AN EXPLORATORY FACTOR ANALYSIS OF THE

HUMAN BEHAVIOR RATING SCALE

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Suzanne Woods-Groves

Certificate of Approval:

Craig B. Darch Professor Rehabilitation and Special Education	Ronald C. Eaves, Chair Professor Rehabilitation and Special Education
Anthony J. Guarino Associate Professor Educational Foundations, Leadership and Technology	Caroline Dunn Professor Rehabilitation and Special Education
E. Davis Martin Jr. Professor Rehabilitation and Special Education	Joe F. Pittman Interim Dean Graduate School

AN EXPLORATORY FACTOR ANALYSIS OF THE HUMAN BEHAVIOR RATING SCALE

Suzanne Woods-Groves

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Signature of Author

_____
Date of Graduation

DISSERTATION ABSTRACT

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HUMAN BEHAVIOR RATING SCALE

Suzanne Woods-Groves

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This paper reviews 27 theories of human behavior. The theories were categorized as arousal, affect, and cognitive; each addressed a certain aspect of human behavior in a discrete manner. Eaves (1993b) proposed an Integrated Theory of Human Behavior that tied together existing theories that were undergirded by empirical support. Eaves described human behavior as consisting of arousal, affect, and cognition. His previous studies were reviewed that tested aspects of his theory. This study examined the internal consistency and construct validity of a new instrument, the Human Behavior Rating Scale, HBRS (2002) that was designed to aid in testing Eaves' theory.

Forty-four sixth, seventh, and eighth grade teachers from two rural southern counties completed a HBRS for 320 of their students. Cronbach's alpha was used to examine the internal consistency for each grade: for the five dimensions of the HBRS: persistence, curiosity, externalizing affect, internalizing affect, and cognition. Reliability coefficients ranged from .91 to .98.

The 94 items of the HBRS were used to construct three parcels for each of the five dimensions. The 15 parcels were then submitted to an exploratory factor analysis where principal axis factor analysis was employed. The Kaiser-Meyer-Olkin index of sampling adequacy was .90 for the sample, indicating that the data represented a homogeneous collection of variables suitable for factor analysis. Bartlett's test of sphericity was significant for the sample χ^2 (105, N = 320) = 6961.33, $p < .0001$, which indicated that the set of correlations in the correlation matrix was significantly different from zero and suitable for factor analysis.

A scree plot identified five factors. Communalities ranged from .85 to .96. An oblique Promax rotation was applied and a five-factor solution was revealed that recovered 90.24% of the total variance. Each of the three parcels loaded saliently on their respective factors; persistence, curiosity, externalizing affect, internalizing affect, and cognition. Pattern matrix coefficients ranged from .56 to 1.03. Intercorrelations between factors ranged from .15 to .76. The results of this study provided support for the reliability and construct validity of the HBRS for use with populations similar to the sample employed.

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I. INTRODUCTION

Historically, professionals from many different fields such as biology, psychology, sociology, and neurology have attempted to unravel the mystery of human behavior. Edward L. Thorndike (1911) noted the need for investigation into the facets of human behavior when he stated,

> A complete science of psychology would tell every fact about every one's intellect and character and behavior, would tell the cause of every change in human nature, would tell the result which every educational force, every act of every person that changed any other or the agent himself would have. It would aid us to use human beings for the world's welfare with the same surety of the result that we now have when we use falling bodies or chemical elements. In proportion as we get such a science we shall become masters of our own souls as we now are masters of heat and light. Progress toward such a science is being made. (p. 6)

With all the technological advances of our day, research within the field of human behavior still grapples with the question: What are the primary building blocks of human behavior? Researchers from a variety of fields have attempted to attack this question from a myriad of angles: (a) anthropologists, look to the past and make extrapolations from concrete remnants found from ancient cultures; (b) psychiatrists look to the medical model, which depicts human behavior as a compilation of neurons and physiological

processes; and (c) counselors, sociologists, philosophers, and clergy look to extrinsic and intrinsic variables that may affect an individual's behavior.

As researchers investigated human behavior, they began to collect a set of principles to which they subscribed. Once a large body of principles was established an individual could begin to organize his or her postulates in a holistic fashion to produce a body of work that attempted to explain a vast array of variables, such as those that influence human behavior. Certain underlying assumptions concerning human behavior are accepted by different researchers within each discipline, which leads to disparity even within a single field. Bolles (1975) noted,

> Although a great number of people have contributed in one way or another to our current understanding of learning, there are a mere half-dozen or so who have made the big contribution of organizing their ideas into unified patterns that can be called theories. That these individuals have had the vision and courage to undertake such syntheses, often with very inadequate data, is reason enough to give them honored places in the annals of psychology. (p. 1)

Theories cover large bodies of information or facts and assert a particular perspective. Bigge and Hunt (1958) stated "Action, whether a part of teaching or any other activity in life, either is linked with theory or it is blind and purposeless. Consequently, any purposeful action is governed by theory" (p. 257).

O'Donohue and Krasner (1995) acknowledged that human beings naturally subscribe to a number of theories about the world, such as the notion that the earth was the center of the solar system and that all the heavenly bodies rotated around it. The authors noted that scientific theories originally grew out of the process of correcting the

erroneous notions of some folk theories. This lends support to the idea that in order for a theory to influence a field in an all-encompassing manner, it must be widely accepted and understood. Individuals must be informed of and understand the postulates of the theory. Theories, which are written in such vague and cumbersome language that the theorists themselves have trouble relating their ideas to others in a clear cohesive fashion, are not easily disseminated or understood by individuals within the field.

Relevance of the Problem

It suffices to say that theories of human behavior need to be based on empirical evidence and readily lend themselves to the testing of their postulates. Individuals such as Charles Spearman (1904), Clark Hull (1935), and B. F. Skinner (1938) have called on the need for theories to be supported by empirical evidence. These theorists methodically constructed systematic methods that outlined the steps to be followed when constructing and attempting to prove a theory. Despite the widely accepted notion that theories should be tested through research methods, some theories are so vague that it is difficult to identify which aspects of the theory to test and how to test them.

Previous and current theories of human behavior tend to focus on discrete aspects without extrapolating to the total realm of human behavior as it exists within everyday situations. Disparate theories of human behavior abound. No one theory has systematically integrated specific schools of thought from other fields. Historically, behaviorists, mentalists, and psychophysiologists have taken respective opposing positions concerning human behavior with no concessions for each other. Eaves' (1993b)

Integrated Theory of Human Behavior attempts to remedy this situation by incorporating information from several different fields into one theory of human behavior.

Theories of human behavior offer direction and information to individuals with the intention of illuminating what drives human behavior and how it can be shaped. It is incumbent that individuals within the field of special education study human behavior. Bigge and Hunt (1958) noted,

> Not only has man wanted to learn, but often his curiosity has impelled him to try to learn how he learns. Since ancient times, at least some members of every civilized society have developed, and to some degree tested, ideas about the nature of the learning process. (p. 254)

The authors acknowledged that most teachers, from time to time, have adopted conflicting features from a variety of theories without realizing that they are fundamentally incompatible and contradictory in nature. By adopting an integrated theory of human behavior, a teacher can pull from a systematically organized set of tenants that can drive his or her assessment, planning, interventions, and teaching style.

Bigge and Hunt (1958) noted that typically, a new theory of learning is not translated into school practice until 25 to 75 years have elapsed. Once a theory is adopted, how does it affect society? A comprehensive theory of human behavior could influence the way special education and psychology construe diagnostic labels for individuals with disabilities. If a comprehensive theoretical framework existed, special educators could have greater validity for diagnostic labels. An example of this occurs within the field of medicine where vast empirical data supports clinically tried treatment approaches.

Within the field of special education the medical field, psychologists, and legislation determine what diagnostic label may be applied to a specific exceptionality. For instance, the diagnostic classification of autism has undergone several changes through the years. Now, autism falls under the pervasive developmental disorder umbrella and is part of a whole array of other conditions. This influences the number of individuals who are ultimately diagnosed with autism. Another example occurs when individuals are deemed not eligible for special education services in the area of emotional disturbance because they are determined to be socially maladjusted. In some instances it appears legislation influences what individuals are identified and ultimately qualify for special education services.

A comparison could be made between the field of special education and the medical field. If an individual is diagnosed with a heart condition, the physician can reference a vast body of work, which has empirical support, and choose which discrete methodology to apply to the specific heart condition that is identified. The field of special education unfortunately does not have an integrated theory of human behavior to provide guidance. Aspects from counseling, neuropsychology, and psychology are taught to special educators in a disparate fashion. Currently, no cohesive theory of human behavior exists which special educators can reference. Bigge and Hunt (1958) encouraged teachers to construct their own theory of human behavior through studying existing theories.

Background of the Problem

The need for an integrated theory of human behavior is evident. However, such a theory should meet several criteria: (a) be written in a simple fashion so it can be easily

understood, (b) integrate existing theories that have empirical support, (c) lend itself to empirical testing, and (d) provide information that can be applied within the field of education. Eaves' (1993b) Integrated Theory of Human Behavior is written in simple language that can be understood by lay persons. His theory has incorporated information from several fields, all of which are undergirded by empirical support. He has constructed his theory in a manner that lends itself to empirical testing.

In order to investigate his theory, Eaves has developed three psychometric assessment instruments. The Visual Similes Test (VST II; 1995), measures affective arousal and cognitive arousal; the Pervasive Developmental Disorder Rating Scale (PDDRS; 1993a) is an autism screener and diagnostic instrument that measures arousal, affect, and cognition; and the Human Behavior Rating Scale (HBRS; 2002) is designed to measure arousal (persistence and curiosity), affect (externalizing and internalizing), and cognition.

Purpose of the Study

The purpose of this study was to review arousal, affect, and cognitive theories, which currently attempt to explain aspects of human behavior. By reviewing different theories one can note the disparity that exists between the theories. Eaves' (1993b) Integrated Theory of Human Behavior was reviewed. His theory proposed that human behavior resulted from the interaction of specific central nervous system components: (a) arousal, driven by the reticular activating system; (b) affect, controlled by the limbic system; and (c) cognition, moderated by the cerebral cortex. Eaves noted that as an

individual interacts with his or her environment, he or she becomes specialized in certain aspects of human behavior.

This occurs in instances where individuals grow up in certain cultures. An individual who grew up in a primitive environment would become specialized in more affective or concrete skills, whereas an individual who was raised in a highly technological environment would become specialized in more cognitive endeavors. Studies that lent support to Eaves (1993b) Integrated Theory of Human Behavior were reviewed and the implications of the findings were discussed.

The primary purpose of this study was to investigate the reliability and construct validity of the Human Behavior Rating Scale (HBRS; Eaves, 2002) with a population of sixth-, seventh-, and eighth- grade students enrolled in public school. Forty-four teachers completed a HBRS for each student who returned a signed parental-consent and child-assent form. Several research objectives were investigated. Two arousal factors, two affective factors and one cognitive factor were expected to emerge from an exploratory factor analysis when an oblique rotation was applied. It was expected that each parcel would load according to expectations and load saliently only on their respective factors.

II. LITERATURE REVIEW

In an attempt to provide an overview of some of the competing viewpoints of human behavior a brief synopsis of select theories has been provided. The theories reviewed have been placed within one of three categories: arousal, affect, and cognitive theories. Ultimately, a final theory is discussed that serves to integrate many findings from theories of arousal, affect, and cognition. The final theory discussed is Eaves' (1993b) Integrated Theory of Human Behavior that proposes that human behavior is a result of the interaction of specific central nervous system components: (a) arousal, located in the reticular activating system; (b) affect, located in the limbic system; and (c) cognition, located in the cerebral cortex. Eaves (1993b) integrated information from different disciplines into a comprehensive theory, which attempts to measure the construct of human behavior through the relationships between arousal, affect, and cognition.

A plethora of theories currently exist concerning human behavior. One theory that has been revolutionary for the study of human behavior and sciences has been Darwin's theory of Evolution (1859). Darwin's theory closed the gap that theologians claimed existed between man and beast. It was hypothesized at the time that man possessed reason and the notion of free will, while animals were mechanized beasts only "capable of simple automations" (Bolles, 1975, p. 4). Bolles (1975) noted that Darwin discarded

the notion that man has free will and is distinctly different from his animal counterparts in intellect and disposition. Darwin suggested in his pivotal book *Origin of the Species* (1859) that man may have specialized during evolution in the development of his intelligence in a manner similar to how birds specialized in the development of wings. As Amsel and Rashotte (1984) described Darwin's theory,

> This work suggested that intelligent or adaptive behavior of animals results from the operation of relatively simple mechanisms provided by the species' evolutionary history and activated by the animal's life experiences. Very simple creatures seemed incapable of profiting much from experience, and relied very heavily on their genetic endowment for adaptation to changing conditions. Animals with more complex nervous systems, and particularly mammals, seemed capable of extraordinary feats of learning which allowed them to adapt and survive and radiate into new environments. (p. 13)

Evolution refers to the change in gene frequency over time within a population and involves natural selection. Corwin and O'Donohue (1995) identified three attributes that are necessary for evolution to occur through natural selection and that all living things possess: (a) inheritance occurs when alleles [gene sets] are passed intact from generation to generation, (b) differential reproduction refers to the variability with which individuals reproduce, and (c) isolation occurs when genetic lines are not able to interbreed freely. According to Darwin (1859) natural selection determines which of the genetically diverse members within a species are best suited to survive and reproduce in a specific environment. Members of a species that are best suited will survive and reproduce, while those that are not will perish.

Darwin (1859) noted that reproductive competition, as well as other forms of competition, exist between members of a species. The genetic variability in a species affects the probability that some members of that species may survive and proliferate. Sexual reproduction produces more genetically diverse offspring than asexual reproduction and as such, may increase the probability of survival for some species. Darwin acknowledged that the result of natural selection is the adaptation of organisms to prospective environments; as such, a highly adaptive member of a species will live while a less adaptive member will die.

Darwin (1859) attempted to explain the evolution of new species and organ systems through the process of gradualism. Gradualism was defined as the process where new structures emerge in a series of discrete steps that are then selected by the environment. In modern times this process is noted when mutations of the genotype have no discernible effect on the phenotype of the organism, and as such, do not affect its appearance. Corwin and O'Donohue (1995) cited three sources for gradualism: (a) the process of intensification, which was defined as large evolutionary changes which occur through a variation on a basic theme such as the formation of glands from scattered secretory cells; (b) change in function, which occurs when a particular structure is able to perform two separate functions or when two different organs can perform the same function within an individual; and (c) the fact that even structures that were beginning to appear and evolve could serve a selective advantage for an individual or species.

Most theories are in some way or another affected by Darwin's theory of evolution. Some theorists have embraced evolution and have been inspired to base their own theories on its tenants while others ignored evolution completely, or vehemently

disputed it. What all of the following theories have in common is that they attempt to explain some facet of human behavior, and as such, add to the formidable body of work produced by homo sapiens to explain why humans behave the way they do.

Historical Perspectives: An Overview of Theories

Arousal

Arousal History

Psychophysiology has been the platform from which the basic elements of psychological processes and the development of adaptive behavior have been investigated (Lindsley, 1958). Why have some individuals devoted their entire lives to studying the concept of arousal and its components? Das, Naglieri, and Kirby (1994) stated that "the concept of arousal has often been linked to the orienting response" and that "arousal interacts with attention and, in a more global sense, with cognition" (p. 35). Sokolov, Spinks, Naatanen, and Lyytinen (2002) noted, that

> … the orienting reflex [arousal] lies at the heart of information processing, within a very broad framework of analyses in the brain, and … can elucidate different levels of organization there, from neuronal levels, through perceptual levels and memory to semantic levels, and ultimately, behavior. (p. 1)

Arousal has been studied by researchers through the examination of physiological and nonphysiological measures. The term arousal has been used to describe state and trait behaviors of individuals, which can lead to confusion when actually defining the concept of arousal (Venables, 1984). For example, the trait of arousal would be used when an individual is described as an extrovert or an introvert. In contrast, a state of arousal exists

when an individual is said to be aroused by drinking several cups of caffeinated coffee. Researchers often interchange meanings of arousal from state to trait even within a single study.

Historically, researchers have struggled with operationally defining the concept of arousal. Some individuals such as Sokolov (1963) and Malmo (1959) have described arousal as a unitary process, which acts as an overriding mechanism to direct an organism into a state of rest or activity along a continuum. Other individuals such as Lacey (1967) have viewed arousal as a multidimensional process. Lacey (1967) stated, "In lower animals, … we may in truth speak of different kinds of arousal — autonomic, electrocortical and behavioral. They are functionally and anatomically separated by appropriate experimental means. Nature's experiments yield confirmatory data in human clinical subjects" (p. 15, 18). Venables (1984) noted that while most psychophysiologists do not adhere to the existence of unitary arousal, many nonphysiological psychologists refer to arousal in this way.

In order to avoid confusion in cited works throughout this manuscript the authors' original wording was used. The reader is asked to bear in mind that the following rubrics are all representations of the same term: orienting reflex, orienting response, orienting reaction, and the "What is it" response. The subsequent researchers attempted to explain the concept of arousal and or its components.

Neuroscience research and the study of arousal found its beginnings within the Soviet Union (Sokolov & Vinogradova, 1975). Sokolov (1963) attributed Sechenov with deriving the notion of perception as a system of reflexive acts and the establishment of a research agenda that investigated the "physiology of sensation" (Schenov, 1952, p. 217).

