

## CHAPTER 1



# Definition and Historical Roots

There are many ways for a person to discover temperament in children. One way is to be exposed to a wide range of children. Another is to intensively study of a smaller number of children in different situations and over time. The third involves observing the differences between one's own children. My discovery of temperament came from observing differences between our two sons, and it led to the exciting challenge of studying the development of individual differences. This book will be in part a story of my studies at Oregon and those of my temperament colleagues, and in part a description of contributions from other areas that can shed light on temperament and vice versa. I begin, however, with some of the differences between our two sons.

My husband and I had thought that after our first child's infancy we had learned what the basic infant was like. It would then be a simple matter of applying the principles of parenting we had learned from the first child to the second one. Like so many parents of two children, we were in for a big surprise. One of the children was easily upset, but his upset was mild, and he could soothe himself. He often seemed to prefer that we did not try to soothe him. His level of activity was moderate. The other child was quite active, positive, and slow to distress, but when he became upset, he required a major effort at soothing. One child was very oriented toward people and sensitive to their reactions to him; the other was chiefly interested in excitement, wherever it could be found. Sitting on the parent's lap did not provide enough excitement for him; he wished to be off and about.

As a psychologist, I was not ready for these observations. I had studied social development in the 1960s at Stanford University's graduate program, and at that time the primary shaper of individual differences in children was seen to be social rewards and punishments. The differences between our sons, however, had shown up well before a history of rewards. In graduate school, I had studied how mothers treat their children depending on whether the child is the first- or second-born child in the family. I had carefully reviewed the research literature at the time, and expected our firstborn to be more attuned to his parents than the second, as described in these studies. In our family, however, the differences we observed were actually reversed. I believe that if our two sons had differed as the birth-order research had predicted, I would probably still be studying birth order. If one had been a girl and the other a boy, I would probably be studying gender differences, but since both were boys, gender was ruled out.

Our sons' differences also mapped in uncanny ways onto differences between me and my husband. Up until then, I had assumed these differences were the result of his growing up in Chicago in a Jewish family and my growing up in the west in a family with Scandinavian roots. These quite different environments no doubt affected us, but it was a good deal less likely that they could account for the early differences between our children. The way our sons' differences corresponded to differences between my husband and me led me to look for their more biologically based sources. This turned out to be the area of *temperament*. The temperament differences between our two sons have persisted: as adults, one works as an artist and the other as a computer software architect. In many ways, however, especially in their character and values and their connections to others, they have become more alike than they were as children.

My study of individual differences in temperament has now lasted over 4 decades. In its course, my colleagues and I have defined temperament, measured it, and studied its relation to personality. In this chapter, I begin by considering definitions of temperament and personality, followed by a brief account of temperament's ancient and more recent history.

## DEFINING TEMPERAMENT

What is temperament? Doug Derryberry and I defined temperament as constitutionally based individual differences in reactivity and self-regulation (Rothbart & Derryberry, 1981). The term "constitutional" refers to the biological bases of temperament. By reactivity, we meant how disposed we are to emotional, motor, and attentional reactions. One's disposition to a reaction can be measured by the latency, intensity, peak intensity of reaction,

and recovery of the reaction. How quick, for example, are we to anger, to fear, to approach? How intense is our reaction? How long does it take us to calm down and recover from the reaction? By self-regulation, we meant processes that regulate our reactivity. These include our tendency to approach or withdraw from a stimulus, and to direct our attention toward or away from it. They also include the ability to control our actions and emotions.

In the mid-20th century, many definitions of temperament stressed the emotions. Valentine (1951), for example, defined temperament as individual differences in emotions and the child's susceptibility to them. Temperament in his view also included "innate tendencies to various kinds of action" (p. 67). By innate tendencies, Valentine meant dispositions toward and away from an object that are built into the structure of the emotions and emotional reactivity. In Valentine's view, individual differences are not only determined by temperament tendencies acting alone, "but by the relative strengths of one (tendency) compared with another, and by the general balance of all the various tendencies" (p. 67). These ideas may seem strange to the reader now, but I hope that in the course of this book, their importance will become clear.

Valentine (1951) recognized that temperament included individual differences in motivations for actions that are part of the organized emotions, such as fighting, fleeing, freezing, avoiding, seeking, and approaching. He also emphasized the importance of a balance among temperamental tendencies. At times, for example, a child can have both strong avoidance *and* strong approach tendencies to the same object or person. In the past, researchers created measures of temperament with high approach at one pole and high avoidance at the other. In these models, a child high in approach would necessarily be low in avoidance, and there would be no conflict between one temperament tendency and another. However, if these tendencies are considered separately, we can accept the possibility of two conflicting or complementary tendencies. The child's reactions in a given situation will then be influenced by the strength of these tendencies and by the child's past experiences in that situation. Reactivity, however, does not provide the full story of temperament; we also need to study individual difference in self-regulation and effortful self-control. Even young infants regulate themselves, and their signals serve to regulate the behavior of their caregivers by leading the caregiver to offer regulation for the infant, as we see in Chapter 4.

### ***Temperament and Personality***

Temperament is part of the broader domain of individual differences in personality, defined by Allport (1937) as the organization of "systems that

determine his [the person's] unique adjustment to his environment" (p. 48). Personality traits in Allport's view are patterns of thoughts, emotions, and behavior that show consistency across situations and stability over time. Temperament traits, a subset of personality traits, include the emotional, motor, and attentional tendencies and regulative capacities. These also show consistency across situations and stability over time. They are seen early in life and form the earliest individual differences in personality.

Unlike other personality traits, however, temperament traits do not include specific thoughts or cognitions, such as concepts about the self and others (e.g., high self-esteem or paranoia). A number of temperament traits also describe nonhuman animals as well as humans. Temperament is present in infancy and early childhood, and forms the biologically based core from which personality develops. In Michael Rutter's (1987) terms, personality represents the projections of temperament tendencies out into the world, and, as I argue, it also involves the specification of temperament tendencies to particular situations. Temperament will also influence specific cognitions about the social and physical world: what is bad and what is good, what is scary and what is benign. In addition to temperament traits, the larger domain of personality includes attitudes; cognitive coping strategies and defense mechanisms; self-concept and self-related emotions such as pride, guilt, and shame; views of others and the physical world; values; morals; and beliefs. Temperament influences the development of these qualities but can be differentiated from them.

