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The Regulative Theory of Temperament:¹

Implications for assessment and teaching

Abstract

Interest in the construct of temperament in recent years, and the differing theories about it, suggests the need for an integrative summary. In this paper temperament is reviewed in terms of historical, logical, empirical, and psychometric studies, along with statistical and factor-analytic evidence. In addition, neurophysiological and behavioural studies, together with ATI research, provide a coherent description of temperament. Finally, it is suggested that temperament plays an important mediating role in efforts to assess and understand individual differences and to facilitate human development.

Résumé

L'intérêt que suscite l'édification du tempérament depuis quelques années et les théories divergentes à ce sujet soulignent le besoin d'un résumé intégré. Dans cet article, l'auteur fait une analyse du construit, tempérament, dans un esprit historique, logique, empirique et psychométrique en plus de s'appuyer sur des preuves statistiques et analytiques. En outre, les études neurophysiologiques et comportementales de même que les recherches de l'ATI fournissent une description cohérente du tempérament. Enfin, il est permis de croire que le tempérament joue un rôle médiateur important dans les efforts visant à évaluer et à comprendre les différences individuelles et à faciliter le développement de l'être humain.

Investigation into social learning aspects of personality and behaviour modification patterns, the influence of heredity on environment, and many other lines of research have come to focus more and more on temperament in recent decades. There is a growing recognition that underlying interview data, psychometrics, and even naive inferences about personality, there is a set of templates, largely hereditary in origin, that exercise a continuing influence on individual reactions. These dispositions tend to manifest a pervasive influence on behaviour as identified in many different studies using different methods.

It is the purpose of this paper to review the construct of temperament, as it has begun to emerge from various research studies, and to outline what may be some important curricular and treatment implications of this research. Because the topic is recognized as important there have been marked efforts to define temperament more clearly. For example, in 1987 a roundtable discussion, including the majority of American researchers in the field (Goldsmith, Buss, Plomin, Rothbart, Thomas, Chess, Hinde, & McCall, 1987), examined the major constructs of temperament.

There were several conclusions reached at the above-mentioned discussion. First, the construct is helpful despite the inability to define precisely how it interacts with environmental influences. Another conclusion was that temperament included elements of activity, energy, intensity, vigor, and pace of movement in both speech and thought, but not in contents; reactivity in terms of approach or withdrawal from stimuli; emotionality; and sociability. A third conclusion was that the origins of temperament were in biological predispositions, but the extent to which this was true was not agreed upon. Finally, there was a recognition that there was a higher degree of stability in temperament expressions through the life span than in other features of personality.

Given the continuing need for clarification of the construct, it is also a goal of this paper to review the sources of evidence for temperament. Specifically, temperament will be considered in the context of a number of studies, including the historical continuity that has existed from antiquity. There are five major foci for such a discussion: (1) logical, empirical, and psychometric studies; (2) statistical and factor-analytic evidence; (3) neurophysiological and neuropsychological evidence; (4) temperament-aptitude treatment interactions; and (5) behavioural studies. Finally, the conclusions drawn from these sources will be related to curricular and psychological treatments.

The Nature of Temperament

Temperament theory has had a long tenure in the house of assessment. Hippocrates enunciated his homeopathic version of it in about 500 B. C. Ptolemy saw it related to celestial components of astrology and astronomy at the beginning of the Christian era. Galen extended it to encompass a wide variety of personality characteristics, including physiology, exercise, and dietetics. He was really the first to summarize the typology drawn from observations of temperament, i.e., the characteristics of introversion and extroversion combined with patterns of stable or unstable consistency in behaviour. Thus introverted individuals could be considered as stable (phlegmatic) or unstable (melancholic) persons, and extroverted individuals could be classified as stable (sanguine) or unstable (choleric) ones. The medievalists even used this typology as a basis for suggesting diets, and for spiritual advising and counselling (Barta, 1956; Tanquary, 1930). For example, choleric and melancholic individuals were often considered poor choices for the priesthood. This typology was endorsed by Kant as representing examples of categorical imperatives applied to individuals; held by Wundt to be verifiable through observation and experience; and formed the basis of character analysis. (Character was considered to be the interaction of temperament dispositions with learned patterns of behaviour.) In addition, temperament along with various characteristics of physiognomy formed the basis of classification systems developed by Kraepelin (1913), Kretschmer (1925), and Sheldon (1954). According to Strelau (1983), it also formed a central component of Pavlov's thinking wherein personality types were thought to represent different mixes of central nervous system characteristics.

Because the construct of temperament has been around for a long time, there are some notable problems in discussing it. First of all, many psychologists feel that because it existed in ancient times, it must be unscientific. Again, others believe that temperament really divides the world into extroverts and introverts, and this seems to be a simplistic category system. In addition, others tends to identify temperament with trait.

These three ideas are wrong. First of all, though temperament theory has been around for a long time, there is nothing wrong with examining an ancient construct in terms of modern research and redefining it in current terms. Simply because an idea is old does not mean it is necessarily wrong. Although we reject the humoral theory of Hippocrates and Galen, it may be that they recognized something empirically that they explained in accordance with their then state of knowledge. Secondly, though extroversion and introversion both are valid concepts relating to neurological characteristics,

it is obvious that there are many gradations of these categories. Finally, temperament is a much broader construct than trait. Traits are rather derivatives of temperament. Most trait characteristics are based either on rational empirical generalizations or factor-analytic solutions. Temperament has its foundations in physiological characteristics and is, therefore, not a construct identical to trait, but rather the broad substratum which mediates experience. It is, therefore, important to recognize that temperament is something much more complex than a given scale of extroversion or introversion.

Increasingly, in recent decades, the construct of temperament has been defined as a cluster of biologically inherited dispositions which immediately and directly interact with environmental elicitation and subjective conditions of the organism such as stress (Allport, 1961). Temperament is a coherent grouping of hereditary dispositions, primarily related to the limbic system of the brain, that tends to serve as a template restricting the total possible range of behaviour in individuals. This restriction of the range of behaviour is the by-product of interaction with the environment in the consequences of learning. Individuals differ in reactions to stimulation, arousal, speed of arousal, and duration of arousal. Buss and Plomin (1975) explain this process by comparing the development of an individual's life from infancy to adulthood as an ever-narrowing funnel. Thus individuals born with a tendency towards extroversion gradually become more extroverted in their behaviour by reason of how they react to environmental stimulation and their learned responses. Similar judgments might be made for introverts, disruptive-impulsive individuals, and others (Buss & Plomin, 1975). Strelau (1983) also views it as the biological base which interacts with physical and social environment components to form what we refer to as personality. Thus, personality is the consequence of temperament interaction with environmental stimulations and reinforcement.

Temperament as an internal mediator

The concept of temperament forms a necessary and functional link in the development of a comprehensive and adequate theory of assessment of individual differences. This proposition needs further explanation. The term "necessary and functional link" is meant to explain the role temperament plays in relation to other assessment phenomena. In assessment theory, one can distinguish a hierarchy of measurable phenomena. The most basic one is the behavioural response. Responses are unified through learning. Psychometric representations of skills or behaviour have been designated as traits - particularly when these characteristics are longitudinal and valid descriptions of individuals. Aptitude tends to be evaluated as a larger construct directly reflecting intelligence, achievement, and skills. It can therefore be viewed as a composite variable related to cognition. Tempera-

ment, by contrast, tends to represent a construct closely related to emotions and survival. It thus has a direct and mediating influence on all of the rest.

