

RESEARCH

LEVELS OF PERSONALITY, CONSTITUTIONAL FACTORS, AND SOCIAL INFLUENCES: AN EXPERIMENTAL APPROACH

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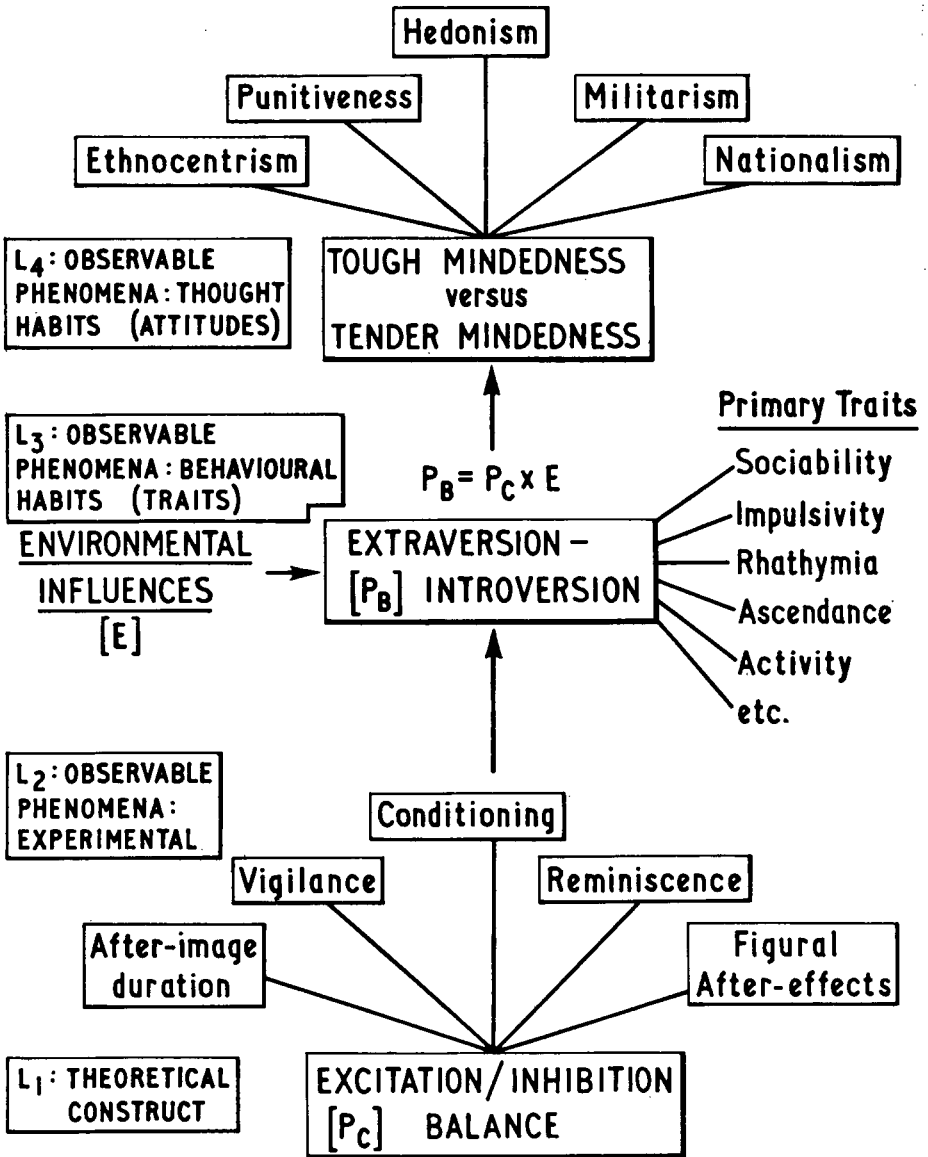
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IN recent years, the concept of *Schichtentheorie* has become more widely known among English-speaking psychologists, due in part to the writings of A. R. Gilbert (1951, 1957). According to this theory, "the holistic personality model of Gestalt psychology and Stern's psycho-physically neutral model [are rendered] more definite by providing them with biologically grounded 'strata'" (Gilbert, 1957, p. 218). Gilbert mentions the possibility of "cross-fertilization between factor analysis and stratification" (*ibid.*), specifically citing the present writer's work on neuroticism and extraversion as an illustration. The writer's most recent studies on the excitation-inhibition balance as underlying extraverted and introverted behaviour patterns (Eysenck, 1957, 1960b) would appear to go even further in the same direction. The present article considers some of the problems raised by any form of stratification theory, the experimental methods applicable to the investigation of the different strata, and the specific difficulties presented by the writer's own theory in this connection.

