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INSTRUMENT FLIGHT PREFERENCE AND FIELD DEPENDENCE

By

Eric R. George
Mark A. Hofmann

January 1974

U. S. ARMY AEROMEDICAL RESEARCH LABORATORY

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13. ABSTRACT

This research investigated the possible relationship between field dependence-independence, as measured by the Rod and Frame Test (RFT), and aviator attitudes regarding IFR flight. Degree of aviator preference for actual instrument flight (determined by questionnaire and personal interview) served as the basis for division of the aviator sample (43 pilots) into high and low preference groups. These groups were examined relative to each of the three field dependency measures derived from RFT performance. The IFR preference group factor did not contribute significantly to the variation in RFT performance, either singularly or in interaction with other factors, such as body attitude or visual field.

In addition, demographic data of both subject groups were reduced and examined. A positive correlation was found between instrument flight experience and total flight hours for the IFR high preference aviators only; no significant differences were demonstrated for other variables.

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The authors would like to express their thanks to those Army aviators who donated their time and effort for this research.

ABSTRACT

This research investigated the possible relationship between field dependence-independence, as measured by the Rod and Frame Test (RFT), and aviator attitudes regarding IFR flight. Degree of aviator preference for actual instrument flight (determined by questionnaire and personal interview) served as a basis for dividing the aviator sample (43 pilots) into high and low preference groups. These groups were examined relative to three field dependence measures derived from RFT performance. The IFR preference factor did not contribute significantly to the variation in RFT performance for any of the measures. Demographic data of both subject groups were also reduced and examined.

APPROVED: ROBERT W. BAILEY
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INTRODUCTION

An individual's perception of verticality of an object is reportedly a twofold process. One regards the position of an item both in relation to gravity (internal cues) and the visual field by which it is surrounded. Some persons place primary importance upon gravity effects, whereas others are more influenced by the visual field (i.e., the horizontals and verticals) surrounding the object.[1,2,3] The more a person relies on the external cues mentioned in the latter situation, the more field dependent he is said to be, and conversely, the less he attends to the surroundings, relying more on gravity cues, the more field independent he is said to be.[1]

Data have shown that the individual's position along this continuum of field dependence/field independence can be discriminated through use of the Rod and Frame Test (RFT).[4,5,6] Perceptual style has also been reported to correlate highly with one's ability to recognize and separate items from fields in which they are surrounded.[7]

Over the last twenty years, Herman A. Witkin and associates at the New York College of Medicine have been prolific in research centered around field dependence, perceptual style, and psychological differentiation. While other researchers have substantiated varied aspects of the Witkin group's position,[8,9,10,11] this support is by no means unanimous. Some have questioned both the statistical magnitude and theoretical validity of Witkin's position.[12,13,14] In particular, a definitive critique by Gruen[15] questions not only the theoretical basis for the Witkin group's orientation, but also the reproducibility of their experimental results. Other authors have noted both the high individual variability with the RFT measure and correlations that do not approach the magnitude of Witkin's.[16,17,18,19]

Though a number of different populations have been investigated in regard to field dependence/field independence,[20,21,22,23] little is known with regard to the performance of rotary wing aviators relative to this phenomenon.[24,25,26] There may be some relation between field dependence and the pilot's ability to perform, or his preference for, instrument flight rules (IFR flight). A field independent aviator may adapt more quickly to instruments because of less confusion in relating and locating his aircraft and himself in a three-dimensional world from information provided only by his instruments. On the other hand, a field dependent person may demonstrate more facility in performing IFR flight or greater preference for IFR flight because the field in which he normally flies, which has a propensity to influence his perception, has been removed and is now represented in a more limited way via his instruments. Finally, there may be no significant relationship between this continuum and the aviator's ability or preference for IFR flight.

This study investigated field dependence and field independence, measured via the Rod and Frame Test as it related to preference for IFR flight. It also investigated this field dependence-independence continuum in regard to a number of demographic variables. A basic familiarity with aviation by the reader is assumed, although a brief summary of terms may be found in the glossary.

METHOD

Subjects

Subjects consisted of 43 instrument rated Army rotary wing aviators, 25 with a high preference for IFR flight and 18 with a low preference for IFR flight. This grouping was determined solely through aviator preference, indicated via an individually administered questionnaire and personal interview. Since the only criterion for subjects was that they be current instrument rated aviators, the demographic variables that each subject brought with him were not controlled for; basic medical parameters, however, were observed. All aviators were on flight status and held FAA Class II Medical Certificates. Their physical condition was assumed to be good; no appreciable somatic differences existed between groups. Subjects having any type of transient cold or sinus condition were rejected. Lastly, due to the truncated age range within an already restricted population (i.e., instrument rated aviators), variation in general intelligence was assumed to be relatively minimal.[27]

A more detailed description of the experimental sample, along with an examination of a number of possibly significant demographic variables, is found in the Results Section.

Apparatus

A survey form was constructed to determine aviator attitudes and preference in regard to IFR flight (see Appendix A). In addition to collecting possible significant data on flight experience, the form presented the aviators with seven forced choice questions designed to help estimate attitudes about IFR flight. This form, in conjunction with an interview discussed shortly, was used to place the aviators in either an IFR high preference or an IFR low preference group.

The Rod and Frame Test consisted of a luminous 40 inch square frame which could be tilted plus or minus 28 degrees and plus or minus 60 degrees. Centered within the frame was a 29 inch luminous rod with a centralized pivot point (Figure 1). This rod was controlled by the subject via an electronic switch and was capable of being rotated 360 degrees. The subject was secured in a chair (modified UH-1 seat) which could be tilted by remote control to plus or minus 28 degrees (Figure 2) The chair was located 8 feet directly in front of the rod and frame and the eye level of the subject was kept with the pivot of the rod. The chair, rod, and frame were calibrated daily. The apparatus was located in a dark room which permitted the subject to see only the rod and frame. The measurement provided by this system was the degree of final adjustment of the rod from true vertical.