### ***A Thought Experiment***

Based on these descriptions, try this thought experiment. If a person is described as both fearful and arrogant, which of these traits would you see as temperamental and which as involving personality? If you chose fear as the temperament trait, and arrogance as the personality trait, you may have applied one or more of the following criteria: (1) fear, but not arrogance, is present in infants and young children; (2) fear, but not arrogance, is present in many nonhuman animals; (3) arrogance seems to be more a product of the person's social and life experience; and (4) arrogance is related to the specific content of thought, that is, thinking one is better than others.

Although any given instance of fear will also be influenced by experience, fear is a biologically based system linked to the functioning of neural structures and circuits that we all inherit (LeDoux, 1989). The objects of fear in older children and adults are often taught by others, but they can also occur without tuition, and they can be self-taught. Differences in the trait of fearfulness or behavioral inhibition also appear early in life, and

have roots in biological systems (Kagan, 1994; Kagan & Fox, 2006). We do not inherit arrogance directly but may inherit a social environment and set of experiences that promote it.

### ***Temperament in Nonhuman Animals***

Although some researchers have called individual differences in nonhuman animals “personality” (e.g., Gosling & John, 1999), I believe it is important to separate the more biologically based processes that we share with other animals (chiefly temperament) from those we do not (chiefly personality). Temperament is part of our basic biological equipment and has evolved to provide behavioral solutions to expectable problems, that is, problems likely to be posed by the environment. Temperament constructs are thus closely linked to research in neuroscience. Strelau (1983) also separates temperament and personality. In his view, temperament results from biological evolution, and is “peculiar to *both* [emphasis added] humans and animals, which cannot be said of personality” (p. 258). In addition, “The individual has a temperament from the moment of birth, since it is determined by inborn physiological mechanisms which, in turn, may be modified under environmental influences” (p. 258). We return to studies of temperament in nonhuman animals in Chapter 3.

### ***Our Definition of Temperament***

We have defined temperament as individual differences in reactivity and self-regulation (Rothbart & Bates, 1998, 2006; Rothbart & Derryberry, 1981). By *reactivity*, we mean how easily our emotions, motor activity, and attention are aroused. Part of this reactivity includes tendencies toward, away from, or against novel or challenging stimuli. Reactivity also refers to the orienting of attention to internal and external stimulation. Temperamental reactivity is seen in broad tendencies, such as negative reactivity or distress proneness, and it is also seen in more specific reactions, such as tendencies to fear or anger, and aspects of physiological reactivity, such as heart rate or galvanic skin response. Reactive temperament can be measured by how rapidly the reaction begins after the occurrence of an arousing event, the intensity of the reaction, its duration, and the nature of its offset and recovery (Rothbart & Derryberry).

*Self-regulatory* aspects of temperament serve to act upon reactive tendencies, increasing or moderating them. Self-regulation includes individual differences in effortful control operating through attention. Effortful control can serve to decrease or increase the onset, intensity, or duration

of temperament reactions. When I discuss temperamental reactivity, I am referring to individual differences in patterns of emotional reaction such as those described for our two sons. At an underlying level, however, I will also be referring to the organization and function of emotion processing and the attentional networks in the human brain that support it (Posner & Rothbart, 2007a, 2007b). The emotions also include motivation and action tendencies that serve a regulatory function. Fear carries with it dispositions toward freezing, withdrawal, or attack; anger carries dispositions toward aggression. In turn, each emotional reaction can feed back to influence the person's future experience. Executive attention and effortful control are more purely self-regulatory systems; they do not specify particular emotions but can serve a large set of emotion-related goals. Effortful control, based on the executive attention system of the brain (Posner & Rothbart, 2007a), allows flexible response in the service of values, and it is a major focus of later chapters.

Temperament describes an individual's tendencies, dispositions, or capacities. These tendencies are not continually expressed; they depend on the appropriate eliciting conditions, that is, the content of situations. A fearful child is not continually distressed or inhibited. When experiencing novelty, sudden or intense stimulation, or signals of punishment, more fearful children are especially prone to a fearful reaction, experiencing it more rapidly and in response to lower intensities of stimulation. The child is also likely to show higher intensities of fear expression. Easily frustrated children are not continually irritable or angry, but when their intentions are blocked, or there is a failure of their expectations, or they are in pain, they are more prone to anger and frustration reactions than other children.

### ***The Emotions***

Human emotions and attention have been shaped over centuries of evolution. The emotions and attention are biological systems ordering feeling, thought, and action so as to deal with environmental challenges and opportunities (LeDoux, 1989). We share our emotions and orienting of attention with other animals. These reactions have been adaptive to our ancestors, signaling the meaning or significance of events to us and others of our species, and preparing us for action. Thus although temperament is individualized in our specific genetic makeup and through the experiences of our lives, it is also inherited by all of us.

Emotion networks have been conserved through evolution to allow species and individuals to deal with environmental and internally generated threat and opportunity. Tooby, Cosmides, and Barrett (2005) argue that

emotions and their related motivations serve the purpose of *valuation*, discriminating situations from each other based on their positive or negative significance to us, and these valuations have been preprogrammed via our genes. With experience, valuation processes are applied to specific events in specific situations, providing meaning for our world. With this introductory description of some of the concepts of temperament, we are in a position to examine the history of these ideas.

## A BRIEF HISTORY OF TEMPERAMENT

I now offer a brief history of temperament. This history is by no means complete, but it touches on some basic ideas from the past that are related to our current thinking. Although temperament can be traced back to the Indian Rig Vedas and the Chinese concept of *ch'i* (Needham, 1973), I begin this section with the Western approach of the ancient Greeks and Romans. Greco-Roman physicians, including Vindician, who in the fourth century C.E., identified temperamental types of persons as reflected in their patterns of emotion and behavior (Diamond, 1974).

### *Ancient Roots of Temperament*

The term “temperament” is derived from the Latin *temperamentum*, or mixture, which came from *temperare* meaning to “mingle in due proportion.” In Vindician’s fourfold typology, the melancholic person is moody, with a tendency to fear and sadness, and seen as having a predominance of black bile. The choleric person is touchy, aggressive, and active, with a predominance of yellow bile. The sanguine person, sociable and easygoing, is seen as having a predominance of blood; the phlegmatic individual, calm, even tempered, and slow to emotion, is seen to have a predominance of phlegm. In our modern usage, a “temperamental” person is thought to be emotionally extreme, but the ancient view suggested that we *all* are prone to all of the temperaments; we differ in the strength and balance of these components.

