

O - Objectivity (as opposed to personal reference or a tendency to take things personally).

Ag - Agreeableness (as opposed to belligerence or a dominating disposition and an overreadiness to fight over trifles).

Co - Cooperativeness (as opposed to faultfinding or over-criticalness of people and things).

A third inventory is entitled "The Guilford-Martin Inventory of Factors G A M I N."¹ It consists of 186 items which were found to be most diagnostic as a result of the analysis of the four hundred original questionnaires administered to 200 men and 200 women college students.

It yields five additional temperament traits which cover the areas of behaviour described below:²

G - General pressure for overt activity.

A - Ascendency in social situations as opposed to submissiveness; leadership qualities.

M - Masculinity of attitudes and interests as opposed to femininity.

I - Lack of inferiority feelings: self-confidence.

N - Lack of nervous tenseness and irritability.

It is evident that the factors assessed in these three inventories were determined by separate and completely independent factorial studies, and there is the possibility, therefore, of an overlap in the factors. In other words, the total of 13 factors taken from the three different inventories may not all be linearly independent.

In a monograph entitled "The Dimensions of Temperament"³ L.L. Thurstone describes in detail an investigation, the purpose of which was to determine the number of factors or dimensions that are implied in current personality schedules. The three Guilford schedules were chosen as they represented careful analytical work

1 A copy of this inventory is included in the appendix.

2 Guilford-Martin (33)

3 A copy of this monograph is included in the appendix.

and the intercorrelations of the scores from the 13 temperament variables were subjected to a factor analysis.

It was found that the scores from these 13 variables could be described in terms of 9 linearly independent factors. The oblique factor matrix ¹ is given below; together with Thurstone's interpretation of the factors.²

Table X.

Oblique Factor Matrix V.

Guilford's Scores	R	F	S	M	L	A	I	X ₁	X ₂
1-S. Social Extraversion	-.29	.11	.32	.01	.42	-.01	.06	-.03	-.04
2-T. Thinking Extraversion	-.76	.06	.36	.07	.00	-.01	.02	-.02	.22
3-D. Freedom from Depression	-.35	.05	.50	.04	.12	.05	-.01	.13	.01
4-C. Emotional Stability	-.26	-.05	.50	-.02	.00	.05	-.05	.22	.02
5-R. Rhythymia	-.41	.21	-.03	.14	.07	-.04	.45	-.02	.03
6-G. General Activity	.02	.00	.05	-.07	-.04	.44	.60	.02	.01
7-A. Ascendancy	.03	-.02	-.03	.03	.55	.18	.00	.30	.04
8-M. Masculinity	.00	.00	.08	.74	.01	-.01	-.04	.01	.02
9-I. Freedom from Inferiority Feelings	.05	.12	.15	.14	.04	.02	.17	.25	-.06
10-N. Freedom from Nervousness	-.01	.24	.32	.24	.00	-.07	.05	.10	.29
11-O. Objectivity	-.08	.31	.07	.06	.00	.16	.13	.34	.02
12-Ag. Agreeableness	.03	.66	.00	-.05	-.01	.03	-.03	-.06	.19
13-Co. Cooperativeness	-.03	.72	.00	.03	.07	.43	-.03	-.03	.00

R. This factor has high negative loadings on Thinking Extraversion, Rhythymia, and less conspicuous negative loadings on Freedom from Depression, Social Extraversion and Emotional Stability. It was generalised as introversion or introspection, but the more generally descriptive adjective Reflective which did not have any socially favourable or unfavourable implications was used to designate this factor.

F. This factor has two large significant saturations on Agreeableness and Cooperativeness with small saturations for Objectivity.

¹ Thurstone, L.L. (25) p. 9

² Ibid., p. 3

Freedom from Nervousness and Rhathymia. It is designated by the descriptive adjective Friendly.

S. This factor has two significant saturations, namely, those for Emotional Stability and Freedom from Depression with lower saturations on Social Extraversion, Thinking Extraversion and on Freedom from Nervousness. This was designated by the descriptive adjective Emotionally Stable.

M. This factor has only one large saturation, that for Masculinity and a smaller saturation on Freedom from Nervousness. This was designated by the descriptive adjective Masculine.