Kimmel (1979) called Schenov (1952) “the father of Russian physiology” and noted his 1863 book, *Reflexes of the Brain,* delved into the physiological processes of the brain (Schenov, 1956). Schenov hypothesized that the ability of an individual to perceive visually a three-dimensional image was a result of the adaptive reflex activity of the visual analyzer, in other words, light reflexes (Sokolov, 1963). Pavlov (1927) viewed Schenov’s conceptualization of light reflexes as a series of chained conditioned reflexes.

Ivan P. Pavlov. Siddle (1983) described Pavlov’s work as an attempt to differentiate certain types of unconditioned and conditioned reflexes from each other according to their function and the attributes of the stimuli. Pavlov (1927) described the following unconditioned reflexes: freedom, feeding, defensive, and investigatory reflexes. His most distinguished contribution to the field of psychology was the discovery of the investigatory or “what-is it” reflex, developed from his studies of classical conditioning in dogs. Pavlov (1927) used various stimuli such as bells, lights, metronomes, rotating discs, and vibrators, all of which tended to elicit an orienting response in his animals even before the conditioning procedure began. Pavlov (1927) observed that a dog’s conditioned response to a stimulus would not appear if an unexpected event occurred which solicited an orienting response. He stated,

> It is the reflex [orienting reflex] which brings about the immediate response in men and animals to the slightest changes in the world around them, so that they immediately orientate their appropriate receptor organ [eyes, ears, nose, etc.] in accordance with the perceptible quality in the agent bringing about the change, making a full investigation of it. (Pavlov, 1927, p. 12)

In an attempt to control extraneous stimuli, Pavlov constructed a special laboratory, the Institute of Experimental Medicine, in Petrograd that he surrounded with an isolating trench and utilized separate sound-proof rooms (Pavlov, 1960). Pavlov referred to his laboratory as the "silence tower" and conducted research that investigated the role of the orienting reflex and its relationship to conditioned responses. He introduced stimuli to animals and recorded behaviors such as eye movements, adjustment of the ears, and movement of the body and head of the animal toward the stimulus (Pavlov, 1960). Pavlov discovered that stimuli, which were novel and elicited early attentional reactions, would later become effective conditioned stimuli.

Eugene N. Sokolov. Sokolov was credited in 1963 with reintroducing the orienting reflex to Western researchers. The orienting reflex occurs when an organism detects a novel stimulus and turns toward the stimulus. The defense reflex is evoked when an organism detects a noxious stimulus and either aggresses, freezes, or flees. Through the completion of his book, *Perception and the Conditioned Reflex,* Sokolov (1963) changed conceptions of the orienting reflex from being treated as something to be avoided in studies of classical conditioning to being viewed as indispensable responses that contribute to adaptation and learning. The orienting response was perceived as a reflexive tool of adaptation, which varied in its intensity based on individual interpretation of stimuli and the specific significance it held for the individual.

Sokolov et al. (2002) described the orienting responses as a system for collecting information from the environment and as a component of exploratory behavior. This point was illustrated by Voittonis (1949) who observed the exploratory behavior of rats placed in a field divided into two sections by an electric fence. The rats overcame the

electric fence to explore the other side of the field. Voittonis hypothesized that exploratory behavior was a form of learning for the animal and that it drove the rats to investigate their environment. Kimmel (1979) concurred by stating “the orienting reflex provides a foundation for all of the organism’s potential adaptive adjustments to environmental events” (p. 3). Exploratory behavior is adaptively important in order for humans and animals to survive and thrive.

Sokolov’s (1963) model described the orienting response as an involuntary, reflex-like response of an organism to changes within the environment. He differentiated between the orienting, defensive, and adaptive responses. Sokolov viewed the orienting response and the defensive response as two arousal systems (Dawson & Lewy, 1989). The orienting response was evoked by stimuli with mild to moderate intensity and served to optimize conditions for the perception of the stimulus, while the defensive response was evoked by harmful stimuli with high intensity and served to reduce the effects of the stimulus on the organism (Dawson & Lewy, 1989). Berlyne (1960) noted that in a case where a change in a stimulus occurred, an orienting response may be elicited from an organism, which could be followed by an adaptive response. An organism’s adaptive response would function to counteract stimulation by desensitizing the organism to the change in the stimulus, thus allowing the organism to return to an optimal state of functioning. Sokolov identified the adaptive reflex as a group of homeostatic reflexes and described them through the example of the regulatory response of the body to cold and hot temperatures.

When an individual was exposed to a certain level of temperature change, certain physiological events took place. When exposed to cold temperature an individual would

experience a constriction of blood flow to the head and fingers as a reaction to the temperature change. Conversely, when an individual was exposed to hot temperature he or she would experience an increase in blood flow to the head and fingers as a reaction to the temperature change. Sokolov (1963) noted adaptive reflexes were specific to a particular type of stimulus and exhibited changes in sensitivity specific to the senses involved such as pupilary dilation in response to changes in light. He hypothesized that the action of the adaptive reflex was contingent on the continued presence of the stimulus and in fact would become more stable and pronounced upon repeated presentations of the stimuli.

The defensive reflexes also served to counteract stimulation. Berlyne (1960) noted that the stimuli that evoked defensive reflexes possessed qualities of high intensity or pain. Sokolov (1963) described defensive reactions as incidents of running away or withdrawing part of the body from a harmful stimuli as well as aggressive movements which served to remove or destroy the target stimuli. When compared, distinct differences in the orienting and defensive responses were acknowledged by Sokolov and Cacioppo (1997): (a) the orienting response was elicited by low or moderately intense stimuli where the defensive response was elicited by high intense stimuli; (b) the orienting response was associated with reciprocal blood restriction within the peripheral nervous system and a dilation of blood vessels within the brain, whereas the defensive response is associated with increased peripheral blood flow and brain blood flow restriction.

Sokolov and Cacioppo (1997) noted further differences between the orienting and defensive responses: (a) an orienting response had a similar autonomic signal to the onset

and offset of a stimulus due to the fact that both were changes in stimulation whereas the defense response exhibited a larger autonomic response to stimulus onset than stimulus offset; (b) the orienting response habituated quickly to stimulus repetition, whereas the defensive response was strengthened or weakened much more slowly as a result of stimulus repetition.

Sokolov (1963) further hypothesized that if stimuli encountered by an organism did not match the mental image previously constructed by the organism, then an orienting response was elicited. When properties of the stimulus matched the mental image the individual had constructed, habituation occurred. In other words, habituation occurred when a stimulus no longer evoked an orienting, defensive, or adaptive response from an organism. The organism becomes familiar, uninterested, and satiated by the stimuli due to repeated exposure. However, any pronounced change in the stimuli might have resulted in dishabituation, thus eliciting the orienting response again.

Posner, Rothbart, and Thomas-Thrapp (1997) pointed out that Sokolov showed that not all sensory stimuli elicited orienting. In fact, sensory stimuli can be habituated when repeated exposure to the stimulus showed it to be without significance. The process of orienting depended on the stimulus itself and the previous experiences of the individual (Posner et al., 1997).

Pribram (1979) attempted to locate the structural parts of the human brain that contributed to Sokolov's neuronal model and hypothesized that the fronto-limbic forebrain was involved in habituation. Pribram (1979) hypothesized that arousal or the orienting response influenced the limbic system and the cerebral cortex. He stated, "the controlled, context-dependent, episodic [learning] was a manifestation of fronto-limbic

function, and the automatic, context-free, semantic [senses] … had references to the functions of the posterio-lateral cerebral convexity" (p. 11).

Robert B. Malmo. Malmo's (1959) activation theory is a unidimensional concept of arousal that ranges from being in a coma, to an experienced heightened state of excitement, to being highly stressed. He posed a unidimensional model of arousal that served as a foundation that facilitates the shift of an organism from a resting state to a state of activity. Malmo (1959) asserted that arousal processes were part of an individual's drive and that these processes revealed the intensive aspects of behavior, and as such, measures chosen to record arousal would correlate with each other. Malmo envisioned a continuum of arousal represented through recorded physiological measures such as electroencephalographs, skeletal motor, and autonomic measures.

An example of activation theory occurs when an individual is aroused by a stimulus and produces autonomic and electroencephalographic responses such as an increase in heart rate and blood pressure, a decrease in blood flow to the fingers, an increase in palmar conductance, and a decrease in baseline alpha activity. These measured physiological responses were taken to be indicators of a unidimensional concept of arousal. Lacey (1967) noted that activation theory required that correlational matrices of measured physiological variables exhibit a significant communality between measures.

John Lacey. Lacey (1967) argued against a unidimensional concept of arousal. He proposed that electocortical, autonomic, and behavioral arousal may be considered to be different forms of arousal. Fowles (1980) noted Lacey argued that at the very least, two arousal systems exist: one in the reticular activating system and one in the limbic system,

which was more closely tied to an organism's behavioral activation. Lacey disagreed with the practice of using one form of arousal as overriding another form of arousal. He felt researchers made this methodological mistake in their studies because the three hypothesized arousal processes (i.e., electrocortical, autonomic, and behavioral) can occur at the same time.

If a researcher used a specific device to measure one type of arousal process such as electrocortical, then the subject's autonomic and behavioral responses may not be represented in the results. Lacey subscribed to the notion that physiological and perceptual-motor responses under typical conditions are for the most part independent functions that do not function as a unidimensional drive. He noted that physiological measures of arousal, such as EEG desynchronization and heart rate, have historically correlated poorly with one another. In order for arousal to be measured in individuals, researchers search for patterns of arousal by observing an individual over time and in many different situations.

Lacey and Lacey (1970) proposed that directional heart rate changes, which accompany the orienting and aversive response in individuals are directly related to changes within the organism's sensory threshold. Attention to the environment involves an increase in informational input and is associated with heart rate decrease, while inattention to one's surroundings resulted in a heart rate increase. Lacey indicated that heart rate is extremely sensitive and directly related to an individual's arousal level and how efficiently information is processed.

He spoke of electrocortical, autonomic and behavioral responses as exhibiting dissociations. A disassociation between cerebral cortex activity with autonomic and

behavioral responses has been shown through invasive surgical and pharmological animal studies (Lacey, 1967). Taking into account these dissociations of physiological measures, Lacey proposed a multidimensional arousal process that reflected the transaction between the organism and his environment and as such, indicated the intended goal of behavior. He asserted that different somatic processes have specific roles to play in the execution of a diverse array of behavior and interactions with other concurrent responses. These different somatic processes may be evident in different levels depending upon the nature of the interaction of the organism with its environment.

Lacey (1967) coined the phrase "situational stereotypy," which he defined as "different stimulus situations [the nature of the interaction of the organism with its environment], which reliably produced different patterns of somatic responses" (p. 52). He noted several examples of situational stereotypy in which behavior was specific to each stimulus situation: "warm and cold stimuli, tapping telegraph keys, looking at pictures, and listening to auditory stimuli," all of which produced different patterns of somatic responses specific to each stimulus situation (Lacey, 1967, p. 53). Lacey acknowledged that recognizing and detecting external stimuli, with no motor response requirement produced a pattern of responses which consisted of a decrease in heart rate, with an increase in palmar conductance along with other autonomic responses. He stated, "attitudes produced different subjective stimulus situations, even though the stimuli were objectively the same," which was another example of situational stereotypy (Lacey, 1967, p. 53). In other words, an individual's previous experiences contribute to how he or she might react to subsequent stimuli.

Daniel Berlyne. Berlyne (1960) investigated what motivated individuals to pursue perceptual and intellectual activities. He noted that humans historically have pursued interests beyond the point of fulfilling their basic biological needs such as forms of entertainment or curiosity in areas of art and humor. Berlyne (1963) defined exploratory responses as behaviors performed by an organism that modified stimuli and or introduced new stimuli from another source into the immediate environment. He noted that virtually all responses exhibited by an organism had some level of exploratory function and as such, served as a type of stimulation for the organism in a proprioceptive, visual, and or auditory sense. Berlyne (1960) placed exploratory behaviors into the following categories according to the type of response the organism exhibited in reaction to a stimulus: (a) orienting responses, which consisted of a change in posture or turning one's eyes, ears, and or nose toward a stimulus; (b) locomotor exploration, consisted of locomotor movement; and (c) investigatory responses, which effected changes in external objects, by manipulating them.

Berlyne further identified exploratory behaviors as either extrinsic, in which exploratory behaviors introduced cues to guide a subsequent action which led to its own source of reinforcement, or intrinsic, in which exploration resulted in introducing stimuli that was rewarding on its own. He also noted there was a distinction to be made between specific and diversive exploration. Specific exploration provided stimulation from a designated source, while diversive exploration fell under titles of recreation or entertainment and served to secure stimulation with "certain structural properties compatible with a large range of content" or interest (Berlyne, 1963, p. 290).

Berlyne (1960, 1963) asked what characteristics or properties of a stimulus tend to increase the probability that an organism will orient toward it? He hypothesized that the strength and direction of exploratory behavior was affected by a particular group of stimulus elements labeled collative properties. Berlyne (1960) defined collative properties as elements of novelty, change, surprisingness, uncertainty, conflict, and complexity and discussed how they affected the onset and duration of exploratory behavior. He examined how collative properties could be combined to produce similarities and differences, and compatibilities and incompatibilities among elements of an object or event. Berlyne defined the concept of novelty and parceled the term into several different levels.

Short-term novelty referred to stimuli that had never been encountered by an organism before and were considered totally new or stimuli that had not been encountered by the organism within the past few minutes. Long-term novelty referred to stimuli that had not been encountered for a period of days. Berlyne (1960) also described an absolutely novel stimulus as possessing some quality that had never been perceived before, while a relatively novel stimulus possessed familiar elements or properties combined in a unique arrangement that had not been encountered before by the organism. He introduced a habituation hypothesis that was based on the premise that all stimuli were at one time considered novel by an organism and that currently novel stimuli must possess properties that have not yet been classified by the organism and placed in their personal catalogue of stimuli categories (Berlyne, 1960). A second hypothesis was posed by Berlyne, which noted that novel stimuli are similar in that they induce conflict.

Berlyne (1960) stated that an optimal stimulus would possess an intermediate degree of novelty. Such a stimulus would be familiar, but also possess enough of a novel quality to evoke an exploratory response from an organism. Stimuli deemed too novel by an organism could evoke fear resulting in a state of conflict. Stimuli that possessed novel characteristics may also have exhibited elements of change and surprisingness. Change referred to a change or movement that occurred while the stimulus was being explored by the organism.

Surprisingness implied that the stimulus was incongruent or disagreed with the expectation the organism held for the stimulus. Berlyne noted stimuli could also be categorized as incongruent by consisting of combinations of stimuli that were novel but that also contained similar and dissimilar elements the organism had encountered before. Incongruency contradicted an organism's expectations based on past experiences. In other words, the stimuli did not fall neatly into an organism's preconceived notions. Berlyne (1960) felt novel stimulus patterns that possessed degrees of surprise and incongruency aroused levels of uncertainty in organisms. Collative properties of stimuli would vary in their power to evoke exploratory behavior in individuals based on their own previous experiences.

Berlyne (1960, 1963) linked exploratory behavior with the concept of an arousal drive by describing certain physiological aspects of the human nervous system. The reticular formation, located in the brain stem, was noted by Berlyne to be responsible for an individual's arousal, wakefulness, vigilance, and energy level. He also noted that the reticular activating system interacted with other structures, such as the cerebral cortex, by sending excitatory messages and receiving facilitatory and inhibitory impulses. Berlyne

(1963) stated that messages from the cerebral cortex traveled via the “hypothalamus and central gray matter of the brainstem, which activated the autonomic nervous system and the areas in the palaeocortex and brain stem whose stimulation has been found to have rewarding or punishing effects” (p. 307). The reticular formation includes both ascending pathways that end in the cerebral cortex and descending pathways, which affect motor output (Berlyne, 1960). He noted that the upper portion of the reticular activating system was called the thalamic reticular system and had the capacity to alert broad areas of the cortex while inhibiting others.

Excitation of the reticular formation resulted in an activation pattern or arousal pattern within the individual. The reticular formation was reported to function in an indiscriminant fashion in which it responded in the same way to excitation no matter what external or internal forces activated it (Berlyne, 1963). Electroencephalograph (EEG) results indicated an arousal pattern occurred in an individual by showing a change in waking but relaxed EEG alpha patterns to fast, irregular, low-amplitude patterns (Berlyne, 1960). When an arousal pattern has occurred in an individual, observable differences may be detected in behavior such as appearing wide-awake and alert. Berlyne noted that arousal could be construed as existing along a continuum in which the lower end would indicate a state of sleep or coma, while the upper end would indicate a state of frantic excitement.

Berlyne (1963) linked exploratory behavior with increases in arousal, which occurred when an individual encountered a stimulus that possessed the right amount of collative variables. The individual would react to certain stimuli as a direct result of his or her previous experience with similar stimuli. Berlyne stated that collative stimulus

properties were the “major determinants of the strength and direction of exploratory behavior” and as such affected arousal patterns within the individual (p. 313). Collative stimulus properties were also sources of conflict as previously noted and as such could result in escalating arousal, which was noted to increase as levels of conflict increased. Berlyne (1963) proposed a theory of collative motivation in which he differentiated between arousal potential, level of arousal, and affective tone (i.e., level of discomfort related to drive level).