Although Galen (second century C.E.) is usually given credit for the fourfold typology (Carey, 1994; Kagan, 1994), temperament ideas were actually well in place before his time and the full typology did not emerge in its complete form until later (Diamond, 1974). Nevertheless, Galen made an important observation about temperament in the young child: “The starting point of my entire discourse is the knowledge of the differences which can be seen in little children, and which reveal to us the faculties of the soul. Some are very sluggish, others violent; some are insatiable gourmands,

others quite the contrary; they may be shameless, or shy; and they exhibit many other analogous differences" (as cited in Diamond, 1974, p. 604). Galen argued that if souls, that is, the essential nature of the young, were interchangeable, then children would be expected to act similarly from early in life, but they do not. Observing consistent differences in infants' and young children's behavior led Galen to argue that children differ from one other from the earliest days.

The fourfold typology of the Greco–Roman period put forward a number of ideas that remain important to our current thinking. First, the typology resulted from consistently observed patterns in the person's emotions and behavior; second, it was linked to human physiology as it was understood at the time—the bodily humors; and third, it was related to psychopathology, as in the relation between melancholia and depression and the relation between the choleric temperament and aggression. Temperament's meaning as a proportionate mixture also foreshadows Valentine's (1951) definition of temperament as involving a balance among tendencies.

Finally, the classic temperament types can be seen as prototypes for several of the basic emotions and motivations I discuss in this book. Positive emotion and stimulation seeking are linked to the sanguine type; fear and sadness to the melancholic; anger and irritability to the choleric; and general slowness in alerting and generating emotion and action to the phlegmatic type. When we consider recent work on temperament, we will see that three of the four types also correspond to three of the six temperament factors identified in childhood (Victor, Rothbart, & Baker, 2006) and in adulthood (Evans & Rothbart, 2007): aggressive negative affect (similar to the choleric type), nonaggressive negative affect (similar to the melancholic), and surgency (similar to the sanguine type). We do not identify the phlegmatic person, except perhaps by low scores on all the emotions, but phlegmatic tendencies are sometimes reported in temperament research involving children (e.g., Bates, Freeland, & Lounsbury, 1979).

The fourfold typology of temperament persisted through the Middle Ages and into the Renaissance (e.g., Burton, 1921; Culpeper, 1657), and was later found in the writings of Kant. Beginning with Wilhelm Wundt (1903), however, temperament typologies were abandoned; instead the basic dimensions on which people varied were identified. More recently, Kagan (1994), Robins (Robins, John, Caspi, Moffitt, & Stouthamer-Loeber, 1996), and others have reintroduced the idea of types, and some authors have mapped temperament dimensions onto the fourfold typology (e.g., Burt, 1937; Cattell, 1933; Eysenck, 1947; Wundt, 1903). The typology approach provides a simplified way of thinking about temperament, but it does not allow study of the conflict or balance between temperament tendencies as is possible in



studying multiple temperament dimensions. I discuss some of the recent typologies in Chapter 3.

### ***Temperament in the 20th Century***

Two major approaches to the study of temperament were begun early in the 20th century. In Russia, Ivan Pavlov's (1935) laboratory carried out temperament research with dogs. Pavlov's approach was continued in the laboratories of Eastern Europe and in questionnaire studies of human temperament carried out in Russia and Eastern Europe (Strelau, 1983, 2008). The second approach, begun in Britain, used early versions of the statistical method of factor analysis on data from questionnaires; this method was later taken up by researchers in the United States. Both the Eastern European and the British approaches involved research on neurophysiology, and provided early frameworks for links between temperament and biology.

During most of the 20th century, however, these two approaches to adult temperament remained isolated from research and thinking about temperament in children. Most of the connections between the adult and child approaches have been relatively recent (e.g., Bates & Wachs, 1994; Halverson, Kohnstamm, & Martin, 1994; Rothbart & Derryberry, 1981). I now describe the Eastern European and British traditions in more detail, beginning with Pavlov.

#### ***Pavlov and the Eastern European Tradition***

Almost all of us have a mental image of Pavlov's dogs from his research on the conditioning of salivation to sound, but few are aware of Pavlov's contributions to the study of temperament. In fact, a strong tradition in temperament study originated in Pavlov's laboratory and continues in Eastern European countries and Canada today (Rusalov & Trofimova, 2007; Strelau, 1983, 2008). Gray (1980) described in detail Pavlov's contributions to the study of temperament. Pavlov and his colleagues used as their subjects mongrel dogs that had grown up outside the laboratory (Gray). These animals were studied over a period of years and in a variety of experimental tasks, and researchers in Pavlov's laboratory came to know the individual animals well.

Classical conditioning responses of the dogs to a tone that preceded the presentation of meat powder were also analyzed subject by subject, and conditioning findings were seen as reliable only when they had been repeated from one dog to another. Thus, Pavlov and his collaborators became familiar with each dog's behavior across situations and over time (Gray, 1980). The dogs in Pavlov's laboratory were also known by name, not by num-

ber. Gray notes that the names given the dogs themselves sometimes indicated the individuality of the animals. For example, the dog “Gunshot” was described as a “lively” animal; “Milord” as a “calm, inactive” one; “Joy’s” name speaks for itself.

Thus, Pavlov’s laboratory created the necessary conditions for observing consistent and stable individual characteristics among the dogs, and after the first observations of dog temperament made by his student Nikiforovsky in 1910, Pavlov decided to study temperament himself. He also began to link the differences among the dogs to variability in the properties of the nervous system as he understood them (Pavlov, 1935; Strelau, 1983). To account for his findings on classical conditioning, for example, Pavlov had proposed the existence of excitatory and inhibitory brain processes. These processes were seen to underlie both conditioned learning and other aspects of behavior. Pavlov now proposed that both his laboratory animals and humans share these brain processes, with individual differences in temperament based on them.

