Psychological selection methods for winter-over members of the Chinese National Antarctic Research Expedition

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Abstract   This is the first study on the psychological selection of winter-over members of the Chinese National Antarctic Research Expedition. The methods include EPQ，BPQ，16PF，Self-reported Questionnaire，test of level of stress and direct observation of behavior. According to the results of the 54 winter-over candidates of the XIII and XIV Team，the validity was roughly tested. This research lay a foundation for the future studies in this field.

Key words   Antarctica，psychological selection of winter-over members.

1 Introduction

Antarctica is called "Iceland". Its terrible coldness and blizzard keep people from approaching. It is required that the explorers，especially the winter-over members，have the abilities to adapt to the harsh physical and lonely psychological circumstances. In the last 30 a，people started to pay attention to the selection of Antarctic explorers. It is understood that the exploring team is a selected group according to the different tasks rather than a general social one(Zhang and Xue 1998).

To select explorers，American researchers used Attitude and Symptom Questionnaire，evaluation by team head and Social Skill Test，designed its system and made its norm in 1960s. The main content is：motivation of task，stability of emotion and social compatibility. Evaluation by head and other members was used to judge the compatible and different validity. In order to reach expectancy，the regression function was made(Zhang and Xue 1998). In Australia Lugg(1987) investigated the personality and work experience of candidates by self-evaluated method. Australian Antarctica Training Center(Zhang and Xue 1998) had a system including questionnaires，physical examination，interview and short-term training. These questionnaires have been tested of reliability and validity for many years，and also had been compared with psychological tests on selection of submarine members. The feedback system mainly evaluated by heads was constructed to improve the validity.

Personality is regarded as the criterion for the selection in some studies. Thus the first task is to find the personalities that explorers should have. Although most of the results are different，it is agreed that the common characters related to adaptation are：indurance，comity，working motivation and the ability of killing time (Zhang and Xue 1998). The researchers of Australian Antarctica Training Center described the explorers as：indifferent，nonaggressive resilient，easy to be self-satisfied

but not be tired. Parlinkas *et al.* (1989) found that most of explorers had positive characters, which were positively related to achievement motivation in MMPI and negatively related to response under stress, anxiety, depression and feeling experience of unrelated matters. They found the personalities of explorers are: fairness, understanding to others, indurance, indifference to sex and nationality, social ability, self-confidence, adaptation to the changes of society and feeling, self-motivatedness, self-disciplinedness, responsibility, social compatibility, acceptance of new challenging environment, support to the leaders, governments, laws and regulations.

In the researches by questionnaire, factor analysis is often used in order to find the decisive, precise characters among lots of words describing the personality. Although such studies have lasted for many years, the general idea has no significant change(Zhang and Xue 1998).

Apart from questionnaire, others such as interview, direct observation of behavior in short-term training and test of coping with emergence were often adopted.

In China selection of members of the Chinese National Antarctic Research Expedition started as early as fast Antarctic exploration. In 1996, psychological tests appeared in the selection on the XIII Team members. In the work of the XIV Team (the 13th CHINARE), 1997, some improvements were made.

2 Methods

Before the winter-training, Self-reported Questionnaire was completed. Personality questionnaires, test of level of stress and observation of behavior were carried out during the winter-training. After that, the committee (including the leaders of the Chinese Polar Administration, psychologists and coach of winter-training) will discuss the comprehensive evaluation and make the final decision of selection.

2. 1 Selection methods of the XIII Team

According to the above items and processes, the selection of the XIII Team members was carried out in Yabuli Ski Field of Heilongjiang province in March of 1996 during winter-training.

2. 1. 1 Physical examination

Before the winter-training, according to the requirement of the Chinese Polar Administration, candidates have to take physical examination in the appointed hospital. Only the qualified one can attend the winter-training. Some items will be re-tested during the winter-training.

2. 1. 2 Self-reported Questionnaire

In order to understand the personality, history of disease and civility of candidates, a self-reported questionnaire is designed.

Based on the published personality and psychological symptom self-reported tests, this Self-reported Questionnaire has 42 items on personality: social ability (8 items), extroversion-introversion (6 items), responsibility (8 items), attribution (6 items) and anxiety-releasing (14 items). Besides these, there are history of disease (25 items), condition of living (1 item), condition of spouse (2 items), general self-description (1 item), possibility of truth (1 item), with 106 items as a whole.

Each answer offers three choice as "yes", "no", "I do not know". It is required to chose one for each question. The result is described by the above 5 personality dimensions. This questionnaire will be completed before the winter-training.

