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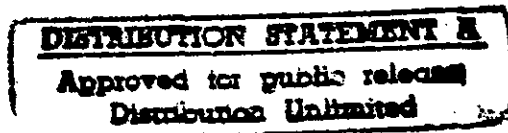
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# Personality Characteristics of Pre/Post-Strike Air Traffic Control Applicants

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16. Abstract The 16 Personality Factors (16PF) test has been routinely administered to personnel applying for Air Traffic Control Specialist (ATCS) positions within the Federal Aviation Administration for more than 3 decades. This study was designed to assess the relationship between personality characteristics of a group of post-strike applicants (1984) with data gathered in the late 1960s to early 1970s (Karson and O'Dell, 1974). Additionally, the comparisons provide a baseline with which to assess characteristics of the new controllers who will start to enter the workforce as the post-strike workforce begins to retire following the year 2000. Outcomes were consistent with previous findings, in revealing that female and male ATCS applicants are brighter than the average individual. When compared with the general population norms, the applicant groups are less anxious, report higher self-discipline, and are more emotionally stable. They are also more self-reliant and assertive. These characteristics appear to be ideally suited for applicants to an occupation that requires quick decision-making and calm, thoughtful responses during emergencies.					
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## PERSONALITY CHARACTERISTICS OF PRE/POST-STRIKE AIR TRAFFIC CONTROL APPLICANTS

### INTRODUCTION

Cattell (1949) developed the 16 Personality Factors (16PF) test to measure normal aspects of adult personality. Since the early 1960s, the 16PF has been routinely administered to personnel applying for Air Traffic Control Specialist (ATCS) positions within the Federal Aviation Administration (FAA). The test has been used to identify applicants who may have potential psychological difficulties.

Karson and O'Dell (1974a) reported on the results of a comparison of the personality characteristics between male and female ATCS applicant groups. Since their study, changes in recruitment efforts and selection procedures may have significantly altered the applicant pool. Firings following the air traffic controllers' strike of 1981 created an increased demand for applicants. While recruitment prior to the strike was more often focused on attracting former military air traffic controllers, the post-strike efforts led to increased use of special advertisements and other more active recruitment efforts, including specific attempts to attract more minority and female applicants.

Another post-strike change was the implementation of a new selection battery by the Office of Personnel Management (OPM) in 1981. Both of these changes may have affected the characteristics of the applicant pool. Detailed demographics of ATCS applicants are not available (currently or from Karson and O'Dell, 1974a) however, an analysis of the demo-

graphics of personnel who enter training at the FAA Academy is most likely representative of changes in the pool of individuals (applicants) who are eligible for hire.

Table 1 illustrates several significant differences in the demographic composition of Academy entrants in 1968-1970 (Cobb, Matthews, & Lay, 1972) from those in 1984 and 1985. More of the 1984-85 entrants had a college degree but fewer had previous ATCS experience. The applicant group comprised a greater number of persons under age 30, and there was also a much higher percentage of females (14.7% compared with 2.2% in 1968-1970). These changes in the demographics of Academy entrants/ATCS applicants may also be reflected in the overall personality profile.

A potential difficulty associated with the interpretation of personality dimensions concerns the influence of response sets on the personality measure. Krug (1978), in commenting on the administration of personality questionnaires to job applicants, and Dolgin and Gibb (1988), in reviewing the relationship between personality measurement and aircrew selection, refer to the role of the "social desirability" response set. This refers to the tendency of applicants to respond in a positive way so as to create a favorable image of themselves. Using an older, and now outdated measure of social desirability, Karson and O'Dell (1974b) found that male ATCS applicants had higher

**TABLE 1 - SELECTED DEMOGRAPHICS OF FAA ACADEMY ATCS STUDENTS**

<u>DEMOGRAPHIC VARIABLE</u>	<u>1968-1970</u>	<u>1984-1985</u>
EDUCATION - COLLEGE DEGREE	10.1%	44.9%
PRIOR EXPERIENCE - ATCS	62.2%	21.0%
AGE - UNDER 30	70.4%	88.8%
GENDER - MALE	97.8%	85.3%

average scores than a comparison group of journey-men tower controllers (a mean of 6.48 for applicants versus 5.31 for tower controllers). Winder, O'Dell, and Karson (1975) reported on the development of two validity scales for the 16PF: motivational distortion (MD) and fake bad (FB). MD refers to the tendency of the respondent to present him/herself in a favorable light ("fake good"). FB is a measure of the tendency for individuals in certain settings to deliberately present themselves in an unfavorable manner. ("fake bad").

Data analyses were designed to determine if: (a) the personality characteristics of the 1984 ATCS applicant group differed significantly from the Karson and O'Dell (1974a) group, (b) the male and female ATCS applicants in 1984 differed from each other on any of the personality dimensions, (c) the 16PF profiles of applicants and those of the general population and college normative groups were different, and (d) the higher order factor structure for the 1984 16PF scores differed significantly from that reported by Karson and O'Dell (1974a). Profiles were also evaluated to determine the presence of a response set. In addition to providing the above comparisons, data collected from the 1984 group can also serve as a baseline with which to assess characteristics of the new controllers that will start entering the workforce following the year 2000.

## METHODS

Applicants completed the 16PF (1967 version of Forms A and B) following notification of their selection for entrance into the ATCS training program and during their interview at selected sites within each of 9 FAA geographical regions. All of the 1984 16PF records were manually entered into a computerized database.

The sample used in this study was comprised of 3,468 applicants from 1984, 18% of whom were women. Karson and O'Dell (1974a) reported on results from the administration of the 1962 version of the 16PF to a sample of 10,103 applicants, of whom 2% were women.

Raw scores for each of the 16 primary factors (Forms A and B combined) and standard scores (stens) were computed, using the appropriate female or male general population adult norms (IPAT, 1970). In addition to the primary factors, scores were also computed for the two validity scales, MD and FB. A list of the factors and adjectives typically used to describe high and low scores are contained in Appendix A. (Scale descriptors for the 16 primary personality factors are those used by Krug (1981).) Descriptive statistics included means, standard deviations, and correlations. Differences between the average raw scores on the 16PF for the 1974 and 1984 applicant groups, female and male comparisons for the 1984 sample, and differences between the 1984 applicant groups and the normative groups were determined through use of multiple t-tests based on the pooled variances of the groups. Risk of Type 1 errors for the multiple comparisons was minimized through the use of Dunn's test (Howell, 1987).

