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Hereditary Components in vocational Preferences [1]

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In 1932 Carter reported on hereditary factors in occupational interests as expressed in the scores of identical and fraternal twins on the Strong Vocational Interest Blank. (Strong 1943).

It seemed worthwhile to attempt to duplicate this work when the opportunity arose in connection with a study of twins conducted at the University of Michigan.

Although occupational choices can hardly be considered to be under direct hereditary control, it seems quite possible that the cognitive and personality traits which underlie such choices are influenced by hereditary factors. After all, it is well-known that scores on the Strong Vocational Interest Blank are correlated with intelligence and personality factors.

The reader will remember that the keys from the Strong scales were constructed by comparing the responses of successful practitioners of the various occupations for which keys are available with the responses of other subjects.

Items may contribute to a variety of keys so that the scores for various occupational keys may be expected to correlate and cluster into groups. While no item intercorrelations are known to have been computed, intercorrelations between scales have been reported and several studies have been published in which clusters were found and named. Consult Buros (1959) for a list of 246 references on this and other aspects of the Strong Vocational Interest Blank.

Carter used an earlier edition of the Strong questionnaire so that the present results are not completely comparable but the revisions seem to have been minor ones, mainly involving the construction of additional keys for additional occupations.

On the advice of the author, Dr. Edward K. Strong, the 1938 edition of the Vocational Interest Blank for Men was used with both boys and girls since results for

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the girls on this form can be more readily used than could results from boys on the form for women.

Use of both the form for men and the form for women would have made impossible an analysis of the data for boys and girls combined.

There were few if any complaints by the girls on this use of the sex-inappropriate blank and the results are meaningful enough to seem to indicate that this procedure was warranted. Of course no vocational guidance could be based on this sex-inappropriate use of the test.

Subjects

The twins were a nearly complete set of the twins from a number of high schools in Ann Arbor, Ypsilanti, Dearborn and Detroit, Michigan. Complete records were obtained from 23 male and 20 female twin pairs and 14 male and 20 female fraternal twin pairs. The twins ranged in age from 12 to 20 with a mean age of 16.3.

The decision whether to regard a pair as identical or fraternal was completely objective and based on a decision function derived from population frequencies of the 8 blood group systems tested. The results of these tests as well as the overall design of the study have been described by Sutton, Vandenberg and Clark, (1962) while the decision function has been published by Sutton, Clark and Schull (1955). Results from other psychological tests are reported by Vandenberg elsewhere (1962).

Statistical analysis

To determine the presence of hereditary components in continuous traits as well as evalutate the statistical significance of such results, the procedure recommended by Dahlberg (1926) was used. This procedure uses an analysis of variance approach (in which the effect of sex is removed when the combined sample is used) and calculates the ratio between the fraternal and identical within-pair variances. The statistical significance of this ratio may be evaluated with the F-test. The formula used is

$$F = \sigma^2_{wf}/\sigma^2_{wi} \text{ which reduces conveniently to } \frac{N_i \Delta^2 f}{N_f \Delta^2 i} \qquad (1)$$

with N_f and N_i degrees of freedom, where Δ is $X_A - X_B$, A and B are a twin pair, and there are N_f pairs of fraternal and N_i pairs of identical twins. Holzinger's h^2 index is frequently misinterpreted as a measure of the proportion of a trait due to heredity, although it is only an index of the relative size of estimates (for the sample studies) of presumed components of variance due to hereditary and to environmental factors. (Holzinger 1929). For criticism of this index see for instance May (1951). It assumes environmental factors equal in size for the fraternal and the identical pairs as well as simple addition of hereditary and environmental factors. Although in general we wish to avoid these assumptions as well as the chance to be misquoted, we decided to re-

port h^2 values also, in order to be able to compare these results with those of Carter. The data reported by Carter are intraclass correlations for the identical and the fraternal twins which permit calculation of h^2 values by the formula

$$h^2 = \frac{r_i - r_f}{1 - r_f} \qquad (2)$$

An analysis of variance could not be performed for Carter's data in the absence of information about the original scores.

