph.D. student at Lincoln University, New Zealand, under the supervision of Dr. Gary Steel. If you have any questions about the research, please feel free to contact either person. Their contact details are below:

Email contacts:
[*email addresses*]

They will be pleased to discuss any concerns you have about participation in the project.

The project has been reviewed and approved by the Lincoln University Human Ethics Committee.

Write the password that has been given to you to take part in this study

Thinking specifically about your current job in Antarctica, during the last 30 days, to what extent do you agree with the following?

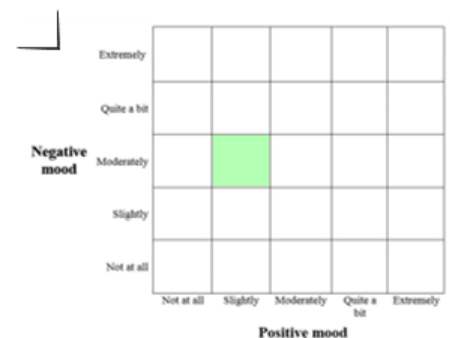
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I find real enjoyment in my job					
My job is unusual					
I like my job better than average person					
My job needs me to be fit					
Most days I am enthusiastic about my job					
My job is time consuming					
I feel fairly well satisfied with my job					

Over the last 30 days, how often have you experienced:

	Not at all	A little bit	Moderately	A lot	Severely
Difficulties falling asleep or staying asleep					
Waking up at night					
Feeling tired during the day					
Being forgetful					
Difficulties in mentally focusing					
Difficulties in finding your words or expressing what you meant					
Feeling confused					

Please indicate on the grid below the extent to which you have felt both positive and negative emotions during the last 30 days. The horizontal scale represents positive emotions and the vertical scale represents negative emotions. Select the square that represents the extent to which you have felt both positive and negative emotions during the last 30 days.

For example, if someone had a moderately negative mood during the last 30 days and slightly felt positive mood, he or she would answer as follows:



Please, select only ONE square.

If you have selected a square by mistake, please click again on it to unselect it.

Negative mood	Extremely					
	Quite a bit					
	Moderately					
	Slightly					
	Not at all					
		Not at all	Slightly	Moderately	Quite a bit	Extremely
		Positive mood				

Please indicate for each of the statements below, the extent to which they have applied to your situation, the way you felt during the last 30 days.

	no!	no	more or less	yes	yes!
I experience a general sense of emptiness					
There are plenty of people I can rely on when I have problems					
There are many people I can trust completely					
There are enough people I feel close to					
I miss having people around					
I often feel rejected					

Privacy could be defined as the claim of an individual to determine what information about himself or herself should be known by others. Not having enough privacy might occur when someone is too much exposed to others, when others have access to one's information that one would rather not share, or when one wishes to be away from people for a while but cannot fulfil this need.

With this in mind, and for the last 30 days at the station, how do you agree with the following statement?

	Strongly disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Strongly agree
I had enough privacy					

If you sometimes feel like having more privacy, how do you fulfil this need? For each strategy, indicate the frequency it has been used over the last 30 days:

	Strategy	1x / month	1x / week	2-3x / week	1x / day	>1x / day
1						
2						
3						
4						
5						
6						

If you had to organise the next winter-over, whom would you select to be part of the next crew? Based solely on their job performance, rank your colleagues at the station from the most preferred to the least preferred.

Please provide only a ranking of people whom you know well enough to judge their job performance. For each person mentioned, use the scale to indicate how well you know them.

Note: You are not asked to rank your colleagues for their likability or popularity, but only for their job performance.

	Names	Compared to most people at the station, I know this person...				
		1 Not at all	2	3	4	5 Very well
1st						
2nd						
3rd						
4th						
5th						
6th						

Indicate the time spent, in an average week during the last 30 days, using the following methods to contact your friends and family.

Please, give your answer **in hours** (put zero if you do not use a given method). You can use decimals.