The large sample sizes resulted in a number of statistically significant differences that were of limited practical significance. Cohen's (1988) index of effect size (*d*) was used to determine which of the differences were of practical significance. Only differences with a medium effect size (.50) or greater are discussed in this report. A second measure of practical significance, the Common Language Effect Sizes (CL; McGraw & Wong, 1992) was also used. The CL measures the significance of any difference based on the number of times out of 100 that a randomly selected entry-level controller will have a higher score on a given personality scale than a randomly selected person from the general population or from one of the other controller groups. For example, a CL of 75 on the Warmth scale means that, for any random pairing of a controller with a member of the general, normative population, the controller would have a higher score 3 out of 4 times. For the purposes of this study CL levels of >70 and <30 were selected as providing evidence of a practical difference between the 1984 ATCS applicants and comparison groups.

Results from this study were submitted to a factor analytic procedure similar to that used by Karson and O'Dell (1974a); an oblim rotation forcing the 16PF variables into 6 factors. A program developed by Hebbler (1989) was used to determine the coefficients of concordance for the female and male 1974 and 1984 comparisons and for comparing the 1984 female-male outcomes.

## RESULTS

**1974 and 1984 Female Comparisons.** Raw score means, standard deviations, and effect sizes (*d* and *CL*) of 16PF scores for female ATCS applicants from this study and those from Karson and O'Dell (1974a) are presented in Table 2. Differences in the average scores for 11 of the 16 factors were statistically significant ( $p < .01$ ). Differences for the Warmth, Intelligence, Conformity, Suspiciousness, and Shrewdness factors were not significant. Differences for the Emotional Stability, Dominance, Boldness, Insecurity,

Radicalism, Self-sufficiency, and Self-Discipline factors had medium or larger effect sizes. Of those with significant *t* values and effect sizes (*d*), only the Dominance, Radicalism, Self-Sufficiency, and Self-Discipline comparisons had *CL* values in the designated ranges (*CL* of  $>70$  or  $<30$ ). Female applicants in 1984 exhibited higher scores on the measures of Emotional Stability, Dominance, Boldness, and Self-Discipline than their counterparts in 1974. Compared with the Karson and O'Dell (1974a) sample, they are significantly lower in Insecurity, Radicalism, and Self-Sufficiency.

Thus, female applicants in 1984 are less anxious and insecure and appear to have greater resources to cope with anxiety when it does arise. They also appeared more self-assertive, adventuresome, independent, and imaginative than the 1974 female applicants.

Results of the 1984 factor analysis of the female 16PF scores were similar to those noted by Karson and O'Dell (1974a). The higher-order factors correspond to what Karson and O'Dell (1974a) called: Anxiety,

**TABLE 2 - 16PF FORM A + B RAW SCORE MEANS AND STANDARD DEVIATIONS FOR 1974 AND 1984 FEMALE ATCS APPLICANTS**

	FACTOR	1974 (N=217)		1984 (N=624)		<i>t</i>	<i>d</i>	<i>CL</i>
		MEAN	SD	MEAN	SD			
A	(WARMTH)	18.82	6.37	18.98	6.14	-0.32	.03	49
B	(INTELLIGENCE)	17.65	2.42	17.88	2.75	-1.16	.08	48
C	(EMOTIONAL STABILITY)	37.57	6.94	40.72	6.27	-5.89*	.50	37
E	(DOMINANCE)	20.38	5.94	25.64	6.27	-11.05*	.84	27
F	(IMPULSIVITY)	28.63	7.76	31.38	6.93	-4.61*	.40	40
G	(CONFORMITY)	31.03	4.69	30.51	4.84	1.39	.10	53
H	(BOLDNESS)	30.17	9.50	35.51	9.70	-7.08*	.55	35
I	(SENSITIVITY)	19.59	5.59	21.54	5.23	-4.49*	.37	40
L	(SUSPICIOUSNESS)	12.59	4.74	11.45	4.87	3.02	.23	57
M	(IMAGINATION)	21.23	5.59	23.63	5.10	-5.56*	.47	37
N	(SHREWDNESS)	22.02	3.39	21.27	4.65	2.30	.16	35
O	(INSECURITY)	16.00	6.40	12.36	6.62	7.14*	.55	66
Q1	(RADICALISM)	20.38	4.02	17.08	4.79	9.88*	.69	70
Q2	(SELF-SUFFICIENCY)	21.55	5.30	16.91	5.53	10.96*	.84	73
Q3	(SELF-DISCIPLINE)	26.32	4.78	30.62	4.71	-11.44*	.91	26
Q4	(TENSION)	16.63	8.33	13.91	8.67	4.09*	.31	59
MD	(DISTORTION)			8.20	3.00			
FB	(FAKE BAD)			0.91	1.10			

\*  $p \leq .01$

*d* .50 or higher for medium effect size

*CL*  $> 70$  or  $< 30$

Extroversion, Independence, Cortical Alertness, Obsessive-Compulsivity, and Intelligence, which primarily involved a single scale (B). However, Extroversion and Independence (the second and third factors in 1974) reversed order to become the third and second factors in the 1984 sample. Using a program developed by Hebbler (1989), coefficients of concordance were determined to compare the factor solutions from the two samples. Provided the order of the factors is adjusted for the differences noted above, the coefficients of concordance for the comparisons; .91, .93, .86, .86, .92, and .94 suggest that the underlying factor structure is highly similar.

**1974 and 1984 Male Comparisons.** Raw score means, standard deviations, and effect sizes of the scores on the 16PF for male ATCS applicants in 1984 and from the Karson and O'Dell (1974a) study are presented in Table 3. All differences in the average scores for the 16 comparisons were statistically significant ( $p < .01$ ).

Six differences in the factor scores were of medium effect size or greater. Male ATCS applicants in 1984 had higher scores on the Emotional Stability, Dominance, Imagination, and Self-Discipline factors than those in the Karson and O'Dell (1974a) study. Their average 16PF scores were lower on the Insecurity and Radicalism factors. Of these comparisons, only Dominance, Imagination, Radicalism, and Self-Discipline had CL values in the prescribed ranges.

The general pattern of differences in the 16PF from 1974 to 1984 for men was quite similar to those noted for women: less tension and insecurity, along with greater self-assertiveness, self-discipline, and emotional stability. 1984 applicants clearly report less anxiety and appear to have greater resources to cope with anxiety than 1974 applicants.