Berlyne (1963) hypothesized that arousal potentials, which referred to any variable capable of evoking an increase in arousal, have a curvilinear relationship to arousal itself. He described instances of curvilinear relationships: (a) in conditions of sensory deprivation, arousal may mount but arousal potential may fall inordinately low; (b) as stimuli that exhibit a decrease in intensity begin to approach the absolute threshold, such as a person who is trying to hear a speaker whose voice lowers to an almost inaudible whisper arousal may go up; and (c) an unexpected delivery of bad news can leave a person in a state of shock or in a trance-like state. Berlyne also noted that individual arousal patterns or drives have distinct thresholds. Some individuals are rarely shaken by stressful situations where others “fall apart.” Individuals may exhibit nervous tendencies or appear to react to situations “as cool as a cucumber.” An individual is affected by many different factors, such as collative stimulus properties and previous experiences that interact with their arousal drive to produce behavior.

Berlyne (1963) proposed that an organism was capable of a minimum level of arousal at anytime and the precise level of arousal depended on internal and external conditions. If an individual suffered from sleep deprivation, his or her level of arousal

might be quite low. However, if the same individual had been placed in an environment filled with loud noises and lights for a period of time, his or her arousal level might be quite high (Berlyne, 1963). In the average individual, Berlyne noted that one's arousal level might fall somewhere in the middle between the upper and lower extremes previously mentioned. However, when one's arousal level is raised above or lowered below its natural resting state, a condition of conflict and discomfort within the individual may arise. It is this conflict that motivates the individual to either escape from his or her current environment or seek out and explore new stimuli. The action of exploratory behavior is a result of the individual's attempt to restore balance to his or her arousal pattern or drive, thus alleviating any discomfort or distress experienced by their heightened or lowered arousal level.

Geraldine Dawson and Arthur Lewy. Dawson and Lewy (1989) examined patterns of arousal for individuals with autism. They defined arousal as "the complex patterns of cardiovascular, respiratory, and central nervous system (CNS) changes that accompany different states of responsivity to external stimuli" (Dawson & Lewy, 1989, p. 49). Porges (1976, 1984) posed a hypothesis for a two-component model of attention. The first component consisted of an orienting response, which referred to an individual's initial involuntary reaction to external stimuli influenced by stimulus properties such as intensity, novelty, and unpredictability. The second component consisted of voluntary, sustained attention toward an external stimulus and is influenced by symbolic qualities of the stimulus. Dawson and Lewy (1989) proposed that children with autism exhibited "deficiencies in arousal modulation, attention to social and nonsocial stimuli, and socioemotional impairments all of which are closely linked" (p. 69).

Dawson and Lewy (1989) stated that autism involves a dysfunction of the cortical-limbic-reticular system, which is responsible for the basis of attention to novelty. They noted that individuals with autism may have an abnormal orienting response, indicated by an acceleration instead of deceleration of heart rate when an orienting response is evoked and the failure to habituate. According to Dawson and Lewy (1989) the cortico-limbic-reticular loop is a system of interactive neurons that connect the cortex, limbic system and reticular activating system together. They described how the cortical-limbic-reticular system functioned by noting that properties of stimuli are analyzed and mediated by the primary sensory cortex and hippocampus. Dawson and Lewy (1989) stated "Once the hippocampus detects novelty in a stimulus, the reticular activating system is influenced and sends messages to the cortex" (p. 162). This is exhibited by a disruption in EEG patterns and is accompanied by other physiological changes that all make up the orienting response. According to Dawson and Lewy, the element of the limbic system that is responsible for inhibiting the brain's arousal and making habituation possible is the hippocampus.

Dawson and Lewy (1989) noted several arousal characteristics of autistic children: (a) abnormal orienting response; (b) accelerations in heart rate and reductions in rate of habituation; (c) a failure to habituate; (d) a failure to reinstate to novelty when habituation does occur; (e) heightened aversive, or defensive, responding; and (f) inconsistencies in all of the characteristics mentioned above. Individuals with autism attempt to regulate their own arousal levels through such methods as perseverative behaviors, avoiding unpredictable stimuli and attending to predictable stimuli such as familiar objects. Dawson and Lewy (1989) stated

> Social, emotional, and linguistic stimuli are, by nature, unpredictable and indeterminate. Thus, these types of stimuli are more likely to be novel and arousal-producing. In contrast, object-oriented stimuli, such as pattern, space, and the mechanical aspects of an object, tend to be more predictable (by the characteristics of the object and/or actions on the object), repeatable, and determinate. (p. 53)

Physiological measures of arousal. Sokolov and Cacioppo (1997), Lacey (1967), Graham and Clifton (1966), and numerous other researchers attempted to measure arousal by utilizing physiological measures such as monitoring cardiac responses, blood pressure levels, the dilation and constriction of blood flow to designated areas of the nervous system and organs, and skin conductance activity. Sokolov (1994) investigated perception through color vision and eye and head movements in addition to attempting to map the autonomic components of the orienting and defensive responses.

Posner and Raichel (1994) used neuroimaging methods to investigate the orienting response. As noted earlier, various physiological measures of arousal do not produce a unidimensional measure of arousal. Fowles (1984) referred to the incongruencies apparent in the various indices of arousal as a “Tower of Babel like” state of affairs. He stated “the indices spoke in diverse tongues with so little in common as to render a unitary concept of arousal meaningless” (Fowles, 1984, p. 143).

Summary of Arousal History

Even though there is disagreement as to exactly how arousal physiologically comes to fruition, all parties concur that arousal is a necessary component of life. Without arousal an individual would not orient to food, shelter, or water, nor would they detect a

life-threatening stimulus. An individual without the capacity for arousal would consequently not be able to adapt effectively to the ever-changing world of today. Problems currently exist in the ability of researchers to measure arousal. Perhaps a further examination of the many possible types of arousal is needed. There may be many types of arousal that, due to the lack of reliable and valid assessment instruments, have not yet been discovered.

Affect

Affect History

Researchers, have attributed characteristics of emotion to the term affect, these characteristics commonly incorporate terms such as anxiety, depression, and aggression. Affect in relation to humans continues to influence our society substantially today from commercials that show delectable food or fancy cars to criminal activity that occurs daily. Historically researchers have explored affect through two lines of thought: (a) behaviorism, which consists of the examination of stimuli response patterns in animals such as dogs, cats, rats, and humans; and (b) mentalism, which involves the investigation of individuals' immediate consciousnesses, mental states, and motivations. Pioneers in the field of behavior analysis included Edward L. Thorndike (1911) and John Watson (1914). Thorndike (1911) described the incongruencies that existed at that time within the field of psychology with regard to the study of behavior when he stated,

> Again, much time was spent in argumentation about the criteria of consciousness, that is, about what certain common facts of behavior meant in reference to inner experience. The problems of inference about consciousness from behavior distracted attention from the problems of learning more about behavior itself.

> Finally, when psychologists began to observe and experiment upon animal behavior, they tended to overestimate the resulting insight into the stream of the animal's thought and to neglect the direct facts about what he did and how he did it. (p. 3)

Edward L. Thorndike. Thorndike (1911) hypothesized that all learning consisted of the automatic formation of an association between a stimulus situation and the correct response. He noted that intelligence is a function of the number of connections learned and as such, occurs through an organism making a direct connection between a stimulus and its response (Bolles, 1975). Thorndike's hypothesis of learning was contrary to the popular ideas of the time. Historically, man and animal were perceived as inherently different, with humans acquiring knowledge through an intellectual process that involved the conceptualization of ideas, experience, and knowledge of logical relationships whereas, animals functioned through the use of instincts and reflexes. Through his theory, Thorndike narrowed the rift between man and animal through the proposition that both learned through stimulus response connections.

Thorndike (1911) wrote *Animal Intelligence*, in which he introduced his law of effect, which posed that learning occurs only if the response derived has an effect upon the environment. If the effect of the response is pleasing, then learning occurs. If the effect of the response is unpleasant, learning also occurs, but the behavior evoked is weakened rather than strengthened. The associations or habits of organisms become strengthened or weakened by the nature and frequency of stimulus response pairings. Thorndike (1911) noted "The greater the satisfaction or discomfort [for the organism], the greater the strengthening or weakening of the bond [between stimulus and response]"

(p. 244). Thorndike devised a method in which he posed that learning could be explained through observable, measurable, and repeatable means. He also introduced the notion of reinforcement.

In addition to the law of effect, Thorndike proposed two other laws: (a) the law of readiness, which hypothesized that a series of responses can be chained together to satisfy some goal that will result in annoyance if blocked, and (b) the law of exercise, which hypothesized that connections become strengthened with practice and weakened when practice is discontinued. The law of readiness dealt with motivation, and, interestingly, Thorndike conceptualized that motivation could be seen as "the particular pattern of readiness that exists in the nervous system at a particular moment" (Bolles, 1976, p. 17). Bolles (1976) noted that Thorndike also proposed the "spread of effect" idea, which posed that rewards affect not only the connection that produced them but temporally adjacent connections as well. Thorndike also hypothesized incorrectly that transfer of learning is dependent upon the presence of identical elements in the original and new learning situations; therefore, transfer of learning was always specific, and never general.

John B. Watson. Watson (1913) mirrored Thorndike's view of behaviorism by stating,

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness. The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and

> brute. The behavior of man, with all of its refinement and complexity, forms only a part of the behaviorist's total scheme of investigation. (p. 158)

Watson (1914) hypothesized that when a stimulus and response occur in close proximity, the connection between them is strengthened. The strength of the connection increases as the number of occurrences increases. Watson differed from Thorndike in the respect that he did not subscribe to the concept of reinforcement. Watson attributed behavior to connections formed through repetition of the stimulus response pattern. He proposed a neurological model in which a stimulus produces activity in a specified part of the brain and a response is produced in another part of the brain. When this occurs simultaneously, neural pathways are strengthened and learning occurs.

It should be noted that Watson hypothesized that all neural pathways have already been formed in an individual. He believed that individuals were blank slates, which were molded by society. In an attempt to explicate his theory, Watson and Rayner (1920) evoked fear in their eleven-month old human subject, Albert, by pairing a loud noise [striking a hammer upon a suspended steel bar] with the presentation of a rat. As Albert reached for the rat a loud noise occurred which resulted in Albert falling over to one side, crawling away, or crying. After three trials, the rat alone evoked the fearful behaviors in Albert.

Following six trials with the rat and the sound, Watson and Raynor conducted a series of transfer of training tests, which employed the use of a white rabbit, a dog, and a fur coat. Even though each stimulus was presented alone, unaccompanied by the loud noise, Albert still exhibited fearful behaviors. When tested a few days later in a novel situation, Albert showed little emotion, so Watson conducted additional conditioning

trials, which resulted in Albert experiencing fear in the novel situation. Unfortunately, Albert was removed from the experimental situation before Watson could employ techniques to decondition him from his learned fearful responses. Watson concluded that is was possible for individuals to learn emotional responses from Stimulus-Response pairings within their environment. Albert was made fearful due to his experiences and interactions in his environment.

Clark L. Hull. In his book *Principles of Behavior,* Hull (1943) mathematically conceptualized the notion of motivation and drives as basic components of human behavior and derived a systematic theory of behavior, which could be tested by subsequent researchers. Hull (1943) stated

> The field of behavior theory centers primarily in the detailed interaction of organism and environment. Individual and species survival depend upon numerous optimal physiological conditions; when one of these critical conditions deviates much from the optimum, a state of primary need arises. Need reduction [drive] usually comes about through a particular movement sequence on the part of the organism. Such sequences depend for their success jointly upon the nature of the need and the nature and state of the environment. (p. 28-29)

Hull's (1943) mathematical formula sEr = sHr x D x V x K can be explained through the following example: performance (sEr) is equal to habit strength (sHr) is multiplied by drive (D), the intensity of a stimulus (V), and by an organism's expectation of acquiring a certain stimulus such as food (K).

Hull (1943) noted that a need usually preceded or accompanied an action of an organism, and as such, the need was said to motivate or drive the associated activity.

Berlyne (1960) parceled Hull's concept of drive into three levels, $drive_{1,}$ $drive_{2,}$ and $drive_3$. $Drive_1$ referred to drive as a condition that indiscriminately influenced the level of activity or the energizing effect of drive on an individual. If the organism exhibited a clear-cut response evoked by a stimulus then one dominant response was elicited. However, if the organism exhibited confusion or conflicting responses to a stimulus then a weakened response was elicited. Berlyne (1960) stated,

> Hull's postulate implied that the strength of any response once aroused, would be multiplied by a factor representing drive strength. The difference in strength between the proponent response and its competitors (its net reaction potential) would therefore be multiplied by the same factor. An increase in $drive_1$ would mean an increase in the vigor, persistence, or reliability with which that response was elicited. (pp. 165-166)

$Drive_2$ was noted by Berlyne to represent an internal condition that makes certain overt responses more probable than others. $Drive_2$ exhibited specificity in that it strengthened relevant response tendencies. Specific cues evoked specific behaviors, which were biologically useful in a particular state. If $drive_2$ was functioning at a high rate of intensity the specificity of the behavior elicited may change and would result in an over generalization of stimuli such as, an animal making sexual advances to inappropriate objects.

$Drive_3$ was described as a condition whose termination or alleviation is rewarding to an organism. This drive is credited with promoting the learning of an instrumental response and refers to the actions in which an organism is motivated to escape from

something (Berlyne, 1960). Hull (1943) noted that an individual's learning depended upon the action of rewards and that all rewards were direct instances of $drive_3$ reduction.

Amsel and Rashotte (1984) noted Charles Darwin's influence upon Hull, "Hull believed that once the laws of learning and their relation to innate behavior were discovered, they would be found to be similar in all mammalian species and that individual and species differences could be handled as parametric variations" (p. 14). The authors also quoted Hull as stating "…any set of principles that comprises a viable behavior theory must take into account automatic and adaptive responses of organisms" (Amsel & Rashotte, 1984, p.14). Hull applied Darwin's concept of variability to his concept of behavioral tendency, which referred to the situation in which a stimulus sets up a behavioral tendency where any one of a number of set responses could be evoked. Each response in the set has an equal probability or reaction potential of being elicited (Fantino and Logan, 1979). According to Hull (1943) the response that is most adaptive will be evoked through reinforcement, will have the strongest reaction potential, and will be the one that occurs.

Hull hypothesized that each response has a measurable reaction potential, and by determining all the factors that might contribute to one's reaction potential, a probability value can be assigned to the occurrence of any response in any situation, thus, predicting behavior. Hull's theory proceeded to address interactions among factors, which contributed to reaction potential (Fantino & Logan, 1979). Bolles (1975) noted that during the 1970s, Hull's mathematical postulates fell out of favor with American psychologists and ultimately were disproved. Amsel and Rashotte (1984) described Hull as a behavioral analyst rather than a learning theorist and noted that his less popular

concepts such as goal attraction, purpose, and directing ideas are still applicable. Ultimately, Hull contributed significantly to the notion that theoretical ideas should lend themselves to hypotheses that can be tested through sound scientific means.

Sigmund S. Freud. LeDoux (2003) noted that upon completion of his medical training in Vienna, Freud took a position as a research scholar focusing on the nervous systems of fish and crayfish. Freud (1895) posed the idea that the nervous system consists of neurons, which are distinct but similar in construction and meet together at contact barriers. He hypothesized that contact barriers allow memory and consciousness to occur in an individual. Freud turned his attention to psychology and as a result constructed his psychoanalytic theory of human behavior.

Freud (1920) basically viewed human behavior as deterministic and the product of irrational forces, unconscious motivations, and biological and instinctual drives which evolved during the psychosexual stages that occurred from birth to 6 years of age (Corey, 2005). Bigge and Hunt (1968) stated

> It would be impossible to overestimate the impact of Freud on psychology, or for that matter, on Western civilization in general. His thinking changed the manner in which mental processes are interpreted, gave us a new vocabulary for labeling mental phenomenal, placed sex in a new perspective, and offered a new approach to the treatment of mental illness. (p. 71)

Behaviorists such as Hull were influenced by Freud's deterministic view of behavior, which attempted to show that even unintentional human behavior has specific antecedents that can be identified. Even though many have denied basic components of

Freud's theory, his notions of the unconscious and the id signaled a shift to examine the concept of affect and behavior.

Freud (1949) denoted five stages of psychosexual development that occurred during human development. The oral stage occurred during the first year of life and referred to the need for an infant to suckle at his or her mother's breast in order to satisfy the need for food and pleasure. If these basic needs are not met then oral fixations may result, coming to fruition in the form of personality problems. As the individual matures such problems as mistrust of others or the inability to have intimate relationships may appear. The anal stage was experienced from the ages of 1 to 2 years old and referred to emphasis being placed on the anal zone as a focus of the child's sexual interests. Children derive pleasure from bowel movements, which create sensations within the mucous membranes of the anal region. Freud noted that children gain maturational control over their sphincter muscles, and learn to hold back their bowel movements until the final moment, which created increased pressure on the rectum and heightened the pleasure of the final release. Freud further described the fundamentals of toilet training and noted that if this was not handled properly an individual could develop personality tendencies in later life such as anal compulsiveness.

Next came the phallic stage, which occurred during the ages of 4 to 6 years old, and referred to unconscious incestuous desires that a child develops for his or her parent of the opposite sex. Male children developed an Oedipus complex, while female children developed an Electra complex. The child represses his or her threatening feelings for his or her parent. According to Freud, if parents react badly to their child's desires, possible harm might be inflicted upon the child's future sexual development.