The influence of temperament is particularly related to the filter it places on perception. In terms of causal relations, temperament acts as formal causality within the forum of consciousness, and particularly with regard to the phenomenon of perception. Temperament provides the intentionality to the act of perception. It is, therefore, closest to the executive functions of individuals that we may generally term either will or ego. Temperament, through its biological anchor, is the filter through which reality is viewed, traits developed, and cognitive aptitudes evolved. It provides the qualities of individual differences that relate to formal intentionality, or goal-centered activities, and is the scaffolding upon which many assessment data are based. This relationship between other levels of assessment data and temperament is not clearly an efficient causal relationship between temperament and cognition, skills, or aptitude, but rather a predisposition towards certain kinds of actions and behaviours that are congruent with the individual goals of arousal-reduction and survival and the level of intelligence.

In terms of assessment itself, it is obvious that responses, skills, traits, and aptitudes all play an important role in understanding individual differences. No real assessment can avoid these components. To a large extent these assessment phenomena are covariates of cognition as permeated by intelligence. But to understand these components, and particularly the intentional perception that underlies consciousness, to probe motivation and goals, temperament is indispensable as the component of personality most closely related to emotionality.

Cognition, volition, and temperament: A logical analysis

Assessment in virtually all instances involves the forum of consciousness. Functions that occur within it are grouped under the general term of "mind". Mind is not synonymous with brain. In the nineteenth century, a great debate was initiated over whether psychology was a biological science or a science of consciousness. Considerable development has taken place in the biological arena over the past hundred years, but it is evident today that consciousness is still the *terra incognita* of psychology, and that careful logical analysis of the phenomena themselves must be made rather than simply ascribing psychic phenomena of thinking, willing, and choosing to neuronal activity.

To understand consciousness it is necessary to identify the components that exist and operate within it. We cannot study the contents of

consciousness as we study biological phenomena, because consciousness has no extension. It is filled with representations derived from perception. It is unitary and successive in terms of a continual flow of mental phenomena, and is virtually always emotionally toned. How then can we study it? One way is to determine its functions, since it is axiomatic that function proceeds from structure. When this axiom is applied to the products of consciousness, it becomes at once evident that consciousness operates as a vehicle in which two major entities are functioning continually. These are cognition and volition.

Consciousness involves awareness, understanding, and decision-making. Both cognition and volition relate to these dimensions. Cognition provides the data for decision-making, and volition provides the actual decisions. Consciousness is the forum for the control of human behaviour. In human beings consciousness reflects an organization dictated by a control hierarchy. This control hierarchy extends from the top down, even as in corporate affairs management extends its control from the corporate suites to the branch offices and individual salesmen. By logical inference, the greater the management control, the more central the component.

The two major functions of consciousness are cognition and volition. Cognition has a biological reference in intelligence, a largely inherited structural component. But it also includes attention, perception, and judgment with subcategories of memory and imagination. Volition is the executive aspect of conscious process. It, too, has a biological component anchored in what has been globally termed emotion.

Unfortunately, common sense and history tells us that cognition does not hold the chief executive position in human consciousness. If it did, knowledge would determine behaviour, studying philosophy would make one wise, knowing theology would make one virtuous, and understanding the consequences of atomic war would lead nations to disarm. Cognition serves in the human cabinet of conscious activity as the controller, i.e., the conservator of resources. It has the programmatic function of amassing facts and the intellectual resources for making decisions.

Volition, on the other hand, has extensive control over the nature and products of consciousness because of its very close relationship to emotions of love and hate, and the primary biological directives of self-survival and species survival. Derangement of normal emotions can have extensive and lasting influences on both consciousness and bodily functions. Thus depression acts as an impediment to cognition. Depression can also influence bodily states through changes in chemistry within the brain itself. Depression often has widespread consequences on the organism both in spatial and

temporal dimensions. The same situation may exist with regard to passion. States of tension within the biological organism not only can make needs aware to volition, but perception can respond to such needs by creating the imagery necessary for bodily arousal.

Regardless of academic controversies over the priority of cognition over volition, the role of direct and subliminal arousal from advertisements, television, and other sources play a great role in selling liquor, vacations, and countless other items. Although the physiological status of the organism can act as a cause in altering states of consciousness as well as impeding cognition and volition, the converse is also true, i.e., that volition itself can make the decision that sets physiological forces in action, or it can choose to shut them down.

A recognition of the importance the volitional control system plays in human behaviour is a moot fact in psychological assessment. How, when, what, and even why people do certain things in life is related to how they perceive, how they feel, and the extent to which they believe they are in control of themselves or are not in control. To estimate these feelings we have to ask them to describe them. Such impressions are important to the process of therapy, and they exist in accessible form or by way of consciousness. Thus we cannot ignore consciousness, even though it can be analyzed at present only through logical analysis.²

If volition constitutes the major controlling feature of consciousness, then a recognition of those forces that relate to arousal and inhibition is important. To continue our corporate analogy further, if volition is the chief executive and cognition the controller, the emotions form the balance of the management team, and temperament is the caucus leader.

Empirical and psychometric studies of temperament

Empirical studies of individual differences provide evidence regarding the impressionistic organization of characteristics related to temperament classification. Empirical documentation of temperament theory has developed slowly, beginning first in the 18th and 19th centuries with observational data related to physiognomy and phrenology. Individual character analysis was believed to be related to nose, chin, eyes, and other features. (For example, note the expressions "a weak chin" and a "tricky" eye.) Phrenology attempted to relate skull characteristics to personality problems and looked at bumps on the head to indicate such characteristics. Later on, a considerable mass of information that included physiognomy, elements of Darwinian evolution, and character analysis that extended into the first decades of the twentieth century, was assembled. (See, for example, Stanton's book on face and form reading, published in 1920.)

Lombroso (1876) argued that there were physical characteristics associated with criminality. These beginnings cannot be called scientific. They were simply first attempts to match physical features to temperament characteristics. More research momentum built up as Nacarrati (1921) found positive correlations of about .23 between body build and intelligence. Ernst Kretschmer (1925) then attempted to correlate psychiatric characteristics to body build, and Sheldon developed, during the 1940s and 1950s, an entire typology of physiological development that related to personality characteristics, medical problems, and life expectancy (Sheldon, 1954).

A systematic examination of the theoretical positions of Adler, Horney, Dreikurs, Lewin, Sheldon, Kefir, Borgatta, and Jung was done by Kefir and Corsini (1974). Though they admit that terminology differs between the theorists, they found evidence that all of these theorists classified people in terms of construct and temperament.

But of all these theorists, Carl Gustaf Jung provided the most direct analysis of temperament characteristics from an analytic standpoint. Jung (1971) developed two broad personality types: the introverted and extroverted. For the introverted, subjective and psychological processes are primary, while for the extroverted object relations and external behaviour are the foci.