If all the animals shared the same basic processes, how did Pavlov account for individual differences in the animals’ behavior? Here is Gray’s (1980) exposition of Pavlov’s thinking:

So we cannot account for Milord’s inactivity by saying that he *lacks* [my emphasis] an excitatory process. What Pavlov did was to suppose that the functional parameters of these basic processes vary from animal to animal. Thus one dog may have an excitatory process which is particularly easily set into motion, or particularly intense . . . another may have an inhibitory process which is particularly difficult to set into motion . . . and so on. In this way, while preserving a unified theory of conditioning, one can nonetheless account for the peculiarities of the behavior of individuals. There is nothing surprising about this move. It is what we all do when we say that such a one is “quick to anger” or such another “hard to frighten”; anger and fear are common to us all, but we vary in our readiness to display them. (p. 106)

These ideas serve to elaborate the concept of temperamental reactivity introduced at the beginning of this chapter. By *functional parameters*, Gray refers to individual differences in the latency, intensity, and duration of activation of the psychological processes, similar to the reactivity differences described in our definition of temperament (Rothbart & Derryberry, 1981). This is a fundamental point about temperament and I will return to it again and again—the processes that underlie temperament are shared by all of us, but variation in the functioning of these processes is what I mean by temperament. Thus, from the very start, the study of temperament stresses ways in which we are alike as well as the ways in which we differ.

Pavlov (1935) was also interested in mental illness, and observed what he called *experimental neurosis* in the laboratory. This condition developed when a dog was required to make a very difficult conditioned discrimination. For example, a dog would be trained to salivate to the presentation of a circle (positive conditioning), but not to the presentation of an ellipse (inhibitory conditioning). The experimenter would then gradually change the circle to become more and more like an ellipse. When animals were required to make these discriminations over a period of weeks, their performance often drastically deteriorated. Dogs started performing incorrectly, not only to the difficult discriminations, but also to simple circles and ellipses. Some of these animals also became disturbed the moment they were put into the laboratory harness, howling and struggling to get away (Gray, 1980). Pavlov called this *experimental neurosis*, and he noted that some dogs were more prone to this condition than others (Strelau, 1983).

Pavlov also described distinctive categories of temperament, and related them to the dogs' conditioning ability and to how easily they succumbed to experimental neurosis (Pavlov, 1935; Strelau, 1983). The four categories of dogs described here include only the simplest of Pavlov's distinctions; later, his list grew to include over 30 different categories. The first of the four categories included dogs that were lively and active when stimulated, but became drowsy when they were not, for example, when they were required to wait quietly in harnesses with no stimuli presented. These dogs developed conditioned responses easily, and were unlikely to develop neurosis, even under the most difficult conditions of conflict. Pavlov saw this to be the ideal type of animal, and he linked it to the ancient *sanguine* temperament type.

The second group of animals established strong and stable conditioned responses but showed difficulty in adapting when conditions changed. This group also was unlikely to develop neurosis. Pavlov linked this group to the ancient *phlegmatic* type. The third category included dogs that formed positive conditioned responses easily, but formed inhibitory responses only with great difficulty, and their inhibition was easily lost. These animals were disturbed when an activity was interrupted, and often fell asleep or became aggressive when difficult discriminations were required. Pavlov linked this group to the *choleric* type.

Finally, dogs linked to the *melancholic* type developed conditioned responses only with difficulty, and were easily disturbed by distracting stimuli. These animals were also the most likely to develop experimental neurosis. Pavlov (1935) wrote least favorably about this fourth group, indicating that "They never fully adapt themselves to the conditions of life, are easily broken, [and] often and quickly become ill or neurotic" (1935, p. 338).

Pavlov felt that similarities between these categories of animals and the ancient temperament typology justified making strong links between temperament in dogs and humans, and to connecting the melancholic category to introversion and the lively and active sanguine category to extraversion.

Pavlov made value judgments about the temperamental characteristics he studied, and indeed, value judgments of temperament characteristics can be seen in the views of researchers up to the present day. The group of dogs Pavlov most valued, the sanguine dogs, was also the group that adapted best to his laboratory, and we might wonder whether Pavlov's need for cooperative subjects may have influenced his judgments. Pavlov's melancholic group of animals, for example, described as ill adapted to the conditions of life, might have adapted well to other circumstances, for example, as loving companion animals in a quiet home. Choleric dogs that had problems in the laboratory might also have adapted well to dominance contests within a wild dog pack. Pavlov's value judgments about dog temperament raised for the first, but not the last time, a question about the need to add evaluations to temperament characteristics. While the basic building blocks of temperament appear to vary little across cultures, for example, children's family, school, and culture often value some aspects of temperament more than others, and terms like "difficult children," to be discussed later, can also raise the question "Difficult for whom?"

Pavlov's (1935) temperament approach inspired much research in the Soviet Union and Eastern Europe. To get a brief glimpse of this work, we can look at two of the nervous system properties he proposed: strength and weakness of excitation. A general "law of strength" discovered in Pavlov's laboratory found that the higher the intensity of the conditioned stimulus (e.g., the louder the bell presented before the food powder), the greater the intensity of the response (e.g., the amount of salivation). Different dogs were also differently susceptible to the law of strength. Pavlov proposed that individuals who could continue to increase the strength of their response under high intensity or prolonged exposure to stimulation possessed "strong" nervous systems; those who easily lost the conditioned response had "weak" nervous systems. Pavlov associated the weak nervous system with the melancholic group of dogs. Later research by Nebylytsyn (1972a), using laboratory measures and drug studies of humans, indicated that individuals with weak nervous systems also showed lower sensory thresholds than those with strong nervous systems.

Serious problems developed for the Soviet tradition, however, when the nervous system properties they thought were general proved to be highly dependent on the specific stimuli used and the specific responses measured in the laboratory (Strelau, 1983). These results did not support the existence

of the general nervous system properties that Pavlov (1935) had posited. Research on individual differences in threshold in the United States also indicated that sensitivity varied from one sensory system to another, for example, from vision to audition. Eventually, workers in Pavlov's tradition abandoned the notion of nervous system properties, and turned instead to the study of behavioral temperament traits (Nebylitsyn, 1972b; Teplov, 1964). With this change, researchers moved out of the laboratory and into the development of questionnaire measures (Rusalov, 1987; Rusalov & Trofimova, 2007; Strelau, 1972, 2008).