2. 1. 3 Personality questionnaires

For understanding the personality and testing the compatible validity of Self-reported Questionnaire, we used EPQ (Chen 1983) and BPQ (Zhang 1985).

2. 1. 4 Test of level of stress

The purpose of this experiment is to test the stability of the function of parasympathetic nerve system and emotion. We defined this stability as: under stressful situation, candidates distinguished physiological changes (blood pressure, heart rate)can return to the baseline in related short time after stress. The candidates who have intensive response which often lead to shock of circus system, may have difficulty in adaptation to Antarctica. According to this definition, the first step is to design the stressful program, under which candidates can expose the physiological changes related to emotion and easy to be tested. The purpose of this experiment is to find such a program beside test the stability of emotion, which will be helpful for the following research.

2~3 days before the experiment, the blood pressure and heart rate of each candidate were tested as baseline with electrodigital blood pressure monitor (made in Japan, Type 100-049). In the experiment, the candidates were told to solve four mathematical problems of middle school level which is impossible to resolve with a required deleted. After 30 min, the candidates' blood pressure and heart rate were tested and compared with the baseline.

2. 1. 5 Observation of behavior

Candidates' behavior was observed directly during winter-training by psychologists in order to understand their physical and psychological condition, civility and ability of co-operation, and ability of leadership and creativity.

2. 2 Selection methods of the XIV Team

In March, 1997, the same processes were used in the selection of the XIV Team in the same place.

2. 2. 1 Physical examination

The same as the XIII Team.

2. 2. 2 Self-reported Questionnaire

According to the results of the XIII Team, we revised the questionnaire: the items on personality and psychological symptom were increased from 42 to 140. The personality dimensions were as followed: self-esteem, depressive-positive mood, anxiety-releasing, indifference, social ability, responsibility, attribution, 20 items for each dimension, history of disease (20 items), with 160 items in total. There are three choices for each item and it is required to chose one. Results were reported in 7 dimensions and the plot was drawn. This questionnaire was completed before the winter-training.

2. 2. 3 Personality questionnaires

EPQ (Chen 1983) and 16PF (Dai and Zhu 1988) were applied during winter-training.

2. 2. 4 Test of level of stress

In order to get higher arousal level, we revised the previous program used in the XIII Team. 2~3 days before experiment, baseline was tested by the same method as the XIII Team. In experiment, subject completed the test of distinguish reaction time (red, green, yellow three lights) with Multiple Abilities Monitor BD-II-509 (made by Peking University Equipment Factory) and was told that his reaction time should not be longer than 0.4 s if their age is below 40 and 0.5 s if their age is above 40, and should not make a mistake more than once. This standard was chosen because most of the subjects can but have difficulty in doing so. They may be highly tensified, but not helpless. The blood pressure and heart rate were tested again after test of reaction time.

2.2.5 Observation of behavior
The revised behavioral record report includes 50 items.

3   Results and discussion

3.1   Condition of the candidates of the XIII and XIV Team

According to different tasks, 54 candidates were divided into two groups: rear service personnel and scientific explorers. The basic conditions of them are listed in Table 1 and Table 2.

There are 27 males in the XIII Team, including 2 head candidates. Their average age is 36.7 (min=23, max=53). 27 males in the XIV Team, including 2 head candidates, average age is 38.1 (min=25, max=53).

Table 1. Age of candidates (number of cases)

Age	XIII Team	XIV Team
21~30	6	5
31~40	11	12
41~50	9	8
51~60	1	2

Table 2. Education of candidates (number of cases)

Education	XIII Team	XIV Team
Primary school	0	1
Middle school	1	7
High school	8	7
BA/BS	16	12
Master	2	0

3.2   The results of the XIII Team

3.2.1   Personality questionnaires
3.2.1.1   EPQ   The results of EPQ (Table 3) showed that factor P and N were low and E was high. This indicated that most of the candidates were extrovert, like partnership and had little intention of anxiety and psychiatry. This was good to their adaptation to the Antarctic environment.

Table 3. Results of EPQ of the XIII Team ($\overline{X} \pm SD$)

	P	E	N	L
Scores of candidates ($N=27$)	3.15±2.07	12.70±3.43	4.48±2.69	4.93±2.15
Chinese norm ($N=368$)	6.08±3.22	9.93±4.39	10.06±4.62	13.30±5.77

3.2.1.2   BPQ   In the 1950s, Friedman and Rosenman (1974) found that some

people who had coronary heart disease had common characters: irritable, unstable of emotion, ambitious, acute and lack of patience. They called this as A Type behavior pattern. The other is called B Type. Between A and B is the Middle Type.