Comparisons of the 1984 factor analysis of the 16PF scores for male ATCS applicants with that of Karson and O'Dell (1974a) were identical to that noted for females. Once again, the order for factors

**TABLE 3 - 16PF FORM A + B RAW SCORE MEANS AND STANDARD DEVIATIONS FOR 1974 AND 1984 MALE ATCS APPLICANTS**

	FACTOR	1974 (N=9886)		1984 (N=2844)		t	d	CL
		MEAN	SD	MEAN	SD			
A	(WARMTH)	18.06	6.52	17.17	6.20	6.68*	-.14	54
B	(INTELLIGENCE)	16.98	2.54	17.88	2.59	-16.43*	.35	40
C	(EMOTIONAL STABILITY)	38.26	6.42	41.33	6.06	-23.54*	.51	36
E	(DOMINANCE)	22.58	5.69	27.19	6.04	-36.39*	.76	29
F	(IMPULSIVITY)	28.04	7.13	30.53	6.95	-16.77*	.36	40
G	(CONFORMITY)	31.87	4.49	30.43	4.70	14.57*	.31	50
H	(BOLDNESS)	31.37	9.27	35.43	9.57	-20.12*	.42	38
I	(SENSITIVITY)	15.05	5.13	16.19	5.38	-10.08*	.21	44
L	(SUSPICIOUSNESS)	13.64	4.93	11.59	4.83	19.89*	.42	61
M	(IMAGINATION)	17.82	4.95	22.93	5.15	-47.12*	.99	24
N	(SHREWDNESS)	21.99	3.79	20.77	4.31	13.68*	.28	58
O	(INSECURITY)	15.01	6.04	11.12	6.07	30.21*	.64	67
Q1	(RADICALISM)	20.73	4.24	17.21	4.79	35.47*	.73	71
Q2	(SELF-SUFFICIENCY)	19.85	5.18	17.28	5.78	21.42*	.44	63
Q3	(SELF-DISCIPLINE)	27.11	4.37	30.86	4.44	-39.91*	.84	27
Q4	(TENSION)	15.25	7.37	12.09	7.68	19.55*	.41	62
MD	(DISTORTION)			8.27	2.94			
FB	(FAKE BAD)			1.05	1.14			

\*  $p \leq .01$   
d .50 or higher for medium effect size  
CL > 70 or < 30

two and three was reversed for the 1984 sample. Coefficients of concordance (following reversal of the two factors) yielded rates consistent with those noted for females: .92, .96, .77, .97, .71, and .98 for each of the 6 higher order factors. Thus, despite differences in the overall profile between the two samples, the underlying factor structure has remained generally stable.

**1984 Male and Female Comparisons.** Table 4 illustrates the raw score means, standard deviations, and effect sizes for the male and female ATCS applicants in 1984. While 5 of the comparisons reached statistical significance, only the difference on the Sensitivity factor had a medium or greater effect size (d and CL). These results are consistent with those of Karson and O'Dell (1974a) in revealing little difference between the personality profiles of male and female ATCS applicants. Results are also generally consistent with those of a recent meta-analysis of gender differences in personality conducted by Feingold (1994). He reported that when compared

with men, women exhibited higher scores on scales measuring extroversion, anxiety, trust, and tendermindedness.

Outcomes for the factor analysis of the 1984 male and female results are presented in Table 5, along with the respective coefficients of concordance. The factor structure for the 2 groups was essentially identical, with the coefficients of concordance ranging from .91 for the cortical alertness factor to .99 for anxiety, extroversion, and compulsivity.

**Comparisons of 1984 Female ATCS Applicants With the General Population and College Norms.** Average 16PF profiles for the 1984 female ATCS applicants and the general population normative sample are presented in Table 6. Female ATCS applicants were significantly different from the normative group on 13 of the 16 factors. Differences on the Imagination, Shrewdness, and Radicalism factors were not significant. Differences in the average factor scores that had a medium effect size or greater included the

**TABLE 4 - 16PF FORM A + B RAW SCORE MEANS AND STANDARD DEVIATIONS FOR 1984 FEMALE AND MALE ATCS APPLICANTS**

	FACTOR	FEMALE ATCS APPLICANTS		MALE ATCS APPLICANTS		t	d	CL
		MEAN	SD	MEAN	SD			
A	(WARMTH)	18.98	6.14	17.17	6.20	6.66*	.29	58
B	(INTELLIGENCE)	17.88	2.75	17.88	2.59	0.00	.00	50
C	(EMOTIONAL STABILITY)	40.72	6.27	41.33	6.06	-2.21	.10	47
E	(DOMINANCE)	25.64	6.27	27.19	6.04	-5.63*	.25	43
F	(IMPULSIVITY)	31.38	6.93	30.53	6.95	2.78	.12	54
G	(CONFORMITY)	30.51	4.84	30.43	4.70	0.38	.02	50
H	(BOLDNESS)	35.51	9.70	35.43	9.57	0.19	.01	50
I	(SENSITIVITY)	21.54	5.23	16.19	5.38	23.02*	1.02	76
L	(SUSPICIOUSNESS)	11.45	4.87	11.59	4.83	-0.66	.03	50
M	(IMAGINATION)	23.63	5.10	22.93	5.15	3.09	.14	54
N	(SHREWDNESS)	21.27	4.65	20.77	4.31	2.46	.11	53
O	(INSECURITY)	12.36	6.62	11.12	6.07	4.29*	.19	56
Q1	(RADICALISM)	17.08	4.79	17.21	4.79	-0.61	.03	49
Q2	(SELF-SUFFICIENCY)	16.91	5.53	17.28	5.78	-1.50	.07	48
Q3	(SELF-DISCIPLINE)	30.62	4.71	30.86	4.44	-1.16	.05	48
Q4	(TENSION)	13.91	8.67	12.09	7.68	4.84*	.21	56
MD	(DISTORTION)	8.20	3.00	8.27	2.94			
FB	(FAKE BAD)	0.91	1.10	1.05	1.14			