The latency stage occurred for children during the ages of 6 to 11 years and referred to the replacement of a child's previous sexual interests with learning gender roles from his or her same sex parent. Freud identified the genital stage, and noted it occurred at the onset of puberty: age 11 years for girls and age 13 years for boys and lasted until senility. During puberty an individual is obsessed with sexual energy, which tends to derail established defenses. The adolescent must break ties with his or her parents at this time, so they can establish new adult-like relationships.

Bigge and Hunt (1968) described Freud's theory as a form of instinct psychology, which assumed the existence of specific inborn psychological drives. Freud (1949) divided the mind into three regions: (a) the conscious, which referred to awareness; (b) the preconscious, which referred to psychological content that can be brought into consciousness when necessary; and (c) the unconscious, which referred to repressed psychological content that was inaccessible to one's consciousness (Bigge & Hunt, 1968). He emphasized that the content of the repressed unconscious is too distasteful and filled with disturbing content to be dealt with openly.

Corey (2005) noted that Freud's greatest contributions to psychology were his concepts of the unconscious and his delineation of the levels of consciousness. Freud (1949) viewed the unconscious as the source of primal, instinctive impulses, which directed the formation of an individual's personality. He hypothesized that if an individual failed to handle his or her unconscious desires, they would come to fruition in the form of a psychological or physiological illness (Bigge & Hunt, 1968). Freud attempted to investigate the unconsciousness through: (a) analyzing dreams, which he felt were symbolic representations of unconscious needs, wishes, and conflicts; (b) slips of

the tongue and instances of forgetting familiar information such as one's phone number; (c) hypnosis; (d) free-association techniques; (e) projective techniques; and (f) analyzing symbolic content of psychotic symptoms.

Freud (1949) also viewed instincts as a vital part of his theory. He identified the term "libido" to refer to sexual energy, but later modified the concept to include life instincts, which referred to all pleasurable acts. The ultimate purpose was to obtain pleasure while avoiding pain. Life instincts increased the possibility of survival of the individual and involved growth, development, and creativity. Freud also identified death instincts, which he noted increased as a person ages. He emphasized the importance of death by noting that the ultimate goal of all life was inevitable death. Freud acknowledged death instincts for being responsible for an aggressive drive in humans. He noted that humans constantly struggle with both sexual and aggressive drives that inevitably determine their behavior.

Freud (1949) further classified human personality into three processes, the id, the superego, and the ego. The primary system, the id, was comprised of instincts, which are present at birth. Freud noted that the id lacked organization, is insistent, and could not tolerate tension. The id subscribed to the pleasure principle of reducing tension, avoiding pain, and gaining pleasure. Freud further described the id as illogical, amoral, and driven to satisfy instinctual needs.

Freud's superego was defined as the judicial branch of an individual's personality and included one's moral code, which determined if an action was right or wrong. The superego represented the ideal rather than reality and strove for perfection in lieu of pleasure. Freud (1949) further described the superego as consisting of ideals originating

from society and parents that functioned to inhibit the id impulses, coax the ego to substitute moralistic goals for realistic ones, and strive toward perfection.

Freud (1949) described the ego as the executive, which governed, controlled, and regulated an individual's personality. The ego mediated between instincts and the external surrounding environment, and, as such, controlled consciousness and exercised censorship. Freud noted the ego was ruled by the reality principle, which guided the ego in realistic and logical thinking and enabled it to formulate plans of action in order to satisfy the needs of the individual. The ego was the seat of intelligence and rationality. It functioned to control the impulses of the id.

Freud (1949) identified three kinds of anxiety: reality, neurotic, and moral. He defined reality anxiety as fear of danger from the external world. Neurotic anxiety referred to the fear that one's instincts might get out of hand and result in punishment. Moral anxiety was defined as the fear of one's own conscience and resulted in guilt if an individual violated his or her own moral code. Freud noted that ego-defense mechanisms provided an adaptive avenue that enables an individual to cope with his or her anxiety, and, as such, prevent the ego from being overwhelmed.

According to Freud (1949), ego-defense mechanisms served two functions: they either deny or distort reality for an individual. The two functions operate on an unconscious level. Freud identified eleven defense mechanisms, the first of which were: (a) repression, defined as an attempt to remove unpleasant, painful, and threatening thoughts from one's consciousness; (b) denial, recognized as operating at preconscious and conscious levels and functioning to distort what one thinks, feels, or perceives in a traumatic situation; (c) reaction formation, defined as the development of conscious

attitudes and behaviors that are diametrically opposed to one's disturbing desires; (d) projection, referred to the placement of one's own unacceptable desires and impulses onto others; and (e) displacement, consisted of directing one's energy from a threatening object or person toward another less threatening object or person.

Freud (1949) further identified the following defense mechanisms: (a) rationalization, occurred when one justified specific behaviors by manufacturing good reasons for their occurrence instead of the original reasons; (b) sublimation, involved the diversion of sexual or aggressive energy into other channels, that are socially acceptable; (c) regression, referred to the clinging to immature and inappropriate behaviors in reaction to severe stress or challenge; (d) introjection, occurred when an individual takes in or begins to own the values and standards of others; (e) identification, referred to individuals who feel inferior trying to identify themselves with successful causes, organizations, or people they see as successful; and (f) compensation occurred when an individual masked his or her inadequacies or weaknesses by developing his or her strengths.

Burrhus F.Skinner. Skinner differed from stimulus-response psychologists such as Watson, Pavlov, and Sechenov, who believed all behavior was controlled by stimulus arrangements and antecedents. He noted the limitations of classical conditioning and explored the possibilities of operant conditioning where behavior occurs and is controlled by the consequences that follow behavior. Skinner (1938) demonstrated how control was exerted through the use of schedules of reinforcement, shaping, and the influence of discriminative stimuli. He examined how environments influenced and ultimately controlled behavior and did not subscribe to the notion of internal drives and states, but

examined overt behaviors. Skinner (1944) noted Hull's "autistic tendency to create appropriate data (one-third of the graphs in his work *Principles of Behavior* represented hypothetical cases)" (p. 276). Bolles (1975) stated "Skinner has frequently argued that to be useful a law of behavior must be applicable to an individual subject" (p. 122).

Skinner (1938) subscribed to controlled single-subject experiments and as such, used systematic procedures. First, Skinner established a stable baseline rate of responding. Then, an experimental parameter was systematically altered and the resulting change or lack of change, from the original baseline rate of responding was recorded. Finally, the experimenter returns to the conditions under which the original baseline was obtained hoping for a return to original baseline levels of behavior.

Skinner (1938) noted that human behavior can be controlled by reinforcing stimuli, which increases behaviors. He identified primary reinforcers such as food, or the removal of pain as possessing natural, or unconditioned, reinforcing properties. Conversely, actions such as an adult's smiles, praise, or attention, which have been frequently associated with primary reinforcers, become conditioned, or secondary reinforcers. Skinner noted that operant behavior is subject to extinction but, prone to spontaneous recovery, which occurs when behavior like tantruming in a child is extinguished but suddenly resurfaces. Another tenant of Skinner's behavior theory was the rate of reinforcement. Skinner used his famous Skinner box to record the rate at which a rat pressed a bar to get a food pellet and noted that a positive relationship existed between increases in bar presses and the timeliness of the delivery of food.

Skinner (1938) also noted that discriminative stimuli exerts some control over subsequent behavior such as when animals are drinking from a pond and note that the

deep blue water is tastier than the putrid algae ridden water. The animals associated the deep blue color of water with tasty water. Discriminative stimuli do not predict subsequent behavior but they do increase the probability of it occurring. Skinner described how stimulus generalization can occur during operant conditioning, by noting the little girl who learns that her pet is a dog. She will look at other dogs she sees in different settings and even though they are slightly different, she will look at them and say, “Dog.”

Skinner (1938) described components of operant conditioning such as shaping, chaining, and schedules of reinforcement. Shaping was defined as the reinforcement of successful approximations of an individual’s behavior. When an individual is learning to tie his or her shoe, he or she would be reinforced for touching the shoe laces. The next time the individual would be reinforced after he or she had touched the shoe laces and crossed them. Behavior chains were defined as behavior that has been broken into steps and integrated in a chain-like progression. Each step would be an opportunity to provide reinforcement upon its completion. An example would include teaching someone to roll silverware. The silverware rolling process would include a series of observable, measurable tasks, which would proceed in a predictable sequential process.

Schedules of reinforcement fell into two different categories, continuous and intermittent. Continuous schedules of reinforcement entail reinforcing a behavior every time it occurred. Intermittent reinforcement can occur in the form of a fixed-interval, fixed-ratio, variable-interval, and variable-ratio schedules. Fixed-interval schedules involve an individual receiving a reward for the first response after a fixed specified period of time. Variable-interval schedules require that reinforcement is administered

after an average length of time, but the intervals are intermixed and vary. Finally, variable-ratio schedules occur when one varies the number of responses needed to produce a reward.

Skinner (1938) noted that intermittently reinforced behavior was difficult to extinguish when compared to behavior that was continuously reinforced. He also discovered that fixed-interval schedules produce a low rate of behavior whereas fixed ratio schedules produce higher rates of behavior. Individuals on either schedule of reinforcement exhibited a lull in their behavior immediately following reinforcement. Skinner further noted that variable-interval and variable-ratio schedules avoided the lulls produced by fixed schedules due to their nature of unpredictability.

Negative reinforcement was described by Skinner (1938) as the removal of unpleasant or aversive stimuli following the target behavior, which results in the strengthening of a behavior. Negative reinforcement works because an individual performs the behavior to escape and thereby terminate the aversive stimulus. An example of negative reinforcement occurs when an alarm clock awakens a sleeping individual. He or she shuts off the alarm and then rises. The negative stimulus of the sound of the alarm clock going off is removed and the following behavior of getting up is strengthened. Positive reinforcement occurs when the contingent presentation of a stimulus immediately follows a response, which increases the future rate and or probability of the response. Positive reinforcement occurs when, upon the successful completion of a task, an individual is immediately rewarded with a consequence that the individual desires. The key to positive reinforcement is that the consequence must be rewarding and desired by the participant.

Skinner noted that punishment is employed by individuals in an attempt to eliminate behavior. He acknowledged that punishment is widely abused by individuals and is ineffective in the long run. He felt extinction is a better procedure. If a behavior occurred and was not reinforced it was eventually extinguished. Skinner advocated combining extinction with the positive reinforcement of incompatible desirable behaviors.

Jeffery A. Gray. Gray's (1987) theory consists of three interdependent neurologically-based systems that are hypothesized to control behavior: the fight-flight (F/F) system; the punishment system, or behavioral inhibition system (BIS); and the reward system or behavioral activation system (BAS). Gray (2000) stated with regard to the fight-flight system, "avoidance, flight and defensive responses are found in all animal phyla and [as such] the functional relationship between these responses is also predictable" (p. 38). He noted that animals avoid noxious stimuli whenever possible, flee if avoidance was not successful, and aggressively defend themselves whenever flight is impossible or difficult. Gray also acknowledged that for humans, fear and anxiety are related to the specificity of the eliciting stimuli and an individual's prior experience or learning with regard to the stimulus involved.

Beauchaine (2001) noted that the fight-flight system initiates escape behaviors and defensive reactions under conditions of frustration, punishment, and pain and that activity in this pathway is affected by the emotional significance an individual attributes to a stimulus. Gray (2000) identified the periaqueductal grey brain circuits in the hypothalamus, the central gray matter, and the amygdala as being responsible for the mediation of fight-flight responding.

As a precursor to identification of the behavioral inhibition system, Fowles (1980) noted that Gray attempted to examine certain pharmacological agents which appeared to reduce anxiety. Gray (1987) subsequently identified the behavioral inhibition system and hypothesized that it was responsible for the reduction of behavior in punishment and extinction situations. Gray viewed this system as the substrate for anxiety due to the fact that it responds to aversive stimuli and can be altered by anti-anxiety drugs.

Beauchaine (2001) described the behavioral inhibition system as the source of aversive motivational functions, which serve to control passive avoidance and extinction in an individual. Through the production of fear and anxiety, the behavioral inhibition system actively inhibits appetitive behaviors when aversive consequences are anticipated. Gray (2000) hypothesized that neural mediation of the behavioral inhibition system is rooted in both the serotonergic projections of the raphe nucleus and the noradrenergic projections of the locus ceruleus.

Grey (1987) acknowledged that primary punishing and frustrative stimuli act on the fight-flight system, which is dissimilar from the behavioral inhibition system. The commonality that exists between the two systems is that they both act on the behavioral approach or activation system. Fowles (1987) noted that Gray identified a system that acted in opposition to the behavioral inhibition system by serving to activate behavior in response to conditioned stimuli for rewards. Fowles (1987) also noted that Gray called this phenomenon “relieving nonpunishment” and described the system as “an appetitive, reward-seeking or approach system which responds to incentives … [but] also mediates escape and active avoidance behavior” (pp. 89-90). Fowles (1987) seemed to be the individual who named this system as the behavioral activation system. He stated “Since

this system parallels the behavioral inhibition system and has as its major function the activation of behavior in response to incentive conditioned stimuli, it seems appropriate to call it the behavioral activation system (BAS)" (p. 90).

Gray (2000) posed that the behavioral inhibition system provides the core for his theory and serves to mediate certain responses to secondary punishing and secondary frustrative stimuli. According to Gray, this system controls the action, which occurs when an individual detects stimuli, which warn of danger, either through an innate or conditioned process, and reacts with an approach to combined with passive avoidance of the stimuli. Gray (2000) stated "the key issue in all [examination of stimuli] cases will not be simply whether the stimulus signals actual or potential danger but rather the extent to which other aspects of the situation require approach or avoidance" (p. 53).

He also noted that in instances where an individual encounters a novel situation he or she should treat the situation as sources of potential danger and conversely a potential source of reward. Gray discussed two characteristics of novel stimuli: after a period of habituation novel stimuli become neutral stimuli, and a novel stimulus has both the approach and avoidance components of conflict within the same stimulus. The behavioral inhibition system can be activated in any approach-avoidance conflict, and is synonymous with anxiety.

Gray (1987) noted that both the behavioral inhibition system and the behavioral activation system have input to the arousal system through the reticular activating system. He proposed that the neural mediation of the behavioral activation system is rooted in the dopaminergic pathway that includes the ventral tegmental area, the nucleus accumbens, and the ventral striatum. Despite the fact that the two systems both have input to the

reticular activating system, they can be antagonistic in nature and operate in an orthogonal fashion. Colder and O'Conner (2004) noted that psychopathology could result within an individual in the following instances: if the behavioral activating system is dominant an increase in externalizing problems may occur, whereas, if the behavioral inhibition system dominates, then an increase in susceptibility for internalizing problems may occur. A dominance of the behavioral activation system can occur as a result of a strong behavioral activation system or because of a weak behavioral inhibition system.

Joseph LeDoux. LeDoux (2006) described his own research as an attempt to investigate how the brain forms, stores, and retrieves traumatic memories. He noted, "the brain has multiple memory systems each devoted to different kinds of memory functions" (p. 1). According to LeDoux, traumatic memories involve two systems: (a) explicit (conscious) memories mediated by the hippocampus and other aspects of the temporal lobe memory system, such as if you return to the scene of a robbery, you will remember details about the experience; and (b) implicit unconscious memories mediated by the amygdala and its neural connections. These unconscious memories come to fruition in the form of an increase in an individual's blood pressure and heart rate, sweating, and a tightening of one's muscles. LeDoux (2006) stated

> [unconscious memories] are memories in the sense that they cause your body to respond in a particular way as a result of past experiences. The conscious memory of the past experience and the physiological responses elicited thus reflect the operation of two separate memory systems that operate in parallel. (p. 1)

LeDoux (2006) acknowledged,

> Only by taking these systems apart in the brain have neuroscientists been able to figure out that these are different kinds of memory, rather than one memory with multiple forms of expression. The work of our lab has been focused on the neural system underlying the formation of implicit emotional memories. (p. 1)

Through the process of studying how organisms acquire and extinguish fears, researchers have attempted to determine how memories are formed and where they are stored.

LeDoux (2003) noted that studies of patients who had brain damage in the area of the hippocampus showed severe explicit memory deficits could result from hippocampal pathology alone. He noted that some researchers hypothesized that the hippocampus and parahippocampal areas are separate components of the temporal lobe memory system. LeDoux acknowledged that information comes into the hippocampus from the neocortex through the parahippocampal areas, and memories are established in the neocortex by way of the reverse connections. Researchers have recorded the activity of hippocampal neurons in rats moving through mazes and noted that the hippocampal neurons represent space and that the firing of these cells recorded spatially where the rat was and where it was going next (LeDoux, 2003). The researchers monitored the rats as they slept and observed that the hippocampal records of the rats' travels through the maze were encoded by place cells and played back during sleep which led to the hypothesis that the hippocampus slowly feeds new memories to the cortex during sleep.

LeDoux (2003) described the arrangement of neurotransmitters in the brain stem and noted that monoamines, which are found mainly in the brain stem and produce substances like serotonin, dopamine, epinephrine, and norepinephrine, communicate through axons to widespread areas throughout the brain, which facilitate or inhibit the

actions of glutamate or GABA (gamma-aminobutyric acid). Glutamate has numerous roles in the body, one of which is its job as an excitatory transmitter in the brain, while GABA serves as an inhibitory transmitter in the brain. These monoamines produce global changes in many brain areas at once, resulting in conditions such as states of high arousal, which occur throughout the brain when an individual detects danger or a potential threatening stimulus.