The psychological result of these two standpoints is two totally different orientations: one sees everything in terms of the objective event (extroverted); the other sees everything in terms of his own situation (introverted). This broad classification does not exclude the existence of a second set of psychological types determined by the four basic psychological functions: thinking, feeling, sensation, and intuition, found within both introverted and extroverted personalities (Jung Abstracts, 1976, p. 45).

Jung utilized his typology to discuss the development of doctrine in Christian theology, viewing early crises in the church and conflicts in doctrine as the result of basic personality differences in proponents. Interestingly enough, Michael and Norrisey (1984), using the Myers-Briggs classification schema, suggest that among the apostles Peter was a sensing-perceiving type, Paul an intuitive type, John a thinking type, and James a sensing type. Thus Peter and Paul are seen as extroverts, and James and John as introverts. Jung also points out that temperament typology was central to the Reformation, and remains an important component in the nature of poetry, psychopathology, and various problems of philosophy.

Among the foremost of those who have attempted to identify some of the properties of temperament have been Thomas and Chess (1977). Over

a twenty-year period these researchers observed children. They began their observations near birth and extended them into adulthood. They concluded from their research that children show temperament characteristics right from birth, and they identify nine categories of observable behaviour that form the bases of three temperament groupings. These characteristics are: (1) activity level, (2) regularity and rhythmicity, (3) approach-withdrawal, (4) adaptability, (5) intensity, (6) sensory threshold, (7) mood, (8) distractibility, and (9) attention span.

Using factor analysis and qualitative analysis of their data, they define major temperament groups. The **Easy Child (EC)** is characterized by

... regularity, positive approach responses to new stimuli, high adaptability to change and mild to moderately intense moods which are preponderantly positive. These children quickly develop regular sleep and feeding schedules, take to most new foods easily, smile at strangers, adapt well to a new school, accept most frustration with little fuss, and accept the rules of new games with no trouble. Such a youngster is aptly called the **Easy Child** and is usually a joy to his parents, pediatricians and teachers. (Thomas & Chess, 1977, p. 23)

Thomas and Chess indicated that this type of child comprised about 40% of their sample.

On the other hand, the **Difficult Child (DC)** was described by Thomas and Chess (1977) as one

...with irregularity in biological functions, negative withdrawal responses to new stimuli, non-adaptability or slow adaptability to change and intense mood expressions which are frequently negative. [This child shows] irregular sleep and feeding schedules, slow acceptance of new foods, prolonged adjustment periods to new routines, people or situations, and relatively frequent and loud periods of crying. Laughter also is characteristically loud. Frustration typically produces a violent tantrum. This is the **Difficult Child**, and mothers and pediatricians find such youngsters difficult indeed. (Thomas & Chess, 1977, p. 23)

Thomas and Chess indicate that about 10% of their sample falls into the DC category. In addition to these categories there is another group that ranges between these two polar types.

Thomas and Chess (1977) observed the consistency of these temperament clusters from initial contact with the infants with their parents up to the preschool setting. They find remarkable internal consistency in the behaviours of children classified by types. They believe that some of the disorders identified by psychoanalytic theory may have their origins in interactions between temperaments of children and that of their parents. For example, DCs create aversive responses even from well-educated parents. The coping with such a child, without the reinforcement of smiling or any degrees of placidity, results in parent frustration with the infant that then starts a coercive-demanding type of relationship between them. Though the Thomas and Chess studies are well-documented through case studies and questionnaires, the conclusions about temperament are based on varying samples.

Martin (1982) developed a temperament assessment battery derived in large part from the Thomas and Chess findings. Lisa Barclay (1987) administered this battery to a group of American preschool children. After translating it into Chinese, it was then also administered to Chinese preschool children in Taiwan. Utilizing in both samples an early-childhood kindergarten screening tool that identifies deficit areas in motor, social, auditory, and cognitive skills (Barclay & Barclay, PACE, 1986), she found that children with more skill deficits at the 4-, 5-, and 6-year-old levels also showed more negative scores on Martin's temperament assessment battery. These studies suggest a linkage between skill deficits in early children and maladaptive temperament. Other studies utilizing the Martin inventory have shown that it is related to a variety of other early childhood problems, academic achievement, and observational data (Martin, Drew, Gaddis, & Moseley, 1988; Martin, Paget, & Nagle, 1983).

Considerable research has been reported in many developmental time periods. Perhaps the greatest concentration has been in the area of early childhood and the findings have been reported in the area's basic journals, such as *Child Development*, the *Merrill-Palmer Quarterly*, and *Developmental Review*. For example, the *Merrill-Palmer Quarterly* (vol. 30, 1984) is virtually devoted to the topic of temperament studies. This research is too voluminous to report here, but the number of research studies of an empirical and psychometric nature support current enthusiasm about the construct of temperament.

Windle *et al.* (1986), using the *Dimensions of Temperament Survey* (Lerner, Palermo, Spiro, & Nesselroade, 1982), have provided data regarding characteristics of early and late adolescents. On the other hand, Burkes and Rubenstein (1979) have applied the Thomas and Chess system to the evaluation and counselling-treatment of adults. They use the same basic dimensions as Thomas and Chess (1977) and describe an interesting method

of client appraisal, using an inventory they devised for adults. On the basis of the results from this inventory, feedback can be made to the client and different emphases in treatment devised. To this point, however, no research has been reported in which the adult version has been used.

Perhaps the most impressive methodological support for a temperament theory of personality has been provided by the work of Buss and Plomin (1975). Utilizing the definition of temperament of Allport (1961), they postulate the existence of four temperament components. These are: (1) activity, referring to total energy output; (2) emotionality, referring to intensity of reaction; (3) sociability, defining the desire for affiliation; and (4) impulsivity, involving the tendency to respond quickly rather than in an inhibited manner to stimuli. What is most important in their work is the careful methodological approach for setting up criteria for deciding which personality dispositions should be called temperaments. The crucial one is inheritance, leading to stability of development expectations during childhood and retention into maturity. They postulate that inheritance is the most important criterion. This means that any theory of temperament must demonstrate a genetic component in human dispositions. A second criterion is stability during development. This is important because if there is a genetic component, this should not be eliminated during development or environmental learning, but should be part of a differential susceptibility to environmental stimulation. One might expect an analogous comparison in temperament development to those anatomical components, obviously inherited, but also modifiable by diet, such as height and weight. A third criterion is that of adaptiveness, which is important, state Buss and Plomin (1975), because all temperament characteristics are subject to a degree of social modification. However, they believe this may be a weaker criterion. The final criterion is seen as presence of temperament characteristics in animals also.

In pursuit of evidence to demonstrate the validity of their findings against the criteria that they establish, Buss and Plomin (1975) emphasize the first one, i.e., heritability. This was demonstrated by the construction of a questionnaire relating to temperament characteristics (EASI - emotionality, activity, sociability, impulsivity). This questionnaire was administered to 139 mothers of same-sexed twins. Zygosity of these children was determined independently via a questionnaire of Nichols and Bilbro (1966) without knowledge of the EASI results. The results indicate high correlations for identical twins and much lowered correlations for fraternal twins. A factor analytic study of these data indicated the presence of four temperament factors. These findings are consistent with other twin studies.