\*  $p \leq .01$   
d .50 or higher for medium effect size  
CL > 70 or < 30



**TABLE 5 - 1984 MALE VS. FEMALE APPLICANT FACTOR LOADINGS ROTATED BY OBLIM**

		FACTOR											
		Anxiety		Independence		Extroversion		Cortical Alertness		Obsessive-Compulsivity		Intelligence	
		I		II		III		IV		V		VI	
		M	F	M	F	M	F	M	F	M	F	M	F
A	(Warmth)	-02	-03	-03	-01	76	73	26	26	12	14	06	-08
B	(Intelligence)	01	01	01	-01	04	-01	-06	00	03	13	100	100
C	(Emotional Stability)	86	87	-01	05	06	03	-05	-07	05	02	02	05
E	(Dominance)	-01	-19	80	63	16	17	-14	-37	04	-03	-06	-05
F	(Impulsivity)	-02	-13	27	15	69	71	-14	-11	-29	-27	-06	02
G	(Conformity)	-08	-09	01	00	12	08	-00	00	90	91	-00	06
H	(Boldness)	42	37	26	26	58	61	00	-17	16	13	-05	-04
I	(Sensitivity)	-16	-19	-10	07	18	12	90	90	06	-00	-02	-03
L	(Suspiciousness)	-77	-83	38	27	-02	-02	-11	-03	15	17	-05	-08
M	(Imagination)	31	34	46	68	-16	-10	55	26	-20	-23	03	12
N	(Shrewdness)	20	25	-48	-29	-14	-11	10	25	28	33	-06	-21
O	(Insecurity)	-81	-80	-20	-22	-13	-13	09	09	-08	-08	-03	01
Q1	(Radicalism)	-01	-03	74	76	-12	-04	11	-01	01	08	11	05
Q2	(Self-Sufficiency)	-12	-14	18	29	-79	-80	03	-01	-05	-05	05	-03
Q3	(Self-Discipline)	40	50	03	05	-13	-12	-01	-04	68	58	-00	-04
Q4	(Tension)	-82	-83	-01	-08	-01	-00	02	07	-19	-16	05	11
Coefficient of Concordance		.99		.95		.99		.91		.99		.96	

factors of Warmth, Intelligence, Emotional Stability, Dominance, Impulsivity, Conformity, Boldness, Sensitivity, Suspiciousness, Insecurity, Self-Discipline, and Tension. CL levels again appeared to be somewhat more conservative in that only 8 out of the 11 comparisons that had significant d values also had CL values in the designated ranges.

Female ATCS applicants, when compared with females in the general population, are more intelligent, emotionally stable, and assertive. They are also more enthusiastic, venturesome, and have greater self-confidence and self-control. Their self-reported level of tension or anxiety is clearly lower than that of the average woman; ATCS applicants are also less insecure and sensitive.

Table 7 illustrates the raw score means, standard deviations, and effect sizes of the female ATCS applicants and those of the female college student normative group. Differences between the ATCS applicant group and the college student group were similar to differences between the applicants and the general population. Average scores on the Intelligence factor are an exception, with the female ATCS applicant mean score (17.88) only slightly higher than that of

college students (17.50). Female college students (33.32) are more impulsive than the general population (26.57) and, to a lesser extent, more impulsive than ATCS applicants (31.38). For several factors, the spread of scores across the groups was somewhat greater. On the Tension factor, ATCS applicants had a mean factor score of only 13.91, compared with 25.96 for the general population and 28.26 for college students. Of the ATCS applicant-college student comparisons with significant t scores, all but 4 were of medium or greater d value. A smaller number reached the appropriate ranges for a significant CL level.

**Comparisons of 1984 Male ATCS Applicants With the General Population and College Norms.** Raw score means, standard deviations and effect sizes of the 1984 male ATCS applicants and normative male data for the 16PF are presented in Table 8. Male ATCS applicants were significantly different from the normative group on 15 of the factors; the difference on the Dominance factor was not significant. Considering only those differences that met the effect size criterion, male ATCS's are like the general population males on about half of the 16PF factors. Male ATCS applicants are less outgoing, suspicious, insecure,

**TABLE 6 - 16PF FORM A + B RAW SCORE MEANS AND STANDARD DEVIATIONS FOR 1984 FEMALE ATCS APPLICANTS AND FEMALE GENERAL POPULATION**

	FACTOR	ATCS APPLICANTS (N=624)		GENERAL POPULATION (N=468)		t	d	CL
		MEAN	SD	MEAN	SD			
A	(WARMTH)	18.98	6.14	22.88	5.91	-10.60*	.64	32
B	(INTELLIGENCE)	17.88	2.75	14.08	3.72	18.59*	-1.18	79
C	(EMOTIONAL STABILITY)	40.72	6.27	30.73	8.39	21.60*	-1.38	83
E	(DOMINANCE)	25.64	6.27	21.39	7.22	10.17*	-.63	67
F	(IMPULSIVITY)	31.38	6.93	26.57	7.35	10.96*	-.68	68
G	(CONFORMITY)	30.51	4.84	26.44	5.61	12.56*	-.78	71
H	(BOLDNESS)	35.51	9.70	25.69	10.49	15.79*	-.98	75
I	(SENSITIVITY)	21.54	5.23	25.78	5.22	-13.26*	.81	28
L	(SUSPICIOUSNESS)	11.45	4.87	14.05	5.33	-8.27*	.51	36
M	(IMAGINATION)	23.63	5.10	24.54	6.79	-2.43	.15	46
N	(SHREWDNESS)	21.27	4.65	21.44	4.53	-0.61	.04	49
O	(INSECURITY)	12.36	6.62	23.18	8.33	-23.13*	1.46	16
Q1	(RADICALISM)	17.08	4.79	16.24	5.01	2.79	-.17	55
Q2	(SELF-SUFFICIENCY)	16.91	5.53	18.44	6.02	-4.29*	.27	43
Q3	(SELF-DISCIPLINE)	30.62	4.71	22.93	6.38	21.95*	-1.40	83
Q4	(TENSION)	13.91	8.67	25.96	8.93	-22.32*	1.37	17
MD	(DISTORTION)	8.20	3.00					
FB	(FAKE BAD)	0.91	1.10					

\* p ≤ .01  
d .50 or higher for medium effect size  
CL > 70 or < 30

**TABLE 7 - 16PF FORM A + B RAW SCORE MEANS AND STANDARD DEVIATIONS FOR 1984 FEMALE ATCS APPLICANTS AND FEMALE COLLEGE STUDENTS**