The "stratified" nature of the writer's theory can best be seen from Fig. 1, which shows in diagrammatic form four main levels assumed to be causally related to one another. At the most fundamental level we have the concept of what Pavlov has called the excitation-inhibition balance. This is assumed to be a constitutional feature of the individual which predisposes him to develop either excitatory potentials particularly strongly and inhibitory potentials particularly weakly, or else to develop inhibitory potentials particularly strongly and excitatory ones rather weakly. All possible intermediate gradations are, of course, possible, and it is not unlikely that the distribution of ratios will follow something like the normal Gaussian curve. The terms "excitation" and "inhibition" do not in this context have any definite physiological meaning, although it is, of course, extremely probable that in due course the link-up will be made between physiological concepts and molar psychological ones such as excitation and inhibition. For the time being, however, these concepts are simply to be regarded as hypothetical constructs or intervening variables in a system of postulates and theorems which mediate and explain a large number of experimentally well-authenticated phenomena.

Some of these phenomena have been listed at the second level (L_2) of Fig. 1. Thus, speed of conditioning, strength of conditioning, and slowness of extinction of conditioned responses are all supposed to be facilitated by excitatory potentials and decreased by inhibitory potentials. Reminiscence, according to modern learning theory, is a direct measure of the amount of inhibition generated during massed practice and dissipated during the subsequent rest pause. Figural after-effects are due to satiation which is conceived of as identical with reactive inhibition. Decrease in vigilance during massed practice in perceptual phenomena is considered as due to the accumulation of reactive inhibition.

FIG. 1



After-image duration is conceived of as being facilitated by excitatory and diminished by inhibitory potentials. The number of experimental phenomena which could be listed at this level is very large indeed, and those given in Fig. 1 are only a few selected examples.

The link between level 2, which is completely concerned with laboratory phenomena, and level 3, which is concerned with behaviour patterns, observable outside the laboratory, is given by the writer's typological postulate (Eysenck, 1957) according to which persons with strong excitatory and weak inhibitory potentials will tend to develop introverted personality traits, and dysthymic

disorders if subjected to a neurotic breakdown, while persons with weak excitatory and strong inhibitory potentials will tend to develop extraverted personality traits, and hysterical and psychopathic symptoms if subjected to a neurotic breakdown. The concepts of extraversion and introversion themselves are defined in terms of observed inter-relationships between various primary traits, some of which (sociability, impulsiveness, rathymia, ascendance, activity, and so on) are listed in Fig. 1. The general link provided by the typological postulate requires more specific demonstration, and some arguments relating to such specific relationships will be presented below. Causally, the progression is from level 1 to level 4; historically, levels 3 and 4 were investigated first, and independently of the others. Work reported in Eysenck (1957) then linked up these