### *The British Tradition*

Whereas temperament research in the Soviet Union originated in the laboratory and only later moved into the administration of self-report questionnaires, in Britain these events were reversed, with questionnaire research coming first and laboratory research later. In the Soviet Union, observations of behavior were also linked to properties of the nervous system from the beginning. In Britain, temperament dimensions were identified first, and theoretical links to the nervous system were made later, chiefly in work by Eysenck (1957, 1967) and Gray (1978).

Some of the first factor-analytic methods applied to temperament were used in British questionnaire research. These methods had been originally applied to the study of intelligence, and were then used to study the structure of temperament and character. Factor analysis reduces a large number of characteristic or trait measures to a smaller number of broad interrelated traits that are believed to underlie the more specific traits. In factor analysis, relations (and nonrelations) among variables are taken into account to identify a relatively small number of related variables, called latent dimensions or factors. When two measures are strongly related, either positively or negatively, they are likely to share the same factors; when correlations are low between measures, they are likely to be linked to different factors. These broad factors can themselves be factored, yielding still broader and hierarchically arranged dimensions.

In intelligence testing, for example, factor analyses by Cattell (1963), and Horn and Cattell (1966) identified hierarchical structures of individual differences in intelligence. At the top, there is general intelligence; at the next level, the broad factors of *crystallized* (facts and skills) and *fluid* (the capacities used to attain facts and skills) intelligence are found. At the next level are more specific factors of visualization, perceptual speed, and fluency. Although today, computers perform factor analyses quickly and easily, the pioneers of factor analysis labored for weeks over their data to identify shared

commonalities across measures of traits. Webb (1915) and Burt (1937, 1938) published separate reports on the factor structure of temperament early in the 20th century, and their work, along with that of Heymans and Wiersma in the Netherlands (1906, discussed below), served as the beginning of a questionnaire tradition in research on temperament and personality.

Webb (1915) and Burt (1937, 1938) each used early forms of factor analysis on large groups of items written to measure the individual's emotionality, self-qualities, and intellect. Webb then had 20 judges observe and rate 194 college students on 39 qualities. He removed the variability in scores related to intelligence, and then asked what other general factors remained. He identified the factor *w*, which he defined as "consistency of action resulting from deliberate volition or will" (p. 34). It included items like "tendency not to abandon tasks in the face of obstacles," "trustworthiness," and "conscientiousness" versus items like "eagerness for admiration" and "readiness to become angry" (Deary, 1996, p. 994). Later reanalyses of Webb's data also yielded a factor labeled Extraversion-Introversion (Burt, 1937, 1938; Cattell, 1933; Garnet, 1918; Studman, 1935), assessing positive and outgoing behavior versus reserve and shyness.

Eighty years after Webb's (1915) original work, Deary (1996) reanalyzed Webb's data once again, and identified six factors resembling those later found by personality and temperament researchers: (1) Willfulness; (2) Extraversion; (3) Conscientiousness; (4) Affiliation; (5) Intelligence, Humor, Originality; and (6) Negative Mood. Deary saw these factors as similar to the "Big Five" or five-factor model (FFM) currently used to describe the structure of personality traits (Digman, 1990; Digman & Inouye, 1986; Goldberg, 1993; McCrae & Costa, 1987), although the match was not complete. The Big Five and FFM, to be discussed at greater length in Chapter 8, include the broad factors of Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness.

Two decades after Webb's (1915) research, Burt (1937, 1938) identified another broad factor, labeled Emotionality or Emotional Instability versus Stability. The emotions in this factor were all negative ones. A similar factor was later identified by Eysenck (1947) and labeled Neuroticism. In a study of neurotic and delinquent children, Burt (1937) also discovered a more specific factor that was obscured by the general negative emotionality factor. One pole of negative emotion was oriented toward "submissiveness, sorrow, tenderness, and disgust, in a word, towards repressive or inhibitive emotions" (p. 182). The other pole "predisposes people towards assertive, angry, sociable, and inquisitive behavior, in short, towards active or aggressive conduct" (Burt, p. 182). Burt's analysis foreshadowed the later distinction between internalizing and externalizing behavior problems and emotions

as described in Chapter 9 and findings on temperament that distinguish less assertive (fear, sadness, discomfort) from more assertive (aggressive) negative emotion (Evans & Rothbart, 2007; Victor et al., 2006).

By 1938, Burt had identified the factor of Extraversion–Introversion in addition to Neuroticism. By combining Extraversion and Neuroticism factors, he was able to derive the ancient typology. In this model, the melancholic person is the neurotic introvert, the choleric person is the neurotic extravert, the phlegmatic person is the emotionally stable (non-neurotic) introvert, and the sanguine person is the emotionally stable extravert. Eysenck (1947) would later put forward the same model.

What Eysenck (1947) added to Burt's (1937, 1938) model was a proposed physiological basis for these temperament dimensions. In an early model, he related extraversion–introversion to cortical excitation and inhibition, and neuroticism to limbic system functioning (Eysenck, 1957). In 1967, Eysenck offered a revised model based on the ascending reticular activating system and individual differences in arousability. Later, Gray (1978) proposed an alternative to Eysenck's model, using the dimensions of behavioral activation and inhibition, as well as a fight-and-flight dimension. Behavioral activation was seen as underlying an approach dimension and behavioral inhibition an anxiety dimension. Gray's initial work was mainly based on research with rats, but it continues to be one of the major current psychobiological models of temperament, along with models put forward by Cloninger (1986), Depue and Iacono (1989), Panksepp (1998), and Zuckerman (1991). I take up these models in more detail in Chapter 3. Before leaving Eysenck's work, however, I note that Eysenck too made value judgments about his temperament dimensions, just as Pavlov (1935) had done. Whereas Pavlov more highly valued the "strong," and more extraverted dog, Eysenck appeared to value the introverted person, whom he described as more reliable than the extravert.

### *Western Europe*

Other research on temperament came out of Western Europe, where early Dutch research was influential, although it did not appear to affect Soviet or British work at the time. Heymans and Wiersma (1906) asked 3,000 physicians to each observe a family, including both parents and children, and to fill out a questionnaire on each person. An early form of factor analysis was then applied to over 2,500 questionnaires, extracting three broad factors: (1) *Activity*, the tendency to express or act out what is thought or desired; (2) *Emotivity*, the tendency to show body symptoms and to be fearful and shy; and (3) *Primary–Secondary Function*, the tendency to react immediately

versus in a postponed and more organized way. These dimensions foreshadowed three of the broad factors of temperament we study today: Surgency, Negative Affectivity, and Effortful Control. I discuss these temperament factors in Chapter 2.