	FACTOR	ATCS APPLICANTS (N=624)		COLLEGE STUDENTS (N=1182)		t	d	CL
		MEAN	SD	MEAN	SD			
A	(WARMTH)	18.98	6.14	22.98	6.04	-13.23*	.66	32
B	(INTELLIGENCE)	17.88	2.75	17.50	2.94	2.72	-.13	53
C	(EMOTIONAL STABILITY)	40.72	6.27	31.19	7.10	29.30*	-1.40	83
E	(DOMINANCE)	25.64	6.27	22.56	7.30	9.36*	-.44	62
F	(IMPULSIVITY)	31.38	6.93	33.32	7.56	-5.37*	.25	43
G	(CONFORMITY)	30.51	4.84	25.33	5.99	19.87*	-.92	75
H	(BOLDNESS)	35.51	9.70	26.66	11.07	17.53*	-.83	76
I	(SENSITIVITY)	21.54	5.23	26.65	5.18	-19.79*	.98	24
L	(SUSPICIOUSNESS)	11.45	4.87	15.51	5.22	-16.42*	.80	28
M	(IMAGINATION)	23.63	5.10	25.24	6.49	-5.79*	.27	42
N	(SHREWDNESS)	21.27	4.65	19.66	4.32	7.16*	-.36	60
O	(INSECURITY)	12.36	6.62	23.16	7.67	-31.16*	1.47	47
Q1	(RADICALISM)	17.08	4.79	17.17	5.11	-0.37	.02	50
Q2	(SELF-SUFFICIENCY)	16.91	5.53	16.94	5.98	-0.11	.01	50
Q3	(SELF-DISCIPLINE)	30.62	4.71	22.18	5.96	32.93*	-1.52	87
Q4	(TENSION)	13.91	8.67	28.26	8.65	-33.45*	1.66	12
MD	(DISTORTION)	8.20	3.00					
FB	(FAKE BAD)	0.91	1.10					

\* p ≤ .01  
d .50 or higher for medium effect size  
CL > 70 or < 30

**TABLE 8 - 16PF FORM A + B RAW SCORE MEANS AND STANDARD DEVIATIONS FOR 1984 MALE ATCS APPLICANTS AND MALE GENERAL POPULATION**

	FACTOR	ATCS APPLICANTS (N=2844)		GENERAL POPULATION (N=1242)		t	d	CL
		MEAN	SD	MEAN	SD			
A	(WARMTH)	17.17	6.20	20.36	6.32	-14.93*	.51	36
B	(INTELLIGENCE)	17.88	2.59	14.08	3.72	32.71*	-1.28	81
C	(EMOTIONAL STABILITY)	41.33	6.06	34.69	8.18	25.69*	-.98	74
E	(DOMINANCE)	27.19	6.04	26.71	6.37	2.25	-.08	52
F	(IMPULSIVITY)	30.53	6.95	28.40	7.45	8.58*	-.30	58
G	(CONFORMITY)	30.43	4.70	26.88	5.78	19.07*	-.70	68
H	(BOLDNESS)	35.43	9.57	30.30	10.26	15.01*	-.52	64
I	(SENSITIVITY)	16.19	5.38	18.25	5.75	-10.74*	.37	40
L	(SUSPICIOUSNESS)	11.59	4.83	14.78	5.48	-17.73*	.63	33
M	(IMAGINATION)	22.93	5.15	25.86	6.36	-14.32*	.53	36
N	(SHREWDNESS)	20.77	4.31	19.76	4.37	6.83*	-.23	56
O	(INSECURITY)	11.12	6.07	17.60	8.49	-24.32*	.94	27
Q1	(RADICALISM)	17.21	4.79	18.20	4.88	-6.00*	.20	44
Q2	(SELF-SUFFICIENCY)	17.28	5.78	18.25	5.78	-4.94*	.17	45
Q3	(SELF-DISCIPLINE)	30.86	4.44	25.24	6.01	29.62*	-1.13	77
Q4	(TENSION)	12.09	7.68	20.61	9.41	-28.09*	1.03	24
MD	(DISTORTION)	8.27	2.94					
FB	(FAKE BAD)	1.05	1.14					

\*  $p \leq .01$

d .50 or higher for medium effect size

CL > 70 or < 30

imaginative, and tense than other men. They also have higher scores on factors measuring Intelligence, Emotional Stability, Conformity, Boldness, and Self-Discipline.

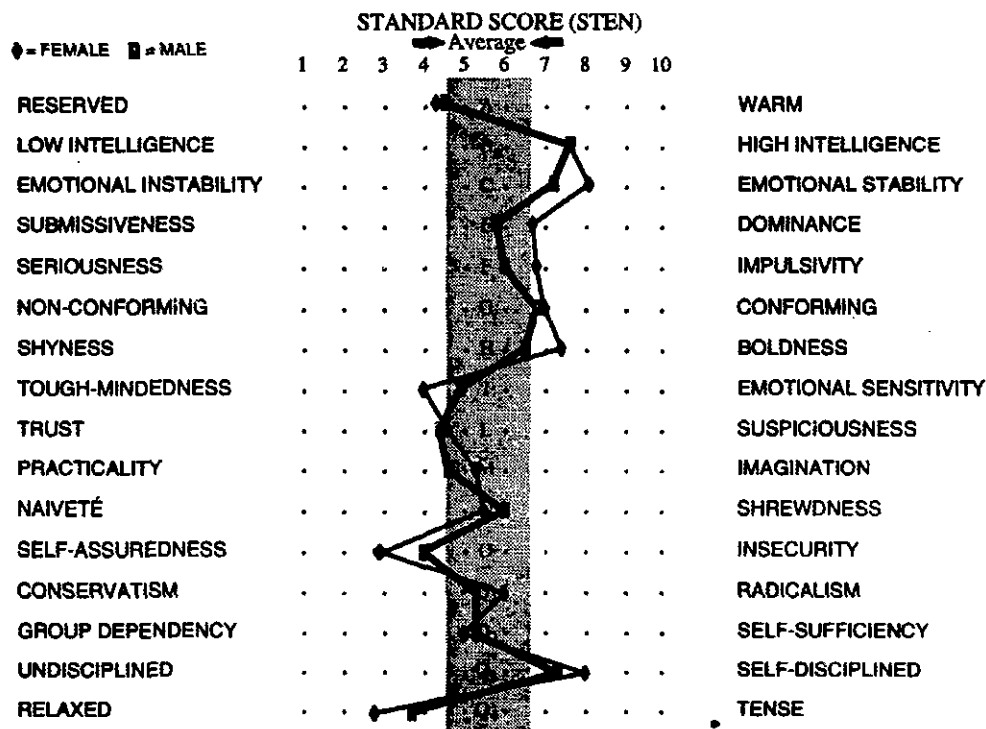
Thus, ATCS men, in contrast to men in the general population norms, are brighter, experience less anxiety, and have greater resources to cope with stress. Furthermore, they are more adventuresome, assertive, self-disciplined, and self-assured. Differences in the factor scores of the female and male ATCS applicants from the general population 16PF norms are illustrated in Figure 1.