Results of BPQ (Table 4) showed most of candidates were Middle Type. According to the concept of Zhang (1985), the results belonged to B Type (scored 19 – 26). This indicated that candidates had patience and indurance which were helpful for the adaptation. In this test, there is one case of A Type (TH+CH=40) and 3 cases of B Type (TH+CH=17, 18, 19). It is known that the extreme A and B Type pattern maybe impact may affect on group relationship and are likely to lead to difficulty of partnership and co-operation, even psychological disorders.

Because there are many arguments on the definition of A Type behavior pattern, the validity of this questionnaire should be studied in the future research.

Table 4. Results of BPQ of the XIII Team ($\overline{X} \pm SD$)

	TH+CH	L		TH+CH	L
Scores of candidates ($N = 27$)	24.52±6.08	15.85±2.23	Chinese norm ($N = 255$)	27.00±8.00	<9.00

3. 2. 1. 3 Self-reported Questionnaire   Results of Self-reported Questionnaire is as follows ($\overline{X} \pm SD$): socialization 7.39±1.34, extrovert 0.35±2.44, relax-ability 12.43±1.83, responsibility 6.13±0.69, attribution 4.52±1.81.

In order to test the validity and relationship of factors, the correlation of this 5 factors to EPQ and BPQ were studied (Table 5). P and responsibility have significant negative correlation and E positively correlated to releasing and social ability. Eysenck and Eysenck(1969) defined P as psychiatry. The responsibility of Self-reported Questionnaire represents care of others, motivation of working, friendliness, earnest and circumspection. It seems to be opposite to P. This is evident in this test. E is extroversion, which has positive correlation to social ability and relax-ability. This indicates that these factors have close relationship.

Table 5. Correlation of the factors in Self-reported Questionnaire and EPQ, BPQ of the XIII Team (r value, $N = 27$)

	P	E	N	TH+CH
Social ability	−0.1603	0.6406**	−0.1605	0.0864
Releasing	−0.2839	0.5081*	−0.2159	0.0161
Extroversion	0.0722	0.3855	−0.0911	0.3316
Responsibility	−0.5151*	0.4026	−0.3767	0.0482
Attribution	−0.1455	−0.1030	−0.1842	−0.2071

*:$P<0.05$; **:$P<0.01$.

On the other hand, except the factors mentioned above, the other factors in Self-reported Questionnaire have no significant correlationship to EPQ and BPQ. One possible explanation is that the validity of this questionnaire is not satisfactory. It is still in need of further improvement the alternative cause is the factors of this questionnaire do not have enough overlap with the personality dimensions in EPQ and

BPQ. Although Eysenck's P, E, N division have many support evidences, there are still arguments on this theory of personality structure. This is the problem needing further study. The solving this problem lies in the perfection of personality theory.

The correlation of factors in one questionnaire is necessary for the evaluation of the questionnaires' validity. This results (Table 6) showed that social ability, extrovert and attribution had significant correlation in the same direction, which indicated that these factors have relationship even they describe the same personality dimension, which is contradictory to the requirement objective of the test.

There are some problems in this questionnaire, such as over exposing of purpose and unclearly description on some items.

Table 6. Correlation of the factors in Self-reported Questionnaire of the ⅩⅢ Team (r value, $N = 27$)

	Releasing	Extrovert	Responsibility	Attribution
Social ability	0.7249**	0.6059**	0.1381	0.7010**
Releasing	—	0.5749**	−0.2255	0.4785*
Extroversion		—	0.0524	0.3383
Responsibility			—	0.3057

* : $P < 0.05$; * * : $P < 0.01$.

3. 2. 2 Test of level of stress

SYS and DIA had no significant change (Table 7) after stress situation. Heart rate increased but had no significance.

This results suggested that this task did not function well enough to excite the parasympathetic nerve system. The alternative possible explanation is the interval between the end of problem-solving and the re-test of the blood pressure and heart rate is too long (up to 10 min in some cases) to find any change.

Table 7. Results of test of level of stress of the ⅩⅢ Team ($\overline{X} \pm SD$, $N = 27$)

	SYS /mmHg*	DIA / mmHg	Heart rate /(beat·min^{-1})
Baseline	130.7±15.2	89.1±11.2	75.7±8.3
After stress	129.1±17.7	87.3±12.3	78.4±10.3
t value	0.45	0.73	1.56

* :1 mmHg=0.133 Kpa.