L. This factor has significant loadings on Ascendancy and Social Extraversion with no other significant loadings and was designated by the descriptive adjective Ascendant in the sense of social leadership.

A. This factor has significant loadings on General Activity and Cooperativeness with slight saturations on Objectivity and Ascendancy. This was designated by the descriptive adjective Active.

I. This factor has only two significant saturations, those for General Activity and Rhathymia, with a small saturation on Freedom from Inferiority Feelings and was designated by the descriptive adjective Impulsive.

X₁. This factor has only small loadings, the largest being .35 on Freedom from Inferiority Feelings and .34 on Objectivity. It was tentatively designated as Confident but was left without definite interpretation.

X₂. This residual factor with its highest loading of .29 on Freedom from Nervousness was also left without interpretation.

The correlations between these primary factors were calculated¹ and were as follows:

¹ Thurstone, L.L. (25) p. 10

Table XI.

Correlations between Primary Factors.

	R	F	S	M	L	A	I	X ₁	X ₂
R	1.00	-.11	-.23	.15	.07	.11	-.01	.06	-.02
F	-.11	1.00	.52	-.03	.01	-.37	-.15	.56	-.14
S	-.23	.52	1.00	.05	.04	-.18	-.10	.66	-.12
M	.15	-.03	.05	1.00	.03	.32	-.11	.30	-.09
L	.07	.01	.04	.03	1.00	-.17	.71	.03	-.19
A	.11	-.37	-.18	.32	-.17	1.00	-.26	-.16	.04
I	-.01	-.15	-.10	-.11	.71	-.26	1.00	-.19	-.22
X ₁	.06	.56	.66	.30	.03	-.16	-.19	1.00	-.01
X ₂	-.02	-.14	-.12	-.09	-.19	.04	-.22	-.01	1.00

The isolation of independent variables of temperament is a field of investigation which bristles with problems. The field is so wide that independent investigators may, and have, identified entirely different variables which have proved valid and useful for the prediction of human behaviour in certain clearly defined situations. The dissimilarity between the sets of factors postulated by different investigators leads one to despair of ever finding a key which will result in some homogeneity in the domain of personality assessment by means of factorial methods.

It is believed that the investigation of the second-order domains in factor studies of personality will yield more fruitful results than have so far been achieved and that in this domain there is more hope of comparable results from independent investigators.

The very fact that there are investigations to isolate temperament variables implies an acceptance of the hypothesis that there are personal characteristics which are relatively permanent for each person. It is further implied that the number of those variables which span the domain of personality is finite and a manageable quantity. This may not be so, in which case it will not be possible to see this domain as a whole.

It is a reasonable assumption that the behaviour of individuals in any particular situation (and it is on ratings of items of this sort that most personality schedules are based) will in the majority of instances not be determined in terms of the degree to which the individuals possess a single temperament characteristic, but rather as the resultant of a combination of

variables in different strengths. The differentiation of groups resulting from a factor study may well be reflecting different combinations of individual temperament traits.

Assuming that independent investigators are all using legitimate and comparable factoring methods, it is clear why it would still be entirely possible for little or no relationship to obtain between the factors isolated. For instance, if it is postulated that there are only 5 independent temperament variables and that the test questions or behaviour situations according to which the group of subjects is being rated are specific and well defined so that on the average only 2 variables are operating at a time, there will be 10 differentiating modes of behaviour which might appear as primary factors. Twenty variables operating two at a time will yield 190 varying responses, while 20 variables operating three at a time will yield 1,140 and 20 operating four at a time will yield 4,845 variations of response. In fact it seems easier to conceive of factors isolated by different investigators as being completely dissimilar. If we are indeed dealing with a domain that requires so many variables with so complex an interpretation for its explanation, it seems most unlikely that it will ever be spanned.

In a second-order domain we are dealing with groups of "groups of variables". If the correlations between the primary vectors indicate that a second-order analysis could be attempted, the interpretation of the second-order factor would bring together what is common to the primaries. If, in the first analysis we were dealing with variables operating in groups of two and there was something common to the two primary factors, then there must be one variable common to both in combination with two different elements. Thus AB and AC, and the interpretation of the second-order factor would hinge around the common element A which is one independent variable. If, on the other hand, we were dealing with some variables which were operating in groups of three, to isolate an independent variable we would have to be dealing with one element in combination with two different sets of elements. Thus if a second-order factor had load-

ings on two primary factors composed of the elements ABC and ADE, the interpretation would hinge around the common and independent variable A. If the combination of elements for the two factors happened to be ABC and DBC the interpretation of the second-order factor would hinge around BC which is not an independent variable.