Postal mail	
Fax	
Telephone	
Email	
Video chat	
Other	

If you have any comment regarding this questionnaire or some of your answers, please feel free to comment here.

Thank you for your participant.

Please, click the green button at the bottom right (>>) to submit your questionnaire.

A.8 Human Ethic Committee letter of approval

Lincoln Research and Innovation

T 64 3 423 0817
PO Box 85084, Lincoln University
Lincoln 7647, Christchurch
New Zealand

www.lincoln.ac.nz

Application No: 2015-21

14 May 2015

Title: Adaptation and adjustment: Person-environment fit in Antarctic winter-overs.

Applicant: Cyril Jaksic

The Lincoln University Human Ethics Committee has reviewed the above noted application.

Thank you for your responses to the questions which were forwarded to you on the Committee's behalf.

I am satisfied on the Committee's behalf that the issues of concern have been satisfactorily addressed.

I am pleased to give final approval to your project. Please note that this approval is valid for three years from today's date at which time you will need to reapply for renewal.

Once your field work has finished can you please advise the Human Ethics Secretary, Alison Hind, and confirm that you have complied with the terms of the ethical approval.

May I, on behalf of the Committee, wish you success in your research.

Yours sincerely

[signature]

Caitriona Cameron
Acting Chair, Human Ethics Committee

PLEASE NOTE: The Human Ethics Committee has an audit process in place for applications. Please see 7.3 of the Human Ethics Committee Operating Procedures (ACHE) in the Lincoln University Policies and Procedures Manual for more information.

A.9 Monte Carlo simulation 1

Given that the database used in studies supporting the averaging correlations method over correlating averages are not the same as the one we have in term of number of participants and number of wave of measures (months), we conducted our own Monte Carlo simulation in order to compare the two methods and verify that averaging correlations would also be advised with our dataset.

Since the median of the number of participants we have per month is 12, that is the number of participants simulated each month. A mock-database has been created with two variables, X and Y, reported for 12 imagined participants, 12 times (simulating the 12 months). The numbers have been randomly generated with the constraint that between X and Y, there should be a true correlation of $r = .50$. On this mock-database, we have performed both methods. As a result, we obtained an averaged correlation as well as a correlation of averages. Such a simulation has been ran 1,000 times.

When averaging the 1,000 correlations of each method, they appear to yield a similar overall correlation with averaging correlations having an overall $r(998) = .482$ and correlating averages yielding an overall $r(998) = .477$. However, the methods differ drastically in term of reliability. While averaging correlations has a $SD = .065$, correlating averages has a $SD = .244$ (see Figure 14). This shows that, for a database similar to ours, having a similar average both methods aim at the same valid target (the true .50 correlation) but averaging correlations happens to be much more accurate in doing so.