Data presented in Table 9 compare the results of the 1984 male ATCS applicant group with normative data from male college students. In most cases, the differences noted between male ATCS applicants and the general population are also true between those ATCSs and college students. Average scores for the Intelligence and Impulsivity factors are 2 exceptions.

The 1984 ATCS applicant mean (17.88) on Intelligence is only slightly above that of college students (17.50). The college student mean for Impulsivity (32.34) is above that of both ATCS applicants (30.53) and the general population (28.40). While most of the ATCS applicants have attended college, they differ from the normative college group in that applicants report less suspiciousness, radicalism, and considerably less insecurity and anxiety. They also are more emotionally stable and have greater self-discipline. Differences discussed above are evident in comparing 16PF profile elevations for the female and male ATCS applicant groups and are shown in Figure 2.

**Validity Scale Comparisons.** While average MD scores of 1984 male and female ATCS applicants were nearly identical (8.20 for females and 8.27 for males), they were clearly above the average value (6.06) for the general population (Krug, 1978). In his validation study of the MD scale, Krug reported average

**FIGURE 1 - 1984 APPLICANT 16PF PROFILE - GENERAL POPULATION NORMS**

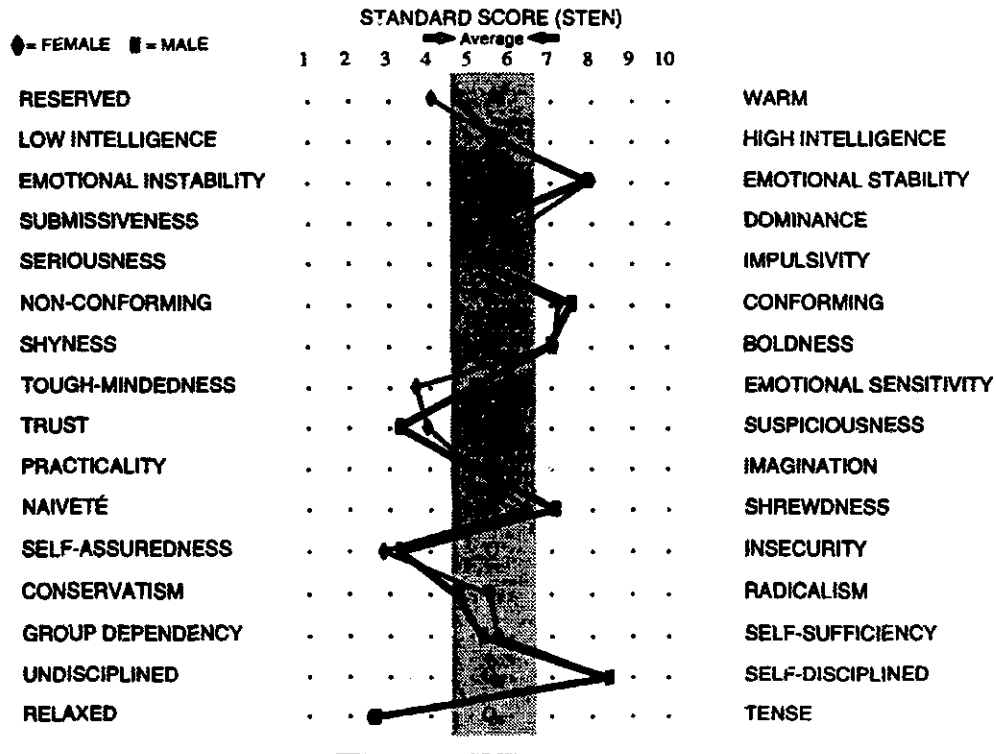


**TABLE 9 - 16PF FORM A + B RAW SCORE MEANS AND STANDARD DEVIATIONS FOR 1984 MALE ATCS APPLICANTS AND MALE COLLEGE STUDENTS**

FACTOR	ATCS APPLICANTS (N=2844)		COLLEGE STUDENTS (N=1517)		t	d	CL
	MEAN	SD	MEAN	SD			
A (WARMTH)	17.17	6.20	19.72	6.92	-12.02*	.39	40
B (INTELLIGENCE)	17.88	2.59	17.50	2.94	4.24*	-.14	54
C (EMOTIONAL STABILITY)	41.33	6.06	31.36	7.19	46.02*	-1.54	86
E (DOMINANCE)	27.19	6.04	27.89	7.11	-3.26*	.11	47
F (IMPULSIVITY)	30.53	6.95	32.34	8.28	-7.26*	.24	44
G (CONFORMITY)	30.43	4.70	24.27	6.25	33.66*	-1.16	79
H (BOLDNESS)	35.43	9.57	27.45	10.96	23.92*	-.79	71
I (SENSITIVITY)	16.19	5.38	17.71	6.46	-7.83*	.26	43
L (SUSPICIOUSNESS)	11.59	4.83	17.83	5.19	-38.76*	1.26	19
M (IMAGINATION)	22.93	5.15	24.79	6.79	-9.34*	.32	41
N (SHREWDNESS)	20.77	4.31	17.80	4.26	21.85*	-.69	69
O (INSECURITY)	11.12	6.07	20.57	7.91	-40.61*	1.40	17
Q1 (RADICALISM)	17.21	4.79	19.91	5.26	-16.66*	.54	35
Q2 (SELF-SUFFICIENCY)	17.28	5.78	18.30	6.26	-5.27*	.17	45
Q3 (SELF-DISCIPLINE)	30.86	4.44	22.64	5.60	49.49*	-1.69	87
Q4 (TENSION)	12.09	7.68	25.75	8.63	-51.72*	1.70	12
MD (DISTORTION)	8.27	2.94					
FB (FAKE BAD)	1.05	1.14					

\*  $p \leq .01$   
d .50 or higher for medium effect size  
CL > 70 or < 30

**FIGURE 2 - 1984 APPLICANT 16PF PROFILE - COLLEGE POPULATION NORMS**



scores of 5.71 for females and 6.36 for males, and recommended using a raw score of 10 as the criterion for determining when the overall 16PF profile may be unduly influenced by an individual's attempt to present him/herself in a favorable light. Distributions of MD scores for female and male ATCS applicants, as well as for the sample from Krug (1978), are presented in Table 10. Comparisons of the male and female ATCS distributions with that of Krug (1978) reveal the skewed nature of the applicant responses for both the MD and FB measures. Using Krug's (1978) criterion, responses for 33.0% of the female and 35.2% of the male ATCS applicants suggested the presence of a "Fake Good" response set. Krug (1978) found that only 12.5% of the overall group met that criterion. M. Rieke (personal communication, February 1, 1994) suggests that Krug's cutoff for the MD is too low and should be closer to two standard deviations above the mean, corresponding to a sten of 9. Even with this higher criterion, approximately 24% of the women and men scored above the cutoff.