Buss and Plomin (1975) not only consider the evidence they amassed for the use of EASI with college and adult samples, but review the literature

relating to temperament characteristics. They believe the evidence is strong for the existence of three temperament factors: emotionality, activity, and sociability. The evidence is weaker, in their judgment, for impulsivity. Nonetheless, they provide a good case for the manner in which environmental effects bring about the gradual narrowing of the range of temperament characteristics over the course of development. They suggest that the initial parameters of temperament characteristics are modified by interactions of the individual with environmental stimulation and learning. This results in a gradual narrowing of the initial parameters much in the manner of a funnel. Thus, with increased development, learning and behaviour, and the individual's initial range of behaviours, attitudes, and views tend to become more restricted and limited.

Factor Analysis and Statistical Inference

Factor analysis and other statistical studies confirm the existence of groupings of traits under higher-order structures. Factor analysis is a common method for attempting to determine the underlying common structure of a number of items, traits, scales, or tests. This procedure for determining the nature of traits and organizing them was originally tried by Bernreuter (1935), who found hundreds of traits, all very confusing in nature, as identified by many researchers and test developers. Prior to the development of factor analysis as a tool, the confusion about how traits related to each other was essentially unanswerable.

Factor analysis basically attempts to determine the amount of variance that certain items, scales, or traits have in common and identify those clusters that load on common factors. This has been no easy task, even with modern computers, because unless items, scales, or traits have been carefully studied both by logical definition and internal consistency, factor analysis will do little to improve the situation.

There have been, however, careful studies of well-defined traits. The results of these studies are often arranged in a circular model. Another approach is an hierarchical tree model. The circumflex approach generally represents a model in which all components are deemed to be equal, and opposing traits are placed at 180 degrees from each other. The tree or hierarchical model suggests the priority and power of earlier and more primary factors *vis-à-vis* subordinate ones.

Conte and Plutchik (1981) provide examples of the circumflex model and report two studies that attempted to develop a higher-order model of traits. The first one places 171 traits rated by three judges in a similar scaling procedure. The second selected 40 major characteristics that were rated by ten new judges on a semantic differential. Similar circular con-

figurations are reported by Widiger and Frances (1985) with reference to DSM-III categories.

Of particular interest to temperament are the extensive studies of Royce and his colleagues (Royce, 1973; Royce & Buss, 1974; Royce & Diamond, 1980; Royce & Mos, 1980). These studies are generally directed at the search for invariant higher-order factors across other factor analytic studies. They do this in a hierarchical fashion, identifying fourth-order factors (which are often equal to the trait characteristics identified elsewhere), third-, second-, and first-order components that are more all inclusive and encompassing. They suggest that a few major components act as independent variables to all the rest. For example, one of the major third-order factors of the affective type is emotional stability. The second-order components of emotional stability are identified as energy mobilization, anxiety, and excitability. These second-order factors load differently on emotional stability. Thus energy mobilization loads positively, anxiety and excitability load negatively. A high factor score on emotional stability would ordinarily mean a high score on energy mobilization, defined as good avoidance, appropriate territoriality, and escape usage. It would also mean a low score on anxiety, defined in terms of low scores on guilt, fearfulness, and ergic tension, and high scores on autonomic balance. Finally, in terms of excitability, which would also load negatively on emotional stability, high excitability would mean high cycloid mood swings, whereas low excitability would relate to positive dimensions of trust and ego strength.

Royce's many studies require much effort to comprehend, but essentially he posits a set of cognitive variables and another set of emotional or affective ones. Since most of his studies were based on other factor-analytic studies, his major thesis is that one can determine a set of invariant factor characteristics across valid factor analytic studies that provides a nomological network of descriptive systems adequate to the definition of a meta-theory of individual differences. Royce concluded out of his analyses that both cognitive and affective systems are biologically anchored and are composed of clusters of traits that combine in specific ways with learning and human development to form individual differences. In the cognitive area he sees the major characteristics as related to perceiving, conceptualization, and symbolizing. In the affective area, the major components are emotional stability, emotional independence, and introversion-extroversion. For purposes of this paper, these basic ideas are highly consistent with other approaches to the identification of temperament.

Another approach to the identification of temperament is to look at the major similarities between the factor structures of well-accepted tests. Stroup and Manderscheid (1977), in three studies using large samples of

college students' test scores on the *California Psychological Inventory* (CPI) and the *Sixteen Personality Factor Questionnaire* (16 PF), found that a common factor structure emerged for the two instruments. The major factors were: (1) a general adjustment factor (represented by the CPI components of conformity vs. neurotic anxiety, and the 16 PF ones of adjustment vs. anxiety), (2) extroversion, (3) intellectual resourcefulness, (4) emotional sensitivity, and (5) superego strength.

The findings of Stroup and Manderscheid (1977) are highly confirmatory of Royce's findings, noting that emotional stability or adjustment appears to be a major component. They are also important in view of the fact that the CPI is a rationally determined system based on empirical observation and distilled out of the *Minnesota Multiphasic Personality Inventory* (MMPI), and the 16 PF is an instrument based on factor analysis.

Barclay (1987), in his study utilizing the 16 PF and Strelau's *Temperament Inventory* (Strelau, 1983), found that these two instruments, when factor-analyzed together, have an identical structure to that reported by Stroup and Manderscheid for the CPI and 16 PF. Since Strelau's inventory was derived in part from physiological studies, including reaction-time and other methods, it would appear that whether one uses a good empirically derived test, a factor-analytically derived test, or a physiologically based test, the second-order factors are identical.

Neuropsychology and Physiology

The ultimate source of temperament differences resides in neurological susceptibility to arousal and inhibition, as derived from heredity and modified by environmental elicitation and learning. One of the besetting problems in relating temperament to brain functioning is a methodological one. Powell (1979) states that one can view brain functioning on five levels: (1) inherited differences in anatomical and physiological structures (visceral, brain, reticular-activating system, neocortex); (2) psychophysical differences (EEG, EMG, GSR, uric acid, and catecholamines); (3) observed differences from experimental studies (conditioning, learning, sensory thresholds, perception, and motivation); (4) personality (extroversion, introversion, neuroticism, and stability); and (5) special phenomena (neurosis, crime, accident proneness, sexual behaviour). Different methods are utilized at each level, and very often direct measures between levels are difficult to come by.

The point being made is that if one wishes to relate two parameters of distant levels of analysis then there is no substitute for a study in which the two parameters are simultane-

ously measured. Such studies are, however, rare in the field of brain and personality. Instead, we often have to fiddle around with results pertaining to shorter causal chains that have to be spliced together to give what we hope is a reasonable representation of the relationship. (Powell, 1979, p. 4)

Of current Western personality theories, that of Eysenck (1957) is most often cited as appropriate for exploration between brain and temperament. This is because Eysenck's theory postulates direct neural actions related to extroversion and introversion, and because Eysenck has found that factor-analytic studies of his own scales yield characteristics directly parallel to the older Galen temperaments (Eysenck & Eysenck, 1964).