Variables

The responses of the twins were copied onto Hankes' answer sheets (Strong and Hankes 1947) and machine scored by Testscor of Minneapolis which firm reported 47 scale values on a summary sheet for each subject.

These values were read off as scores running from -10 to 90 for the various scales. A list of the 47 scales will be found in Table 1 where the results are presented and need not be given here. Twenty-one of the twenty-three scores used by Carter are identified in this list by an asterisk. Two scores in the earlier study, i. e. those for " school man " and " vacuum cleaner salesman " cannot be directly identified with any of the present scales. The four groupings of interests employed by Carter, i. e., interest in science, language, people or business, will also be used later in the paper when the results of the present study will be compared with Carter's findings.

Results of this study

In Table 1 the results are presented for the 47 scales used in the present investigation. The scales are listed in order of decreasing evidence for hereditary components, i. e., by size of the F-ratio for the results of boys and girls combined. The F-ratios for each sex separately are also shown, as well as the results of the t-test for sex differences in the 47 vocational interest scales. A higher mean value for the boys is indicated by a negative sign in front of the t value.

Looking first of all at the results for all the cases together, we find in the case of the three scales for Physicist, Mathematician and Osteopath an F value beyond the one percent level of significance for the fraternal vs identical within pair variance which indicates the presence of a considerable hereditary component, while for 9 more scales an F-ratio at better than the five percent level of significances gives some indication of a possible hereditary component. These 9 scales are for Dentist, Personnel Director, Veterinarian, Sales Manager, Aviator, Interest Maturity, Chemist, Public Administrator, and Engineer.

The evidence for hereditary components in 12 of the 47 scales seems rather startling since such authors as Roe (1956), Super (1949) and Darley and Haganah (1955) agree on the idea that vocational choices are made gradually and quite late in ado-

Tab. 1. Heritability indices, F-ratios and significance levels for scores on occupational scales and three personality scores of the strong vocational preference blank for 43 identical and 34 fraternal twin pairs and F-ratios for males and females separately. The last column presents t-test results for sex differences