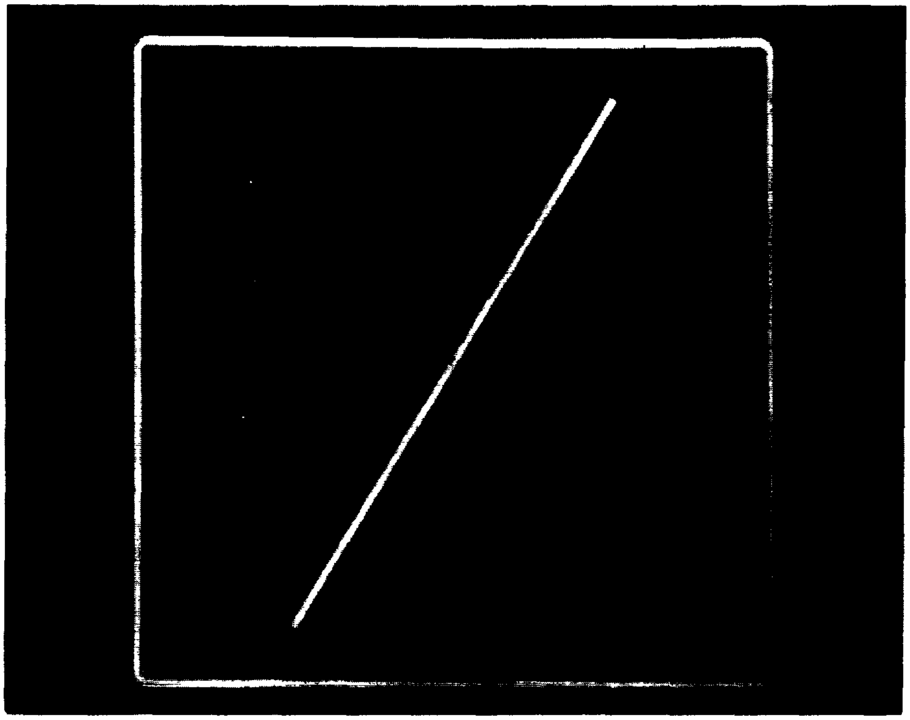

Figure 1

Rod and Frame

Figure 2

Subjects' Modified UH-1 Seat

Initial testing indicated that varieties of the Embedded Figures Test failed to yield any difference in the population under study. For this reason, the National Institute of Mental Health (NIMH) Hidden Figures Test was also evaluated. It was ascertained that the complexity of this instrument precluded meaningful variation, therefore most complex figures were simplified varying degrees.

Though this modified instrument (mHFT) provided adequate power of discrimination between subjects, it did not correlate well with other variables (including RFT performance), which caused the Rod and Frame data to be used as the sole criterion for determining field dependence/independence.

Procedure

The individual survey was in all cases administered by the project investigator. Questions and problems were discussed, with every effort being taken to insure the accuracy of all recorded data.

Subjects were classified as having either high or low preference for instrument flight from survey responses coupled with personal interview. The interview included several important criteria regarding the IFR continuum. Actual instrument conditions were given as "a ninety mile flight within heavy overcast." The ceiling was placed at 800 feet, no turbulence, with normal IFR flight planning and procedures throughout. All subjects were instructed to assume that no requirements to become current in IFR need be fulfilled; the aviators were encouraged to examine their preferences on a personal level, as opposed to external regulations and requirements.

Because the aviators took pride in their ability to perform under instrument conditions, care was taken to explain that preference, rather than competence, was the issue at hand. Every effort was taken to provide the rapport and informal atmosphere in which the subjects would feel free to be candid. Only when it was certain that the subject had arrived at an externally unbiased preference choice did the investigation continue.

The simplified form of the NIMH's Hidden Figures Test was administered directly after the survey and interviews were completed. Scores were derived by dividing the number of correct solutions by time, and multiplying by a factor of ten. Subjects for the most part utilized the entire ten minute period allotted for the solution of the sixteen hidden figures, yielding a score which was generally synonymous with the number correct.

The Rod and Frame Test was then administered over the latter half of the one hour time period. The subject was strapped in a tiltable UH-1 aircraft seat, via lap and shoulder harness, foot restraint, and headrest (Figure 2). After insuring proper seating, any possible perceptual cues were eliminated (e.g., fluorescent watches). The subject was at this time told to adjust the rod in all cases until it appeared truly vertical to the floor or as "a plumb bob would hang from the ceiling." It was often necessary that these instructions be elaborated upon, the investigator used the criterion "parallel to me, as I stand here," along with further instructions whenever the subject expressed any uncertainty as to task criterion. After no questions remained, a pretest of four trials was administered to familiarize the subject with the various body attitudes and mechanics of the task. The pretest period also allowed for a period of dark adaptation.

The test, consisting of three series of ten trials each, was then administered. Each series was determined by the subject's body attitude which for any one series was either vertical (0^o), or tilted 28^o to either side of vertical ($\pm 28^o$) Each subject therefore received 30 test trials, 10 trials for each series. The ten trials within each series consisted of two trials at each of five frame tilts (0^o, $\pm 28^o$, $\pm 60^o$). The order of series across subjects was random, as were the trials in each series. The starting point for the rod for each test trial was either plus or minus 28^o from the true vertical, evenly divided between the ten trials. Direction of rod and frame tilt was thus coincident during half the total trials, and opposed during the remaining half. Between each series of trials, three adaptive trials were presented to minimize any cues created by the subject's change in attitude. At the termination of the final series, four more trials were presented at the body attitude and frame positions used in the four pretest trials. Any variation in subject responses over time could thus be determined; indeed, no appreciable differences were found between the initial and final trials.

RESULTS

Performance on the RFT was assessed by measuring, in degrees, the variance that rod tilt had from true vertical. For purposes of analysis, three scores were derived from these measurements. These scores were absolute error (AE), constant error (CE), and root mean square (RMS). Absolute error was simply the sum of the absolute values of error. Constant error was the algebraic sum of the error scores. In determining CE, deviations to the right side (S's view) of vertical were considered negative or minus error and error in the other direction was designated as positive or plus error. The RMS score was the square root of the mean squared deviation about the mean of the signed errors of prediction. This yielded a measure of variability about one's mean.

Each of these scores was subjected to a three-way analysis of variance with repeated measures on two factors. The significance level selected was .01. The structure of the statistical design followed in these analyses is presented in Table 1.

TABLE 1

Analysis of Variance Model for CE, AE, and RMS

		B_1	B_2	B_3
		$C_1C_2C_3C_4C_5$	$C_1C_2C_3C_4C_5$	$C_1C_2C_3C_4C_5$
	Subjects			
	1			
A_1	-			
	18			
	1			
A_2	-			
	25			

[a]Factor A = Groups
[b]Factor B = Body attitude
[c]Factor C = Frame tilt

Results of the analysis of variance of the subject's absolute error scores are summarized in Table 2. It should be reiterated that this measure concerns the subject's performance without regard to consistency or direction of error.