3. 3 The results of the ⅩⅣ Team

3. 3. 1 Personality questionnaires

3. 3. 1. 1 EPQ   This results (Table 8) were similar to the ⅩⅢ Team. P and N were low (N was lower than the Chinese norm) and E was high. One candidate, whose N score was significantly higher than norm, during the winter-training, was very anxious about his results of psychological tests, tensified, difficult to relax and stubborn. These characters suggested that this candidate was likely to be anxious. This can lead to the psychological disorder of individual and a tense atmosphere on group. It is necessary for the Chinese Polar Administration to pay attention to this candidate.

Table 8. Results of EPQ of the XIV Team ($\overline{X} \pm SD$)

	P	E	N	L
Scores of candidates ($N=27$)	3.52±1.97	14.96±3.69	4.44±3.87	15.48±2.89
Chinese norm ($N=368$)	6.08±3.22	9.93±4.39	10.06±4.62	13.30±5.77

3. 3. 1. 2 16PF   In order to find a more suitable personality questionnaire, we used 16PF instead of BPQ. In the results of 16PF (Table 9), *C* factor was high, which indicated that most of candidates is stable in their emotion which is beneficiary for the wellness of the whole group. In the extreme environment of Antarctica, coldness, loneliness and quietness may shatter the emotional balance of vulnerable person, even lead to psychological disease. This will damage the order of station.

L factor was low. This suggested that subjects were easy to get along with, no too suspicious, too ambitious, indifferent, but co-operative. This is helpful for group interrelationship, which is considered very important for living and working in Antarctica. Co-operation, trust worthy and open-minded are regarded as necessary components of personality of explorers.

Table 9. Results of 16PF of the XIV Team ($\overline{X} \pm SD$)

Personality factor	Scores of candidate ($N=27$)	Chinese norm ($N=567$)	Personality factor	Scores of candidate ($N=27$)	Chinese norm ($N=567$)
A	9.85±3.12	10.02±3.27	Q1	11.22±2.83	11.50±2.91
B	9.07±2.18	8.65±2.61	Q2	10.63±3.56	12.95±3.34
C	19.41±3.00	15.00±3.95	Q3	14.70±3.09	12.16±3.58
E	13.15±4.23	12.77±3.60	Q4	6.69±3.60	10.78±4.01
F	14.78±4.23	12.39±4.40	X1	0.14±3.69	4.30-6.13*
G	14.85±3.35	12.63±3.31	X2	15.67±4.38	7.60-17.68
H	14.00±4.51	11.07±4.43	X3	8.98±2.91	4.85-6.53
I	7.26±2.58	9.65±2.95	X4	11.22±2.51	9.27-15.97
L	7.67±2.34	10.95±3.06	Y1	43.74±10.32	29.38-30.78
M	10.19±2.29	10.89±3.51	Y2	143.67±19.28	92.18-160.74
N	10.52±2.79	9.66±2.75	Y3	97.93±14.49	95.09-123.41
O	5.48±2.81	8.53±3.64	Y4	34.85±7.12	26.95-37.15

* :Computed by the Chinese norm.

3. 3. 1. 3 Self-reported Questionnaire   The improvement of the XIV Team is as follows: delete the items on civility and keep history of disease and personality, the scores of 7 personality factors ($\overline{X} \pm SD$) and good in concealing the test objective, F1: self-esteem 29.36 ± 3.53; F2: positive mood 34.92 ± 3.08; F3: relax-ability 31.28±6.07; F4: indifference 25.60±6.28; F5: social ability 25.52±6.01; F6: responsibility 24.92±3.32; F7: attribution 22.16±5.45.

E factor of EPQ positively correlated to F3 and F5, which is consistent with the results of the XIII Team. *L* factor is not only related to the function of questionnaire, but also represents a stable personality. *L* negatively correlated to F4 and F7. F4 suggests natural, relax-ability, opposite to the compulsive. High score in F7 indi-

cates that one has little intention to feel sinful, less responsibility in some situation. There two factors may have relationship to social simplify. L can be divided into several personalities, which may have cross relation with F4 and F7.

F1 – F7 have many correlation to the factors in 16PF (Table 10,11), especially C, H, N, O, Q4. C is stability, which positively correlated to F1, F2, F3, F4. H is courageousness, which had significant positive correlation to F2, F3, F4, F5. N, which represents social-tact, had significant negative correlation to F1, F2, F3, F4. O represents anxiety, which negatively correlated to F1, F2, F3, F4, F5, F7. Q4 is tension, which had significant negative correlation to F1, F2, F3, F4. These results suggested that the compatible validity of the revised Self-reported Questionnaire is improved.