Name of scale in this study	In Carter's study	All cases		F-ratio		t*
		h^2	F	♂	♀	
* Physicist		62	2.65[1]	2.12[1]	3.15[2]	.79
* Mathematician		61	2.61[2]	1.78	3.31[2]	—1.86
Osteopath		55	2.23[2]	2.30[1]	2.27[1]	.72
Dentist		53	2.15[1]	1.23	2.75[1]	—1.30
* Personnel director		50	2.03[2]	2.19[1]	2.02	—6.54[3]
Veterinarian		49	2.00[2]	1.67	6.13	—.44
Sales manager		48	1.93[2]	2.61[1]	1.44	2.37
Aviator		46	1.87[2]	2.08	1.55	1.39
Interest maturity		45	1.85[2]	2.51[1]	1.69	3.97[3]
* Chemist		44	1.81[1]	1.85	1.88	.42
Public administrator		43	1.78[2]	1.23	2.77[1]	—4.74[3]
* Engineer		41	1.69[2]	1.40	2.12	1.21
* Purchasing agent		39	1.64	1.61	1.88	5.81[3]
* Psychologist		38	1.60	1.96	1.38	.20
* Physician	(Lecter)	36	1.57	1.30	1.93	—.75
* Real estate salesman		35	1.53	1.06	2.39[1]	—3.23[3]
Accountant		33	1.50	1.03	2.32[1]	—4.35[3]
Pharmacist		31	1.45	1.31	1.60	1.61
* Office man	(Office clerk)	30	1.43	1.73	1.12	—.92
Mortician		30	1.42	.91	2.27[1]	2.96[2]
* Architect		29	1.42	1.85	1.18	.99
Forest service		27	1.38	1.45	1.23	—6.18[3]
* Artist		28	1.38	1.56	1.10	3.38[3]
Printer		26	1.35	1.39	1.31	—4.51[3]
Production manager		26	1.35	1.38	1.37	5.01[3]
Math-physics science teacher		25	1.33	1.36	1.31	—3.17[2]
* Lawyer		23	1.29	.86	2.48[1]	4.10[3]
* Minister		20	1.25	1.13	1.30	.92
* Farmer		18	1.23	1.71	.73	—8.13[3]
* C. P. A.		16	1.19	.67	2.23[1]	—1.72
* City school superintendent		16	1.18	1.23	1.18	1.83
Senior CPA		16	1.18	.83	1.75	3.41[3]
* Advertising man	(Advertiser)	15	1.17	1.30	1.13	2.44[1]
Carpenter		13	1.15	1.03	1.33	—6.61[3]
Industrial arts teacher		12	1.13	.84	1.58	—2.94[2]
* YMCA secretary		09	1.10	1.01	1.08	—4.40[3]
Policeman		09	1.10	1.66	.74	—9.74[3]
YMCA physical director		08	1.08	1.33	.72	—2.41[1]
Social science high school teacher		00	.98	1.01	1.01	—5.93[3]
Banker		00	.94	1.59	.69	—2.87[2]
Author-journalist	(Journalist)	00	.93	.99	.75	2.48[1]
Masculinity-femininity		00	.91	.89	.84	—2.98[2]
Occupation level		00	.88	1.03	.70	5.25[3]
Vocational agriculture		00	.86	.74	.94	—10.79[3]
Musician		00	.83	.96	.80	3.74[3]
President manufacturing concern		00	.83	.97	.77	3.53[3]
Life insurance salesman		00	.80	.19	1.72	4.82[3]

[1] significant beyond p = .05
[2] significant beyond p = .01
[3] significant beyond p = .001

* negative values indicate higher scores by males than by females and vice versa.

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lescence. Are we then to conclude that these results merely reflect the greater intimacy and mutual sharing of interests on the part of identical twins?

While this conclusion cannot be ruled out entirely, it seems that it goes too far and does not fit in with our findings that for 75 per cent of the scales there is *no* statistical evidence for such sharing and intimacy. In fact in 8 of the 47 scales the fraternal within-pair variance was less than the within-pair variance for the identicals. These scales were for Social Science High School teacher, Banker, Author-Journalist, Masculinity-Feminity, Occupational Level, Vocational Agriculture, Musician, President of a Manufacturing Concern, Life Insurance Salesman. While it may be objected that the F-ratios for these scales are too close to 1.00 to be significantly different from 1.00, the question still remains why the results for these scales-as well as for the remaining 27 non-significant ones do not also show the effects of the greater intimacy of identical twins.

Perhaps there are after all hereditary factors that produce greater differences between fraternal twins with respect to these 12 Strong scales than with respect to the 35 others.

A second objection which might be raised has to do with the possibility that these 12 scales measure the twins' true interests better than do the other 35 scales. If this were the case it might explain the failure of these 35 scales to demonstrate the hypothesized effect on vocational interests of the greater intimacy and sharing of interests by identical than by fraternal twins. But if there is evidence for such selective reliability or validity of these particular scales in the literature, it is not known to this author.

We are thus — it seems — justified in assuming that scores on these scales are under some degree of hereditary control, presumably because they are somewhat closer to those personality and ability variables which are the source of the hereditary divergence of the fraternal twins. Finally we remind ourselves again that the scores on the various scales are not experimentally independent because the same items contribute to them. However, not too much should be made of this, since scales which may be expected to correlate fairly highly did not have F values of the same magnitude. This is more readily observed in Table 2 in which h^2 values are used to allow comparison with Carter's study. In this table the results are grouped into 4 major areas: interests in science, language, people or business.