TABLE 2

Summary of Analysis of Variance
Absolute Error-RFT Performance

Source	SS	df	MS	F
Between Ss	68574.58	42	1632.73	
A (Group)	4076.09	1	4076.09	2.59
Ss within Groups (Error A)	64498.49	41	1573.13	
Within Ss	125246.25	602	208.05	
B (Body attitude)	26405.18	2	1826.335	9.65*
AB	3652.67	2	6601.295	2.67
B x Ss (Error B)	56092.8	82	684.06	
C (Frame Tilt)	1858.96	4	464.74	6.52*
AC	393.67	4	98.42	1.38
C x Ss (Error C)	11683.44	164	71.24	
BC	703.4	8	87.925	1.20
ABC	402.98	8	50.37	.69
BC x Ss	24053.15	328	73.33	

*$p < .01$

It may be seen that body attitude and frame tilt (background reference) were the only significant factors in RFT performance.

Constant error score allowed for a useful measure with regard to direction of error. The three-way analysis of variance was applied to this measure and is summarized in Table 3.

TABLE 3

Summary of Analysis of Variance
Constant Error-RFT Performance

Source	SS	df	MS	F
Between Ss	30916.396	42		
A (Group)	85.29	1	85.29	.11
Ss within Groups (Error A)	30831.106	41	751.97	
Within Ss	320487.12	602		
B (Body attitude)	62635.067	2	31317.533	14.29*
AB	5718.377	2	2859.188	1.30
B x Ss (Error B)	179755.156	82	2192.136	
C (Frame Tilt)	4954.154	4	1238.538	9.73*
AC	367.54	4	91.885	.72
C x Ss (Error C)	20875.606	164	127.29	
BC	1443.883	8	180.485	1.35
ABC	689.061	8	86.132	.64
BC x Ss	44009.436	328	134.175	

*$p < .01$

Table 4 shows that body attitude and frame tilt again provide the only significant sources of variation in RFT performance. Likewise, as with absolute error, the group effect (Factor A) is not significant.

A variance measure was constructed, based upon variability of subjects' response range at a specific body attitude and background reference. This variability was relative to the subjects' mean, rather than the true vertical (0^o mark). The above univariate treatment was lastly applied to this measure. Results are seen in Table 4.

TABLE 4

Summary of Analysis of Variance
Root Mean Square-RFT Performance

Source	SS	df	MS	F
Between Ss	3114.23	42	74.15	
A (Group)	42.15	1	42.15	.56
Ss within groups (Error A)	30.72	41	74.93	
Within Ss	18569.27	602	30.85	
B (Body attitude)	1516.29	2	758.15	20.02*
AB	82.12	2	41.06	1.08
B x Ss (Error B)	3105.66	82	37.87	
C (Frame Tilt)	148.86	4	37.22	1.33
AC	32.27	4	8.07	.29
C x Ss (Error C)	4583.81	164	27.95	
BC	523.00	8	65.38	2.55
ABC	178.19	8	22.27	.87
BC x Ss (Error BC)	8399.07	328	25.60	

*$p < .01$

Only one factor proves significant in Table 4. Body attitude, shown significant in regard to the previous absolute and constant error measures, also proves a significant factor for the variance measure. Perhaps most noteworthy is the failure of the frame tilt to account for variability in performance, particularly when the subjects were seated in the upright (0°) position.

For the measures of constant and absolute error, body attitude and visual reference contributed significantly to performance. The dominant influence of visual reference and body attitude on the measure of CE and AE is illustrated in Figures 3 through 8.

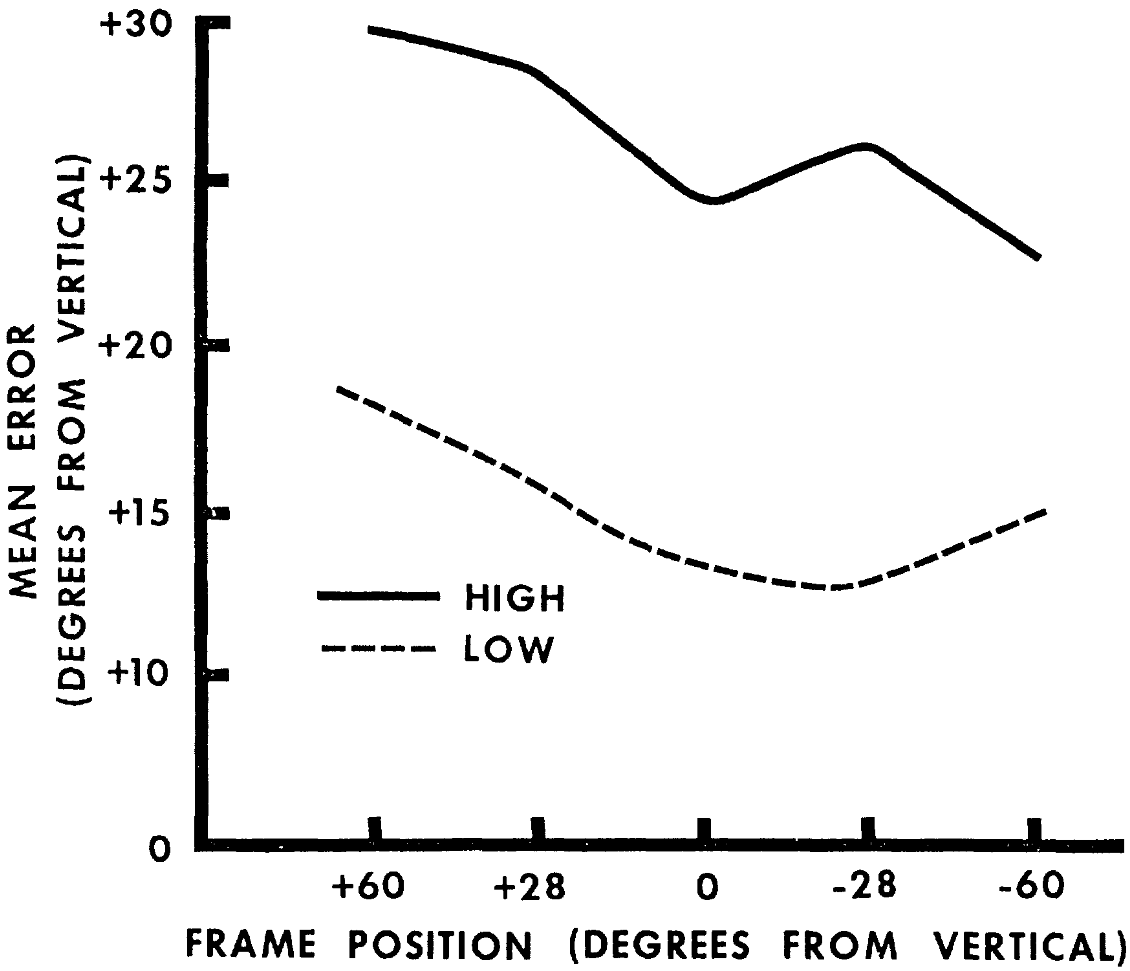

Figure 3

AE - IFR Preference Groups Right Bank (-28°)