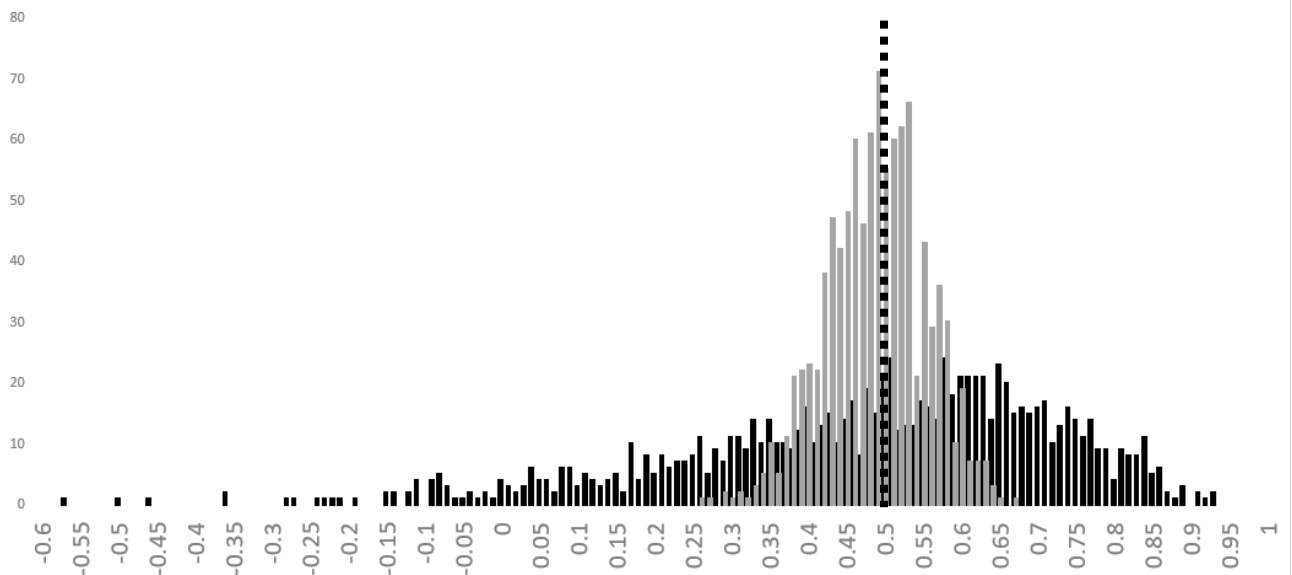


Figure 14. Distribution of 1,000 overall correlations obtained by averaging each month's correlations (grey) and 1,000 correlations obtained by correlating each month's averages (black). Data based on simulated data with a true correlation of .50.

This simulation supports not only previous findings but also the application of the 'averaging correlation' method to the specific set of data of Study 1.

A.10 Monte Carlo simulation 2

Another Monte Carlo simulation was conducted, this time comparing the accuracy of the average of the “raw” correlations and the average of the z-scores of the correlations back-transformed into a correlations. Again, 1,000 simulations were used. As predicted by the literature, the Fisher’s z transformation allowed for a more accurate correlation with an average of .508 (SD = .067) compared to an average of raw correlations of .478 (SD = .066). The difference between the two methods is significant with $t(1998) = 10.087, p < .001$.

Appendix B

Study 2

B.1 Email to Antarctic-related organisations, clubs and associations

Dear [*name of organisation*],

As part of my PhD study at Lincoln University (New Zealand), supervised by Dr Gary Steel, I plan to study psychological and social variables amongst former winter-overs.

As an important society, you attract many fans of Antarctica from diverse horizons and diverse implication with the white continent. Amongst your members, it is thought that there are people who have spent an austral winter in Antarctica. Those former winter-overs would be ideal participants for this study. Thus, we would like to know whether it would be possible for you to forward the link for our survey to your members. It is an online questionnaire of approximately 20 minutes. Of course, participation in the study is entirely voluntary and participants will not be asked to disclose their name, guaranteeing their anonymity.

This study aims to investigate the psychological factors related to adjustment to Antarctic stations. Specifically, we are interested in predicting one's social fitness to the station, job satisfaction, job performance, mood, sleep quality and cognitive performance.

Please find attached the email to be forwarded to your members. If you accept to collaborate with us,

- 1) simply send the 'survey advertisement_ [*name of organisation*]' pdf file to your members.
- 2) or, if you prefer not to send an attached file but rather send the link directly in an email content, simply copy-paste the content of the same pdf file into the email you will send.
- 3) or, if you prefer not to send a long advertisement, you can simply copy-paste the content of Word file attached ("survey short advertisement") whose link will redirect people directly to our survey which also displays all the relevant information on the front page.

You can also find attached a pdf of the survey ('online questionnaire') for your own interest only, not to be sent to your members (as we want them to fill in the online version of the survey and not to have access to a pdf of it).

This research has been reviewed and approved by the Lincoln University Human Ethics Committee (Lincoln University, New Zealand).