TABLE 1

	<i>I</i>	<i>E</i>	<i>Reference</i>
Neurotic syndrome:	Dysthymia	Hysteria: Psychopathy	Eysenck, 1947
Body build:	Leptomorph	Eurymorph	Eysenck, 1947
Intellectual function:	High I.Q./Vocabulary ratio	Low I.Q./Vocabulary ratio	Himmelweit, 1945; Foulds, 1956
Perceptual rigidity:	Low	High	Canestrari, 1957
Persistence:	Low	High	Eysenck, 1947
Speed:	High	Low	Foulds, 1952
Speed/accuracy ratio:	Low	High	Himmelweit, 1946
Level of aspiration:	High	Low	Himmelweit, 1947; Miller, 1951
Intra-personal variability:	Low	High	Eysenck, 1947
Sociability:	Low	High	Eysenck, 1956, 1957
Repression:	Weak	Strong	Eriksen, 1954
Social attitudes:	Tender-minded	Tough-minded	Eysenck, 1954
Rorschach test:	M High	D High	Eysenck, 1956
T.A.T.:	Low productivity	High productivity	Foulds, 1953
Conditioning:	Strong	Weak	Franks, 1956, 1957
Reminiscence:	Low	High	Eysenck, 1956
Figural after-effect:	Small	Large	Eysenck, 1955
Stress reactions:	Over-active	Inert	Davis, 1948; Venables, 1953
Sedation threshold:	High	Low	Shagass, 1956
Perceptual constancy:	Low	High	Ardis & Fraser, 1957
Time judgment:	Longer	Shorter	Claridge, 1960
Verbal conditioning:	Good	Poor	Eysenck, 1959d Eysenck, 1959c; Sarason, 1958
Response to therapy:	Good	Poor	Foulds, 1959
Visual imagery:	Vivid	Weak	Costello, 1957
Necker cube reversal:	Slow	Fast	Costello, 1957
Perception of vertical:	Accurate	Inaccurate	Taft & Coventry, 1958
Spiral after-effect:	Long	Short	Claridge, 1960; Willett, Holland, & Eysenck, 1960
Time error:	Small	Great	Claridge, 1960
Vigilance:	High	Low	Claridge, 1960;
Motor performance decrement:	Little	Much	Bakan, 1957 Ray, 1959
Problem solving; performance decrement:	Little	Much	Eysenck, 1959e
Smoking:	No	Yes	Eysenck <i>et al.</i> , 1960
Car driving constancy:	High	Low	Venables, 1956
Cheating:	No	Yes	Keehn, 1956

two sets of levels by means of experiments largely carried out at level 2. These experiments have usually taken the form of testing deductions like: "Extraverts (under certain conditions of massed practice, etc.) show greater reminiscence effects", or "Introverts condition better", or "Rotating spiral after-effects persist longer in introverts". Results from experimental tests of such deductions from the general theory have been reported in some detail (Eysenck, 1957, 1960b); they are favourable in a sufficient number of cases to retain interest in the theory under investigation. (See Table 1.) Negative results have been reported by several investigators, but the deductions made (Hamilton, 1957; Eysenck, 1959h) and the experimental design used (Rechtschaffen, 1958; Eysenck, 1959a) have not always been such as to make possible a proper test of the theory.

Of particular importance in relating levels 2 and 3 is the theoretical conception of the *socialization process*, which is being mediated through some form of conditioning (Mowrer, 1950; Eysenck, 1957, 1959f). According to this view, socialized behaviour in the adult has as its basis anxiety and fear responses to anti-social acts of an overtly aggressive or sexual character; these responses are conditioned in childhood and cohere together according to the principles of stimulus generalization (aided by verbal identification). The resulting barrier to the immediate satisfaction of every passing impulse (conscience, "inner light", super ego) is stronger in introverts than in extraverts, due to the greater strength of the conditioning process in the former. Taken to extremes, this gives us the neurotic introvert, the dysthymic, who is over-socialized and prone to phobias and anxieties due to his over-strong conditioning equipment, and the neurotic extravert, the psychopath, who is under-socialized and prone to anti-social acts due to his defective conditioning equipment. This conditioned ethico-religious barrier to impulse satisfaction in the introvert also emerges in the attitude field in the form of "tender-minded" attitudes, while the relative absence of such barriers gives rise to "tough-minded" attitudes (Eysenck, 1954).