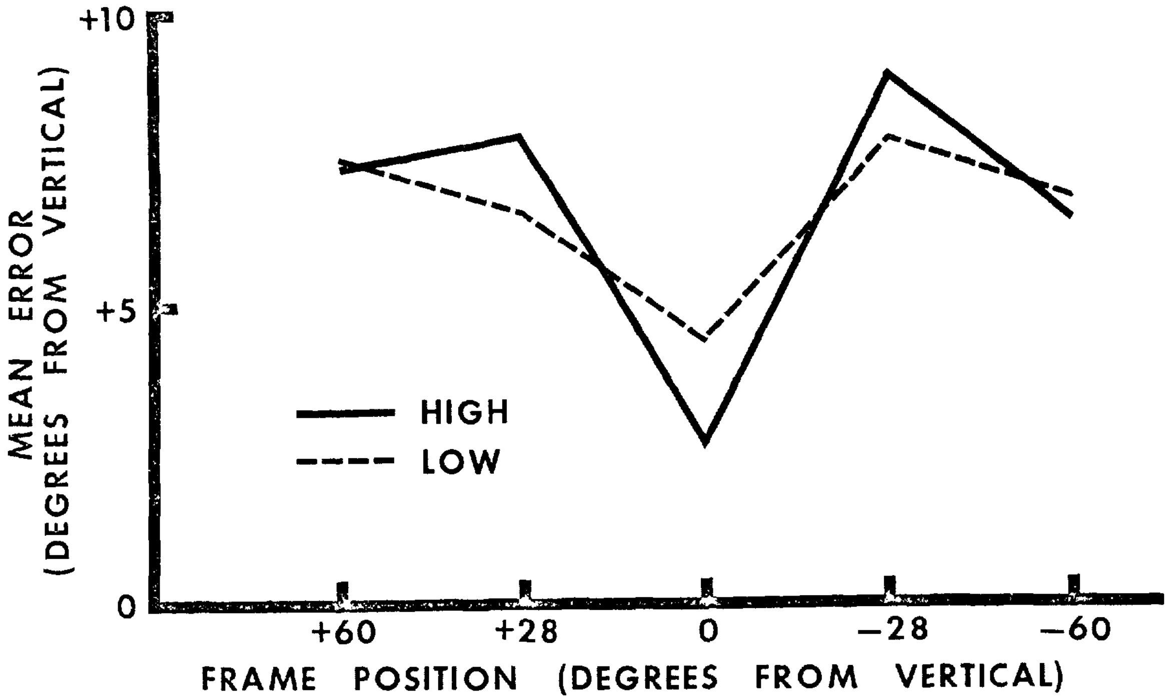

Figure 4

AE - IFR Preference Groups Upright (0^{o})

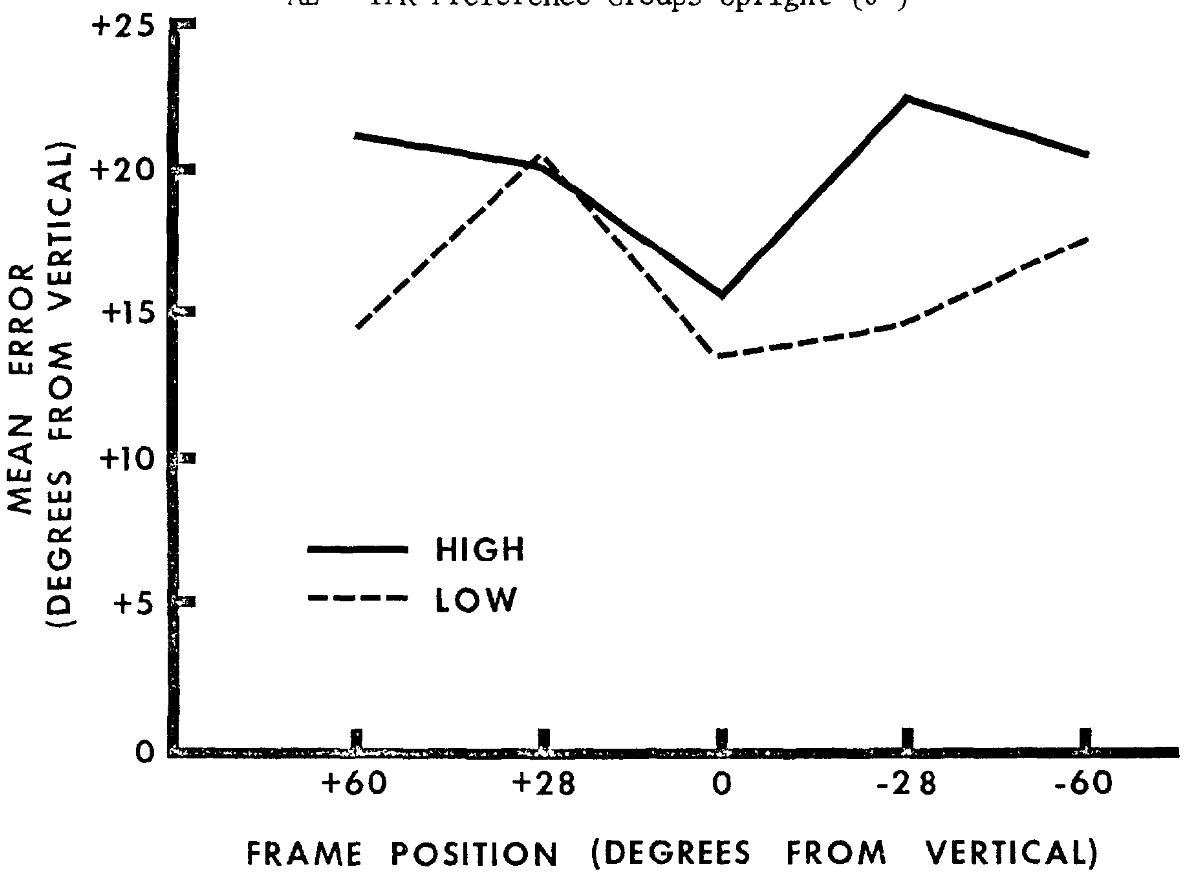

Figure 5

AE - IFR Preference Groups Left Bank ($+28^{o}$)