Heymans and Wiersma (1906) also crossed the extremes of each of these three factors, forming eight types. These were labeled passionate, choleric, phlegmatic, apathetic, sentimental, nervous, sanguine, and amorphous. Heyman and Weirsma's work also inspired longitudinal research on infants in Western Europe. Wallon (1925, 1934) in France, and later Meili and Meili-Dworetzki (1972) in Switzerland, studied individual differences in muscle tension and emotionality in infants, using video recordings of children's behavior, and finding stability over time in infants' distress to intense stimuli. The infant's distress reaction also predicted later behavioral inhibition or shyness at 5 and 7 years. The Swiss work showed a number of similarities to the more recent work of Kagan (1994) and his colleagues (see Zentner, 2008), as well as to work in our laboratory.

At about the same time as Wallon (1925), Carl Jung (1923) developed his theory of extraversion-introversion. Jung saw extraversion as related to a person's outgoing orientation, with rapid approach to external objects and greater physical activity. He described introversion as a disposition toward pulling away from external objects, with a greater preoccupation with internal states. Jung argued that both introverted and extraverted tendencies are present in everyone, but that for a given person, one of the tendencies will be more elaborated and conscious, the other more primitive and unconscious. Jung beautifully described differences in extraversion and introversion in young children:

The earliest mark of extraversion in a child is his quick adaptation to the environment, and the extraordinary attention he gives to objects, especially to his effect upon them. Shyness in regard to objects is very slight; the child moves and lives among them with trust. He makes quick perceptions, but in a haphazard way. Apparently, he develops more quickly than an introverted child, since he is less cautious, and as a rule, has no fear. Apparently, too, he feels no barrier between himself and objects, and hence he can play with them freely and learn through them. He gladly pushes his undertakings to an extreme, and risks himself in the attempt. Everything unknown seems alluring. (1928, p. 303)

When psychoanalysts like Jung (1928) refer to a person's orientation toward objects, they include social objects (persons) as well as physical objects. Thus, the introverted child is also more wary in new social situations, approaching strangers with fear or caution; the introverted adult tends



to react negatively to new situations or social gatherings, showing hesitation and reserve. The extraverted person more readily accepts, approaches, and acts directly upon both social and physical objects. An important idea here is that for extraverted persons, attention is more outwardly focused; introverted persons tend to focus attention more inwardly and are more introspective. Jung (1928) also suggested that the introverted attitude is inclined toward pessimism about future events; the extraverted attitude toward optimism.

Jung was also interested in the relation between temperament and mental illness, suggesting that introverts were prone to *psychasthenia*, “a malady which is characterized on the one hand by an extreme sensitiveness, on the other by a great liability to exhaustion and chronic fatigue” (1923, p. 479). Extraversion, on the other hand, was seen as predisposing the person to *hysteria*, “characterized by an exaggerated rapport with the members of his circle, and a frankly imitative accommodation to surrounding conditions” (p. 421).

### *Early Research on Temperament in the United States*

In the United States, Gordon Allport (1937, 1961) made major contributions to our understanding of temperament. He identified temperament as a subdomain of his trait-based theory of personality (1961). Like Valentine (1951) at the beginning of this chapter, Allport identified temperament with emotion, and defined temperament as “The characteristic phenomena of an individual’s emotional nature, including his susceptibility to emotional stimulation, his customary strength and speed of response, the quality of his prevailing mood, these phenomena being regarded as dependent upon constitutional make-up and, therefore, largely hereditary in origin” (1961, p. 34). Allport, like Valentine, stressed individual differences in emotion in his definition and did not include attention (Thomas & Chess, 1977) and self-regulation, as others have done (Rothbart & Derryberry, 1981).

Cattell (1933a) also carried out research on temperament, asking college students to rate others known to them. He identified four factors of temperament: a Will factor like that of Webb (1915), with characteristics like persistent versus changeable, a Surgency factor; a Maturity factor, including qualities like good-natured versus malicious, a Kind on principle factor, versus absence of kindness; and a Well-adjusted factor, including qualities like emotional versus unemotional and balanced versus extreme.

Cattell (1957) later argued that what a person will do in a given situation depends on his or her traits, abilities, and motivations, and also on the extent to which the environment creates a *press* upon (that is, tends to elicit)

those characteristics. If there is no press for fear, the trait of fearfulness will not be relevant to the situation. As the press for a given reaction increases, the trait will more strongly influence a child's behavior. Individuals high on a trait will be more sensitive to the environment's press on that trait than those low on the trait. This is another way of saying that you will not see evidence of a temperament disposition if the situation does not evoke it or press for it, but if the situation tends to elicit it, individual differences in reactivity will appear. This point also stresses the importance of environmental contributions to the child's experiences.

Thus, a young child may be fearful, but his or her parents may attempt to limit his or her exposure to threatening events. When parents avoid exposing the child to fear-provoking situations, or adapt situations so they will not press for the trait, the trait will be less evident, even though its potential for expression will continue. When the child enters school, for example, this new situation will exert a stronger press on the trait of fearfulness. The school setting is also likely to be less flexible and adaptable than the home environment, and teachers may be less (or more) likely than parents to use the child's temperament to inform their actions.

### *Temperament in Childhood*

I now consider some of the early observations of temperament in childhood. The great normative studies of the 1930s in the United States followed infants' development on repeated occasions, searching for the "normal" or normative time at which children developed skills such as crawling or walking. The normative studies also led researchers to discover individual differences in temperament in young children (Gesell, 1928, cited by Kessen, 1965; Shirley, 1933). Researchers like Gesell observed large numbers of children; researchers like Shirley studied a small number of children intensively over time. The goal in both approaches was to establish a timeline for normal sequences of development, known as the "norms" of child development.

Following the small-sample approach, Mary Shirley (1933) intensively observed 25 infants over the first 2 years of their lives. Although she had originally planned to study only motor and intellectual development, she was struck by the differences among the infants that she called the "personality nucleus." Thus, in addition to the volumes on motor and intellectual development she had planned to write, Shirley added a third volume on the infants' core personality or temperament during the first 2 years. Shirley concluded her book by writing personality/temperament sketches of each of the children.