Such a one-to-one relationship between levels 2 and 3, however, obtains only as long as that total set of environmental influences which may be conceptualized as the conditioned and unconditioned stimuli remains constant from person to person. Such an assumption, however, is clearly contrary to the facts, just as is the assumption of frictionless movement which underlies Newton's laws of motion and Galileo's law of falling bodies. General laws of this kind are of great importance in science, but they require adaptation before they can be used to make accurate predictions in the complex circumstances of our natural environment. A "natural extravert" may be brought up very strictly, receiving so many CS—UCS pairings that a reasonable strength of "socialized habit" (sHrs) is finally acquired, while a "natural introvert" may be brought up in such a *laissez faire* environment that even the minimum number of CS—UCS pairings required to produce a reasonable strength of sHrs is not forthcoming. Worse still, the introvert may be brought up in a criminal sub-society where the total amount of conditioning received is directed towards ends exactly the reverse of those emphasized by society as a whole. Even apart from criminal groups, there is some evidence that certain lower-working-class groups not only fail to condition children to avoid the overt expression of sexual and aggressive urges, but actually encourage such expression. Consequently no simple equation of extraversion = criminality can be made; in each case we have to consider not only the conditionability of the subject, but also the actual conditioning in fact received (Eysenck, 1959f).

These considerations suggest that observed correlations between experimental tests taken from level 2 and personality traits taken from level 3 would not be very high, unless corrected by partialling-out environmental influences, or using some convenient numerical estimate of them as a suppressor variable. This prediction is reinforced by a consideration of the probable lack of reliability of individual test scores on such measures as reminiscence (Eysenck, 1956), and the far from perfect reliability of personality measures at level 3. In fact, correlations usually run between .2 and .4 with only very few (possibly chance) correlations going up to .6; it is not infrequent to find correlations below .2. It is very rare indeed, however, to find that the direction of the correlations obtained is contrary to prediction.

The general hypothesis outlined above may be presented in the form of a schematic formula:

$$P_B = f(PC \times E)$$

where P_B denotes the behavioural personality trait of extraversion-introversion, PC the constitutional personality trait (source trait), in this case the excitation-inhibition balance, and E the sum total of relevant environmental influences. Unfortunately, very little is in fact known about E , in spite of the predominantly environmentalistic bias of modern psychology; it might almost be more meaningful to rewrite the equation and solve for E ! (A similar equation would, of course, apply to neuroticism; we would simply substitute this trait for extraversion in the formula. The constitutional aspect [PC] would be represented by an inherited over-responsiveness of the autonomic nervous system.*)

This formula is rather static, and applies to the fully developed personality; it will be clear that in our conception childhood and adolescence are the primary periods where E interacts with PC . It is commonplace to regard this period of growth as one in which socialization takes place; there are still to be found psychologists who argue that the essential process takes place in the "first five years", while others would extend this period until considerably later. The baby and the very young child are clearly completely "extraverted" in the sense of lacking all internal barriers to immediate satisfaction of impulses, and the "growth of introversion" and socialization is a rather gradual one. If this notion be accepted, then it should be possible to derive some kind of "personality quotient" by analogy with the I.Q.; this would then make it possible (as it is not at present) to compare children of different ages. (It will be noted that our formula applies equally to intelligence as to other personality traits; the term " E " in it is usually assumed to be equal for all Ss, or attempts are made, as in the use of "culture-free tests", to equalize it. Much fruitless disputation has taken place because the distinction between P_B and PC has not been borne in mind.)

This general view must also be applied to the extension of this scheme to the neurotic field. Jung, it will be remembered, suggested that extraverted persons tended to develop hysterical, introverted persons psychasthenic, mental disorders. Our researches (Eysenck, 1947, 1957, 1960b) have in general supported this hypothesis, although only in a relative sense; hysterics tend to be more extraverted than psychasthenics (or dysthymics, as we prefer to call them),

* It is interesting to note that a leading Russian psychologist in the personality field has arrived at a somewhat similar formulation. After some discussion he points out that "On peut considérer comme démontré le fait que chez les animaux les tableaux typiques du comportement ne sont pas des indices directs des propriétés typologiques du système nerveux. Ces propriétés ne peuvent être connues avec précision qu'à l'aide de procédés expérimentaux spéciaux."