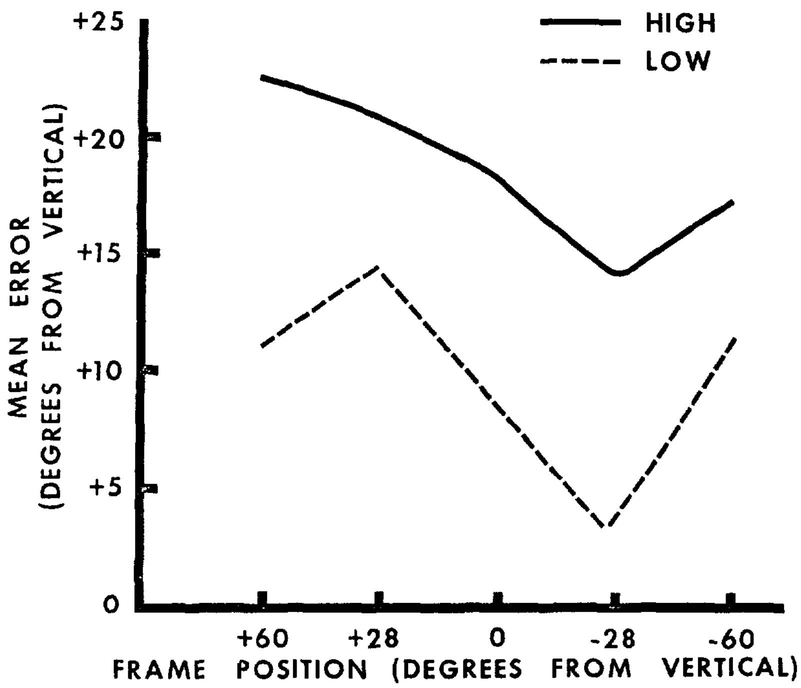

Figure 6

CE - IFR Preference Groups Right Bank (-28°)

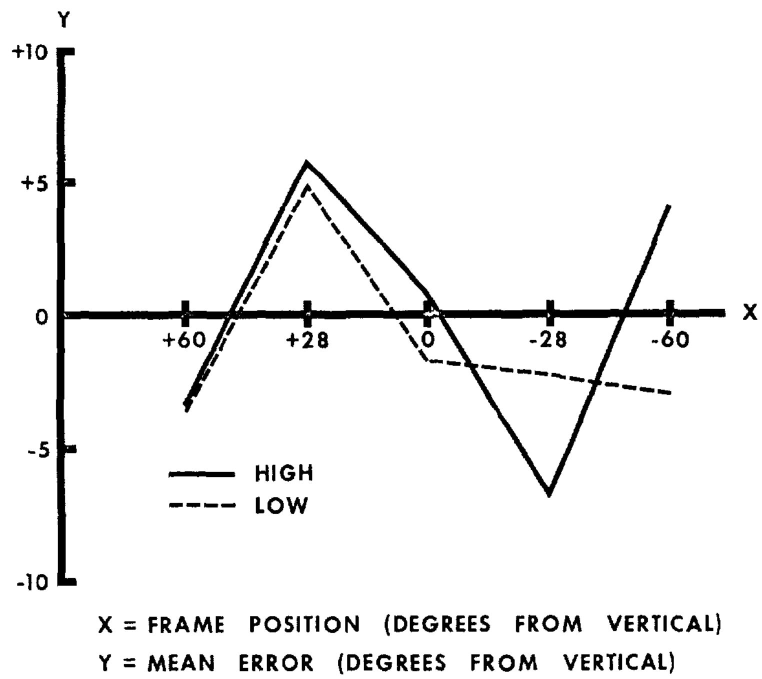

Figure 7

CE - IFR Preference Groups Upright (0°)

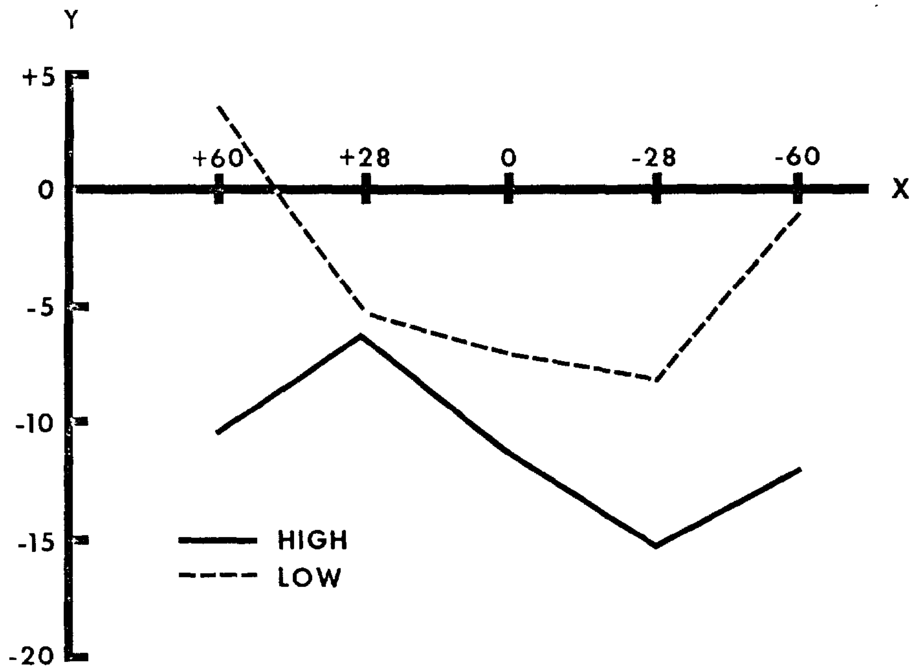

Figure 8

CE - IFR Preference Groups Left Bank (+28°)