Comparison of the results for the boys and the girls

For 23 scales the mean scale value for the girls was higher than for the boys and for the remaining 24 scales the reverse was the case. Of the 26 significant values, 10 were in favor of the girls and 16 in favor of the boys. This may be regarded as partial confirmation of the idea that the use with girls of the male form of the Strong Vocational Interest Blank is not meaningless in this type of research. Of course one has to keep in mind that the keys for the various scales were developed on males so that the

Tab. 2. Intraclass correlations and h^2 values for males and females separately and for all cases combined in Carter's study and in this study

	Carter 1932									Vandenberg 1964								
	Intraclass correlations						h^2			h^2			Intraclass correlations					
	♂ Id.	♂ Frat.	♀ Id.	♀ Frat.	All cases Id.	All cases Frat.	♂	♀	All cases	All cases	♂	♀	♂ Id.	♂ Frat.	♀ Id.	♀ Frat.	All cases Id.	All cases Frat.
Number of pairs	21	22	22	21	43	43	43	43	86	77	37	40	23	14	20	20	43	34
" Science " interests																		
Psychologist	28*	23	44	18	36	20	06	32	20	26	00	50	54	57	67	34	60	46
Mathematician	56	14	52	37	54	26	49	24	38	58	76	21	79	12	37	20	65	17
Physician	59	00	59	58	59	29	59	02	42	43	49	38	49	00	45	12	47	07
Chemist	74	29	54	37	64	33	63	27	46	34	26	27	61	47	43	22	55	32
Physicist	79	07	51	37	65	22	77	22	55	46	60	13	76	40	29	18	62	30
Architect	71	06	52	45	62	26	69	13	49	19	20	25	29	—11	59	45	44	31
Engineer	84	22	63	06	74	14	79	61	70	44	50	19	72	44	19	00	61	30
Farmer	56	64	42	26	49	45	00	22	07	33	00	46	59	65	46	—07	54	31
" Language " interests																		
Journalist	47	24	22	27	34	26	30	00	11	00	24	00	50	34	36	55	43	50
Lawyer	77	18	23	17	50	18	72	07	39	39	73	07	78	20	38	33	57	29
Advertising	39	23	23	35	31	29	21	00	03	00	00	19	48	63	61	52	55	57
Artist	35	02	52	58	44	30	34	00	20	10	26	00	46	27	34	48	39	32
Interests in " People "																		
YMCA Secy.	64	16	51	36	58	26	57	23	43	00	26	00	52	35	29	50	41	46
City school supt.	59	42	66	16	62	29	29	60	46	24	43	02	58	26	50	49	55	41
Personnel Mgr.	37	27	54	42	46	34	14	21	18	37	49	19	60	22	40	26	53	25
Minister	58	13	58	13	58	13	52	52	52	18	45	00	64	34	45	49	55	45
School man	27	33	58	16	42	24	00	50	24	No comparable scale available								
" Business " interests																		
Vacuum cleaner salesman	66	14	42	58	54	36	60	00	28	No comparable scale available								
Real estate salesman	33	05	28	14	30	10	29	16	22	13	56	00	58	04	37	53	47	39
Life insurance salesman	60	24	47	38	54	31	47	15	33	06	52	00	58	13	43	85	52	49
Purchasing agent	52	28	20	42	36	35	33	00	01	51	55	56	51	07	73	38	64	26
Office clerk	60	10	32	31	46	20	56	01	32	24	44	11	47	05	44	37	46	29
C. P. A.	48	24	46	38	47	31	32	15	23	17	46	00	57	20	34	46	45	34
Averages (after r to z transformations and back to r after averaging)																		
8 Science scales	60	22	52	34	58	27	49	27	42	39	42	33	62	34	45	18	56	28
4 Language scales	52	17	30	33	40	25	42	00	20	10	32	00	57	37	43	47	49	43
4 People scales	55	24	57	27	56	25	41	41	41	20	41	00	58	29	41	44	52	40
5 Business scales	51	18	35	33	43	25	40	03	24	26	49	00	54	10	48	56	52	35
All 21 scales	61	22	48	34	53	27	50	21	36	28	45	08	61	29	46	41	55	37

* All decimal points omitted.

sex differences found may in part reflect quite general differences and in part merely the inappropriateness for girls of some of the items in the male form. In any case it seems warranted to assume that all the scales are affected by this to a comparable degree, so that at least comparisons between the scales are possible.