"Chez l'homme, les propriétés typologiques du système nerveux se manifestent moins directement encore dans le comportement, le caractère ou les traits de la personnalité; l'influence de l'éducation sur la formation des traits de la personnalité chez l'homme est très grande: il y a là une différence qualitative d'avec ce qui se passe chez l'animal lors de la formation des modes de comportement typiques." (Teplov, 1957, p. 155.)

but they are usually only slightly, if at all, more extraverted than normals. It is the psychopaths who emerge as the most extraverted group of all, and this is of course well in line with the causal theory mentioned in an earlier paragraph. In spite of this observed relationship between extraversion-introversion, on the one hand, and dysthymia—hysteria—psychopathy, on the other, it should not be assumed that any perfect identity is postulated between the two dimensions. The events which are responsible for the neurotic breakdown (which is conceptualized in our system as a kind of traumatic conditioning process—see Eysenck, 1960a, c) must in part determine the form which the symptom shall take; here also we must posit the inevitable interaction between PC (of which PB is an imperfect measure) and E, which in this special case refers to the precipitating events of the neurotic breakdown. Foulds (1958, 1959) has given interesting empirical support to these theoretical speculations; he has also demonstrated the differential responsiveness of different “types” to therapy.

Throughout this discussion we have used the term “extraversion” as representative of the aggregate of traits and attitudes which make up, by their inter-correlation, this second-order factor (Eysenck, 1960e). This is permissible as long as we are trying to trace out the causal chain from PC to PB; historically, of course, the argument has been the other way. Jordan, Gross, Heymans and Wiersma, Jung, and the other originators of the modern typological theory of “extraversion-introversion” (Eysenck, 1960e) deduced the existence of this second-order trait or “type” from the (intuited or observed) correlations between primary traits such as those shown in Fig. 1 (sociability, impulsiveness, rathymia, ascendance, activity, etc.). The next step then was usually that of searching for some molar or physiological concept that might serve to “explain” the observed trait-cluster; thus Gross advanced his notion of “primary and secondary function”, while Spearman followed the Dutch school in postulating a general law of “inertia” and a corresponding personality trait of “perseveration”. Some form of “stratification” has therefore always been connected with the discussion of extraversion-introversion (for a historical summary, see Eysenck, 1960e); the theory here advanced has the great advantage over previous ones that the molar-physiological substratum for PB is rooted in modern learning theory, with its widespread net of supporting experimental evidence, instead of having been hastily created *ad hoc*. As it stands, this substratum (L_1 in Fig. 1) is essentially molar rather than physiological in character; it is possible that the recent work on the ascending reticular activating system (Samuels, I: 1959) may furnish us with the beginnings of a genuinely physiological understanding of the mechanisms underlying inhibition and excitation. The usual speculations about synaptic changes, even when bolstered up by references to the work of Eccles and others, do not really take us much beyond the “conceptual nervous system”.

II

The verification and validation of personality theories has always been a sore point in psychology, and the success which has attended such endeavours in the past has not been such as to make it possible at the moment to say that there is any considerable agreement on the adequacy of any particular theory. Whatever may be the disadvantages of the theory here discussed, it will be clear that it presents ample opportunity for disproof both along the lines of analysis of dependence and of interdependence (Kendall, 1950). Thus the predicted relationships *within* levels 2, 3, and 4 respectively may be (and have been)

analysed by means of factor analytic methods (Eysenck, 1947, 1954, 1957, 1960b, e); the relationships *between* levels may be investigated by means of analysis of variance and other types of analysis of dependence (*ibid.*).