LeDoux (2006) acknowledged the importance of investigating the basic biology of the fear system in an attempt to reveal important information both about where emotions come from and what goes wrong in emotional disorders. He employed classical fear conditioning techniques in order to investigate emotional memories (LeDoux, 1998). In fear conditioning, the subject receives a neural stimulus such as an auditory tone in connection with some unpleasant event such as an electric shock. Consequently, the neutral stimulus (auditory tone) acquires an association with the unpleasant event (electric shock) and as a result, evokes protective reactions in anticipation of danger from the subject.

LeDoux (1998) investigated fear through the amygdala, which he identified as the key to the fear pathways in the brain. He noted that damage to this area dramatically changes the way animals and people behave when they are faced with danger. Human studies, which have involved temporal lobe lesions restricted to the amygdala, have shown deficits in fear conditioning (Bechara, 1995), and the ability to perceive fear in facial expressions (Young, Aggleton, Hellawell, Johnson, Broks, & Hanley, 1995). LeDoux (1998) stated “Fear is a normal reaction to threatening situations and is a common occurrence in daily life. When fear becomes greater than that warranted by the

situation, or begins to occur in inappropriate situations, a fear or anxiety disorder exists" (p. 1229).

LeDoux (2003) noted the amygdala detects danger and can be described in terms of a three-level excitatory chain of cells which trigger the release of glutamate (an excitatory transmitter in the brain), which in turn activates projection cells (neurons with long axons) in the sensory systems to subsequently excite projection cells in the amygdala, and ultimately activate projection cells in motor control areas. He acknowledged that amygdala cells receive inputs from the sensory world on a continual basis but, ignore most of them. The amygdala cells are activated when the right kind of stimulus is present that signifies danger or another biologically significant event. Inhibitory neurons that release gamma-aminobutyric acid (GABA) keep the amygdala cells from becoming activated with irrelevant stimuli. The process of a noxious stimulus evoking fear in an animal or individual is an adaptive process that serves to facilitate survival. He acknowledged that the lateral amygdala is a key site of plasticity during fear learning and serves as the input zone for stimuli.

LeDoux (2003) noted, when the lateral amygdala's nucleus detects a threatening stimulus, the central nucleus initiates the expression of defensive behaviors such as freezing and changes in blood pressure and heart rate, accompanied by stomach contractions and sweat gland activity. LeDoux (2003) and his colleagues conducted studies that indicated that the lateral amygdala receives input about stimuli through two pathways: (a) a crude but fast influx of information from the sensory thalamus which bypasses the neocortex and (b) a slower but more complete representation from cortical sensory areas that involves the path of the thalamus through the cortex to the amygdala.

The latter path involves information about objects and experiences to initiate fear reactions. LeDoux noted that the pathway from the thalamus to the amygdala can detect the intensity or loudness of a stimulus and contains less synapses than the cortical route thus, providing faster temporal processing. Cells in the lateral amygdala respond to information directly from the thalamus at a much faster rate than from the thalamus, cortex path. LeDoux (2003) emphasized that the amygdala engages in implicit processing, including implicit learning via both types of pathways.

Sotres-Bayon, Bush and LeDoux (2004) defined fear extinction as the ability to adapt as situations change by learning to suppress a previously learned fear and described the process as "a gradual reduction in the capacity of a fear-conditioned stimulus to elicit fear by presenting the conditioned stimulus repeatedly on its own" (p. 525). The authors noted that fear extinction is context-dependent and involves the establishment of inhibitory control of amygdala-based fear processes and the medial prefrontal cortex which consists of the following structures: anterior cingulated cortex, infralimbic, prelimbic cortices and the medial frontal gyrus. Sotres-Bayon et al. (2004) noted that under typical circumstances the medial prefrontal cortex and amygdala orchestrate the control of affective states by regulating each other in a dynamic temporal fashion.

Summary of Affect History

Affective behaviors were historically thought of as animalistic behaviors that were to be parceled out or removed from the more sophisticated nature of man. Theorists have evolved from viewing humans as preprogrammed individuals with an already intact set of neuronal connections to seeing humans as highly reactive, dynamic organisms that are constantly learning and adapting to environmental circumstances. Freud (1895) posed

the idea that the nervous system consists of neurons that allow an individual to form memories. Grey (1987) investigated two distinct systems: the BIS and BAS that he hypothesized serve to regulate the way an individual will react to potentially noxious stimuli. LeDoux (2006) further investigated fear and memories by identifying pathways within the limbic and cortical regions that he hypothesized create, store, and communicate memories involving affective stimuli. There is still much research to be done within the area of affect. Even though physiological studies have identified areas of the brain such as the amgydala, and hippocampus, they do not know exactly how memories are created and how arousal and affect come to fruition in the behaviors of individuals.

Cognition

Cognitive History

Numerous individuals paved the way for the development of the intellectual theories of today. Sir Francis Galton has been described as the father of the cognitive testing movement. Galton's (1869) book, *Hereditary Genius*, supported the idea that intellectual ability is inherited. Galton developed the statistical tools of regression toward the mean and correlation, which allowed for the relationships between intelligence test scores and other variables to be examined. Eaves (1984) noted that Galton was responsible for: (a) the creation of the test and questionnaire, (b) introduction of the term eugenics, and (c) utilization of the normal distribution curve as a tool to study individual differences in human attributes. Wasserman and Tulsky (2005) attributed Galton with conducting the first large-scale standardized data collection using psychological tests.

Galton focused on anthropometric measurements. He felt that an individual's intelligence was reflected in his sensory acuity, reaction time, and other physical attributes.

James McKeen Cattell adopted Galton's view of one's physiological attributes reflecting one's intelligence and in 1890 coined the phrase *mental tests*. Sattler (2001) noted that Cattell "… demonstrated that mental ability could be studied experimentally and practically" (p. 130). Contributions from Karl Pearson allowed researchers to employ the product-moment correlation coefficient, the partial correlation coefficient, the phi coefficient, and the chi-square test in order to analyze data collected from intellectual tests.

Cattell's graduate student, Clark Wissler (1901), conducted a research study in which he examined data collected through Cattell's anthropometric measures that used a sample of over 300 undergraduates from Columbia College's School of Arts and School of Mines. He found little to no correlation between the data collected through Cattell's laboratory tests and the students' academic performance (Wasserman & Tulsky, 2005). Wissler's findings ultimately caused researchers to move in new directions to measure intellect.

Charles Spearman summarized the body of anthropometric research to date in his 1904 seminal paper, "General Intelligence Objectively Determined". He acknowledged that acuity measures had shown no correlation with intelligence but noted the methodological flaws that existed in the majority of research that was conducted. Even though Spearman cited Wissler's research as one of the more carefully constructed studies of the day, he noted certain methodological flaws: Wissler's subjects were all Columbia University students which led to restriction of range of ability in his sample.

This affected the magnitude of his correlations. In addition, Spearman noted that the subjects were tested in groups of three and administered 22 tests in 45 minutes. The examiners were instructed to collect descriptive data of each participant and record each subject's head length while conducting the tests. Factors such as a hurried testing session with multiple measurements being taken simultaneously from multiple subjects could affect the reliability of the evaluations.

Spearman (1904) collected data that examined the ability to discriminate visual, tactile, and auditory stimuli and compared them with the subjects' school performance. He found that the measures of discrimination tended to be positively correlated with measures of intelligence. Spearman and Alfred Binet disagreed on what type of test would provide the most effective measurement of intelligence. Binet had investigated reaction times and intelligence but did not see a relationship in his research results.

Alfred Binet was the first person to develop a successful measure of intelligence (Binet & Simon, 1905). Binet believed that intelligence could be investigated best by examining commonplace mental processes instead of sensory acuity as Galton and Cattell had proposed. Eaves (1984) noted that Binet advocated teaching children according to their aptitudes and directing their instruction toward a vocation. Binet collaborated with Theodore Simon to develop the Binet-Simon Scale in 1905. This was the first practical intelligence test that employed items ranked by difficulty and utilized precise instructions for administration. A mental age could be derived as the test score. Stern introduced the procedure of dividing the mental age by chronological age and multiplying by 100 to derive an intelligence quotient (Eaves, 1984).

Henry H. Goddard translated the Binet-Simon Scales to English and distributed the scales in the United States. In 1912, Lewis Terman adapted Binet's scales and developed the Stanford-Binet, which became the most successful American version. The process of evaluating recruits during World War I boosted the wide spread use of psychological and educational tests in the schools. The testing program conducted by the United States Army was one of the most important events in the growth of intelligence testing.

David Wechsler constructed the Wechsler Scales, which, in their various revisions, are the most widely used intelligence tests in the United States today. In 1918, Wechsler enlisted in the Army and served as a wartime psychological examiner conducting individual examinations on recruits. He began to see the incongruities of the results obtained from intelligence tests and an individual's ability to function successfully within his or her environment when recruits who previously held steady well-paying jobs obtained mental age scores of 8 years on the Stanford-Binet scale. In 1939 Wechsler published the Wechsler-Bellevue Scale, which consisted of subtests and items found in the Army test battery used in World War I.

Wechsler synthesized items and subtests of previous tests in order to create the Wechsler scales. He judgmentally assigned subtests to the verbal and performance scales in the Wechsler Bellevue Scale, rather than using an empirical process such as basing the construction of his test on a theory. According to Boake (2002), Wechsler was credited with the following contributions: (a) organization of the Wechsler-Bellevue Scale into verbal and performance scales that could be administered and interpreted separately, (b) employment of deviation standard scores, (c) provision of a statistical basis for

interpreting the subtest profile and verbal-performance discrepancy, and (d) use of a large standardization sample, spanning from childhood to adulthood that was selected in a precise manner.

During the 1940s clinical psychology grew rapidly and culminated in psychology becoming an established profession. The Stanford-Binet and the Wechsler-Bellevue Scale were in wide use within the United States. As intelligence tests were revised, the latest statistical methods were incorporated. Theorists were able to analyze and compare intelligence tests and their data in a more sophisticated fashion, which in turn spawned theoretical perspectives of intelligence.

Cognitive Theorists

The construct of intelligence has been pondered throughout the history of mankind. Different researchers have taken divergent paths in order to uncover the source of intelligence or to define it. Some psychometric theorists, such as Spearman (1904), have investigated cognition as a unitary construct, while others felt it was a collection of abilities, which could be broken down into three strata (Carroll, 1993). Still others such as Luria (1979), Sternberg (2005), and Ceci (1990) adopted a nature-nurture approach and examined how different aspects of cognition are interrelated to each other and interplay with genetics and the environment.

Psychometric Theorists

Sattler (2001) noted that factor analytic theorists could be categorized into two groups: those who hypothesize a general factor (g) theory of intelligence and those who favor a multiple-factor theory. The early factor theorists conducted research that employed exploratory factor analysis in an attempt to uncover the nature of intelligence.

Several cognitive factor theorists' work are noted in the following section and their contributions to the development of the field of psychology are acknowledged.

Charles E. Spearman. Jensen (1993) referred to Spearman as "the father of classical test theory" (p. 47). He was the pioneer of factor analysis and developed the statistical techniques of correction for attenuation and Spearman's rank-order correlation coefficient. Spearman's theory of intelligence was detailed in his 1904 seminal paper, "General Intelligence Objectively Determined and Measured." Wasserman and Tulsky (2005) attributed Spearman with the first attempt to develop an empirical theory of intelligence. Spearman's correction for attenuation was a mathematical formula, which took into account the error of measurement that exists within correlations and provided a correction for unreliability. It answers the question, what would be the correlation between the two variable measures if both measures were perfectly reliable. Spearman's rank-order correlation coefficient allowed for variables on an ordinal scale to be correlated. He was the first to analyze psychological measures through the use of a correlation matrix and to compare the results with other measures in order to investigate the relationship of one measure with another. In his 1904 paper he set the precedent for a systematic use of correlation research.

Cattell (1987) noted that Spearman tried to determine whether intelligence was "a single power or a bundle of very unrelated abilities — a crowd of faculties" (p. 7). Through the process of factor analysis, Spearman analyzed data he collected from children on a range of sensory functions and discovered that by arranging the tests in descending order according to their correlation coefficients along the edge of the matrix a

hierarchy emerged. The correlation coefficients decreased in size from above downwards and from left to right. Cattell (1987) noted

> He showed that the existence of a hierarchy is compatible with the theory that every ability can be divided into two contributions: (a) a general mental ability which it shares with all other abilities, and (b) an ability absolutely specific to that performance. (p. 23)

Spearman described the first contribution as the general factor of intelligence, which represented the concept of mental energy.

Arthur Jensen. Jensen has amassed a formidable body of work, which used factor analysis to investigate the nature of Spearman's theory. Vernon (1998) described Jensen as "one of the major figures in the history of the psychology of individual differences" (p. 270). Brody (1992) stated, "At the center of Spearman's paper of 1904 is a belief that links exist between abstract reasoning, basic information-processing abilities, and academic performance. Contemporary knowledge is congruent with this belief" (p. 349). Jensen's work continues to build upon Galton's anthropomorphic measures and Spearman's notion of "g" through such avenues as the exploration of reaction times in relation to intelligence. He hypothesized that the characteristics of the nervous system determined an individual's reaction time and that individuals whose nervous systems function in a more effective fashion develop more complex intellectual skills. Jensen (1993) described the general factor, *g*, as "the highest order common factor in all complex tests of cognitive abilities" (p. 47).

Louis L. Thurstone. Brody (1992) described Thurstone as an American psychologist who in 1938 constructed a theory of intelligence based on the possible

existence of specific abilities. Thurstone (1938) described these specific abilities as primary mental abilities. Thurstone (1933) developed multiple factor analysis, and employed the process of oblique rotation, which allowed factors to be related. By employing this procedure he examined correlation matrices in order to identify the number of factors that accounted for the relationships among the tests included in the matrix (Brody, 1992). Throughout his analysis he used the term mental ability to identify "a constellation of tests which lie in the same cluster in the factorial analysis and which correlate nearly unity when they are corrected for attenuation" (Thurstone, 1933, p. 17).

Thurstone required that the factor matrix include a maximal number of near-zero loadings; this was called rotating to simple structure (Carroll, 1997). This process allowed factors to be examined at the same time. Thurstone identified several primary mental abilities: verbal, perceptual speed, inductive reasoning, number, rote memory, deductive reasoning, word fluency, and space or visualization. Consequently he developed a theory of intelligence based on the existence of these specific primary abilities, which did not include the acknowledgement of Spearman's *g*.

Raymond B. Cattell. Spearman and Thurstone's theories were investigated by Cattell. He hypothesized that Spearman's *g* could be divided into two factors. Cattell based his work on Thurstone's primary mental abilities. He developed the Gf-Gc theory, which posits the view that cognition consisted of two broad factors: fluid ability and crystallized ability. Cattell was further influenced by research conducted by Hebb (1942), in which changes in intellectual ability in individuals with traumatic brain injury were investigated.

As Brody (1992) noted, “Hebb developed two factors for intelligence called intelligence A, which was the basic biological capacity to acquire knowledge, and intelligence B, which was ability that was influenced by acculturation” (p. 18). Cattell utilized second-order factor analysis of oblique factors and construed two factors that he labeled factor $g_{f,}$ fluid ability, and factor $g_{c,}$ crystallized ability. The fluid ability factor was derived from tests that measured inductive reasoning and spatial reasoning. Crystallized ability was defined by tests that attempted to measure the influences of one’s schooling and acculturation, such as vocabulary tests (Brody, 1992). Cattell argued that possibly five second-order factors existed: g_f, g_c, visualization, memory, and a cognitive speed factor.

Cattell acknowledged that in instances of traumatic brain injury, certain events in prenatal development, and nutritional concerns could affect an individual’s intellectual ability (Brody, 1992). He attempted to develop “culture-fair tests of intelligence,” which allowed individuals to deal with novel problems requiring reasoning and hypothesized that biological changes in an individual affect g_f to a greater degree than g_c (Brody, 1992). Cattell hypothesized a relationship between age and an inevitable decline in fluid reasoning, which he did not relate to crystallized ability. He asserted that fluid ability was directly related to an individual’s crystallized ability. In other words, an individual who possessed limited fluid reasoning would find his or her crystallized ability also limited.

However, if an individual had an optimal level of fluid reasoning, he or she may not have achieved a certain level of crystallized ability due to environmental circumstances. He noted that fluid reasoning represented an individual’s ability to acquire

knowledge. One cannot acquire knowledge without a certain level of ability being present.

John Horn. Cattell's student, Horn, conducted further work on Cattell's theory of fluid and crystallized intelligence. He, like Cattell, disagreed with the notion of general intelligence and did not support a unitary theory (Horn & Blankson, 2005). Horn and Blankson (2005) described an "extended Gf-Gc theory" which allowed relationships for visual, auditory, and basic memory functions to be represented as broad abilities (p. 45). Horn's extended Gf-Gc theory lists the following ten second-stratum abilities: fluid ability, crystallized ability, visual processing, auditory processing, short–term memory, long-term memory, processing speed, decision speed, quantitative knowledge, and reading and writing skills. Horn proposed the existence of 55 primary abilities and postulated that these abilities are independent from each other. He noted that some of the factors exhibited an age-related relationship while others did not and stated that different factors have different relationships in terms of the influence of behavioral genetics, school, occupational performance, and neurological variables (Horn & Blankson, 2005).