As could be expected, given the high MD scores, there was little evidence of any "Faking Bad" on the 16PF for the ATCS applicants. The average FB scores for ATCS applicants (0.91 for females and 1.05 for

males) were clearly below the average of 2.82 reported for the general population norms. Using the criterion of a raw score of 6 or higher (Krug, 1978), only 0.5% of each of the female and male ATCS applicants were in the "Fake Bad" range.

Correlations between the validity scales and the 16PF primary factors are presented in Table 11. Consistent with Krug's (1978) results, MD scores are most closely related to the Emotional Stability, Conformity, Boldness, Suspiciousness, Insecurity, Self-Discipline, and Tension factors. Individuals who attempt to present themselves in a positive light on the 16PF will report less tension, insecurity, and suspiciousness, and greater emotional stability, conformity, boldness, and self-discipline. It is noteworthy that, on many of these same factors, female and male ATCS groups differ most from their respective normative groups. Correlations between the FB scores and the 16 primary factors were relatively low. The highest correlations were within the .22 to .27 range. FB was negatively correlated with Emotional Stability, Boldness, and Self-Discipline. Positive correlations were evident between FB and scores on the Suspiciousness, Insecurity, Self-Sufficiency, and Tension factors.

**TABLE 10 - PERCENTAGES OF VALIDITY SCALE SCORES FOR FEMALE AND MALE ATCS APPLICANTS**

RAW SCORE	FAKE GOOD (MD)				FAKE BAD (FB)			
	ATCS %		KRUG 1978		ATCS %		KRUG 1978	
	FEMALE	MALE	STEN	PERCENT	FEMALE	MALE	STEN	PERCENT
0	0.2	0.1	1	0.0	43.8	37.3	1	19.7
1	0.3	0.5	2	3.7	34.0	36.6	2	24.5
2	1.3	1.7	3	6.6	14.7	15.9	3	19.2
3	2.6	3.0	3	9.2	4.8	6.4	4	11.4
4	6.9	5.6	4	10.8	1.8	2.4	5	9.5
5	7.9	7.9	5	13.6	0.5	0.8	6	5.8
6	12.2	10.4	6	13.1	0.2	0.4	7	3.9
7	12.9	11.5	6	12.1	0.0	0.1	8	2.9
8	11.1	12.6	7	9.8	0.3	0.0	9	1.7
9	11.9	12.5	7	7.6	0.0	0.0	10	0.9
10	9.3	11.3	8	5.6	0.0	0.0	10	0.4
11	8.0	8.4	9	3.7	0.0	0.0	10	0.0
12	6.9	7.5	10	1.9	0.0	0.0	10	0.0
13	3.4	5.0	10	0.8	0.0	0.0	10	0.0
14	4.6	2.0	10	0.4	0.0	0.0	10	0.0
15	0.8	0.9	10	0.1	0.0	0.0	10	0.0

**TABLE 11 - CORRELATIONS BETWEEN THE 16PF FACTOR SCORES AND THE VALIDITY SCALES**

FACTOR	FAKE GOOD (MD)		FAKE BAD (FB)	
	FEMALE	MALE	FEMALE	MALE
A (WARMTH)	.15	.25	-.06	-.11
B (INTELLIGENCE)	.13	.02	-.03	-.04
C (EMOTIONAL STABILITY)	.56	.56	-.24	-.25
E (DOMINANCE)	.07	.06	.13	.05
F (IMPULSIVITY)	-.13	-.06	-.00	-.04
G (CONFORMITY)	.43	.44	-.07	-.16
H (BOLDNESS)	.41	.47	-.19	-.26
I (SENSITIVITY)	-.20	.01	-.02	-.11
L (SUSPICIOUSNESS)	-.35	-.40	.27	.25
M (IMAGINATION)	.11	.09	-.04	-.06
N (SHREWDNESS)	.26	.24	-.10	-.09
O (INSECURITY)	-.54	-.56	.25	.22
Q1 (RADICALISM)	.04	-.06	.09	.09
Q2 (SELF-SUFFICIENCY)	-.15	-.24	.19	.22
Q3 (SELF-DISCIPLINE)	.57	.55	-.24	-.22
Q4 (TENSION)	-.60	-.62	.25	.23

## CONCLUSIONS

These data support the findings of Karson and O'Dell (1974a) in revealing that female and male ATCS applicants have highly similar personality profiles. Despite a number of changes in the demographic composition of the ATCS applicant groups since the Karson and O'Dell (1974a) study, the basic 16PF profiles are quite similar. Results from current data were generally consistent with prior studies. For example, 1974 ATCS applicants (Karson and O'Dell, 1974a,b) controllers on the job (Karson and O'Dell, 1974 b; Rose, et al., 1978), and applicants in 1984 were found to be brighter than the average individual.

Elevations in scores for several of the other factors were also consistent with previous findings for both controller and applicant groups (Karson and O'Dell, 1974a,b; Rose, et al., 1978). While controllers were less anxious, as evidenced by lower scores on the Tension, Insecurity, and Suspiciousness factors, they had correspondingly higher scores on the Self-Discipline and Emotional Stability factors. They were also more self-reliant and assertive. In his review of research on the aptitudes, interests, motivations, personality, and attitudes of air traffic controllers, Smith (1994) provides a similar description of their salient characteristics.

The higher MD scores for female and male ATCS applicants suggest that the elevations of certain 16PF factors may be partially attributable to the tendency of applicants to present themselves in a favorable light. However, when a correction (IPAT, 1970) for elevated MD scores is applied to the relevant 16PF factor scores, the overall profile is found to be essentially the same. It is also possible that some vocational objectivity (awareness) or self-selection may be responsible for part of the results, as a person with high levels of anxiety and insecurity is not likely to choose air traffic control as a career option. On the other hand, while social desirability has generally been interpreted to be a situationally-based response set, there are indications (Furnham, 1986) that social desirability may be a relatively stable trait. Ones, Viswesvaran, and Reiss (1996), in their recent meta-analysis of the social desirability literature, support

Furnham (1986) in demonstrating that social desirability has a consistent relationship with the personality dimensions of Emotional Stability and Conscientiousness. Additionally, they found that social desirability is less pervasive than anticipated and exhibits little influence on the relationship between various personality measures and job performance. If this is true, it suggests that the higher MD scores exhibited by the ATCS applicants may be reflective of more positive psychological adjustment in that group.