This type of work, whether it be directed to the elucidation of relationships within or between levels, is characterized by a failure to manipulate the independent variable (except by selection—it is of course possible to manipulate the extraversion-introversion variable by selecting groups high and low respectively on extraversion). Manipulation by selection, although it has good precedence in the work of Spence and Taylor (Taylor, 1956) on the M.A.S., is far from ideal, and consequently a search was made for alternative methods which would make possible genuine manipulation of the independent variable. (This phrase should be understood to mean: variation by experimental means of any variable at a given level in Fig. 1, such that changes in a dependent variable at a higher level can be studied.) Such a possibility was opened up by the formulation of the writer's drug postulate (Eysenck, 1957), which asserts that C.N.S. stimulant drugs increase excitation and decrease inhibition (level 1) while C.N.S. depressant drugs have an opposite effect. It would follow from this postulate, which extends and unifies theories formerly advocated by Pavlov (1927), McDougall (1929), and Hull (1935), that predictable consequences at level 2 should follow from the administration of such drugs, and it may be surmised that certain changes at higher levels should also be observed. A considerable amount of work has been done on the changes produced by stimulant and depressant drugs in relation to conditioning, nonsense syllable learning, pursuit rotor learning, reaction times, kinaesthetic figural after-effects, visual figural after-effects, apparent movement, flicker fusion thresholds, visual after-image duration, rotating spiral after-effects, the suppression of the primary visual stimulus, vigilance, meta-contrast, static ataxia, pupillary reaction, flutter fusion, and other phenomena; a review of some of this work, as well as that on sedation threshold by Shagass (1956), has been given by Eysenck (1960d), and a more general review of work in the psycho-pharmacological field, with special reference to dimensional hypotheses of this type, by Trouton and Eysenck (1960). Our work with animals has also been reviewed in these two publications; it is clear that as long as we confine ourselves to L_2 , predictions from the drug postulates can be made just as well for rats as for humans. Thus, alternation behaviour (Sinha, Franks, and Broadhurst, 1958) and the conditioned emotional response (Singh, 1960) have lent themselves well to experimental testing of hypotheses of this kind. The generally favourable results of these studies will not be reviewed again here; the purpose is rather to discuss certain theoretical problems which arise in the attempt to use drug effects for the validation of a general personality theory such as that under consideration.

At first blush, one might assume that simple confirmation of the general hypothesis would be most informative: thus Franks's demonstration that introverts condition better than extraverts (1957), that dysthymics condition better than hysterics (1956), and that dexedrine facilitates conditioning while sodium amytal retards it (1955, 1958) might appear particularly favourable to the theory linking drug action with personality. To the writer, certain other outcomes have appeared even more impressive; one example of each will be given.

(1) *The predicted effect fails to appear.* Hull (1937) and the writer (1957), for rather similar reasons, predicted that the bowing of the serial learning

curve would be accentuated after depressant and lessened after stimulant drugs (Hull), and that it would be accentuated in extraverts and lessened in introverts (Eysenck). Hull failed to find this effect, and we also failed to discover any personality correlations and any drug effects of this nature. This suggested that possibly the Hull-Lepley theory of serial position effects, which mediated both predictions, was in error. A special experiment was carried out in which series of nonsense syllables were presented continuously (without break between series) as well as discontinuously (with breaks between series, as is usual). On the Hull-Lepley hypothesis continuous presentation should decrease drastically any bowing effects; it did not in fact affect the bowing effect at all (Eysenck, 1959g). This argues strongly against the correctness of the mediating theory, so that neither Hull's nor our own prediction can be said to follow from the general personality-drug theory in question. It equally follows that no predictions can be made with regard to personality differences or drug effects.

(2) *The predicted effect appears, but in the wrong direction.* The writer predicted that thresholds of temporal discrimination in connection with flicker fusion would be lower in extraverts and hysterics; it would of course follow that they should also be lowered after depressant drugs, and raised after stimulant drugs. This prediction was made in terms of a peripheral theory involving pre-excitatory inhibition (Granit's P. III component of the electroretinogram). The actual results of work in this field appear to give consistent results in the opposite direction, i.e. higher thresholds for extraverts, and after depressant drugs (Simonson and Brôzek, 1952). This suggests that the writer was in error in postulating peripheral mechanisms to account for individual differences in C.F.F., and that central inhibitory mechanisms must be assumed to play a major part.

(3) *The predicted effect appears, but in a much more complex fashion than originally postulated.* The writer has predicted that visual figural after-effects would be stronger in extraverts, and after depressant drugs; this prediction follows directly from the identification of satiation with inhibition (Eysenck, 1955). This hypothesis appears to be too simple, and to leave out of account reactive inhibition arising from muscular and cognitive efforts to maintain fixation for long periods of time; this inhibition, developing more quickly in extraverts, would lead to interference with fixation of the stimulus, thus decreasing figural after-effects. As satiation appears to develop more quickly than (motor) inhibition, it would seem possible to argue that with short periods of fixation (15 to 30 sec.) extraverts would have stronger after-effects; with long periods of fixation (3 to 5 min.) introverts would have stronger after-effects; while with intermediate periods after-effects would be nearly equal. Results tend in this direction, both for personality and for drug effects (Eysenck, 1960b; Eysenck and Easterbrook, 1960), although definitive proof of this compound hypothesis is still lacking.