Table 10. Correlation of the factors of Self-reported Questionnaire to EPQ of the XIV Team ($N =27$)

Factor	P	E	N	L	Factor	P	E	N	L
F1					F5		+		
F2					F6				
F3		+			F7				−
F4				−					

+:Significantly positive correlation; −:Significantly negative correlation.

Table 11. Correlation of the factors of Self-reported Questionnaire to 16PF of the XIV Team ($N =27$)

	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3	Q4
F1			+					−			−	−		+		−
F2			+		+	+	+				−	−				−
F3			+				+				−	−				−
F4			+				+				−	−				−
F5				+	+		+					−				
F6						+		+							+	
F7												−				

+:Significantly positive correlation; −:Significantly negative correlation.

The correlation of the factors in the Self-reported Questionnaire (Table 12, 13) show that there are still many factors have significant correlationship, especially in F2, F3, F4. This suggest these three factors may describe the similar personality. This is supported in the correlation to the factors in 16PF. Factor analysis is a good method to improve the quality of questionnaire. It was not used this time because of the small numbers of subjects ($N =27$) and items ($n =3$). This work should be done in further research.

Table 12. Correlation of the factors in the Self-reported Questionnaire of the XIV Team (r value, $N =27$)

	F2	F3	F4	F5	F6	F7
F1	0.5155**	0.3659	0.4138*	0.1908	0.0168	0.5202**
F2	−	0.6181**	0.6029**	0.2969	0.0238	0.4498*
F3		−	0.6002**	0.2217	−0.1127	0.3850
F4			−	0.2438	−0.3035	0.7170**
F5				−	−0.0187	0.2617
F6					−	−0.5940**

* : $P < 0.05$; * * : $P < 0.01$.

Table 13. Correlation of the factors in Self-reported Questionnaire ($N =27$)

Factor	F1	F2	F3	F4	F5	F6	Factor	F1	F2	F3	F4	F5	F6
F2	+						F5						
F3		+					F6						
F4	+	+	+				F7	+	+		+		−

+:Significantly positive correlation; −:Significantly negative correlation.

Because we have no record of former winter-over members at station, as criterion, the criterion related validity is not tested.

3. 3. 2 Test of level of stress

SYS and DIA (Table 14) increased significantly ($P < 0.001$). Heart rate increased too ($P = 0.115$). After changing the program, this experiment improved greatly. The physiological change under stressful situation can be tested.

Table 14. Results of test of level of stress of the XIV Team ($\overline{X} \pm SD$, $N = 27$)

	SYS/mmHg*	DIA/mmHg	Heart rate/(beat·min^{-1})
Baseline	125. 6±12. 3	73. 8±10. 2	82. 6±16. 5
After stress	135. 1±14. 1	90. 0±10. 3	86. 7±14. 2
t value	4. 54**	8. 73**	1. 63

*: 1 mmHg = 0. 133 kPa; **: $P < 0.01$.

During the winter-training, direct observation of behavior was carried out. This method will be improved systematically in further work. In 1991, French researchers distinguished "select-in" and "select-out" in the psychological selection and tried to design the different methods and processes.

"Select-in" is to select the members who reach a standard among a group. "Select-out" is deleting the members who are not in the permitted dimension. The processes including the psychological selection during the winter-training in our system is, in fact, the so-called "select-out" to delete the individuals who are unable to adapt to Antarctica.

The results of personality questionnaires showed that most of factor (90%) are in Chinese norm. In the other words, these candidates, compared with normal men, had no markable personality. This supported the idea of "select-out". Although no evidence shows the existence of such personality, there are some common characters: extroversion, positiveness, social ability, co-operation, indifference, responsibility.

Psychological character is a complex, dynamic system, rather than simple piling up of numbers. It is difficult to forecast one's ability before the practical work. There are interplay among many factors. It is possible that we will miss the useful information we divide mind into independent unit and only peruse to the precise of quality. So there should be many standards besides psychological test and multiple methods to understand the candidates.

4 Conclusion

This research discussed the psychological selection methods of Chinese National Antarctic Research Expedition. The selection system should be improved in further studies. It is very important to construct the information feedback system including evaluation by the team leaders and the team heads, in order to improve its validity.

This work needs rather long time to accomplish. It is an important task to collect information continually in the future.

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