If you have any questions, feel free to contact:

Cyril Jaksic
[*email address*]
tel. [*phone number*]
Dept. of Tourism, Sport and Society
Lincoln University, Canterbury, New Zealand

Or alternatively:
Dr Gary Steel (Supervisor): [*email address*]

Associate Professor Kevin Moore (Associate supervisor): [*email address*]

Dr Emma Stewart (Associate supervisor): [*email address*]

Please, letting us know your decision on whether you would like to collaborate or not would be much appreciated.

Kind regards,

Cyril Jaksic

B.2 Complete advertisement for Study 2

WINTER-OVER STUDY

Dear *[member of the given association]*,

This study is led by PhD candidate, Cyril Jaksic, from Lincoln University, New Zealand. Its aim is to collect psycho-social data from former winter-overs to investigate the social context in such an unusual environment. The results should help, amongst others, to refine training processes for future Antarctic expeditions or socially similar environments (e.g., spaceship, submarine).

Important note: The present survey is solely aimed at former winter-overs; that is to say, you should only complete this survey if you have spent a winter in an Antarctic station.

The survey consists of two parts:

- Part One (about 10 minutes): questions related to your experience during your last winter-over in an Antarctic station
- Part Two (about 10 minutes): personality questionnaire

The results of the project may be published, but you may be assured of your anonymity in this investigation: you will not be asked to disclose your name. No personal data will be published. The data will be analysed as a whole and no individual data will be disclosed.

This research is independent from any National Antarctic Programme and your participation is entirely voluntary.

By filling in the questionnaires you confirm that you have read and agreed with the conditions mentioned above, and that you give your consent to participate in the research. You can also withdraw from the study at any time until the submission of your survey. Be aware that only completed survey will be analysed and any data on surveys left uncompleted will be deleted.

If you have already spent an austral winter in an Antarctic station and you are willing to take part in our survey, you will find the survey on this link:

[link to survey]

We would appreciate if you could complete the survey within a month, thank you.

This research has been reviewed and approved by the Human Ethics Research Committee, Lincoln University.

The project is being carried out by:

Cyril Jaksic: *[email address]* / *[phone number]*

Dept. of Tourism, Sport and Society

Lincoln University, Canterbury, New Zealand

He will be pleased to discuss any concerns you have about participation in the project.

Alternatively, you may also contact the following people:

Dr Gary Steel (Supervisor): *[email address]* / phone: *[phone number]*

Associate Professor Kevin Moore (Associate supervisor): *[email address]*

Dr Emma Stewart (Associate supervisor): *[email address]*

B.3 Short advertisement for Study 2

Dear members,

We received this advertisement for a survey targeting anyone who has wintered-over in Antarctica. This study comes from a PhD student at Lincoln University (New Zealand). If you are interested, click on the link below to know more about it and to take part in it:
[link to survey]

The researchers would appreciate if you could complete the survey within one month.

Best regards,
Cyril Jaksic

B.4 Human Ethic Committee letter of approval

Research and Innovation

T 64 3 423 0817
PO Box 85084, Lincoln University
Lincoln 7647, Christchurch
New Zealand
www.lincoln.ac.nz

4 May 2016

Application No: 2016- 15

Title: Job performance and satisfaction: A person-environment fit approach to adaptation in an Antarctic station amongst former winter-overs

Applicant: C Jaksic

The Lincoln University Human Ethics Committee has reviewed the above noted application.

Thank you for your response to the questions which were forwarded to you on the Committee's behalf.

I am satisfied on the Committee's behalf that the issues of concern have been satisfactorily addressed. I am pleased to give final approval to your project.

Please note that this approval is valid for three years from today's date at which time you will need to reapply for renewal.

Once your field work has finished can you please advise the Human Ethics Secretary, Alison Hind, and confirm that you have complied with the terms of the ethical approval.

May I, on behalf of the Committee, wish you success in your research.

Yours sincerely

[signature]

Grant Tavinor

Chair, Human Ethics Committee

PLEASE NOTE: The Human Ethics Committee has an audit process in place for applications. Please see 7.3 of the Human Ethics Committee Operating Procedures (ACHE) in the Lincoln University Policies and Procedures Manual for more information.