Since RFT performance did not discriminate between preference groups, demographic variables were considered. An eight factor intercorrelation matrix, Table 5, was generated for the demographic variables for all subjects. Because error and variance measures had not differentiated between groups, they were not included in this matrix. Subject age and total flight hours were two of the eight factors considered. Subject ages varied from 24 through 54 years, with a mean age of 32.06 years (S.D. 5.67 years) for the high preference aviators and a mean age of 34.61 years (S.D. 8.09 years) for the low preference aviators. Rank varied from Chief Warrant Officer (W-2, W-3, W-4) through Major (O-4). All subjects had over 500 flight hours, with the total mean hours for the high preference group being 3010 (S.D. 1509). The low preference group produced a similar mean for total flight hours, 3011 (S.D. 1514). Though coincidental, it is of interest to note the close similarity between the groups' mean ages and total flight hours. Three factors concerned more directly with instrument flight experience included in the matrix are number of hours of actual instrument (AI) time, number of hours of hood time, and the number of IFR flight plans filed by an aviator. The remaining variables were of a less descriptive nature. A numeric total of four key questionnaire responses (questions 9, 11, 15, 16) provided an estimate of the subjects' degree of comfort with instrument flight conditions. Performance on the modified Hidden Figures Test, originally assumed to correlate with RFT performance, was examined for possible significant correlation to other demographic data. Lastly, the subjects' number of occurrences of vertigo was included.

TABLE 5

Intercorrelation of Demographic Variables for all Aviators

	Factor Number							
Factor	1	2	3	4	5	6	7	8
1. Age	1.00	-.17	.07	.01	.66	.29	.32	.10
2. Q Score		1.00	-.07	.37	-.08	-.33	-.24	-.41
3. mHFT			1.00	-.10	-.05	-.02	.14	-.11
4. Vertigo				1.00	.14	-.06	.23	-.05
5. Total Hours					1.00	.51	.26	.33
6. Hours A. I.						1.00	.40	.79
7. Hours Hood							1.00	.31
8. #IFR Flt. Plans								1.00

The intercorrelations generated for all aviators, as can be seen, follow for the most part an expected pattern. These correlations do not address whether or not such correlations might be different for the two groups. Consequently, matrices were generated for both groups, across the same variables considered in Table 5. These matrices (Tables 6 & 7) can be seen to differ in certain respects.

TABLE 6

Intercorrelation of Demographic Variables
For IFR High Preference Aviators

Factor	Factor Number 1	2	3	4	5	6	7	8
1. Age	1.00	-.21	.35	.42	.68	.26	.59	.22
2. Q Score		1.00	-.13	.48	.04	-.34	-.18	-.35
3. mHFT			1.00	.15	.19	.02	.38	.14
4. Vertigo				1.00	.42	.04	.36	.07
5. Total Hours					1.00	.61	.45	.40
6. Hours A. I.						1.00	.23	.86
7. Hours Hood							1.00	.22
8. #IFR Flt. Plans								1.00

TABLE 7

Intercorrelation of Demographic Variables
For IFR Low Preference Aviators

Factor	Factor Number 1	2	3	4	5	6	7	8
1. Age	1.00	-.40	-.28	-.19	.74	.42	.15	.06
2. Q Score		1.00	-.20	.32	-.30	-.40	.04	-.39
3. mHFT			1.00	-.30	-.39	-.03	-.12	.14
4. Vertigo				1.00	-.03	-.13	.30	-.15
5. Total Hours					1.00	.30	.11	.22
6. Hours A. I.						1.00	.75	.74
7. Hours Hood							1.00	.62
8. #IFR Flt. Plans								1.00

While both preference groups evidenced only a small number of what could be considered significant intercorrelations, the high preference matrix (Table 6) shows that for the high IFR preference groups age was found to correlate positively with a number of occurrences of vertigo, total hours, and total hours hood. Conversely, the low preference aviators evidenced only a positive correlation between age and total flight hours, indicating that, for this group, increased age did not necessarily imply increased instrument training per se.

Such a thesis is further borne out by the correlation of total hours with other variables found in the IFR high preference matrix. For example, total hours correlated with age, occurrence of vertigo, number of hours A.I., number of hours of hood training, and the number of IFR flight plans filed. However, for the IFR low preference group, total hours correlated only with age.

The questionnaire score correlated only with occurrence of vertigo for the high preference group; no difference between subject groups is apparent along this continuum. The correlations involving the modified Hidden Figures Test (mHFT), however, present an interesting contrast between preference groups, Correlations between the mHFT and the five factors of age, vertigo, total hours, hours hood, and hours A.I. are seen as negative in the low preference group matrix. Though not significant, the negative value of these correlations is obtained due to decreased mHFT performance for subjects with increased flight experience.

Conversely, mHFT correlations in the high preference matrix, while again not significant, were positive in regard to age, vertigo, and the three flight time measures. This accounts for a pronounced relative difference between the two preference groups.

DISCUSSION

While the RFT did discriminate between aviators on a singular basis, discrimination between groups of aviators could not be justified on the basis of the field dependence continuum. A direct examination of possible difference in field dependence between groups is shown in Tables 2 through 4. It may be seen that body attitude (factor B) contributes the largest amount of variation to perceptual style. While error at the vertical sitting position was quite low for both groups (3.36 and 3.31 degrees) this error is, of course, greatly multiplied when the subjects were tilted from the vertical. Increased error was generally in the form of overcorrection in the direction opposite that of the subject's chair tilt (the classic E effect).[1] Error also occurred with high directional regularity, particularly for the more field dependent aviators who exhibited a larger error. This consistency (response set) opposes Hellkamps observation that college students show a greater frequency of response sets than did more analytic and field independent subjects.[6]

Additionally, both groups evidenced higher error scores when tilted right (-28°) than when tilted to their left. In an aviator population, some degree of relation of body attitude to corresponding angle of bank in an aircraft would seem unavoidable. Indeed, many aviators described their tilted positions as, "when I was in a right bank." This relation to the cockpit, however pronounced, may account for differential performance from what would appear two equivalent series. Aircraft generally execute only left turns while in traffic prior to landing or while departing after takeoff. Practice effect may cause the left bank to become a more comfortable attitude than the right bank; the lower relative error while tilted left may be a reflection of this.

The visual field as represented by frame position (factor C) contributed the other consistently significant source of variation. Again Tables 2 through 4 illustrate that body attitude (factor B) and visual field (factor C) were the major determinants of performance. Visual field was also noteworthy in that it ceased to be a significant factor in regard to variance, where only body attitude remained a significant factor.