Cases of types 1, 2, and 3 are particularly interesting because they tend to show that the personality variable and the drug effect act in a similar manner regardless of prediction; both may appear, both may fail to appear, or both may appear but in a direction counter to that predicted. What is completely lacking in our files is even one case where personality and drug acted in the opposite directions; at most, one effect might have been significant, the other

not, although generally in the same direction. (It is interesting to note that on the whole brain damage, which according to the writer's theory also has an extraverting effect [Petrie, 1952] and produces effects similar to those of a C.N.S. depressant drug, fits in very well with the experiments quoted so far. Thus, to take but one example, Franks [1959] has just completed an experiment comparing brain-damaged and non-brain-damaged mental defectives on the same eye-blink conditioning apparatus which had been used by her husband in the work on normal and neurotic extraverts and introverts, and on drug effects; the acquisition and extinction curves of the brain-damaged Ss are almost identical with those of the extraverts, the hysterics, and the group treated with the depressant drug, while the non-brain-damaged Ss resemble the introverts, the dysthymics, and the group treated with the stimulant drug, although falling a little lower throughout.)

It is difficult to know whether this general principle of the extraverting effects of depressant drugs (and brain damage) can in fact be applied quite universally, or whether there are not certain fields where it requires to be modified. Presumably drugs can only affect PC and not E; functions, traits, and attitudes entirely due to E should therefore presumably be immune to drugs, as should responses controlled completely by past events. Thus one might imagine that replies to personality questionnaires, stressing habitual responses, should not be altered by drugs. It has, however, been found that this is not so, and that depressant drugs cause Ss to give more extraverted responses on suitable questionnaires (Franks and Laverty, 1955). While the cause of this phenomenon is not clear, and may indeed be found in drug-induced changes in response set, it is certainly possible that self-perception under drugs is sufficiently modified to change the retrospective kind of self-perception which is mediated by questionnaire responses.

Along rather different lines, extraversion leads to a failure to establish certain conditioned responses which lie at the basis of socialization and "conscience"; can the effects of temporarily depressing the already established responses of introverts by means of alcohol or sodium amytal lead to actions precisely identical with those of non-intoxicated extraverts? Even if this were possible, it is nevertheless unlikely that stimulant drugs could make up for the failure of the extravert to develop responses of this type throughout his life, thus making him act in an identical fashion to the non-drugged introvert. Clearly, there are many profound and puzzling problems left in this field which have not even been approached thus far.

There is one obvious use, however, to which the theory outlined above can be put directly in the psychiatric field. As I have pointed out elsewhere (Eysenck, 1960a), it is possible to regard all neurotic disorders as being in fact unadaptive behaviour patterns caused by faulty or defective conditioning of autonomic and muscular processes. I will not restate here the argument in favour of this hypothesis, nor will I go into detail again regarding the methods of cure which are suggested by modern learning theory. Instead I shall draw attention to one important point directly related to the argument so far advanced. As I have argued (Eysenck, 1960a), the cure of neurotic disorders depends very much on the building up of new conditioned responses, either in place of responses not in the past built up at all, as in the case of psychopaths and hysterics, or else, as in Wolpe's (1959) notion of "reciprocal inhibition", in

order to counter other conditioned responses built up in the past and responsible for the symptoms complained of by the patient. Such build-up of new conditioned responses should, according to the theory, be much easier with introverted and dysthymic than with extraverted and hysteric-psychopathic subjects. However, as we have seen, C.N.S. stimulant drugs increase conditionability, and it would appear that during the experimental sessions devoted to the building up of new conditioned responses, it would be helpful to administer such drugs to the more extraverted subjects in order to increase their conditionability for the time being. One study from our laboratory (Meyer, 1957) has made use of this notion, with considerable success. Many questions, of course, still remain to be answered in this connection. Does the administration of a stimulant drug affect the strength of conditioned responses acquired on a previous occasion, when no drug was administered? Does a conditioned response acquired under a drug retain its strength once the drug effect has disappeared? Here as elsewhere it would seem that experimental work and clinical-therapeutic studies can with advantage go hand-in-hand under the guidance of a general theoretical framework.