Certainly there is no assurance that independent variables will emerge in a second-order analysis, but it seems more likely that they will so emerge than that any large quantity of them will appear in their pure form in a first-order analysis, if the first-order analysis is based on a large number of unselected behaviour responses.

There is another problem which besets the investigator in the domain of personality. Even if one assumes that there are characteristics which are inherent to the individual which cause him to respond in a certain way, the form of his behaviour will always be modified by his environment. First he must adjust his behaviour to conform to the demands of his immediate family and growing circle of acquaintances. Later his behaviour will be affected by the various social groups of which he is a member.

Such characteristics as the individual's table manners, habits of personal cleanliness, political affiliations or his views on religion are largely determined by his cultural environment, and may change from time to time in the light of new experiences. These characteristics would not be employed in an investigation to isolate temperament variables.

Unfortunately, it is not always so easy to decide whether a characteristic has been largely determined by environmental conditions or whether it falls into what Cattell has called the temperament modality. The systematisation achieved by factor studies of a great number of behaviour responses may to some extent be reflecting differentiations in response caused by different sets of environmental conditions on the same set of inherent characteristics. It appears as a possibility that if there is anything common to and characteristic of individuals, this will be more likely to emerge from the

investigation of a second-order domain where attention is directed toward the common elements among the original sets of behaviour responses. It is quite possible that some of these environmental influences will be so strong and all-pervading that they will never be sifted out completely.

Let it be clearly stated that it is not implied that an analysis of second-order domains is the panacea for all the difficulties which beset the research worker in the field of personality. In fact, on the basis of the arguments advanced here it would seem advantageous to continue with the analysis of third and fourth order domains, but the original data employed would seldom, if ever, be stable enough to warrant such a step. It is merely suggested that if there are inherent and independent variables of temperament, these will be more likely to emerge in a second-order analysis, and if the correlations between the primaries warrant it, it would certainly seem advisable to continue a factor study of personality to this stage, especially if the first-order analysis is based on a large number of unselected behaviour responses and represents only the first systematisation achieved in a wide domain.

This preliminary investigation consisted of the analysis of the intercorrelations between the 9 primary factors given on page 63. The first step in the procedure was an estimation of the communalities. The first estimate was the highest absolute value of the correlation coefficients in each of the successive columns of the correlation matrix. The other estimates were obtained by successive factorings by the centroid method. The estimates are given in Table XII and it will be seen that the two last estimates are in agreement to within .03.

Table XII.

Successive Estimates of the Communalities.

	Highest r	1	2	3
F	.23	.22	.22	.22
R	.56	.63	.61	.64
S	.66	.78	.82	.84
M	.32	.35	.37	.38
L	.71	.69	.68	.67
A	.37	.48	.50	.50
I	.71	.77	.85	.88
X ₁	.66	.74	.79	.77
X ₂	.22	.10	.07	.06

The final orthogonal factor matrix obtained by the centroid method of factoring had 4 factors and is given in Table XIII. In this factoring the diagonal entries were the communalities given in column 2 above. The fourth factor residuals are given in Table XIV.

Table XIII.

Orthogonal Factor Matrix F.

	I	II	III	IV
R	-.18	-.08	.74	.35
F	.59	.40	-.16	.32
S	.65	.59	.12	-.24
M	-.14	.24	.53	.14
L	.47	-.50	.45	.03
A	-.57	.15	.36	-.16
I	.46	-.76	.30	-.07
X ₁	.45	.65	.28	.26
X ₂	-.18	.06	-.16	-.01

Table XIV.

Fourth Factor Residuals.

	R	F	S	M	L	A	I	X ₁	X ₂
R									
F	-.04								
S	-.01	.00							
M	-.03	-.02	-.03						
L	-.01	-.01	-.01	-.02					
A	-.01	.02	.01	.03	.02				
I	-.04	-.05	-.01	-.02	-.03	-.01			
X ₁	.03	-.01	.02	.01	.01	.06	.03		
X ₂	-.01	-.08	-.02	-.05	-.01	-.01	-.01	.07	

The orthogonal factor matrix F was rotated by the method of radial rotation. The transformation matrix Λ is given in Table XV and the resulting oblique factor matrix in Table

Table XV.