John B. Carroll. Jensen (2004) deemed Carroll "grandmaster of quantitative cognitive science" (p. 1). Carroll was a student of B. F. Skinner and Thurstone. He introduced the concept of elementary cognitive tasks (ECTs) in an effort to quantify the measurement of the basic processes involved in variation in human cognitive abilities. He assigned response time as the dependent variable to very simple ECTs, each one constructed to reflect the cognitive abilities required to complete the designated task.

Carroll's lasting contribution to the field of psychometrics was his cognitive taxonomy entitled *Human Cognitive Abilities: A Survey of Factor-analytic Studies*

(1993). In this previous work, Carroll conducted a meta-analysis of 460 sets of data gathered over the past seven decades and concluded that cognitive ability could be described in terms of a three-strata model. Carroll (1997) described Stratum I as consisting of 60 narrow abilities, such as the ability to perform basic subtraction operations, or the ability to discriminate musical tones. At Stratum II, he proposed that ten broad abilities exist that included fluid intelligence and crystallized intelligence. Within Stratum III, at the apex of the model, the single factor g, exists, which, Carroll hypothesized, is present to some degree in most measures of cognitive ability.

Carroll (1993) stated that, on average, the g factor was found to recover more than half of the total common factor variance in a given test. Jensen (2004) noted Carroll's taxonomy of cognitive abilities and stated "Carroll's magnum opus thus distills and synthesizes the results of a century of factor analyses of mental tests ... it will long be the key reference point and a solid foundation for the explanatory era of differential psychology …" (p. 5).

Philip E. Vernon. Vernon (1964) hypothesized a hierarchical group-factor theory of the structure of intellectual abilities and noted that intelligence can be described as being comprised of abilities at different levels of generality. Vernon (1964) defined a general factor at the highest level, then two group factors; the verbal-educational factor (v:ed), which include verbal and numerical ability, and the mechanical-spatial ability factor (k:m), which included space ability, manual ability, and mechanical information. The next level included minor group factors, which were divided from the two group factors. The final level included specific factors.

Johnson and Bouchard (2005) noted that Vernon stressed the importance of general intelligence in contributing to all mental abilities. He noted that when a general intelligence factor is removed from ability tests, the remaining correlations fall into two groups: (a) v:ed, verbal and educational abilities, which can be learned through an individual's experiences and education; and (b) k:m, perceptual speed, psychomotor, and physical abilities, which are developed in non educational activities. Vernon (1964) did not construct a factor that was comparable to a general fluid factor, instead he considered the factors v:ed and k:m to be influenced through different cultural and educational experiences (Johnson & Bouchard, 2005). Vernon continued to advocate that the general factor of g reflected most of the common variance in intellectual tests.

Joy P. Guilford. Guilford (1967) based his theory a three-dimensional taxonomy of intellectual tasks. He performed a large set of factor analyses that he reported resulted in the identification of many of the factors he eventually incorporated into his theory (Brody, 1992). Guilford's factor analyses employed orthogonal rotations that resulted in zero correlations between the factors. He rejected the concept of *g* based on the fact that 17% or 48,140 correlations he computed fell within the interval of -.10 to +.10 (Brody, 1992). However, his results did not support his theory according to Brody (1992) due to the fact that he found that 83% of his correlations actually exceeded .10. Guilford hypothesized that a three-dimensional taxonomy of intellectual tasks existed. He proposed five operations: cognition, memory, divergent production, covergent production, and evaluation. Guilford related these operations to five types of contents: auditory, visual, symbolic, semantic, and behavioral. When Guilford applied an operation to a content, one of six possible products was formed. Guilford defined products as: units,

classes, relations, systems, transformations, and implications. His theory hypothesized 150 first order factors would yield 85 second order factors and ultimately 16 third order factors (Brody, 1992). Guilford's theory proposed that a global factor or "g" did not exist. Guilford also denied the verbal-nonverbal distinction and proposed the four categories of intellect: figural, symbolic, semantic and behavior. Kelderman, Mellenbergh, and Elshout (1981) reanalyzed some of Guilford's data and determined that his orthogonal factors were not evident. Brody (1992) noted that Guilford's theory did not have empirical support. The factor structure that Guilford hypothesized had not been shown in analyses of his data.

Ecological Theorists

The following theorists departed from the psychometric theorists in that they felt the previous psychometric approaches were not fully capable of investigating the diverse construct of human intelligence. While the psychometric theorists attempted to uncover the specific facets of intelligence through measuring an individual's performance with specifically designed tasks and instruments, others developed theories that hypothesized human behavior was a function of an interplay of genetics and environment. These latter theorists took into account an individual's culture and experience and attempted to examine how these factors could affect one's intellectual functioning. Ceci, Rosenblem, de Bruyn, and Lee (1997) noted Anastasi's 1958 Presidential Address to APA that called for a departure from the current practices of trying to determine how much variance was accounted for by genetics and environment. She also addressed the pressing issue of how do phenotypes develop in human beings and what major determinants cause significant qualitative differences in human intelligence.

Alexander R. Luria. Luria's (1973) theory was derived from his work in neuropsychology and incorporated three functional systems hypothesized to work together to form mental processes. The first functional unit controls arousal and attention and is hypothesized to be associated with the brain stem, diencephalon, and medial regions of the hemispheres (Das, Naglieri, & Kirby, 1994). Luria (1979) noted that in order for an individual to acquire knowledge in an efficient manner, an optimal state of arousal or a state of wakefulness must be achieved, and this in turn affects one's ability to direct attention.

The second functional unit's processes are regulated by the occipital, parietal, and temporal lobes posterior to the central sulcus of the brain and are responsible for the successive processes and simultaneous processes (Das, Naglieri, & Kirby, 1994). Successive processes involve information that is organized in a linear fashion and is integrated in a chain-like sequence. Simultaneous processing, which also occurs within the second functional unit, incorporates stimuli into groups or categories with similar characteristics and involves the holistic perception of stimuli or the comprehension of grammatical statements, which requires the integration of words into an idea that is meaningful. Das, Naglieri, and Kirby (1994) noted that "simultaneous and successive processing are involved with the acquisition, storage, and retrieval of knowledge according to the demands of the task rather than its modality, method of presentation, or the task's content" (p. 16).

The third functional unit is regulated by the frontal lobes, mainly the prefrontal area, and enables the individual to conduct planning processes, such as the formulation, initiation, and evaluation of the effectiveness of plans (Luria, 1973). Planning processes

exert cognitive control, self-regulation, knowledge, and intention. Luria (1973) described the three functional units as operating together when an individual is required to complete an intellectual task. He noted that some processes play a more dominant role than others, depending on the task, and that all three processes are affected by the previous experiences of the individual and the environment in which the individual exists.

Luria's work emphasized that different cultural traditions affect higher psychological functions in people and lead to qualitative differences (Luria, 1979). He also investigated the positive change in thinking processes that occurred when individuals who were classified as illiterate and devoid of modern compensatory schooling, were exposed to literacy and modern technology (Luria, 1979). Luria was influenced by Vygotsky's experimental techniques, which attempted to measure the way individuals performed elementary and higher psychological functions.

Luria (1979) investigated the interaction of biological and social variables and how they affect the structure of more complex psychological functions. He attempted to examine what types of cultural differences affect thinking by conducting a research study with the inhabitants of Uzbekistan and Khirgizia in Central Asia. Luria (1979) noted that this setting was uniquely suited to his study of cultural influences. During the early 1930s the social climate of the villages was rapidly changing and technological advances were spurred on by the changing of political attitudes of the country. The country was moving toward the "collectivization and mechanization of agriculture" (p. 60).

Luria (1979) presented the residents of a remote village with several tasks designed to investigate categorization, abstraction, verbal problem solving, and self-analysis. The categorization tasks allowed for practical or abstract strategies to be used.

These techniques were designed to assess the way the subjects cognitively conveyed their experience. Luria (1979) reported, “In each of these areas we discovered a shift in the organization of people’s cognitive activity that paralleled the changes in the social organization of their work lives” (p. 64). The participants who were from the isolated areas and were illiterate differed from the literate participants in the way they responded to tasks.

The illiterate individuals solved tasks in a practical, concrete manner relying on direct experience to help them reason. They would categorize objects according to their experience with the objects and relate to them in a very direct concrete manner. If they had no experience with the content of a task, they would not complete it. These individuals would not “imagine” or “project” themselves into a situation in which they had no experience. The other subjects who were literate classified objects and performed tasks in a manner comparable to individuals in other areas of the world that had experience with compensatory schooling or modern socialization. Luria’s (1979) research lent support to the theory that individuals’ psychological processes are shaped by their culture and experience.

Robert J. Sternberg. The Triarchic Theory of Successful Intelligence was described by Sternberg (2004) as an examination of successful intelligence, which he defined as “ the ability to adapt to, shape, and select environments so as to accomplish one’s goals and those of one’s society and culture” (p. 428). Sternberg (2004) noted that successful people recognize their strengths and optimize them while trying to compensate for their weaknesses. He described the basic idea of his theory as the process of “information-processing components of intelligence being applied to experience in order

to serve various kinds of functions in real-world contexts" (Sternberg, 1997, p. 349). Sternberg (1997) viewed his theory as a systems approach and noted that the Triarchic Theory of Successful Intelligence specified analytical, creative, and practical abilities to be of primary importance. He defined analytical abilities as the ability to "identify the existence of a problem, define the nature of the problem, set up a strategy to solve the problem, and monitor one's solution to the problem" (p. 430).

Sternberg (1997) described creative abilities as necessary in generating problem solving options such as taking an unpopular idea and making it popular and then profiting from it. He defined practical abilities as the "acquisition and use of tacit knowledge, which is the knowledge of what one needs to know to succeed in a given environment that is not explicitly taught and that usually is not verbalized" (Sternberg, 1997, p. 430). He described four characteristics which tacit abilities possess: (a) they are acquired through successful experiences; (b) they are mainly manifested within one domain; (c) the acquisition and use of tacit abilities is independent of other abilities; and (c) tacit knowledge has shown an ability to predict criteria of job success as well as IQ.

Sternberg (1997) identified three subtheories: componential, experiential, and contextual. The componential subtheory specified the three processes involved in human intelligence: (a) metacomponents, (b) performance components, and (c) knowledge acquisition components. Metacomponents were described as higher-order processes that aid in constructing a plan of action, monitor the plan as it is executed, and evaluate the planning process after it is completed. They also allow the individual to define the problem, select a collection of lower-order processes for solving the problem, and then select a strategy for implementing the processes. Through metacomponents the individual

can identify and choose a strategy, allocate mental resources, monitor the problem-solving process, and evaluate the effectiveness of the solution after the problem is solved.

Performance components were identified as lower-order processes which serve to execute the directions received from the metacomponents and give feedback. They attempt to establish relationships with newly encoded stimuli and previously encountered stimuli while referencing previous rules applied to stimuli and then offer a response. Knowledge-acquisition components aid in solving problems. These components employ selective encoding to decide what is relevant information during learning. Selective comparison allows one to recognize what information or stimuli are relevant and allows for the conglomeration of selectively encoded information to form a complete picture or integrated whole for the individual.

Sternberg (1997) defined his experiential subtheory as an application of the previous metacomponents to one's experience. Relatively novel experiences would require the individual to apply the metacomponents of intelligence in slightly new capacities that would take the individual beyond what he already knows. Metacomponents are utilized in automatic experiences such as reading, riding a bike, brushing ones teeth with little to no effort, and draw on learned routines. Sternberg (1997) described the contextual subtheory as "the application of the components of intelligence via experience to three life tasks: adaptation to existing environments, shaping of existing environments in order to render them better …, and selection of new environments" (p. 350).

Sternberg (2005) described successful individuals as those who: (a) utilize an integrated set of abilities to achieve success in their cultural context; (b) recognized their

strengths and weaknesses; (c) adapted, shaped, and chose environments; and (d) found equilibrium in the use of their analytical, creative, and practical abilities. He has utilized a diverse array of tasks to attempt to test the subtheories of his Triarchic Theory of Successful Intelligence and promotes his theory as a way to implement interventions in academic settings in order to promote student performance in the areas of analytical, creative, and practical abilities.

Howard Gardner. Sternberg and Kaufman (1998) described Gardner's Theory of Multiple Intelligences as another systems approach theory. Chen and Gardner (2005) stated that human intelligences were orthogonal in nature and as such functioned as autonomous intelligences. Gardner identified eight intelligences: linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, naturalistic, interpersonal, and intrapersonal (Chen & Gardner, 2005). He described each person as having a profile of intelligences, which consisted of his or her eight intelligences, some of which are strengths and some of which are weaknesses (Gardner, 1993).

Gardner (1993) identified a set of criteria that an ability must meet in order to be described as an intelligence: (a) the occurrence of brain damage in an isolated area that might spare another isolated area and not affect a particular kind of intelligent behavior, (b) exceptional individuals exist who demonstrate remarkable ability or deficit in a certain kind of intelligent behavior, (c) a certain set of operations that are necessary to perform distinct behaviors, (d) a developmental history that notes a transformation from novice to expert, (e) a documentation that reflects an increase in intelligence correlated with one's adaptation to an environment, (f) corroborating information from cognitive-

experimental research, (g) evidence from psychometrically sound instruments, and, (h) receptiveness to encoding in a symbol system such as spoken or written language.

Stephen J. Ceci. Sattler (2001) described Ceci's Bio-Ecological Theory (1990) as an attempt to explain the development of intelligent behavior by utilizing the following perspectives: (a) intelligence is a conglomeration of abilities; (b) the interaction of genes and environment at different points in human development produces a change in intelligence; (c) cognitive processes are influenced by the context in which they exist and contextual environments that are motivating to individuals interact with the individual's mental representation of the task and how it is placed in memory; and (d) intrinsic noncognitive abilities such as temperament, physical traits, and motivation significantly affect development.

Bronfenbrenner and Ceci (1994) stated that the Bio-Ecological Theory differs from other biological theories in that it takes into account the specific phenotype events that may effect an individual's development. The authors described proximal processes as "assessable mechanisms … through which genetic potentials for effective psychological functioning are actualized" (Bronfenbrenner & Ceci, 1994, p. 568). Bronfenbrenner and Ceci (1994) listed several types of environmental outcomes that can be affected by proximal processes: (a) modified perception and response, (b) channeling and controlling one's behavior, (c) managing stress effectively, (d) acquisition of skills, (e) creating and maintaining mutually rewarding relationships, and (f) shaping one's own physical, social and symbolic environment. Bronfenbrenner and Ceci (1994) hypothesized that "when proximal processes are weak, genetically based potentials for effective psychological

functioning remain relatively unrealized but they may become actualized to a progressively greater extent as proximal processes increase in magnitude" (p. 569).

The authors hypothesized that as proximal processes are increased, the proportion of one's differences attributable to actualized genetic potential will also rise, thus increasing the heritability factor (Bronfenbrenner & Ceci, 1994). Ceci, Rosenblum, de Bruyn, and Lee (1997) noted the importance of considering distal processes, such as books, parents' education level, etc., in combination to proximal processes due to the fact that distal processes contribute to stability for an individual. The authors noted that there are times in an individual's life, such as during critical periods of development, in which proximal and distal processes are even more important to an individual's development. Even so, proximal and distal processes continue to affect an individual for the duration of his or her lifetime. Ceci et al. (1997) posited that the dynamic interaction of genetics and environment are never wholly separated.

Summary of Cognition

The study of cognition has a rich and vast history. Psychometric theorists such as Spearman, Galton, and Binet helped develop the foundation for the field of cognitive research. Other theorists such as, Luria, Sternberg, and Ceci examined not only cognitive performance but also how an individual's environment might affect their cognitive abilities. The nature nurture debate continues to exist. Theorists such as Jensen and Ceci posed quite different views of the roll heredity can play in intelligence. Jensen viewed heredity and genetics as a major component while, Ceci described the importance of phenotypical development, one's cognitive ability is a result of an inter-play of one's heredity combined with one's environmental experiences. There still is much research to

be conducted in the field of cognition. Once again, it is not clear how arousal comes to fruition in forms of persistence and curiosity or motivation in cognitive endeavors. Nor is it clear what part affect plays, if any, in the roll of cognitive functioning.

Eaves' Integrated Theory of Human Behavior

Eaves' (1993b) integrated evidence from various disciplines to construct a theory of human behavior. He noted that several concepts must be considered when examining his theory of human behavior: (a) the roles of natural selection and adaptation are essential in the origin and survival of *homo sapiens sapiens*; (b) each structure in the human nervous system has an original role that provided an adaptive advantage to our ancestors and still exist today; (c) older structures in human beings did not cease to function after new neurological structures were added; instead, they continued to perform functions similar to those seen in our ancestors; and (d) the study of human behavior would be better served by refraining from assigning lofty goals to *homo sapiens sapiens*, and instead recognizing that humans, like other species, have the ultimate goal of adaptation and survival.

Eaves' (1993b) Integrated Theory of Human Behavior outlined eight key concepts that focused on: the theory of evolution, components of the central nervous system, the significance of neurological structures, memory, neurological behavioral control mechanisms, consciousness, critical periods, and cultural influences. Ultimately, Eaves described human behavior as consisting of five distinct systems: sensory, arousal and attention, affective, cognitive, and the motor systems.