Another reason why the use of the male form with these girls seems acceptable is provided by the fact that the F-ratios for the fraternal vs. identical within-pairs variance are higher for the girls than for the boys for 24 of the 47 scales. Because separate analyses for the boys and the girls lowers the degrees of freedom, fewer F-tests are significant for the two sexes separate than combined, but more F-tests are significant for the girls alone, than for the boys. This is in part due to the fact that there were only 14 fraternal pairs of boys. Even so, the values for the F-ratio tend to run somewhat higher for the girls than for the boys, as Table 3 shows.

Tab. 3. Distribution of F-ratios for fraternal vs. identical within pair variances of male and female twins (for 47 strong scales)

	less than 1.10	1.10-1.69	1.70 and up
♂	17	18	12
♀	12	17	18

Because of the rather small number of cases and because of the use of the male form for the girls we will leave this comparison at this point and we will not attempt to interpret the findings for any specific scale.

Comparison with Carter's results

We mentioned earlier already that only 21 of Carter's 23 scales can be compared with scales from the present study. Table 2 summarizes the results of such a comparison.

Because Carter's 1932 paper reported for the identical twins and for the fraternal twins intraclass correlations which make possible the use of formula (2) given earlier, intraclass correlations were also correlated for the Michigan twins. The formula

$$r_i = \frac{\sigma^2_b - \sigma^2_w}{\sigma^2_b + \sigma^2_w} \tag{3}$$

was used, where σ^2_b is the between pairs variance

$$\sigma^2_b = 1/2\, \Sigma (X_A - X_B)^2 - \frac{1}{2N} (\Sigma X_A - \Sigma X_B)^2 \tag{4}$$

and $$\sigma^2_w = \frac{1}{N}\left[\Sigma X^2_A - \Sigma X^2_B - \frac{1}{2} \Sigma (X_A - X_B)^2 \right] \tag{5}$$

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The first 6 columns of Table 2 show the intraclass (or " double entry " correlations) for the Michigan twins, identical and fraternal separately for each sex and for the groups combined. Columns 7 — 9 show the h^2 value according to formula 2 for the Michigan data. Columns 10-12 show h^2 for all the Carter twins and for the boys and girls separately. Finally Carter's intraclass correlations are repeated for the reader's convenience. In studying first of all the two middlle columns with the h^2 values for the Carter and for the Vandenberg study we notice immediately that the values seem somewhat smaller in the later study. After Z transformation of the intraclass correlations these averaged transformed values were transformed back into r values and h^2 values calculated from these « average » intraclass correlations.

The bottom row of the table shows the results. The average h^2 value for the 21 comparable scales in the Carter study is .36, for the Vandenberg study .28. When these results are considered it seems warranted to say that in spite of non-significant h^2 values for many scales, there is small but rather persistent tendency for increased within-pair variation in the fraternal twin pairs in both studies, indicative of hereditary components in the individual differences for the 21 scales averaged.

The next thing to notice is that there is only a slight tendency for the same scales to show higher h^2 values in both studies. The rank order correlation of the values for all cases in the 21 scales common to the two studies is in fact only .16. The corresponding values for the h^2 values obtained for the males and for the females separately are .35 and .00. This lack of comparability in the pattern of high and low h^2 values may of course be due to changes in the value systems associated with preferences for different vocations or with changes in the nature of some of these jobs, but this hypothesis conflicts in part with the high stability of Strong patterns on retesting the same individuals after many years (Strong 1951, 1955).