Transformation Matrix Λ .

	A	B	C	D
I	.507	.427	-.428	-.266
II	.658	-.582	.112	-.241
III	.543	.685	.735	-.098
IV	.124	-.099	-.514	.929

Table XVI.

Oblique Factor Matrix V.

	A	B	C	D
R	.03	.10	.06	.37
F	.52	-.12	-.49	.06
S	.75	.04	.00	-.55
M	.39	.15	.40	.06
L	.16	.80	.06	-.02
A	-.01	-.07	.61	-.07
I	-.11	.85	-.03	-.03
X ₁	.84	-.02	-.05	-.06
X ₂	-.14	-.22	-.03	.04

Interpretation of the Factors.

Factor A has loadings of .84 on Thurstone's X₁ (Confident), .75 on S (Emotionally Stable), .52 on F (Friendly), and a smaller loading of .39 on M (Masculine). Thurstone's factors, in turn, have their highest loadings on the following Guilford-Martin factors:¹

Thurstone's Factors.	Loadings on Guilford-Martin Factors.
Confident	.35 Freedom from Inferiority Feelings .34 Objectivity
Emotionally Stable	.50 Emotional Stability .50 Freedom from Depression
Friendly	.66 Agreeableness .72 Cooperativeness
Masculine	.74 Masculinity

From a consideration of the interpretations of the Thurstone factors and of the Guilford-Martin factors on which they have saturations, it appears that what is common to the behaviour responses described by these factors is an absence of emotional complexity which facilitates adjustive responses. Even the lesser loading on Masculine fits in with this picture as Guilford-Martin ascribe to the Masculinity factor an absence of irrational fears such as fear of the dark, of deep water and of snakes and a preference for the more objective and active occupations such as mathematics and the building trades rather than literature, music, flowers, art and dancing etc.² The designation Emotionally Stable is therefore retained for this factor.

¹ See pp. 61, 62.

² Thurstone, L.L. (25) p. 6

Factor B has only two high positive loadings, one of .85 on Thurstone's I (Impulsive) and one of .80 on Thurstone's L (Ascendant or Social Leadership). Thurstone's factors, in turn, have their highest loadings on the following Guilford-Martin factors:

Thurstone's Factors.	Loadings on Guilford-Martin Factors.
Impulsive	.60 General Activity
	.45 Rhathymia
Ascendant	.55 Ascendancy
	.42 Social Extraversion

Some of the sample items for the Guilford-Martin General Activity factor are: "Quick in actions, eats rapidly, walks fast, 'on the go', starts work with enthusiasm, hurries, talkative, impulsive, daredevil, group leader."¹ Behaviour characteristics for Rhathymia include: "Happy-go-lucky, carefree disposition, lively, impulsive."¹ Ascendancy is described as social leadership¹ and Social Extraversion by such behaviour as: "Sociability, tendency to seek social contacts, to enjoy company of others."²

In the Heymans-Wiersma scheme of temperament assessment it is postulated that Secondary Function manifests itself as a modifying or "braking" effect on present Primary mental content, chiefly through a spontaneous or associative re-arousal of previous mental content. Thus the predominantly Primary Functioning individual will react spontaneously and rapidly to the immediate stimulus whereas the Secondary Functioning individual's approach will be more cautious and reserved. The qualities which are regarded as characteristic of Primary Function are listed on the temperament and personality assessment blank shown on page 44. These are: (1) impulsiveness, (2) restlessness, (3) variability, (4) expansiveness, (5) distractability and (6) quick worker. These qualities are well represented in the behaviour responses which characterise Factor B. In general terms the behaviour of the predominantly Primary Functioning individual can be described as follows: "..... the prevailing mood will be cheerfulness. This cheerfulness will be unbraked and therefore far more unrestrained, gay and bubbling

1 Thurstone, loc. cit.

2 ibid., p. 5

over than the S.F. The P.F. are on the whole mobile and restless, noisy, quick, and on the move The P.F. are impulsive because they react to the stimulus of the moment, the desire c. impulse of the moment.¹ All of which fits the description of Factor B extremely well, it is therefore designated Primary Function.