The Significance of Evolution

Adaptive Advantage, Natural Selection, and Survival of the Fittest

Darwin (1859) argued that species selected by nature are those most fit to survive. This is the only intentional purpose intrinsic to a species, thus like other species, humans focus their energies on outcomes that have an adaptive advantage. He noted that the available resources of the planet are inadequate to supply the needs of all the organisms that exist on it and as such, organisms are in constant competition with one another for survival. Eaves (1993b) offered examples of adaptive advantages that species may possess include: (a) producing a large number of offspring thus, increasing the odds that some members of the species will survive; (b) possessing the ability to camouflage oneself against predators thus, evading being killed; (c) being extremely facile in escaping predators; and (d) possessing a propensity for violence, coupled with sharp claws, teeth, and a keen sense of one's environment.

Environmental and Morphological Change

Evolution is a dynamic process in which species that can adapt to changes in the environment, such as a shift in climate temperature or an ensuing drought, are more likely to survive. Darwin (1859) described heritable morphological (i.e., structural) variations as a second way evolution occurs. This involves a new organism being created that possesses one or more genetically distinct attributes. This can occur in several ways: (a) a mutation of the normal genetic structure, (b) cross-breeding of two species or varieties, and (c) the repeating or crossing over of chromosomes during the reproductive process. He noted that in order for an evolutionary change to occur, the morphological change must be heritable (i.e., passed on to offspring genetically), and represent an advantage

over other species who are in competition for common resources. Darwin (1859) also recognized that morphological changes may be of two kinds: (a) an existing structure may change in its function and (b) accretion, which occurs when new structures are added to old, structures (as has occurred in the evolution of the human nervous system).

Eaves (1993b) highlighted the importance of accretion and noted that it does not commonly lead to the elimination of earlier structures and functions. The process of accretion increases adaptive advantages of the organism by adding new structures to the advantages of already existing structures, which continue to perform their requisite functions. Eaves noted that the major components of the human central nervous system (e.g., spinal column, brain stem, cerebellum, limbic system, and cerebrum) are examples of accretions, which are passed on through evolution and enable humans to successfully adapt and flourish in their environments. The process of accretion is a critical part of Eaves' theory of human behavior in that newer structures in the human nervous system perform regulating functions involving older structures, while, the older structures possess a significant degree of independence in directing behavior.

According to Eaves (1993b) the only ultimate goal of a species, including *homo sapiens sapiens*, is successful adaptation. He stated,

> … humans believe that our species exists to fulfill any number of higher-order goals (e.g., to dominate the earth, explore the universe, or discover the meaning of life). Yet, I would argue that although a few humans have some facility in addressing these goals, the overriding majority of humans see little point in these higher purposes. This is especially true when such goals demand great effort, large amounts of time, and have little immediate utility. (Eaves, 1993b, p. 8)

Central Nervous System Components

Mesulam (1998) noted “a major task of the central nervous system is to configure the way in which sensory information becomes linked to adaptive responses and meaningful experiences” (p. 1014). He noted all vertebrates take in information through their senses. The human central nervous system incorporates the following internal processing structures: the brain stem, limbic system, and the cerebrum. Each structure is separate and, as such, has its own functions and characteristics, yet all of the structures work together to produce a highly receptive, dynamic system. This ultimately facilitates an individual’s ability to adapt to their environment. Information is taken in through the senses, and is then processed through the central nervous system, which, in turn leads to the initiation or inhibition of a motor response.

The motor system. Sperry (1952) acknowledged that the whole output of the human brain goes into the motor system. The central organ of the human motor system is the cerebellum, which interacts extensively with other organs, including the tactile, visual, and auditory sensory receptors. The cerebellum processes information concerning equilibrium and the state of muscles and joints, which it communicates to the cerebral cortex, specifically, the motor areas. Eaves (1993b) noted that the cerebellum possess three times as many afferent fibers (i.e., input channels) as efferent fibers (i.e., output channels), which facilitate the synthesizing of a myriad of sensory information into a single signal to a muscle group. He also noted that the cerebellum in humans is highly complex and extremely sophisticated.

Eaves and Williams (2004) stated “All animal species share these two attributes: the ability to be stimulated by changes in the environment and the ability to move in

response to such changes" (p. 1). The cerebellum makes possible a wide variety of motor movements, which range from gross-motor movements, such as the broad jump to delicate fine-motor movements, such as weaving. Eaves noted that the cerebellum regulates motor movement and posture, while others have attempted to attribute higher order processes to it such as reading ability (Moretti, Torre, Antonelli, Cazzato, & Bava, 2003). The cerebellum does not initiate behavior but instead, integrates signals from other brain locations, which come to fruition in observable forms of human behavior.

The sensory system and bilaterality. An individual uses information taken in through his or her senses to make decisions and ultimately to help him or her function within the environment. The senses take in information, which is in turn interpreted by the arousal, affective, and cognitive systems. An important aspect of the sensory system in humans is that it is bilateral in nature. There is an evolutionary advantage to humans possessing bilateral organs. If one organ such as a kidney is damaged, then the other kidney can handle the additional workload. Eaves (1993b) noted four advantages that bilaterality provides for organisms: (a) balance and equilibrium, (b) depth perception, (c) directional orientation, and (d) localization. The chiasma, are the mechanisms that make these advantages possible. A chiasm is an anatomical crossing over of nerve fibers in the central nervous system and occurs in the vision, hearing, touch, and movement systems (Springer & Deutsch, 1998). An example is the optic chiasm, which is responsible for the crossing over of visual information. Stimuli from an individual's right sensory field will be processed within the left side of the brain whereas stimuli from an individual's left sensory field will be processed within the right side of the brain (Springer & Deutsch, 1998).

The arousal and attention system. Arousal has been tied to the reticular formation, which is a netlike set of neurons located in the center of the brain stem that extend from the medulla to the reticular nuclei of the thalamus (Berlyne, 1960). The reticular formation, or reticular-activating system (RAS), takes in sensory information from the major sensory pathways and sends this stimulation via the thalamus to the limbic system and the cortex. Eaves (1993b) acknowledged that the RAS is responsible for arousal and serves the function of alerting the rest of the brain when relevant stimuli are encountered. Individual sensory systems convey specific information directly to their associated cortical and limbic sensory reception areas.

Research has shown that in order for an organism to become aroused, the RAS must be involved; without the RAS a state of arousal cannot be achieved. Fuster and Uyeda (1962) and Moruzzi and Magoun (1949) conducted studies, in which they observed the inability of animal subjects to become aroused by stimulating their higher cortical regions when their RAS are anesthetized. Berlyne (1960) and Sokolov (1963) noted that novel stimuli are more likely to cause arousal than familiar stimuli that the organism has habituated, which results in a cessation of heightened arousal for the organism. Eaves (1993b) averred,

> … the RAS prepares the brain for dealing with novel and potentially important sensory stimuli; it apparently does not serve to determine what responses might be appropriate to those stimuli. The means by which the brain selectively attends to some stimuli while ignoring others are not known. (p. 7)

Luria (1973) proposed that the prefrontal cortex communicates with the reticular formation in order to select which stimuli to attend to and which to ignore. Eaves (1993b)

noted that the process of individuals consciously choosing to focus on some stimuli while inhibiting other stimuli from conscious awareness, ultimately resulting in selective attention, probably involves the frontal lobes. Deutsch, Papanicolaou, Bourbon, and Eisenberg (1988) investigated cortical function involving tasks that required a high attention level. When the path of blood flow in the left and right frontal lobes was compared, the right side showed greater blood flow than the left. According to Springer and Deutsch (1989), the "finding suggest a very general role for the right hemisphere in attention and vigilance" (p. 121).

Williams, Eaves, and Cox (2002) acknowledged that arousal has been investigated and implicated in a wide array of phenomena: the orienting response (Spinks & Siddle, 1983), the defensive response (Mogenson, 1977), curiosity (Berlyne, 1960), habituation and perception (Sololov, 1963), attention (Rose, Feldman, Wallace, & Cohen, 1991), motivation (Revelle & Loftus, 1992), vigilance (Kinomura, Larsson, Gulyas, & Roland, 1996), preference for novelty (Thompson, Fagan, & Fulker, 1991), stimulation seeking (Zuckerman, 1979), and persistence (Lindsley, 1958). O'Gorman (1983) noted that arousal levels are constitutionally and probably genetically variable. Eaves acknowledged that infants vary virtually from birth in their capacity to actively attend to and explore novel stimuli in their environment.

The affective system. Eaves (1993b) noted,

> Based on both animal and human research, it has become clear that the limbic system (i.e., hippocampus, amygdala, septum, cingulated cortex, and mammillary bodies) and the nearby thalamus and hypothalamus (important parts of the

diencephalon) are largely responsible for the selection and display of primitive survival behavior, much of which can be classified as emotional in nature. (p. 7)

LeDoux (2003), Gray (2000), and Fowles (1980) described the universal fight or flight response, which is evident in all animal phyla. The fight or flight response is evoked when the brain identifies a given stimulus as a threat, and a part of the brain, (possibly the amygdala) selects fear or aggression as an appropriate response. A molecule called corticotrophin releasing factor (CRF) triggers the hypothalamus to signal the pituitary gland, which in turn sends adrenocorticotrophic hormone (ACTH) into the bloodstream. When ACTH reaches the adrenal glands, two or more hormones are produced: epinephrine and norepinephrine, which are released into the sympathetic nervous system (Eaves, 1993b).

Kolb and Whishaw (1990) noted chemical reactions result in a myriad of physiological reactions: the liver releases glucose into the bloodstream, heart rate increases, which delivers extra glucose and oxygen to the muscles for needed energy, and blood vessels in the skin contract so that cuts or bites bleed less and coagulate faster. Further physiological reactions include the shutting down of digestive processes in order to preserving the body's energy supply, the chest expanding to increase the oxygen supply, bronchial tubes grow larger, and breathing that is deeper and more rapid. Sweat glands open in anticipation of a rise in body temperature, while pupils dilate. An organism's body hair might stand straight out, producing a defensive display, in an attempt to make the organism appear larger and more formidable (Kolb & Whishaw, 1990).

Eaves (1993b) acknowledged,

> … the behaviors regulated by the hypothalamus and the limbic system are many and varied. The hypothalamus alone is known to regulate: (a) body temperature, (b) water balance (drinking, sweating, and urination), (c) appetite, (d) blood pressure, (e) sexual behavior, (f) fear, (g) aggression, and (h) sleep. In addition, the hypothalamus stimulates feelings of pleasure and pain. (p. 8)

Woodbourne (1967) noted that the hypothalamus functions as a mediator of emotions through its connections with the autonomic nervous system, but it is not involved in the "experiencing of emotion or motivational states" (p. 227). Research conducted by LeDoux (2003) and Gray (2000) lends support to Woodbourne's (1967) proposition that "the limbic system is relatively separate from the strictly informational aspects of cortical function. It is, then, concerned with the affective aspects of experience" (p. 228).

Eaves noted (1993b) that the limbic system and diencephalon serve an adaptive function by enabling organisms to learn from their experiences. Thus, cats are genetically aroused by movements exhibited by unknown stimuli; they are innately attracted to organisms that move away from them, or laterally in the vision field. Kittens, however, do not recognize smaller organisms as natural prey. A transition occurs when the mother cat stops delivering food for the kittens and they begin catching their own food. Eaves acknowledged that certain animals are later identified as prey only after many environmental experiences that are associated with the satiation of hunger. He asserted

> that certain animals who hunt for food in order to survive must learn to recognize which species can be considered prey, which species may be life threatening and best avoided, how to effect the 'killing bite' to different prey, and a variety of other survival skills. It is this ability of the individual to learn from and adapt to

its environment that leads to the great evolutionary advantage of early mammals. (1993b, p. 8)

The cognitive system. As previously discussed, the limbic system and diencephalon gave mammals the capacity to learn from their environmental through direct experience. Primates possess a cerebrum, which gives them an increased capacity to learn and deal with material that is symbolic in nature and consists of more complex and abstract concepts. Language development expands the capacity of the learning process and consequently humans learn adaptive behavior without having to expose themselves to the danger of direct experience.

Eaves (1993b) noted the cortex resides in the outer one-eighth-inch layer of the cerebrum and enables an individual to think by utilizing the following skills: (a) organizing environmental stimuli, (b) communicating symbolically, (c) analyzing elements of a whole, (d) synthesizing diverse data, (e) evaluating and selecting among alternatives, and (f) initiating action. He also acknowledged that underneath the gray matter is the white matter, which contains a profuse layer of fibers that form axon pathways to other parts of the brain. These fibers appear white because the neural axons and glial cells are coated with myelin.

Despite their inordinate number, glial cells only have the following functions attributed to them: (a) they provide a guidance function for migrating neurons during early development, (b) they serve as physical support structures for axons, (c) they provide nourishment to nerve cells, and (d) serve as packaging material to insulate neurons (Eaves, 1993b; LeDoux, 2003; Ornstein (1997). Galambos (1961) has postulated a more intriguing role; he suggested that the glial cells serve as the locations of engrams,

the long sought-after repositories of memories. Although no compelling evidence exists to support or refute Galambos' hypothesis, the sheer mass of these structures invites speculation that glial cells could serve as the metaphorical "hard drive" of the brain, the place where memory is stored.

The cerebrum is bilateral and as such, each of its four lobes (frontal, temporal, parietal, and occipital) resides in the left and right hemispheres. The left and right hemispheres are considered to be lateralized, with each hemisphere exhibiting specific cognitive processes. Eaves (1993b) acknowledged an early hypothesis posed by Semmes (1968) that the left hemisphere operated as a comparatively separate system, which revealed itself when lesions or damage to an area resulted in specific deficits, whereas damage in the same location in the right hemisphere often had no obvious effect on behavior. This led Semmes (1968) to note that the right hemisphere functioned in a widely distributed fashion, which was not localized.

Ornstein (1997) extended Semmes' (1968) proposal by asserting that the left and right hemispheres represent two disparate and distinct cognitive processing styles. Sperry (1974) conducted research, which involved patients who had their corpus collosa severed. Sperry (1974) observed,

> Each hemisphere … has its own private sensations, perceptions, thoughts, and ideas all of which are cut off from the corresponding experiences in the opposite hemisphere.… In many respects each disconnected hemisphere appears to have a separate "mind of its own. (p. 7)

Eaves noted that some researchers have discussed the existence of dichotomous hemispheres (LeDoux, 2003; Ornstein, 1997; Springer & Deutsch, 1998). However, some

neuroscientists, such as Kolb and Wishaw (1990), recommended caution in accepting the notion of dichotomous dimensions. To date, no one has developed a theory to explain this phenomenon.

The Significance of Human Neurological Structures

Eaves (1993b) attributed the human neurological system's evolution to an accretionary process, which referred to new structures being added to older structures. He noted the new structures acquired by an individual exerted moderating influences on older structures, while older structures often retained a substantial degree of independence of function. Eaves acknowledged the spinal cord is shared with all species of the vertebrate family while, the brainstem, located at the top of the spinal cord, is almost all that is needed by fish to survive. As noted earlier, early mammals evolved and added the limbic system, while later mammals and primates evolved the cerebral cortex.

Newer structures allowed the evolved organism to adjust or modify, temporarily, the function of older structures. Eaves (1993b) stated this process can be noted when

> the sympathetic nervous system, the diencephalon, and limbic system increase both heart rate and respiration, while the function of the digestive system is shut down during periods of danger. This gives the organism an increased capacity to respond, depending on the nature of the species and the particular environmental circumstances. (p. 11)

The evolution of the cerebrum provided higher-order mammals additional control over the more ancient structures. This is exhibited when humans react to threats from weaker organisms not with aggression, but with reason or some devised stratagem.

Eaves (1993b) hypothesized that newer structures do not always monitor and adjust the function of older structures. He noted that usually the limbic system does not usurp the regulatory functions of the brain stem and that in times of immediate peril the normal function of the limbic system cannot easily be overridden by the cortex. In these instances the limbic system will usually produce the most advantageous outcome rather than any behavioral strategy devised by the cortex. Eaves (1993b) stated "insofar as environmental events call for functions directly related to a particular brain structure, newer structures may be unable to supersede" (p. 11). He noted that if this proposition is confirmed by research, the semi-independent nature of the limbic system could explain a number of forms of emotional disturbance found in human beings (e.g., murder, rape, and psychotic behavior).

The Role of Memory

The Significance of Memory

Eaves (1993b) stated "It is crucial for survival that individuals respond appropriately to various environmental stimuli" (p. 3). Springer and Deutsch (1998) acknowledged that the majority of neurological disorders affecting more complex mental functions have some impact on memory such as Alzheimer's dementia. When an individual encounters stimuli, an acquisition of skills, retention, and the consequent transfer of training cannot occur unless memory is involved. Eaves noted that humans use long-term memory to store learned strategies that are related to previously encountered stimuli. Two types of long-term memory are semantic memory and episodic memory (Springer & Deutshch, 1998).