It will be seen that the use of drugs is particularly advantageous in sorting out the influence on P_B of P_C and E respectively, because the drug clearly acts almost entirely on P_C and cannot in the nature of the case act on E . Consequently the study of the effect of stimulant and depressant drugs on experimental phenomena relevant to the excitation-inhibition hypothesis can give us a much needed basis for purifying the compound and complex behavioural patterns observed and studied by the factor analyst; by excluding to a considerable extent the environmental variable it makes it possible to study more or less directly the excitation-inhibition balance, which according to the theory forms the constitutional basis for the phenomena of extraversion-introversion. If this argument be correct, then we should be able to take a given person and determine not only his behavioural degree of extraversion-introversion (P_B) but also his constitutional degree of excitation-inhibition balance (P_C) separately; given these two variables, we should also be able to form an estimate of the strength and direction of the environmental influences (E) which have combined with P_C to determine his present behaviour. The measurement of P_C is possible through a battery of experimental tests of the type shown in Fig. 1 on the second level, and validated through their responsiveness to stimulant and depressant drugs. Undoubtedly this general picture is very much over-simplified, and will require many detailed modifications in time; nevertheless it does appear to present a new and positive contribution to the problem of sorting out constitutional and environmental influences and measuring separately different levels of personality.

III

There is a curious bifurcation of interest in theoreticians and experimentalists working in the general field of personality. Environmentalists tend to ascribe all or nearly all of the observed phenomena to social determinants of one kind or another, disregarding completely, or dismissing with a curt nod, constitutional and hereditary factors. On the other side, hereditarians tend to ascribe overwhelmingly strong predispositional forces to constitutional factors, and to disregard environmental ones. Watson's well-known claim to be able to make anything he liked out of any child who was given to him, regardless of hereditary predispositions, is an example of the former; Sheldon's claim to have

discovered correlations of the order of .8 and above between personality traits and constitution, is an example of the latter. It is difficult to regard such claims as serious scientific pronouncements, and in the absence of any widely recognized technique for apportioning determinate parts of the variance to environment and constitutional causes, it seems idle to argue the case. Most psychologists are agreed that not only do both heredity and environment play an extremely important part in producing variations in the behaviour patterns demonstrated by human beings; they would also agree that the respective influence of heredity and environment differs from trait to trait, and from person to person. Cattell (1955) has published some figures to show that when a variety of traits is studied in identical and fraternal twins, and in people related to varying degrees, then the results show differential effects of heredity as from one trait to another. Similarly, it is clear that the more closely alike are environmental conditions for any two people, the less likely are these environmental conditions to have produced differences in the behaviour of these people, whereas, conversely, large differences in environmental conditions between any two people would be much more likely to have been responsible for behavioural differences between them.

These complexities which afflict the experimental study of causal relations in the field of personality make it all the more necessary to seek for methods which would be capable of throwing some light on the constitutional features of our experimental subjects, divorced, as far as possible, from environmental effects. It is for this reason that the drug postulate was introduced, and has been investigated in such a concentrated fashion. It was anticipated that the intimate link between levels 1 and 2 in Fig. 1 would lead to predictable drug effects on the various measures listed at the L_2 level, and that consequently groups of these measures could then be used with confidence in the assessment of the excitation-inhibition balance. It was not anticipated that the relationships between these measures and the personality traits at level 3 would be particularly close because at level 2 we are dealing much more with constitutional factors, whereas at level 3 there is a pronounced influx of social and general environmental factors to interfere with the discovery of high correlations. On the whole it would probably be fair to say that this method has been successful to a degree not anticipated when the work was begun. It now seems necessary to carry out similar investigations with respect to other important personality variables, such as neuroticism for instance. It should be possible, in due course, to discover a number of type factors, such as this, and to trace their constitutional roots through the use of psycho-pharmacological principles. There is no other method of investigation which enables us with such ease and such promise to use the traditional experimental paradigm of the dependent and the independent variable in the field of personality.

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