Factor C has a high positive loading of .61 on Thurstone's A (Active) and a smaller positive loading of .40 on Thurstone's M (Masculine). It has also a negative loading of -.49 on Thurstone's F (Friendly). Thurstone's factors, in turn, have their highest loadings on the following Guilford-Martin factors:

Thurstone's Factors.	Loadings on Guilford-Martin Factors.
Active	.44 General Activity
	.43 Cooperativeness
Masculine	.74 Masculinity
* Friendly (negative)	.72 Cooperativeness
	.66 Agreeableness

Sample items have already been given for the Guilford-Martin General Activity and Masculinity factors. The behaviour pattern indicated here is one of sustained vigorous activity. A serious-minded person with a preference for active and objective occupations. There is in addition, however, a negative loading on Friendly. It is quite conceivable that the serious-minded individual with much driving force would be successful and cooperative in a work situation but that he would be lacking in the ability to cultivate genial and friendly social relationships. Bearing this qualification in mind this factor could be designated Activity but is perhaps better generalised as Driving Force.

Factor D has a positive loading of .37 on Thurstone's R (Reflective) and a high negative loading of -.55 on Thurstone's S (Emotionally Stable). Thurstone's factors, in turn, have their highest loadings on the following Guilford-Martin factors:

Thurstone's Factors.	Loadings on Guilford-Martin Factors.
Reflective	..76 Thinking Extraversion
	-.41 Rhythymia
Emotionally Stable	.50 Emotional Stability
(negative)	.50 Freedom from Depression

The behaviour pattern here is one of thinking introversion, emotional instability and depression combined with negative Rhythymia. These are all emotionally toned responses which are in general non-adjustive and the designation Emotionally Unstable is retained for this factor.

One alternative rotation was indicated by the structure. The Λ matrix for this rotation is given in Table XVII and the resulting oblique factor matrix in Table XVIII.

Table XVII.

Transformation Matrix Λ .

	A	B	C	D
I	.737	.427	.032	-.266
II	.460	-.582	.487	-.241
III	-.098	.685	.831	-.098
IV	.485	-.099	-.265	.929

Table XVIII.

Oblique Factor Matrix V.

	A	B	C	D
K	-.02	.10	.06	.37
F	.79	-.12	.00	.06
S	.62	.04	.47	-.55
M	.02	.15	.52	.06
L	.09	.80	.14	-.02
A	-.46	-.07	.40	-.07
I	-.07	.85	-.09	-.03
X ₁	.73	-.02	.49	-.06
X ₂	-.10	-.22	-.11	.04

Alternative Interpretation of the Factors.

Factors B (Primary Function) and D (Emotionally Unstable) remain unchanged.

Factor A still has high positive loadings (.79) on Thurstone's F (Friendly), (.73) on X₁ (Confident) and (.62) on S (Emotionally Stable) but the loading on M (Masculine) has dropped to .02 and there is, in addition, a smaller negative loading of -.46 on A (Active). Thurstone's factors, in turn, have their highest loadings on the following Guilford-Martin factors:

Thurstone's Factors.	Loadings on the Guilford-Martin Factors.
Friendly	.66 Agreeableness
	.72 Cooperativeness
Confident	.35 Freedom from Inferiority Feelings
	.34 Objectivity
Emotionally Stable	.50 Emotional Stability
	.50 Freedom from Depression
Active (negative)	.44 General Activity
	.43 Cooperativeness

This factor is still characterised by a warm feeling tone and adjustive responses. The negative loading on A, however, suggests a greater placidity and a less vigorous response. Still emotional adjustment but without much force.

Factor C still has positive loadings (.52) on M (Masculine) and (.40) on A (Active). In addition there are positive loadings of .49 on X_1 (Confident) and of .47 on S (Emotionally Stable). The negative loading on F (Friendly) has become zero. Thurstone's factors, in turn, have their highest loadings on the following Guilford-Martin factors:

Thurstone's Factors.	Loadings on Guilford-Martin Factors.
Masculine	.74 Masculinity
Active	.44 General Activity
	.43 Cooperativeness
Confident	.35 Freedom from Inferiority Feelings
	.34 Objectivity
Emotionally Stable	.50 Emotional Stability
	.50 Freedom from Depression

A clear pattern of behaviour responses is evident. There is sustained, quick and vigorous activity combined with a preference for objective and active occupations. There is emotional stability, objectivity, freedom from inferiority feelings, cooperativeness and freedom from depression.