Preference group, as a determinant of performance, did not approach significance on any of the three measures. Further, preference group was found to be non-significant in interaction with the variables of body attitude and frame tilt. In effect, there existed no significant difference in field dependence (as measured by RFT performance) between IFR preference groups.

This is due in large part to the high individual variability of the measure. While many IFR low preference aviators were quite field independent, one third of the group produced the high error scores characterizing field dependence. The IFR high preference aviators were even more variable as a group, with half evidencing a relatively high degree of field independence and half at the opposite end of the spectrum.

The unique population under investigation is also thought to account for a lack of clear delineation between performance of the groups. The aviators compose a population in which particularly gross dependence upon the visual field has likely been truncated through selection and training methods.

It may be concluded that rotary wing aviators as a total group tend to be more field independent than a normal population.[28,29] However, the aviators were apparently less field independent than the airline pilots of Cullen, et al.[24], who performed in a significantly more field independent fashion than did a group of engineers. Indeed, the aviators performed (in total error) at almost exactly the level (7.69° vs 7.7°) of Barrett and Thornton's engineers[25], who in turn proved significantly more field independent than a normal college sample.

Though RFT performance did not permit such discrimination within the confines of the aviator population, an alternate method of differentation is reflected in Tables 6 and 7. For both high and low preference groups, an 8-variable correlation matrix was generated, relating the available demographic variables.

Such a descriptive focus was thought desirable to view possible group differences not demonstrated by the inferential treatment of performance data. While preference groups could not be differentiated via contrasting correlation coefficients, there exist interesting differences between these matrices.

It appears that for IFR high preference aviators, increased flight time often means increased actual instrument time and is also accompanied by the concommitant necessity of IFR flight planning and hood time. The observation that instrument time correlates highly with total flight time only in the IFR high preference group may account for this group's increased comfort with, and preference for, IFR conditions. The high incidence of AI time would also likely account for the correlation of total hours and occurrence of vertigo. Conversely, all data now available indicate that for IFR low preference aviators a greater number of hours does not assume an increased amount of instrument experience, either actual or simulated. This apparent lack of increased instrument time (both actual and hood) with total hours may cause some degree of discomfort among the low preference aviators. It must be reiterated that both groups consisted of instrument rated aviators, most with combat experience. However, particular mission profiles (e.g., gunship vs medevac) may account for differential need to fly on instruments; also, fixed wing experience added to many aviators' IFR experience. It is likely that a number of factors have contributed to this differential in instrument experience. It seems equally likely that a high preference for IFR flight would be accompanied by a commensurate amount of instrument flight time.

The observed relative difference between the mHFT coefficients for each group remains puzzling. While not a significant factor in either group, performance of the mHFT seems to decrease slightly with an increase in age and flight experience of the IFR high preference group. A slight positive relation of mHFT performance to increased experience of the IFR low preference subjects is thus made particularly apparent. Though one would not hazard any prediction upon such observation, further research might well utilize them.

In summary, there exists no firm basis for relating rotary wing instrument flight preference to either field dependence or independence as measured in this investigation. Rotary wing aviators were, however, shown more field independent than a normal college population. Differential RFT performance at seemingly equivalent body attitudes was observed and may prove an interesting basis for further research.

LITERATURE CITED

1. Witkin, H. A., Lewis, H. B., Hertzman, M., Machover, K., Meissner, P. B., and Wapner, S. Personality through perception, New York: Harper, 1954.

2. Witkin, H. A., Dyk, R. B., Paterson, H. F., Goodenough, D. R., and Karp, S. A. Psychological differentiation. New York: Wiley, 1962.

3. Witkin, H. A. The perception of the upright. Scientific American, 1959, 200, 51-70.

4. Silverman, J. Towards a more complex formulation of rod and frame performance in the schizophrenias. Perceptual and Motor Skills, 1968, 27, 1111-1114.

5. Witkin, H. A. and Oltman, P. K. Cognitive style. International Journal of Neurology, 1967, 6, 119-137.

6. Hellkamp, D. T. Perceptual response sets on the rod and frame task in a college sample. Perceptual and Motor Skills, 1968, 27, 591-594.

7. Karp, S. A. Field dependence and overcoming embeddedness. Journal of Consulting Psychology, 1963, 27, 294-302.

8. Pillsbury, J. A., et al. Electroencephalographic correlates of perceptual style: field orientation. Psychosomatic Medicine, 1967, 29, No. 5, 441-449.

9. Ong, J., and Kessigner, D. J. Perception of verticality with a rod and frame apparatus. American Journal of Optometry and Archives of American Academy of Optometry, 1971, 48, 662-666.

10. Gross, F. The role of set in perception of the upright. Journal of Personality, 1959, 27, 95-103.

11. Fine, Bernard J. Field dependence-independence as "sensitivity" of the nervous system: supportive evidence with color and weight discrimination. Perceptual and Motor Skills, 1973, 37, 287-295.

12. Zigler, E. A measure in search of a theory? Contemporary Psychology, abstracts, 1963, 8, 133-135.

13. Zigler, E. Zigler stands firm. Contemporary Psychology, 1963, 8, 459-461.

14. Young, H. H. A test of Witkins field-dependence hypothesis. The Journal of Abnormal and Social Psychology, 1959, 59, 188-192.

15. Gruen, A. A critique and re-evaluation of Witkin's perception and perception-personality work. The Journal of General Psychology, 1957, 56, 73-93.

16. Bloomberg, M. An inquiry into the relationship between field independence-dependence and creativity. Journal of Psychology, 1967, 67, 127-140.

17. Sherman, J. A. Problem of sex differences in space perception as aspects of intellectual functioning. Psychological Review, 1967, 74, 290-299.

18. Rudin, S. A., and Stagner, R. Figure-ground differentiation under different perceptual sets, Perceptual and Motor Skills, 1968, 27(1), 71-77.

19. DeFazio, V. J. and Moroney, D. F. Performance characteristics of field dependent and field independent individuals on an auditory signal detection task. Journal of Psychology, 1969, 71, 77-82.

20. Long, G. M. Field dependency-independency a review of literature. Monograph 19, Naval Aerospace Medical Research Laboratory, Pensacola, Florida, June 1972.

21. Witkin, H. A., Karp, S. A., and Goodenough, D. R. Dependence in alcoholics. The Quarterly Journal of Studies on Alcohol, 1959, 20, 493-504.