From the same table it is also apparent that the h^2 values for the separate scales usually run higher for the males than for the females. The h^2 values based on the averages for all 21 scales are .50 for the males and .21 for the females in the Carter study and .45 for the males and .08 for the females in the present study. This conflicts with the findings earlier discussed, when all scales were being considered.

The lower h^2 values for the girls on these selected scales is probably a reflection of the fact that the sex inappropriate form was administered, although we should keep a simpler explanation in mind, i. e., that high school girls — in general — have less clear vocational plans than boys, because marriage and home making is regarded by many high school girls to be the first and principal « vocational plan ». The fact that on many of the scales the girls obtained a higher mean scale value than the boys and occasionally a higher F-ratio for the fraternal vs identical within pair variance may therefore be due to the inappropriateness of the male form. Perhaps " romantic " rather than realistic preferences are not sufficiently discounted for the girls when the male form and male scoring keys are used.

Finally we can see from Table 2 that the h^2 values based on the " average " of intraclass correlations for the 4 groups of scales do not differ very much between the four groups of interests in the Carter study, while there is less similarity in the h^2 values for

the four groups in the present study. In both studies however the average intraclass correlations for the 8 science scales led to the highest h^2 value among the 4 groups of interests.

Summary

The Strong Vocational Blank inventory was administered to 43 pairs of identical and 34 pairs of fraternal twins in high schools in the Metropolitan Detroit area, and scores obtained on 44 vocational preference scales and 3 personality scales. F tests of the ratio between fraternal and identical within twin pair variances were significant beyond the .01 level of significance for the scales for Physicist, Mathematician and Osteopath while 9 more scales had F-ratios significant beyond the .05 level; these were for the scales of Dentist, Personnel Director, Veterinarian, Sales Manager, Aviator, Chemist, Public Administrator, Engineer and for the scale of Interest Maturity. Thus a total of 12 scales had F-ratios indicative of some hereditary contribution to the within pair variance of the twins in this study.

A comparison with the results published by Carter in 1932 was possible for 21 scales, by computing intraclass correlations for the present data. From these, as well as from the intraclass correlations reported by Carter, h^2 values were computed and compared. There was stronger evidence for hereditary components in the earlier study, and the rank order correlation for the h^2 values in the two studies was only .16, although in both studies it was found that the " Science " group of interest scales had the highest " average " h^2 value (computed from average intraclass correlations, after Z-transformation).

These results are interpreted as indicative of a small but persistent contribution of hereditary components to the vocational choices reflected in scores on the Strong Vocational Preference Blank, particularly for scientific careers.

The use of the male form for the female twins in this study seems partly justified by the presence of equally often high mean values on scales and higher heritability estimates on some scales compared with the boys.

References

Buros O. K.: The fifth mental measurements yearbook. The Gryphon Press, Highland Park, N. J., 1959.

Carter H. D.: Twin similarities in occupational interests. J. educ. Psychol., 1932, 23: 641-655.

Dahlberg G.: Twin births and twins from a hereditary point of view. Stockholm, Tidens Tryckeri, 1926.

Darley J. G. and Theda Haganah: Vocational interest measurements: theory and practice. University of Minnesota Press, Minneapolis, 1955.

Holzinger K. J.: The relative effect of nature and nurture influences on twin differences. J. educ. Psychol., 1929, 20: 241-248.

May Joan: Note on the assumptions underlying Holzinger's h^2 statistics. J. Ment. Sci., 1951, 97: 466-467.

Roe Anne: The psychology of occupations. Wiley, New York, 1956.

Strong E. K.: Vocational interests of men and women. Stanford University Press, Stanford, Cal. 1943.

— Hankes E. J.: A note on the Hankes Test Scoring Machine. J. Appl. Psychol., 1947, 31:212-214.

— Interest scores while in college of occupations engaged in twenty year later. Ed. Psychol. Meas., 1951, 11: 335-348.

— Vocational interests 18 years after college. Minneapolis, University of Minnesota Press, 1955.