These results present a positive picture of ATCS applicants: their intellectual capacity and analytical skills are high; they have sufficient resources to cope with stressful events; and they are assertive enough to make effective decisions.

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## APPENDIX A

### FACTOR A (WARMTH)

#### LOW SCORE

RESERVED  
DETACHED  
CRITICAL  
COOL, ALOOF  
FORMAL  
RIGID

#### HIGH SCORE

OUTGOING  
WARMHEARTED  
EASYGOING  
PARTICIPATING  
LIKES PEOPLE  
ADAPTABLE

### FACTOR B (INTELLIGENCE)

#### LOW SCORE

LESS INTELLIGENT  
CONCRETE THINKING

#### HIGH SCORE

MORE INTELLIGENT  
ABSTRACT THINKING  
BRIGHT

### FACTOR C (EMOTIONAL STABILITY)

#### LOW SCORE

AFFECTED BY FEELINGS  
EMOTIONALLY LESS STABLE  
EASILY UPSET  
WORRYING

#### HIGH SCORE

EMOTIONALLY STABLE  
FACES REALITY  
CALM  
MATURE  
UNRUFFLED

### FACTOR E (DOMINANCE)

#### LOW SCORE

HUMBLE  
MILD  
ACCOMMODATING  
CONFORMING  
EASILY LED  
OBEDIENT  
SUBMISSIVE

#### HIGH SCORE

ASSERTIVE  
AGGRESSIVE  
STUBBORN  
COMPETITIVE  
BOSSY  
DOMINANT  
HEADSTRONG

**FACTOR F (IMPULSIVITY)**

**LOW SCORE**

SOBER  
PRUDENT  
SERIOUS  
TACITURN  
RESTRAINED  
SILENT, INTROSPECTIVE

**HIGH SCORE**

HAPPY-GO-LUCKY  
IMPULSIVELY LIVELY  
ENTHUSIASTIC  
EXPRESSIVE  
TALKATIVE

**FACTOR G (CONFORMITY)**

**LOW SCORE**

EXPEDIENT  
DISREGARDS RULES  
FEELS FEW OBLIGATIONS  
SELF-INDULGENT  
UNDEPENDABLE

**HIGH SCORE**

CONSCIENTIOUS  
PERSEVERING  
STAID  
MORALISTIC  
RULE BOUND  
RESPONSIBLE

**FACTOR H (BOLDNESS)**

**LOW SCORE**

SHY  
RESTRAINED  
TIMID  
THREAT-SENSITIVE  
HESITANT

**HIGH SCORE**

VENTURESOME  
SOCIALY BOLD  
UNINHIBITED  
SPONTANEOUS  
RESPONSIVE

**FACTOR I (SENSITIVITY)**

**LOW SCORE**

TOUGH-MINDED  
SELF-RELIANT  
REALISTIC  
NO-NONSENSE  
HARD

**HIGH SCORE**

TENDER-MINDED  
CLINGING  
OVER-PROTECTED  
SENSITIVE  
KINDLY, GENTLE  
INSECURE

**FACTOR L (SUSPICIOUSNESS)**

**LOW SCORE**

TRUSTING  
ADAPTABLE  
FREE OF JEALOUSY  
EASY TO GET ALONG WITH  
PLIANT TO CHANGES

**HIGH SCORE**

SUSPICIOUS  
SELF-OPINIONATED  
HARD TO FOOL  
SKEPTICAL  
DISTRUSTFUL

**FACTOR M (IMAGINATION)**

**LOW SCORE**

PRACTICAL  
CAREFUL  
CONVENTIONAL  
REGULATED BY EXTERNAL REALITIES  
PROPER  
"DOWN-TO-EARTH" CONCERNS

**HIGH SCORE**

IMAGINATIVE  
WRAPPED UP IN URGENCIES  
CARELESS OF PRACTICAL MATTERS  
BOHEMIAN  
ABSENT-MINDED  
UNCONVENTIONAL

**FACTOR N (SHREWDNESS)**

**LOW SCORE**

FORTHRIGHT  
NATURAL  
ARTLESS  
UNPRETENTIOUS  
OPEN  
GENUINE  
SPONTANEOUS

**HIGH SCORE**

SHREWD  
CALCULATING  
WORLDLY  
PENETRATING  
SOCIALY AWARE  
POLISHED

**FACTOR O (INSECURITY)**

**LOW SCORE**

SELF-ASSURED  
CONFIDENT  
SERENE  
FREE OF GUILT  
SECURE  
COMPLACENT

**HIGH SCORE**

APPREHENSIVE  
SELF-REPROACHING  
WORRYING  
TROUBLED  
GUILT-PRONE  
LONELY, BROODING

**FACTOR Q1 (RADICALISM)**

**LOW SCORE**

CONSERVATIVE  
RESPECTING ESTABLISHED IDEAS  
TOLERANT OF TRADITIONAL DIFFICULTIES

**HIGH SCORE**

EXPERIMENTING  
LIBERAL  
ANALYTICAL  
FREE-THINKING  
OPEN TO CHANGE  
REBELLIOUS

**FACTOR Q2 (SELF-SUFFICIENCY)**

**LOW SCORE**

GROUP-DEPENDENT  
A "JOINER" AND SOUND FOLLOWER  
DECISIONS  
LISTENS TO OTHERS

**HIGH SCORE**

SELF-SUFFICIENT  
PREFERS OWN  
RESOURCEFUL

**FACTOR Q3 (SELF-DISCIPLINE)**

**LOW SCORE**

UNDISCIPLINED SELF-CONFLICT  
FOLLOWS OWN URGES  
CARELESS OF PROTOCOL  
UNCONTROLLED  
LAX

**HIGH SCORE**

CONTROLLED  
SOCIALY PRECISE  
FOLLOWING SELF-IMAGE  
COMPULSIVE

**FACTOR Q4 (TENSION)**

**LOW SCORE**

RELAXED  
TRANQUIL  
UNFRUSTRATED  
COMPOSED

**HIGH SCORE**

TENSE  
FRUSTRATED  
DRIVEN  
OVERWROUGHT  
FRETFUL

Descriptive information for the factors was taken from the 16PF test profile (1967), Karson & O'Dell (1976), and the Administrator's manual for the 16PF (1986).