Eysenck maintains that extroverts (individuals preferring sociable outgoing and gregarious activities) differ from introverts (individuals preferring to keep their own company) with respect to the speed with which excitation and inhibition are produced, the strength of the excitation and inhibition produced, and the speed with which the inhibition is dissipated. These differences are related to stimulus-response connections and properties of the physical structure of the brain. Individuals in whom excitatory potential is generated slowly and in whom excitatory potentials so generated are relatively weak, are predisposed to develop extroverted patterns of behaviour; individuals in whom excitatory potentials so generated are strong, are predisposed to develop introverted patterns of behaviour (Eysenck, 1957).

Crucial to an understanding of Eysenck's theory is an understanding of what is meant by excitation and inhibition. Powell's clarification is particularly succinct.

Excitation concerns the ease with which impulses can travel from neuron to neuron in a very general sense (and hence is easily linked with nonspecific, facilitative effects on neural transmission or activation in the ascending reticular formation). But it also includes the growth of facilitative connections between specific neurons (learning). Inhibition includes both Pavlov's distraction by an external source or an internal gradual build-up of resistance to a conditioned reflex, and Hull's concepts of reactive inhibition and conditioned inhibition. (For example, the acquisition of a conditioned eye-blink response is taken as an obvious facilitative or excitatory process whereas its extinction would be an inhibitory phenomenon, as would be taking a rest pause during a boring task [Powell, 1979, pp. 8-9].)

Powell (1979) demonstrates the relationship of Eysenck's theory to brain functioning on several chains of evidence. The first one relates to

matching results of classification as extrovert or introvert to excitation-inhibition responses. He cites 27 studies that relate to the establishment of this link. For example, extroverts condition poorly, show more reminiscence, show greater work deterioration, see flickers at a higher frequency, pause more frequently, are less vigilant, tolerate pain better, are poorer at rote learning, and show less after-effects on the spiral after-effect.

The second source of evidence relates to the consequences of drugs on excitation and inhibition. Here Powell (1979) cites 14 studies that indicate depressant drugs increase cortical excitation, and thereby produce extroverted behaviour patterns. On the contrary stimulant drugs decrease cortical inhibition, increase cortical excitation (such as is the case with introverts), depressants tend to make them more extroverted. Thus alcohol can make an introvert who is unwilling to go to a party, more extroverted and relaxed. Conversely, stimulants may increase cortical excitation, particularly in extroverts and possibly make them more task-ordered. Powell also cites the work of Barkley (1977), who reported research with hyperactive children ($N = 915$). He found that 75 % of these children who received amphetamine treatments showed a reduced level of attention deficits.

Aside from these arguments, Powell (1979) also examines the results of various surgical procedures on patterns of extroversion and introversion. It is known that the hypothalamus and the amygdala both have a relationship to the arousal and emotional level of the organism. When surgical procedures such as amygdalotomy and hypothalamotomy have been done, there are some changes in basic patterns of extroversion or introversion. Similar changes have been noted in operation on or damages to the frontal lobes. Powell argues that most likely the reasons for such changes are related to disconnection of redundant fiber connections in the brain. What would appear to be evident here is that introverts seem to have a higher level of redundant connections in the brain that tie together the reticular-activating system, the limbic system, and the frontal lobes. Severing some of these connections often creates a diminishing of overriding anxiety and increases in extroverted behaviour.

The neurological basis of temperament has also been a primary target of Russian and Eastern Bloc research. The directions of Pavlov's early research were based on some major assumptions about temperament theory. Pavlov felt that central nervous processes relating to reactivity, inhibition, and mobility were related to properties of the nervous system. Much research has focused on these properties. Strelau (1983), in summarizing the research, identifies three major properties of the nervous system that relate to whether it should be considered "strong" or "weak". The first of these is the level of energy and activity demonstrated by excitation; the second

generally corresponds to the notion of inhibition as utilized in Western research; and the third is mobility reflecting ability to shift from one area to another.

Strelau defines the components of the strength of the nervous system to be related to the strength of excitation, the strength of inhibition, and the mobility of the nervous system itself. Strength of excitation is defined by Strelau as "the ability to do long-lasting intensive work, speed of recovery after fatigue and intensive activity, persistence and ease in coping with obstacles". Strength of inhibition is defined as "the ability to regain control, the ability to refrain from a given activity, and restrained speech". Finally, mobility of the nervous system is defined as "ease of passing from one activity to another, ability to organize behaviour in situations requiring different kinds of activity, and uninhibited social contacts" (Strelau, 1983, p. 116).

Because most of the Eastern Bloc studies employed physiological measures that are time-consuming and often difficult to use outside of laboratories, Strelau developed an inventory, in part based on physiological research, called the *Strelau Temperament Inventory* (STI). The inventory consists of 150 items to which responses are made by "yes", "no", and "don't know". Four scores are obtained from the inventory: an excitation score, an inhibition score, a mobility score, and a ratio score (E/I). A number of studies relative to this instrument are reported by Strelau (1983). In addition, Barclay (1987) administered an Americanized form of the STI along with the 16 PF to a sample of 80 college students in Kentucky, and he factor analyzed the results. He also analyzed results from a Chinese version of the STI that was administered to 200 junior high school students along with the *Barclay Classroom Assessment System* (BCAS) (1983a). The results suggest a close convergence of excitation scores from the STI with positive sociometric scores, and significant positive correlations between the BCAS reticent nominations and the STI inhibition scores.

In summary, from both British and Eastern Bloc studies, it would appear that there is a basic consensus on the involvement of neurological components in the determination of temperament. Specific differences between Eysenck's ideas and those of the Eastern Bloc psychologists still remain unresolved.

Aptitude - Temperament Interactions (ATI)

Interactions between aptitudes or temperaments and alternative treatments provide experimental evidence of the utility of the concept of temperament. By ATI is meant the classification of individuals as high or low

on some given variable and the application of alternative treatments (curricular, behavioural, or learning) to these classified groups. Though this technique has been around for some time and has been seen as a promising but unfulfilled approach to interaction studies (Hunt, 1975), the most succinct review of the literature relating to it has been that of Cronbach and Snow (1977).

The acronym ATI is meant to convey the idea of the analysis of interactions between aptitudes and treatments. An interaction, in this sense, is an effect that results in a different set of outcomes for one individual (or group) as against others. The basic assumption is that individual differences constitute a set of characteristics that react uniquely to alternative treatments. Cronbach and Snow indicate that a decade or more of ATI research has shown few outstanding examples of promising findings. They suggest that at least part of the problem for the paucity of such findings with such a potentially powerful technique may have been the questionable ways in which aptitude and treatment have been defined by researchers. In discussing these two key terms, they write:

... to keep the problem as open as possible, aptitude is here defined as any characteristics of a person that forecasts his probability of success under a given treatment. We emphatically do not confine our interest to aptitude tests. Personality as well as ability influences a response to a given kind of instruction. Non-test variables (social class, ethnic background, educational history) may serve as proxies for characteristics of the learner that were neglected in aptitude tests developed under selection models, since tests that predict outcomes under a standard treatment may not be differentially predictive of success when more than one treatment is considered. New kinds of aptitude probably need to be detected and measured. (Cronbach & Snow, 1977, p. 6)

Three ideas are important here: (1) the identification of the construct of aptitude as something larger than a test score on a standardized test; (2) the need to utilize a larger complex of characteristics that are more representative of the organism as such; and (3) the need to identify this cluster, possibly by new methods not traditionally associated with previous tests. With regard to the construct of treatment, Cronbach and Snow (1977) give to this notion a broad meaning.