— Interests of fathers and sons. J. appl. Psychol., 1957, 41:284-292.

— Vocational interest blank for men. Consulting Psychologists Press, Palo Alto, Cal. 1938.

Super D. E.: Appraising vocational fitness by means of psychological tests. Harper, New York, 1949.

Sutton H. E., Clark P. J. and Schull W. J.: The use of multi-allele genetic characters in the diagnosis of twin zygosity. Amer. J. Hum. Genet, 1955, 7: 180-188.

— Vandenberg S. G. and Clark P. J.: The hereditary abilities study, selection of twins, diagnosis of zygosity and the program of measurements. Amer. J. Hum. Genet., 1962, 14:52-63.

Vandenberg S. G.: The hereditary abilities study: hereditary components in a psychological test battery. Amer. J. Hum. Genet., 1962, 14: 220-237.

RIASSUNTO

Il Questionario per le Aspirazioni Professionali di Strong è stato applicato a 43 coppie di gemelli MZ ed a 34 coppie di gemelli DZ della scuola superiore del territorio metropolitano di Detroit, ottenendo risultati per 44 classi di aspirazioni professionali e 3 classi di personalità. I tests F dei rapporti tra mono- e dizigotici per le varianze intracoppia si sono rivelati significativi oltre il livello di significatività 0,01 per le classi di Fisico, Matematico ed Osteopatologo, mentre altre 9 classi hanno rivelato rapporti F significativi oltre il livello 0,05, cioè per le classi di Dentista, Capo del Personale, Veterinario, Capo Ufficio Vendite, Aviatore, Chimico, Pubblico Amministratore, Ingegnere e per le classi di Maturità di Interesse. Quindi un totale di 12 classi presentava rapporti F indicanti una certa componente ereditaria nella varianza intracoppia nei gemelli di questo studio.

Per 21 classi è stato possibile un raffronto con i risultati pubblicati da Carter nel 1932, prendendo in considerazione le correlazioni intraclasse per i dati attuali. Da questi e dalle correlazioni riportate da Carter, sono stati calcolati e raffrontati i valori h^2. Vi erano maggiori prove di fattori ereditari nello studio precedente, e l'ordine di correlazione per i valori h^2 nelle due ricerche era solo di 0,16, per quanto in ambedue le ricerche si trovasse che il gruppo « Scienze » presentava il più alto valore medio h^2 (calcolato dalle correlazioni intraclasse dopo trasformazione Z).

Questi risultati appaiono indicare l'esistenza di un limitato ma continuo contributo della componente ereditaria nella scelta professionale che si riflette nei risultati del Questionario per le Aspirazioni Professionali di Strong, particolarmente per le carriere scientifiche.

L'avere applicato il questionario per maschi a gemelle appare in parte giustificato dalla frequenza spesso uguale di valori medi di classe e da quella di stime di ereditarietà più alte per alcune classi, rispetto ai maschi.