The frontispiece of Shirley's (1933) third volume, a picture of "serene Winnie and expansive Fred" (Figure 1.1), deserves our close attention. First, using Jung's (1928) terms, the photo suggests a distinctively extraverted attitude in Fred, and possibly an introverted attitude in Winnie. Second, the children's facial expressions suggest that they are having quite different emotional experiences in the situation. The twins are also engaging in, and thereby practicing, different behaviors, with a distinctly social bid from Fred and greater social reserve from Winnie.

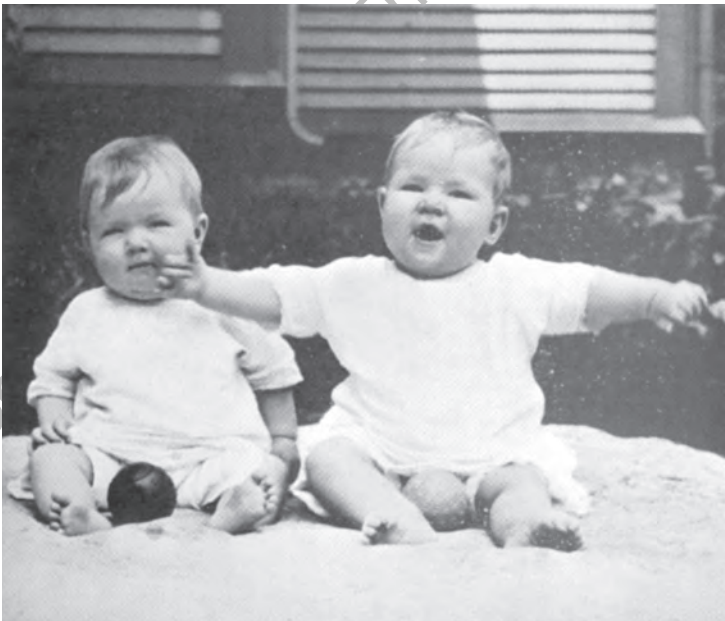
As a thought experiment, imagine yourself as the photographer.

Would Fred and Winnie bring out the same or different reactions from you?

Would you be likely to pay more attention to Fred because you respond with delight to his joy and desire to be close to you?

Or would you attend more to Winnie, because you feel it is important to respond to the child who does not come forward?

Which child would you be likely to pick up and hold?



**FIGURE 1.1.** Winnie and Fred at 35 weeks. From Shirley (1933). Copyright 1933 by the University of Minnesota Press. Reprinted by permission.

The social interchanges of these two children with other people will influence others' expectations and behavior toward them now and in the future.

At the same time, the children's experiences in social interchanges will shape their own views of other people and themselves, and influence their future responses to others. Children's temperament reactions are thus likely to influence their mental models of people (as approachable or dangerous), and of the self (as lovable or unlovable). The influence of temperament on these views of the self and others will be automatic and reflected chiefly in the infant's behavior, but later it can be represented in statements about the self and other people, moving us more clearly into the domain of personality. I revisit these ideas in Chapter 5.

In her research, Shirley (1933) found both general changes in infants' temperament-related behavior over the first 2 years, and stability of differences in children's temperament over time. Based on her observations, Shirley developed at least seven principles of individual differences in infancy:

1. Differences can be seen as early as birth, in "irritability, in tone and timbre of the cry, in activity, and in tonicity of the muscles, as well as in the quality of reactions to the test situations" (p. 216).
2. The personality nucleus "may be observed in a variety of situations with consistent results" (p. 217). In Shirley's research, these included laboratory test situations and interactions of children with their families.
3. Age trends are consistent across the whole group of children, such as showing declines in irritability and distress proneness with age.
4. Each infant exhibits a pattern of traits that changes little with age, even when developmental change is occurring. For example:

Virginia Ruth and James Dalton both decreased in irritability with age, in accordance with the trend of the group; but the former was consistently the most irritable and the latter the least irritable of the group. A behavior item, moreover, sometimes waned and lapsed, only to be supplanted by another that apparently was its consistent outgrowth. The baby who manifested the first characteristic in a high degree was high in the new trait also. When Virginia Ruth, Maurice, and Matthew gave up screaming, they became the most strongly addicted of the children to escaping from the examination. Similarly, Quentin's timorous crying gave way to apprehensive watching and that in turn to hiding temporarily behind his mother and being reluctant to play and talk in the examiners' presence. (pp. 218–219)

5. Similarities in traits are observed within families. Some families were characterized by shyness, or by high activity level, sociability, or proneness to distress. Shirley suggested that assortative mating, where like marries like, may have influenced these similarities.
6. She also notes that “in some instances specific training by the mother seemed to have little effect in counteracting a strongly established trait or developing one in which the child was weak” (p. 220). This is a critical issue in child development: How do the child’s temperament and the parents’ socialization attempts affect each other? I return to this question later in the book.
7. Finally, Shirley concludes that

the evidence marshaled in this study is strongly on the side of innate differences in personality. The early appearance, pervasive nature, and relative stability and permanence of personality traits, their consistent pattern and their harmony with familial traits, all point to a hereditary basis. Developmental change in the frequency with which each trait is manifested supports the maturation hypothesis. To be sure, these results cannot be interpreted as conclusive evidence that personality potentials are laid down in the genes. But they do indicate that personality has its origin and physiological basis in the structure and organization of the nervous system and of the physio-chemical constitution of the body as a whole. Environment, it goes without saying, (also) has its influence on the physiological organism. (p. 220)

When the infants Shirley (1933) had observed were 15 years older, Patricia Neilon (1948) followed up on the sketches Shirley had written about the infants. She obtained independent personality descriptions of the children, who were now adolescents. A group of clinical psychologists then attempted to match the teenagers with their infant personality sketches. These judges performed considerably better than would have been expected by chance. Neilon’s results suggested that at least some of the individual differences observed by Shirley in infancy showed considerable developmental stability.