It covers any manipulable variable. Instructional studies vary the pace, method, or style of instruction. Classroom environments and teacher characteristics are also treatment variables of interest. Even where a characteristic cannot be manipu-

lated, e. g., sex of teacher, the student's experience can be manipulated by an assignment policy. (Cronbach & Snow, 1977, p. 6)

Part of the overall critique that is evident in this evaluation of ATI by Cronbach and Snow is related to the difficulty of establishing a cluster of predictors that relate differentially to treatment conditions. Particularly with human beings in either educational or life settings, it is difficult to establish precisely the nature of the treatment itself. And yet, as they state:

... the whole process of seeking order in behavioural and biological science is one of partitioning a grand matrix of organisms and situations into blocks in such a manner that a single generalization applies to all the organisms and all the situations classified within a block. The science of human behaviour is built up by identifying a class of persons who respond similarly to some particular range of situations. (Cronbach & Snow, 1977, p. 3)

The fact that it is necessary to take into consideration some parsimonious grouping of individual characteristics for use with alternative treatments is also highlighted by the authors when they point out that it is simply not possible to look for uniform differences from treatments. Thus the typical approach of studies that have attempted to apply "open education" to all, or to use a specific reading method, or a specific curriculum applied to all children must necessarily fail since individuals do not respond to alternative treatments in a uniform manner. In similar ways, classroom environment affects children with varying individual characteristics in different ways.

Cronbach and Snow (1977) state: "Genetics has established a multivariant conception of environments and of heredities and recognizes that the ecology that benefits one genotype blocks the development of another. A similar complexity is required in thinking about social environments" (p. 10). It is therefore imperative, particularly in learning, to ascertain the kind of environment that will enhance a specific set of desired outcomes. Practically speaking, what this means is that the same method of teaching and/or curriculum materials that will aid mentally retarded or slow learners will prove to be boring and therefore detrimental to gifted children.

The point of this discussion is simply that a treatment may be excellent in conception and execution, but, without a relevant classification system for grouping individuals, it is unlikely that results will be obtained. Harootunian (1978) has stated:

Not using an ATI model in doing research on teaching may almost insure the finding of non-significant results because of what might be termed the canceling effects of individual differences. As the results accumulate, the bases for matching will become more clear and would benefit not only the learner but the teacher. (Harootunian, cited in Goldstein, 1978, p. 402)

Comparatively few studies have used personality variables in ATI interactions. Domino (1971) used personality variables drawn from the CPI in an ATI study. Hypothesizing that achievement would be better for college students when the instructor facilitated students' natural learning styles, he tested sophomores in an introductory psychology course on the CPI with specific reference to the scales AI (achievement by independence) and AC (achievement by conformity). Identifying 50 individuals high on AI and 50 high on AC, Domino then divided each group in half, assigning 25 to a section compatible with their learning style and the other half to a section not compatible. An instructor who did not know on what basis students were assigned agreed to teach two sections emphasizing independence learning, and two sections utilizing conformity. The results of the study indicated that students with high AI did better in the classes where independence was emphasized. Similar results were found for those high on AC.

McCord and Wakefield (1981) reported a study in which arithmetic achievement in fifth graders was seen to be a function of introversion-extroversion and teacher use of reward and punishment. Following Eysenck's theory, they hypothesized that the arithmetic achievement of extroverts would be better than that of introverts in classrooms where teacher-presented rewards were predominant. Conversely, they hypothesized that introverts would do better under conditions of threat or mild punishment. After administering the *Junior Eysenck Personality Questionnaire* to a total of 101 fourth and fifth grade students, they identified samples of introverts and extroverts, and classified teachers in accordance with their predominant style of teaching, i.e., use of reward and reinforcement, or use of threat and/or mild punishment. They then covaried original arithmetic achievement scores and observed consequent gains over a 40-day period on an arithmetic posttest. They found significant changes in gains on arithmetic scores that supported their hypotheses.

Barclay (1983b) completed another study utilizing the ATI format. Drawing individuals from a number of studies that had utilized the *Barclay Classroom Assessment System* (BCAS) (Barclay, 1983a), he classified them according to the second-order factor structure of the BCAS (i.e., high

energy-high sociability, high-energy-low sociability, low energy-high sociability, and low energy-low sociability). These groups are described in sequence to the above factor scores as leaders, thinkers, followers, and agitators. The children were all in third through sixth grades. Various educational and counselling treatments had been administered in these different studies, four of them related to the curriculum, that is: (1) a traditional approach, (2) an open approach, (3) a behavioural approach, and (4) the use of mastery learning. Three counselling approaches involved: (1) a humanistic approach using group discussion and projects (DUSO); (2) a discipline-confrontive approach modeled on rational-behaviour therapy; and (3) a teacher consultation model that involved working individually with children targeted from the assessment.

Utilizing meta-analysis and effect-size scores from pre- and post-comparisons, an analysis of the four polar groups, based on temperament, was made against the seven treatments. Though there were many significant findings to this study (and the reader is referred to the article reporting them in detail [see Barclay, 1983b]), some of the major conclusions were:

1. Children who have higher ability and are characterized by an adequate or above average level of achievement and social support systems from teachers and peers do well in the comparatively unstructured "open" classroom. They also appear to be able to excel in the traditional approach, but they do not do as well in the behavioural approach.
2. Children who had lower ability and who are characterized as impulsive and uncontrolled do best through mastery learning, and show some moderate gains in behavioural approaches. But they did very poorly in the "open" classroom and did not do well in traditional classrooms.

Perhaps the most striking result of this study was what happened when all effect sizes for all groups were pooled and the methods were looked at separately. The results were insignificant effect-size scores. The same finding occurred when all treatments were pooled and tried against each temperament. Again, absolutely significant effect-size scores were found. This confirms what Harootunian (1978) said earlier, i.e., that individual groups may react differently to alternative treatments, and averaging all results will then cancel out the actual differences. It was only when the pre- and post- results were analyzed in a temperament times treatment paradigm that significant positive and negative results were obtained.

The three studies reviewed here suggest strongly that temperament characteristics form a viable focus for the ATI format. The results are

confirmatory of Hunt's ideas that learning style, conceptual level, and degree of structure are the primary variables influencing learning (Hunt, 1975). They also support Cronbach and Snow's contention that personological variables may be crucial to successful ATI studies.

Behavioural Confirmation

One of the besetting problems with the construct of trait, in general, and the clustering of traits in temperament, in particular, is the relationship found between behavioural observations and psychometric characteristics. The analysis of repeated behavioural observations confirms psychometric trait characteristics in instances where those traits are clearly defined. Much criticism has been directed at tests by behaviourists on the grounds that one-time sets of behavioural observations do not show high correlations with psychometric measures. Mischel (1968, 1969, 1972, 1973) has been a primary advocate of abandoning psychometric traits because he has maintained that there is little evidence for the consistency of behaviour and much more evidence for the specificity of behaviour. He has also stated that traits are in the mind of the observer. He has suggested that there is little or no predictability from such psychometric traits.