RÉSUMÉ

Le Questionnaire de Strong pour les Aspirations Professionnelles a été appliqué à 43 couples de jumeaux MZ et 34 DZ de l'école supérieure du territoire métropolitaine de Detroit, obtenant des résultats pour 44 classes d'aspirations professionnelles et pour 3 classes de personnalité. Les tests F des rapports entre MZ et DZ pour les variances entre couple son résultés significatifs au delà du niveau de significativité 0,01 pour les classes de Physicien, Mathématicien et Ostéopathologue, tandis que 9 autres classes ont donné des rapports F significatifs au delà du niveau 0,05, c'est-à-dire pour les classes de Dentiste, Chef du Personnel, Vétérinaire, Chef du Bureau des Ventes, Aviateur, Chimiste, Administrateur Publique, Ingénieur et pour les classes de Maturité d'Intérêt. Un total de 12 classes présentait, donc, des rapports F indiquant une contribution héréditaire dans la variance entre couple chez les jumeaux de cette étude. Pour 21 classes une comparaison a été possible avec les résultats publiés par Carter en 1932, considérant les corrélations entre classes pour les données actuelles. Moyennant ces dernières et les corrélations rapportées par Carter, les valeurs h^2 ont été calculées et comparées. Les facteurs héréditaires étaient plus évidents dans l'étude précédente et l'ordre de corrélation pour les valeurs h^2 dans les deux recherches n'était que de 0,16, quoique dans toutes les deux il résulta que le groupe « Sciences » présentait la valeur moyenne h^2 plus élevée (calculée à travers les corrélations entre classes après transformation Z). Ces résultats semblent indiquer l'existance d'une contribution limitée mais continue des facteurs héréditaires dans le choix professionnel, qui se reflète dans les résultats du Questionnaire de Strong pour les Aspirations Professionnelles, surtout en ce qui concerne les carrières scientifiques. Le fait d'avoir appliqué un questionnaire pour mâles à des jumelles paraît en partie justifié par la fréquence, souvant égale, des valeurs moyennes de classe et par celle d'estimations d'hérédité plus élevées pour quelques classes, vis-à-vis des mâles.

ZUSAMMENFASSUNG

Auf 43 EZ-Paare und 34 ZZ-Paare der höheren Schule des Stadtbezirks von Detroit wurde der Strong'sche Fragebogen zur Feststellung der Berufswahl angewandt. Dabei wurden Ergebnisse erhalten, die sich auf 44 Berufs- und 3 Persönlichkeitsgruppen erstreckten. Für die Berufe als Physiker, Mathematiker, Osteopathologe lagen die Werte der F-Tests, welche die Unterschiede zwischen Paarlingen bei EZ und ZZ bestimmen, über dem Bedeutungsniveau von 0,01. Für den Beruf als Zahnarzt, Personalchef, Direktor einer Verkaufsabteilung, Flieger, Chemiker, öffentlicher Verwalter, Ingenieur sowie für die Unterrichtsfächer, die sich mit Zinsberechnung usw. befassen, war das F-Verhältnis oberhalb des Niveaus von 0,05 bedeutungsvoll. Bei insgesamt 12 Berufsgruppen zeigte sich also in dem F-Verhältnis eine gewisse Erbanlage in den Unterschieden zwischen den Zwillingen dieser Serie.

Für 21 Berufsgruppen konnte man einen Vergleich mit den 1932 von Carter veröffentlichten Ergebnissen anstellen, indem man für die derzeitigen Erhebungen die Korrelationen zwischen den einzelnen Berufsgruppen berücksichtigte. Aus diesen und aus den von Carter angegebenen Korrelationen zwischen den Berufsklassen wurden die Werte h^2 errechnet und verglichen. In der vorhergehenden Untersuchung waren mehr Beweise für die Erbkomponente gegeben, und die Korrelation der Reihenordnung für die h^2-Werte in beiden Untersuchungen betrug nur 0,16, obwohl es sich herausstellte, dass unter den Interessegruppen die Gruppe « Naturwis-

senschaften » in beiden Untersuchungen den höchsten « Durchschnitts » h^2-Wert erreichte (Dieser Wert wurde nach Z-Transformierung aus den durchschnittlichen Korrelationen innerhalb der verschiedenen Gruppen errechnet).

Diese Ergebnisse werden als bezeichnend für das Vorhandensein einer beschränkten, aber doch persistenten Erbkomponente in der Berufswahl angesehen, welche sich in den Ergebnissen des Strong'schen Fragebogens besonders in den naturwissenschaftlichen Berufen zeigt.

Der für männliche Probanden vorgesehene Fragebogen ist auch auf weibliche Zwillinge angewandt worden. Das erscheint zum Teil damit gerechtfertigt, dass bei den Mädchen gleich häufig hohe Mittelwerte für die Berufsgruppen und für einige Gruppen eine höhere Erblichkeitsschätzung als bei den Jungen vorkommen.

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