Arnold Gesell (1928, cited in Kessen, 1965), another great normative developmental psychologist, filmed and studied hundreds of children in his Yale laboratory, and was similarly struck by the individual differences he observed. He also noted different developmental pathways among children, and suggested that while some characteristics of the children would be relatively stable, others would be more strongly influenced by socialization. An example of his thinking about developmental outcomes was presented in Gesell’s description of CD in the Preface.

Gesell (1928, cited in Kessen, 1965) and Shirley's (1933) observations point to three fundamental concepts in our understanding of temperament and development. First, temperament traits form the nucleus or core of the developing personality and influence the directions or trajectories followed in development. Second, although relative stability of temperament traits across children is expected, outcomes will also depend strongly on developmental changes and on the child's socialization and experience. And finally, as Gesell's discussion of CD indicates, temperamental characteristics allow multiple pathways to developmental outcomes, so that a more surgent child like CD may become a delinquent or a good citizen, empathic or aggressive, depending on training and experience.

### *Clinical Studies of Temperament*

After the work of the normative psychologists, temperament concepts generally disappeared from psychologists' discussions of social and personality development. During this period, social learning theories were in ascendancy. At least one influential theorist at the time argued that personality traits were merely social constructions, not true phenomena (Mischel, 1968), although he created measures of children's self-regulation that later showed the stability that would be expected from temperament or personality traits (Eigsti et al., 2006). During the heyday of social learning theories, environmental influences were seen as almost entirely responsible for personality differences, especially the child's history of rewards or punishments. Freudian or psychoanalytic theory was also influential during this period. It, like the social learning theories, emphasized effects of the environment rather than temperamental individual differences.

Theories of cognitive development views gained ascendancy from the 1960s onward, especially following publication of Flavell's (1963) important introduction to Piaget's theory, and these ideas came to be discussed in my later years in graduate school. As early as the 1940s and 1950s, however, a biologically oriented group of child physicians and clinicians were carrying out significant studies of temperament. Bergman and Escalona (1949), for example, identified children who were strongly reactive to low intensities of stimulation in one or more sensory modalities, especially sight, hearing, and touch. In the 1960s, Sybil Escalona (1968) proposed the fundamentally important concept of the child's *effective experience* on development. Her idea was that events in children's lives are experienced only as they are filtered through the individual child's nervous system, so that an environmental event is not the same for all.

Escalona (1968) noted, for example, that an adult's vigorous play with an infant may lead to pleasure in one child, yet to distress in another. By

simply describing environmental events, she argued, we fail to capture essential information about the child's *reaction* to them, that is, the child's effective experience. Thus, we may observe parent-child interaction and note a parent's vigorous stimulation, such as bouncing or tickling the child. Coding the stimulation alone, however, does not capture the child's reaction as influenced by temperament, nor does it tell us anything about the child's experience in the situation. To study experience, we need to observe the child's behavior and physiological or self-reported reactions to the situation. One child may respond with animation and laughter; another may cry and attempt to get away. The heart rate, respiration, and/or cortisol response of two children may differ. One child may tell us he or she had a good time; another that he or she did not.

Murphy and Moriarty (1976) followed up a group of infants who had originally been studied by Escalona (1968). They studied preschool-age children's vulnerability, resiliency, and coping, and I discuss some of their important observations in Chapter 7. During the 1950s and 1960s, Fries and Woolf (1953; Fries, 1954) studied what they called congenital activity type. Korner (1964) studied neonatal individuality and developed an extensive observation schedule for the newborn, and Birns (1965) and her associates (Birns, Barten, & Bridger, 1969) developed some of the earliest laboratory assessments of temperament.

#### THE NEW YORK LONGITUDINAL STUDY

The most well known clinical studies of temperament in children, however, and indeed of all recent temperament research, was reported by Thomas and Chess and their colleagues in the early 1960s. Thomas, Chess, Birch, Hertzig, and Korn published the first of their volumes on children's reaction patterns in the New York Longitudinal Study (NYLS) in 1963. Later, Michael Rutter suggested they use the term "temperament" to describe their area of study, and this term was adopted for their future publications (Chess & Thomas, personal communication, 1992).

The NYLS findings arrived at a time when researchers in social development were also becoming aware of children's own contributions to their development, laying the groundwork for the study of temperament. These psychologists argued that social influence flows from the child to the parent as well as from the parent to the child. Robert Sears and his associates (e.g., Sears, Maccoby, & Levin, 1957) and others (Bell, 1968; Schaffer & Emerson, 1964) argued that influences in socialization are bidirectional; children are not born as homogeneous lumps of clay to be shaped into their differences by society. Instead, they show variability in behavior that can, in turn, elicit differences in the behavior and attitudes of their parents and teachers. The

view that social influence works in both directions seems obvious to us now, but it was major news when it first appeared. At that time, behaviorism held sway in psychology and social learning theories attempted to account for individual differences almost entirely through parental reward and punishment.

Others who stressed children's contributions to their own development were cognitive developmental theorists like Piaget and Kohlberg. Piaget's (1954) observations of how children "construct" their views of the world, based on their experiences with it, emphasized how children influence their own development through their mental representations of events (see also Kohlberg, 1969). As children develop notions of their own self-identity, their thinking becomes an important determinant of the child's personality, and helps to shape concepts of self and others. Later, I consider models of the self and ideas about how cognition influences social development.

A fourth group of researchers were also actively studying the period of infancy (see Osofsky, 1979). One of the goals of their research was to describe the initial state of the infant and to study its relation to later development. Because the initial state of the newborn infant clearly varied from one infant to another (Escalona, 1968; Korner, 1964), early differences in emotions, activity, and attention were seen as providing the raw material for development. This work set the stage for the major contributions of Thomas and Chess (1977) and the NYLS, to be addressed in Chapter 2.

## SUMMARY

In this chapter, I have offered a definition for temperament and distinguished temperament from personality. A brief account of adult models of temperament from ancient times was also offered. In Britain and Europe, early factor-analytic research yielded broad traits of introversion and extraversion, negative emotionality, and traits having to do with self-regulation. These dimensions of temperament are examined in more detail in Chapter 2. In that chapter, I also continue the historical review by describing Thomas and Chess's (1977) NYLS and some of its many insights. I then describe a more recent search for the structure of temperament in infancy and childhood, and the temperament dimensions that I and others have identified. In Chapter 3, I consider animal models of temperament and the brain architecture that may underlie these temperament dimensions.

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