Epstein (1979), in reviewing the arguments against trait theory, states that observational data made on a one-time base can hardly be considered evidence for the existence or the denial of a trait, and that in analysis of variance procedures "the proportions of variance attributable to any one factor, such as individuals, is always influenced by the range of variability represented by the other factors" (p. 1102), and therefore the null hypothesis cannot be demonstrated by the failure of many studies to demonstrate stability in personality traits.

Epstein reports three studies that provide evidence relative to the stability of behaviour. His hypothesis for these three studies is phrased thus:

Stability can be demonstrated over a wide range of variables as long as the behaviour in question is averaged over a sufficient number of occurrences. This applies equally to data derived from the direct measurement of objective behaviour, from self-reports, and from ratings by others. (Epstein, 1979, p. 1105)

In addition, he maintains that behavioural ratings and psychometric traits derived from tests will also show appropriate correlations (provided that there are a sufficient number of behavioural observations).

Epstein documented his hypothesis by showing that the initial behavioural observation had a low but insignificant correlation with test traits. However, as multiple observations were made, these correlations rose in significance. For example, heart-rate range correlated significantly with disturbed hostile feelings and uncontrolled anxiety, as well as with the *Eysenck Neuroticism Scale*. The same was true for headaches and a variety of other physiological measures.

The implications of Epstein's studies are clear. Obviously, not every person is as predictable as the next one, but some are clearly quite predictable in their behaviour. Self-report behaviour is related to observations by others and to standardized personality assessment instruments. But the crucial determinant is the frequency of observation. The stability of self-report and behavioural measures, as well as the correlations obtained by means of psychometric instruments, are directly related to the frequency of repeated observations.

Block (1975) has also dealt with some of the objections that Mischel (1968) raised earlier. Is there a consistency of personality over time? Block points out that, in a study with the CPI in which adult subjects were administered this inventory over a ten-year period and four independent samples were involved, the discriminant validity (e. g., whether the specific scale correlates higher with itself over the period or with other scales) for each of the samples was very high: 89% for sample one (16 out of 18 scales); 100% for sample two (18 out of 18 scales); 89% for sample three (16 out of 18 scales); and finally 100% for sample four (18 out of 18 scales). According to Block, the mean convergent validities for the samples were .68, .70, .72, and .73.

In addition, Block reports a study that spanned a 25-year-period from senior high school to middle adulthood, in which significant correlations were obtained between an inventory designed by Block and the CPI administered 25 years earlier. For the CPI ego control scale correlations with Block's scale of overcontrol were .52 and .50 with the CPI self-control scale.

One of the classical studies that has been cited as adverse to test traits is the series of studies on honesty done by Hartshorne and May (1928, 1929) and Hartshorne, May, and Shuttleworth (1930). This was a national project of great magnitude that involved the testing of over 8000 children. There were a number of behavioural items relating to cheating and honesty, and when correlations were obtained with tests of honesty it was found that the average intercorrelation of 23 subtests that were used as a part of the total

character scores was 23. This apparently resulted in a conclusion by Hartshorne and May that honesty in any particular setting does not generalize to others.

Epstein (1979), in commenting on these findings, points out however that when Hartshorne and May combined several tests of honesty (in effect combining observations) the reliability coefficient of the single score increased to .73. In addition, a later factor analysis of the same data by Burton (1963) resulted in a conclusion that a factor of honesty accounted for nearly 50% of the total variance (Epstein, 1979, p. 1101).

In summary, it would appear that different methods of observation (behavioural, self-report, and sociometric) can relate to each other, providing they are each reliable measures and based on repeated observations. Parenthetically, it is probably because sociometric nominations are based on prolonged observation of others that such outcome data have such robustness in predicting future behaviour (Barclay, 1983a).

A Theory of Temperament as a Regulative Theory of Behaviour

Recently, Strelau (1988) has enunciated a regulative theory of temperament based on his own research relating to a Pavlovian concept of types of the central nervous system (CNS), theories of arousal and arousability, and a theory of action. The regulative theory of temperament is drawn from both East and West influences, and it represents the most recent integration of Strelau's thinking. It holds as a main thesis that temperament primarily acts as a set of regulative principles of relatively stable nature that serve as control mechanisms for the flow and intensity of activity in human beings. Strelau suggests that reactivity and activity are the two basic dimensions responsible for individual differences.

Reactivity is a temperament trait that reveals itself in relatively stable and characteristic intensity or magnitude of reactions. It co-determines sensitivity and endurance. Activity is a temperament trait that reveals itself in the amount and range of undertaken actions, i.e., goal-directed behaviours of a given stimulative value. By means of activity the individual regulates the level of arousal in order to attain or maintain the optimal level of arousal. (Strelau, 1988, address at UK)

Strelau states that there is a relationship between reactivity and activity. Reactivity is directly determined by physiological mechanisms, whereas activity is an outcome of the level of reactivity and socialization. Reactivity refers to the manner in which individuals choose to bond with the

environment. It refers to the characteristic mode of reacting to stimuli from the environment - the manner in which operant behaviour is established. Activity, on the other hand, is the thrust of energy that flows from the characteristics of the organism as mediated by reactivity. Activity, to use a metaphor, is like the flow of water from its source. Reactivity acts like the set of dams, locks, or flood plains and refers to operant (goal-directed) behaviour. As a consequence, Strelau suggests that high reactive individuals (high sensitivity and low endurance) show low levels of activity, and low reactive individuals (low sensitivity and high endurance) show high levels of activity.

In both high and low reactives, the function of reactivity is directly related to the regulation of activity and stimulation proceeding from the environment. Thus, high reactives find highly stimulating situations (such as scenes in which there is much unplanned-for interruptions, noise, and disorganization) a detriment to their performance in situations bordering on deprivation of stimulation. Low reactives find lack of stimulation hard or nearly impossible to deal with.

In terms of style of action and behaving, high reactives prefer situations of low stimulative value, while low reactives prefer situations of high stimulative value. To repeat the metaphor once more, individuals of high reactivity cannot stand excessive stimulation so, like beavers, they construct a number of dams or barriers to restrict the flow of stimulation so it does not rush too fast through the terrain of individuality. In low reactives, the faster the better. In general, low reactives may be characterized as sensation seekers, sociable, fast decision-makers, and impulsive as compared to high reactives. High reactives then appear to be sensation-controllers or reducers, slow decision-makers, and inhibited as compared to low reactives.

Implications for Research

There are some monumental implications for research and treatment applications in the construct of the regulatory theory of temperament. These implications can be grouped under the headings of (1) life adjustment and counselling therapy, and (2) learning and education. These are not all-inclusive headings but they will illustrate the far-reaching nature of temperament as a regulative theory of behaviour.