In the Haymans-Wiersma scheme of temperament assessment Activity would seem to be the expression of general vigour, mental, physical or both. Activity shows itself particularly in the following ways:

(a) General Vigour of Behaviour. This is observable in:-

- (1) The quickness with which a person starts a given task;
- (2) The degree to which activity can be maintained at a high level;
- (3) The intensity of effort put into it.

- (b) Determination. The way in which the individual will tackle problems of some difficulty, problems which, possibly, he dislikes tackling; his unwillingness to give up until every possible means has been tried; his "guts" in taking punishment and undergoing hardships.
- (c) Keeness to be occupied with something, other than mere passive stimulation of the senses or satisfaction of some strong primary drive.
- (d) General Euphoria. Active people are on the whole bright and optimistic. They know how to enjoy life, or when circumstances are adverse, how to make the best of things.

Activity further facilitates enthusiasm, counteracts over-cautiousness, variability, aggressive expression of the emotions and emotional complexity.¹

These concepts are well represented in the behaviour pattern of Factor C and there is evident justification for designating this factor Activity.

The Emotionality variable as described in the Heymans-Wiersma scheme cannot be directly related to the factors isolated in this investigation. Factor A, in either rotation, is more descriptive of adjustive behaviour responses and has been called Emotionally Stable, while Factor D describes maladjustive emotional responses and has been called Emotionally Unstable. Whether general Emotionality is the independent variable underlying both factors or whether the maladjustive and adjustive emotional responses are qualitatively different and relatively permanent for the individual so that they will always appear as different factors is a matter for further investigation. If this should prove to be the case they would be more useful for the description of human behaviour than the over-all concept of general Emotionality.

In this investigation we have covered the areas of

¹ Biesheuvel, S. (27) p. 11

personality traditionally known as "introversion-extraversion", "paranoid tendency" and "vigorous activity, ascendancy, masculinity, selfconfidence and lack of nervousness". In their original inventories Guilford and Martin utilised 511 different behaviour characteristics to cover these areas of personality. These areas have been described in terms of four factors, two of which (Primary Function and Activity) have been identified with the Heymans-Wiersma variables and the remaining two may have some relationship to the third Heymans-Wiersma variable of general Emotionality. From these results we can conclude that at least two of the Heymans-Wiersma variables are operative in a wide area in the domain of personality.

In the following chapter an attempt is made to check these results and to obtain more information about these factors by means of a new factorial investigation.

CHAPTER V.

THE EXPERIMENTAL DESIGN.

- (a) Statement of the aim of the experimental investigation.
- (b) A check to ascertain whether the word list of descriptive adjectives to be used in the experimental investigation contained any synonymous words.
- (c) Description of the method of assessing the behaviour traits.
- (d) Description of a check for the consistency of the assessments.
- (e) The raters.

"Factorial studies may be roughly classified as of two kinds. When there are no hypotheses to guide the study of a new domain, the experimenter tries to cover the domain with tests or measures that are diversified within the domain The second kind is the experiment in which some hypotheses are available and in which tests are specially constructed to represent the presence and the absence of each postulated factor or parameter. Such studies are likely to be more productive of definitive results."¹

It was decided to continue this investigation by setting up a new factorial experiment to test certain definite hypotheses, using tests, or in this instance personality items, which would cover the concepts embodied in the four factors isolated in the Preliminary Investigation and also the concepts in the Heymans-Wiersma general Emotionality factor as shown on the Temperament and Personality Assessment blank.

The questions which we set and about which we hope to get some information as a result of this investigation are as follows: Will the three emotionality factors emerge again and have to be retained as distinct patterns of behaviour or will the concepts in the general emotionality factor be covered by the two linearly independent factors designated Emotionally Stable and Emotionally Unstable? Can these second-order factors be made to appear as first-order factors in a new factorial study by careful selection of the behaviour items to be assessed?

¹ Thurstone, L.L. (20) p. 340

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