22. Sugerman, A. A., and Cancro, R. Field independence and outcome in schizophrenia: A U-shaped relationship. Perceptual and Motor Skills, 1968, 27, 1007-1013.

23. Gruen, A. The relation of dancing experience and personality to perception. Psychological Monographs, 1955, 69, 1-16.

24. Cullen, J. F., Harper, C. R., and Kidera, G. J. Perceptual style differences between airline pilots and engineers. Aerospace Medicine, 1969, 40, 407-408.

25. Barrett, G. O., and Thornton, C. L. Cognitive style differences between engineers and college students. Perceptual and Motor Skills, 1967, 25, 789-793.

26. Kennedy, R. S. The relationship of field independence, extraversion and neuroticism to success in naval aviation training. AGARD Conference Proceedings, No. 109, 1973, B6-1 - B6-5.

27. Goodenough, D. R., and Karp, S. A. Field independence and intellectual functioning. Journal of Abnormal and Social Psychology, 1961, 63, 241-246.

28. Witkin, H. A. Sex differences in perception. *Transactions of the New York Academy of Sciences*, 1949, *12*, 22-26.

29. Witkin, H. A. The nature and importance of individual differences in perception. *Journal of Personality*, 1949, *18*, 145-170.

APPENDIX A

Questionnaire Data

FOR OFFICIAL RESEARCH PURPOSES ONLY

This questionnaire is part of a research endeavor aimed at solving some of the problems currently found in aviation.

Although the questions on the following pages may seem to reflect upon your proficiency as an aviator, do not approach them from that viewpoint. Their purpose is simply to draw important data upon the IFR-VFR attitudes and preferences among Army aviators. This information is important in current and anticipated research which may well have an impact upon future training and aircraft design. In order for this data to be of most value, absolute honesty upon your part becomes a necessity.

This data sheet is COMPLETELY CONFIDENTIAL, and under no circumstances will this questionnaire be viewed by anyone other than this experimenter. You are asked not to give either your name or SSN. In addition, this questionnaire will be destroyed immediately after the data contained herein is pooled with that of other subjects, thus insuring complete anonymity.

The time and effort you are contributing to this research is greatly appreciated. Thank you.

PERCEPTUAL DIFFERENTIATION - PERSONAL DATA SHEET

RANK:

AGE:

DATE:

DUTY:

TYPES OF TICKETS & DATE EARNED: ____________________
____
____
____

1. Approximate total hours of flying experience VFR and IFR by aircraft type. Please estimate hours as accurately as possible.

ROTARY WING		Approx Hrs. VFR	Approx Hrs. AI	Approx Hrs. Hood
A/C Model/Type	________	________	________	________
A/C Model/Type	________	________	________	________
A/C Model/Type	________	________	________	________
A/C Model/Type	________	________	________	________
FIXED WING				
A/C Model/Type	________	________	________	________
A/C Model/Type	________	________	________	________
A/C Model/Type	________	________	________	________

2. If you are dual rated, please answer the following:

a. Most of my IFR flight experience has been in F/W____; R/W____.

b. I would rather fly IFR in F/W____; R/W____.

3. Are you presently undergoing any phase of aviation training? Yes___ No___

If yes, what is it? ______________________________

4. About how many times have you experienced vertigo? ____________

5. Under which of the following flight conditions did your vertigo occur? Check as many as apply.

_____ IFR
_____ VFR
_____ Day
_____ Night
_____ Marginal weather
_____ Autorotation
_____ Other (Specify) ______________________________

_____ Hover
_____ Formation flying
_____ Approach
_____ Take-off
_____ Descending turn
_____ Ascending turn
_____ Straight and level

6. How did you recover from your vertigo?

_____ By reference to instruments
_____ Gave controls to copilot
_____ Crashed
_____ Other (Specify) ______________________________________

7. How often does your stomach become queasy or you experience some motion sickness when flying?

_____ Never
_____ Seldom
_____ Fairly often
_____ Quite often
_____ All the time

8. On how many occasions have you turned over the control of an aircraft due to the uncertainty of your perceptions or judgments? ____________

9. For you, is flying while under the hood -

_____ Very easy
_____ Easy
_____ Slightly difficult
_____ Moderately difficult
_____ Difficult
_____ Extremely difficult

10. In relation to other aviators, do you feel you have a greater/lesser (circle one) dependence upon instruments?

11. When going inadvertent IFR, do you typically sense -

_____ No pucker factor
_____ Slight pucker factor
_____ Medium pucker factor
_____ High pucker factor
_____ Extreme pucker factor
_____ Have never gone inadvertent IFR

12. How many times have you filed an IFR flight plan? __________

13. During IFR flight (hood or AI) have you ever made control movements based on what you felt as opposed to what the instruments indicated?

_____ Yes _____ No

14. In conflicts between your judgment and the instruments, what degree of trust do you place in the instruments?

_____ Absolute
_____ Extreme
_____ Moderate
_____ Uncertain
_____ Hesitate to believe the instruments

15. If you were forced to fly IFR (AI), would you feel

_____ Very comfortable
_____ Fairly comfortable
_____ Slightly uncomfortable
_____ Moderately uncomfortable
_____ Acutely uncomfortable

16. In anticipation of IFR flight, I -

_____ Feel dread
_____ Feel uneasiness
_____ Don't care either way
_____ Look forward to it

17. During flight school, attaining instrument proficiency was, for me,

_____ Not difficult
_____ At times difficult
_____ Moderately difficult
_____ Very difficult
_____ Extremely difficult

GLOSSARY OF AERONAUTICAL TERMS+

A. I.: Actual Instrument conditions. Weather conditions in which the aviator's instruments provide the sole source of information about his aircraft.

Ceiling: The height above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration" and not classified as "thin" or "partial."

Flight Plan: Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an air traffic control facility.

IFR: Instrument Flight Rules. Weather conditions below the minimum prescribed for flight under VFR dictate IFR conditions. Failure to meet either ceiling or visibility minimums necessitates the filing of a complete IFR flight plan and obtaining an air traffic clearance (see VFR).

Overcast: Cloud cover obscuring over 90% of the sky.

VFR Conditions: Basic weather conditions prescribed for flight under Visual Flight Rules. These conditions, in controlled airspace below 10,000 feet, require 3 miles visibility and 500 feet below clouds.

+Taken from Federal Aviation Administration, Airman's Information Manual, Part I, Government Printing Office, Washington, D. C., 1973.