Life adjustment and counselling therapy

Given the biological constraints to enhancing or reducing stimulation, it is suggested strongly that individuals subjected to overstimulation (in the case of high reactives) or stimulus deprivation (in the case of low reactives) may undergo severe adjustment problems. Thus it may be that

temperament mismatched with environmental settings could be a major source of maladaptive behaviour. Though these hypotheses have not been documented in research relating to counselling — chiefly because a comprehensive approach to measuring temperament has not been used extensively in this field — there has been an empirical impression found in many marriage counsellors who find that the life patterns of some couples simply create problems for both of them. Interpreted within the previous discussion of reactivity and activity, a high reactive may want to retire in the evening to watch television or read a book, while a low reactive mate may want to “go out on the town.” Such observations are multiple in the counselling experience. The mismatch is seldom because of intelligence or educational differences, but more often on the basis of temperament characteristics which represent something quite different for each of the individuals.

Again, in a study of drug abusers, Sears (1992) worked with habituated drug abusers in a state hospital in North Carolina. Dividing a group of about 100 subjects in high and low reactives, using Strelau’s STI, he found that low reactives tended to begin and continue to use drugs as a form of stimulus enhancement, and high reactives began such usage as a means of reducing internal anxiety and tension. In short, low reactives might use alcohol to increase their activity and stimulation, and high reactives may use it to feel less tense, less anxious, and so on. Much of this is confirmed by the results of other research. For example, Zuckerman, Bone, Neary, Magelsdoff, and Brustman (1972) found that correlates of sensation-seeking were related to the MMPI and 16 PF dimensions associated with uninhibited, nonconforming, impulsive types of extroversion. Studies about adolescent drug use (Andrucci, Archer, Pancoast, & Gordon, 1988) indicate similar findings for adolescents. So perhaps a clue to drug usage is contained in biological templates of temperament. If this is so, then the classification of drug users may provide a strong key to the type of treatment most beneficial for specific groups.

Education and learning style

Of all the possible components of educational reform that have been discussed for decades, the one missing link is that of temperament. We have continually and completely ignored the possibility that early temperament differences in children dispose them to different kinds of environmental stimulation, and that such differences are crucial and critical to enhancing individual differences in learning. It is for this reason that this writer has documented very carefully the historical roots of temperament and the consideration of its modern biological characteristics as a regulator of human performance. The magnitude of this ignorance is demonstrated in an article by Shapiro (1987) in which he reviewed the number of articles

published from 1981 to 1986 in 13 journals related to school-age populations and interventions. He found 597 articles related to behavioural interventions, i.e., those that have an immediate pay-off by changing maladaptive behaviour in one way or another, and only three related to nonbehavioural interventions! This is a good index of the continued insistence of American researchers to explain individual differences solely in terms of reinforcement contingencies rather than to recognize that high and low reactive children are differentially affected by reinforcement, have differing levels of susceptibility to conditioning, and differing thresholds of anxiety related to failure and school experience.

The author has spent over thirty years researching the assessment of temperament in children. *The Barclay Classroom Assessment System* (1983a) is a system of assessing children in the third through seventh grades, using self-report, peer nominations (sociometry), and teacher ratings to determine those children who are at risk, who are gifted, who have behaviour problems, and who lack appropriate achievement. The research is extensive and has comprehensive documentation. What is reported there are the means for school districts, principals, teachers, school psychologists, and counsellors to identify children who are at risk and set interventions accordingly both for individuals and groups. Children who are high reactive and low reactive can be identified, and computer reports provide the objective basis for looking at every child in the classroom.

This system, though very comprehensive, has not been used widely within the United States because few have considered its temperament basis as that important. In view of the fact that the system also provided data relative to the numbers of children at risk, it now is seen as highly relevant to usage in many schools because of its multiple uses related to performance assessment. To a large extent it provides an alternative to traditional testing in the sense that social competence (a major temperament variable as defined by all temperament theorists) is judged by the collective consensus of children in a classroom along with teacher judgment and self-report of the individual.

Findings document that children who are high reactive may require different environmental settings for learning than do low reactive children. The preliminary studies of Barclay, relating to alternative educational treatments and outcomes for temperament groups, would suggest this conclusion (Barclay, 1983b). Research may indicate in the future that the constructs of locus of external and internal control, causal attributions of responsibility, and even expectation theory are linked to temperament characteristics. Further, it may well be that motivation itself is a by-product of temperament.

If temperament is a reality factor in education, then installing various and sundry cognitive treatments in learning cannot be expected to yield results unless temperament is considered as a strong component. For if high reactives and low reactives differ in the ways that have been described, their reaction to alternative cognitive treatments will be in accordance with their predisposition for high or low environmental stimulation. Any treatment that involves both will then result in confounding outcomes.

The vital question, however, is what can one do about the reality of temperament differences in education? The Soviet psychologist, Merlin, who worked for several decades in the Urals applying temperament theory to education without much recognition from his colleagues, posed questions that are of considerable importance to the utilization of temperament theory in educational situations. He suggested that, given the known differences and continuing influence of temperament characteristics, education has three possibilities: (1) ignore the differences; (2) modify learning environments to accommodate to temperament differences; and (3) systematically teach all individuals how to cope with their own temperament characteristics (Merlin, 1967, 1970). Thus far, in American education, we have ignored such differences. Merlin's second alternative, to shape schools to meet temperament differences, is obviously not financially viable or desirable as such. Nonetheless, with the reality of individual differences linked to temperament, it might be well to reduce the excessive environmental stimulation of many classrooms, and to provide alternative and supplementary approaches to learning.

What seems most useful is Merlin's third alternative, i.e., to provide students with a knowledge of their own temperament characteristics, learning styles, and study methods linked to temperament, and aid them to develop strategies for coping with situations that may give them occasion for stress. For both counselling reasons and for the enhancement of learning we need to inform individuals about their own temperament limitations and style. This could provide inestimable contributions to both education and mental health.

Summary

In this paper the evidence for considering temperament as a typology of human behaviour has been reviewed. Historical, clinical, empirical, psychometric, and neurological studies support temperament as a meta-theory. In addition, aptitude-treatment interactions and behavioural studies confirms the validity of the construct in research. Temperament theory is a system that involves a few major biologically-anchored components that tend to specify the direction and intensity of human development. It is therefore parsimonious in identifying activity, sociability, impulsivity, and

emotionality as the core ingredients. Secondly, it is based on comprehensive evidence, including presence in animals, and consistency across methods of assessment, and, thirdly, it possesses power potential for change as can be witnessed from the ATI results. Fourthly, and finally, temperament is a dimensional and hierarchical system of classification that has many potentials for integrating diagnosis with treatment and for establishing a prevention framework within education and many other aspects of society.

If we choose to ignore the implications of temperament, we will be abandoning, without further testing, probably the most important dimension of individual differences in education, assessment, and treatment that could provide major means for spectacular breakthroughs in the quality and satisfaction of performance in these fields.

NOTES

- ¹ The term "regulative theory of temperament" was originated by Jan Strelau in his talk at the University of Kentucky, November, 1988.
- ² My thoughts in the foregoing section are related, but not identical, to the seminal arguments of Franz Brentano on the nature of psychic phenomena (Brentano, 1973).

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