Winson (1985) noted while most people understand the function of semantic memory, few recognize the purpose of episodic memory. He posed that an individual's first encounters are the key to understanding episodic memories. First encounters such as the death of a loved one or close friend or the first bite of a soon to be favorite food can be readily recalled. Eaves (1993b) stated,

> The significance of these memories seems immediately apparent; they represent our understanding of the world, the events that can occur, our feelings about those events, and our behavioral responses to them. Thus, it seems reasonable to suggest that the purpose of memory is to provide the individual with environmental scenarios and response strategies that can be used when similar events recur. (p. 12)

The RAS and parts of the frontal lobe, as noted earlier, are highly receptive to novel stimuli (Berlyne, 1960; Sokolov, 1963; Lacey, 1967). Habituation occurs after repeated exposures to previously novel stimuli, which results in a decrease in arousal. Eaves (1993b) noted that habituation serves an adaptive function by enabling the individual to acknowledge and remember the first exposure to a stimulus rather than the tenth exposure. Remember learning is occurring through the acquisition of memories; thus, usually first exposures to important events are more vivid in our memories than later, similar events.

Types of Memory

Semantic memory. Kolb and Whishaw (1990) described semantic memory as symbolic and abstract in nature. The authors asserted that semantic memory allows individuals to process concepts such as linguistic rules, mathematical formulas, spatial

patterns, and other stimuli that hold abstract or symbolic meaning. Eaves (1993b) acknowledged that currently, the process by which semantic memories are stored and retrieved is not known. He noted that the importance of semantic memory in the acquisition of concepts is universally recognized as crucial to an individual's successful adaptive behavior. Behaviors such as recalling one's phone number, the names of acquaintances, how to drive a car, and the process of long division enhance adaptation.

Episodic memory. Eaves (1993b) recognized that episodic memory was an older form of memory and as such is shared by all mammals. He acknowledged that episodic memories are represented as actual events in adaptive living. Researchers consider the hippocampus, a structure of the limbic system, to be critical in the function of episodic memory (Gray, 2005, LeDoux, 2003). Episodic memory is believed to deal with real events due to the fact that the limbic system cannot interpret symbolic material. Eaves (1993b) noted that episodic memory is an older form of memory, which stores experiences as specific events within the context of the individual's life. The process of transforming an individual's life events into episodic memory involves the hippocampus and amygdala, two important elements of the limbic system.

Winson (1985) investigated the notion that memory processed by the hippocampus is represented as visual scenes because "language and abstract concept played no part in the lower mammalian brain" (pp. 217-218). Eaves (1993b) asserted "the hippocampus has no mechanism for dealing with cognitive information, except by representing it in the context of life events" (p. 12). He described Winson's novel hypothesis, which posed that dream sleep served the purpose of allowing the brain to assimilate important information, integrate it with past experiences, and formulate

strategies for future behavior. Eaves acknowledged that memory provided the material from which an individual can select strategies or responses to their ever changing environment.

Limbic memory and cortical memory. Researchers such as LeDoux (2003) and Gray (2000) have investigated exactly where memories are stored. Although they differ in some theoretical aspects, both agree that the hippocampus is critically important to the storage of long-term memories. Kesner (1983) and Winson (1985) stated that the hippocampus is crucial in the long-term storage of episodic, or limbic, memory. Researchers have not determined whether the hippocampus is involved in the storage of symbolic, or cortical, memory. LeDoux (2003) and Mishkin and Appenzeller, (1987) noted the bilateral removal of both the hippocampus and amygdala prevents the further consolidation of long-term episodic memory. Eaves (1993b) acknowledged that the existence of disparate limbic and cortical memory storage is a viable hypothesis even though there are many questions to be answered through future research.

Neurological Behavior Control

Eaves (1993b) noted that monitoring the environment is accomplished through the senses and involves: (a) analyzing external stimuli, (b) judging which type of behavior is the appropriate response, and (c) determining if motor responses should be initiated or inhibited. He acknowledged that humans face wholly novel, partially novel, or highly familiar environmental stimulus sets and described a wholly novel stimulus set as an organism's first exposure to a stimulus, which causes arousal (e.g., a child's first bike wreck, one's first date, the first experience of being under fire in battle). Eaves (1993b) stated,

> It is well documented that individuals behave in unusual ways when confronted with such [novel] circumstances yet one's choices are actually quite limited. Typically, organisms respond in only a few ways. They may ignore the stimuli, (b) do nothing (be still), (c) emit trial and error responses, (d) flee, (e) become hysterical, or (f) aggress. (p. 13)

Gray (2000) noted that all phyla's first response to noxious or potentially noxious stimuli is to freeze. Eaves (1993b) used the example of soldiers in war who fail to return fire from the enemy. Another example noted by Eaves was disaster victims who may fail to take obvious measures to save their own lives such as individuals on the *Titanic* who became hysterical and failed to enter lifeboats that were readily available. Thomas Edison was said to employ trial and error methods when searching for the right material to use as a filament for his electric light bulb, including a co-worker's human hair (Eaves, 1993b). Gray (2000) noted that organisms commonly run away from novel stimuli in search of a more familiar environment while others turn to aggression.

Eaves (1993b) noted that partially novel stimuli are encountered by an organism when stimuli in the set are familiar and the other stimuli are novel to the organism. In this situation the brain relates the familiar stimuli with similar past experiences in an attempt to find an adaptable response strategy. He acknowledged that at the limbic level, a predatory mammal (e.g., a mountain lion) might encounter a wolverine for the first time. Since the wolverine is small and has much in common with other, known prey, the lion may attack, only to find that the wolverine is a vicious opponent. In this instance, the strategy failed, even though aspects of the stimulus set indicated that the strategy had a reasonable chance for success. Eaves (1993b) noted that at the cortical level, a human

might recognize a partially novel stimulus such as a painting by Picasso or a waltz by Chopin even though he or she had never been exposed to these specific works before.

A third type of strategy is used to respond to highly familiar environmental stimulus sets (e.g., the localization of known food sources or driving the family car). Familiar stimuli evoke a previously learned response (an association) that is overlearned. He described responses to familiar stimuli as requiring minimum mental effort and of being more automatic in nature such as brushing one's teeth, getting dressed, or riding a bicycle. Eaves (1993b) stated, "….the behavioral focus is quite different, depending on whether the activity is conducted at the level of the limbic system or the cortex" (p. 14).

Limbic behavioral strategies. Eaves (1993b) described behavior that is limbic in nature: (a) eating, procuring food (through exploration), (b) rage, aggression, (c) fearful behavior such as running away, (d) sexual behavior such as masturbation and intercourse, (e) temperature regulation, (f) respiration regulation, and (g) feelings of pleasure and pain. He noted that all the behaviors listed clearly deal with survival. Eaves acknowledged that it is possible for humans to also deal with these topics cognitively, with conscious awareness. Cognitive examples include the discussion of good and bad food or having a conversation concerning the physical features of attractive men and women.

Eaves (1993b) affirmed, "There are many levels of conscious awareness inside our brains" (p. 14). He acknowledged that autonomic responses conducted by older structures in the brain such as breathing, digestion, and the initiation of heart beats do occur outside of the consciousness of the individual These behaviors are classified as involuntary and usually the organism is unaware of their functioning. Eaves asserted that

the organism is more conscious of activities conducted by the limbic system such as pangs of hunger, which initiate food getting, and the feeling of being stalked by a ferocious predator. Eaves (1993b) stated,

> Although the animal's awareness of the relationships between the stimuli, its responses to those stimuli, and the consequences that follow must be considered rudimentary at best, it is certain that a limbic consciousness exists and that it is a step above whatever consciousness may be associated with the activities of the autonomic nervous system. (p. 15)

Eaves described four defining characteristics of limbic behavioral strategies: (a) they deal with concrete observables, (b) language or other symbolic representations play no role, (c) they are affective and visceral in nature, and (d) they are fundamentally related to the survival of the organism and/or the species.

Cortical behavioral strategies. Eaves (1993b) noted at the cortical level, the means for directing behavior are conceptually much the same, but the stimulus-response referents are characteristically different from those of the limbic system. The limbic system is heavily invested in basic affective, visceral, survival responses to concrete, environmental situations, while the immediate life or death of the individual does not so commonly hinge on behavior directed by the cortex. Cortical behavior is cognitive, symbolic, and abstract, rather than affective, emotional, and concrete in nature. He noted that the well-rehearsed behavioral strategies of the cortex include expressing verbal idioms, completing mathematical problems, displaying social conventions, discriminating different-sized wrenches, and other behavioral sequences that have been overlearned by the individual.

With reference to the cortex, an alternative means for directing behavior can best be described by repeating a definition of intelligence once offered by Carl Bereiter: "What you do when you don't know what to do" (cited in Jensen, 1980, p. 232). The limbic system as well as the cortex faces circumstances for which no well-rehearsed behavioral strategies exist (Eaves, 1993b). The cortex attempts to make the best match between the current stimulus set and some generalized stimulus-response scenario previously stored in long-term memory (Berlyne, 1960; Sokolov, 1963). Eaves noted that successes and failures are monitored by the cortex and, if the stimulus-response contingencies are important enough, they may be stored in long-term semantic memory as new behavioral strategies or adjustments to old strategies. Cortical strategies deal with abstract, symbolic representations, rather than with concrete, observable phenomena.

A Hypothesis to Explain Hemispheric Asymmetry

Eaves (1993b) stated,

> I propose that the left cerebral hemisphere is specialized for mediating highly familiar, over-learned routines, or strategies, to adapt to abstract, symbolic stimuli. Left-hemisphere routines (as well as left-side limbic strategies) are well rehearsed and can be implemented relatively effortlessly. Unlike limbic strategies, left-hemisphere cortical strategies manipulate material symbolically. (p. 16)

He noted that seminal research by Goldberg, Vaughn, and Gerstman (1978) and Goldberg and Costa (1981) undergird these assertions.

Eaves (1993b) described how a person's experience would influence what memories would be residing in his or her left hemisphere. The well-versed computer

programmer would have no problem accessing his own learned strategies when encountering a familiar computer problem. Eaves (1993b) stated, “One interesting aspect of less complex left-hemisphere functions is that the individual need not know why a particular strategy works, only that it does work” (p. 17). An individual can readily learn to flick a light switch on, but does not have to know the intricacies of electrical wiring. Humans, like other animals, typically develop and use strategies to adapt to specific situations. On a day-to-day basis, this implies that, for many humans, effectively and efficiently adapting to the immediate environmental circumstance is the overriding goal of behavioral strategies.

Eaves (1993b) noted that the right hemisphere mediates responses to infrequently encountered symbolic stimuli that are poorly understood by the individual; that is, the right hemisphere handles symbolic material for which no well-practiced behavior strategy exists. He noted that if the right hemisphere deals with poorly understood material, then the material will appear to be more highly complex, abstract, and ambiguous than well known left–hemisphere material. Since language is a tool used to codify known phenomena, unknown ambiguous material would be dealt with in a nonverbal fashion. Eaves stated, “Because right hemisphere material is, at best, only dimly grasped by the individual, it follows that verbal descriptions will be laborious and uncommunicative, or even nonexistent” (p. 17).

Williams (2000) acknowledged that Eaves took the left-right hemisphere hypothesis a step further in his assertion that left-right functions exist for the limbic system as well as the cerebral cortex. Thus, an organism’s left limbic system would deal with familiar stimuli for which well-rehearsed affective behavioral routines have been

contrived. Conversely, the right limbic system would handle behavior situations that are wholly novel. Williams (2000) noted that societal problems such as murder, rape, and assault could be related to affective behavioral routines that are either well established or that occur when an individual is faced with a novel situation. Affective behaviors are stored in an individual's episodic memory.

Consciousness

Historically, the notion of consciousness, or sense of self, has been investigated repeatedly. The philosophers and psychologists of today still have not definitively described what constitutes a state of consciousness. Eaves (1993b) stated, "The concept of consciousness is inextricably bound to our notions of the self. Thus, we display consciousness only to the extent that we exhibit self-awareness" (p. 19). Ornstein (1997) noted that self-awareness has been linked to the function of an individual's ability to describe verbally, his or her perceptions or beliefs about his or her own personal attributes (e.g., ideas, motives, intelligence, attractiveness, strength) and experiences.

Linguistic consciousness verses phylogenetic consciousness. LeDoux (1986) offered three sets of evidence for accepting the view that consciousness (self-awareness) is tied to natural language systems: (a) species without well-developed language systems lack demonstrable self-awareness, while self-awareness is readily exhibited by language-using humans; (b) commissurotomy patients, whose language functions are lateralized in the left hemisphere, exhibit right-hemisphere deficits in self-awareness; and (c) among commissurotomy patients whose language functions are bilateral, "each half-brain seems to possess an independent and well-developed sense of self" (LeDoux, 1986, p. 350).

Eaves (1993b) noted that humans use language to translate our personal experiences into an accessible comprehensible code.

Eaves (1993b) stated “I would argue that there exists no overarching reason why consciousness demands linguistic explication for its existence” (pp. 19-20). The visceral thrill felt by hang gliders as they wait to take off from a cliff is a conscious experience even though the experience was not given linguistic tags in the mind of the individual. He hypothesized that many mammalian species, which possess comparable brain structures, experience a similar conscious awareness when placed in similar environmental circumstances.

The problem of the self, consciousness, and behavioral control. Eaves (1993b) asserted that the notion of consciousness is implicitly tied to the idea that an organism must be in control of its behavior in order for it to be a conscious action. Society recognizes the difference in behaviors, that occur without premeditation such as criminal acts. The penalty for unpremeditated crimes of passion is less severe in our society than preplanned crimes of a similar nature. Eaves asserted that two forms of consciousness exist: the traditional form of consciousness, which includes the ability to verbalize one’s experience, and the nonverbal form of consciousness in which the person is aware of his or her behavior, even though linguistic awareness might have come after the fact. Eaves (1993b) stated,

> From this point of view, humans may be seen to have many selves, which, under certain circumstances, function independently from the traditional, linguistic self. Therefore, well-practiced activities (e.g., identifying the key to state the ignition of your car) generally require no prior, conscious approval from the linguistic self,

> it is as if the self needn't be bothered with such trivial pursuits. In emergency situations, there is no time to make prudent, informed decision. Regarding crimes of passion, it seems likely that linguistic, cortical control was overridden by limbic functions. (p. 20)

Eaves (1993b) noted that in addition to linguistic consciousness, both limbic and right hemisphere functions constitute their own forms of consciousness.

Eaves (1993b) stated,

> When the requirement of language is dropped and consciousness is defined as the totality of an organism's mental experiences, that is, its awareness of its sensations, behavior, and surroundings, then much of the mind-body problem disappears. This definition requires the acknowledgement of several selves, each corresponding to important phylogentic systems in the brain. (p. 20)

He asserted that there is no reason that consciousness has to be confined to the left cerebral hemisphere. Eaves hypothesized that consciousness exists in several neurological levels (cortical, limbic, brainstem) and relies on language, experiences, and sensations. Examples of left-side cerebral consciousness can be demonstrated through an individual's use of language to explain his or her feelings and experiences.

An individual can explicate he or she is angry and usually tie it to a specific event that has occurred, thus demonstrating his or her awareness of his or her own state of anger. Eaves acknowledged (1993b) that right-side cerebral consciousness can be demonstrated when the solution to a problem for an individual suddenly pops in his or her head long after they have moved to another task. This is referred to as the "eureka" effect by some. Eaves described limbic consciousness previously as a visceral experience

an individual may experience when seeing a horrific event, the feeling the stimulus evoked may not be named by the individual, but it is definitely conscious.

Critical Periods

During the normal course of brain development, eight distinctive events take place: (a) neuronal induction, (b) neuroblast proliferation, (c) cell migration, (d) neuron aggregation, (e) neuron differentiation, (f) neuron death, (d) synapse elimination, and (h) myelination (Kolb & Whishaw, 1990). Eaves (1993b) noted that the environment can and does have its own moderating effects on neuronal progression and as such, environmental effects seem to be maximized when they occur during critical periods. Eaves defined a critical period is an interval of time during which specific processes must occur without significant interference. He noted that, should the process not take place at the appointed time, the subsequent integrity of the neurological system in question is jeopardized. All of the known critical periods occur either prior to birth or during the development and growth of the individual.

Evidence for critical periods. Researchers have investigated critical periods through animal research. Hubel and Wiesel (1970) deprived kittens of visual stimuli for 3 days during their critical periods of development. As a result, the kittens were functionally blind. Woolsey (cited in Mishkin & Appenzeller, 1987) removed a mouse's whiskers soon after birth and noted that the whiskers, which are critical for the search of food, resulted in no development of corresponding neurons in the sensory cortex. In a series of studies, Harlow (e.g., 1960, 1962) showed that infant monkeys deprived of close, physical contact with their mothers became much more fearful adults than

monkeys raised normally. Further, isolation-reared monkeys became self-injurious and aggressive toward other members of their own species.

Eaves (1993b) noted research that has lent support to the notion of critical periods existing in human development. Skeels and Dye (1939) compared experimental- and control-group orphans and revealed dramatically higher IQs among the former group as a result of enriched environmental arrangements. Lazar and Darlington (1982), following a review of 11 preschool intervention projects for low-income families, concluded that the projects had produced significant positive effects on the following parameters: cognition, achievement, attitudes, and values. Eaves noted that remedial and compensatory programs for older individuals have had less impressive outcomes.

Language development in humans has been investigated and research has indicated that, should language development be impeded during the critical period, language deficits may be difficult or impossible to overcome. The process of myelination insulates, and protects axons, and is considered by most neurologists to be a sign of the functional maturity of a differentiated group of neurons (Kolb & Whishaw, 1990). The fact that myelination of the cortex, the last brain structure to attain maturity, reaches a plateau sometime during late adolescence is another source of evidence that the developmental years represent a critical period among humans (Curtiss, 1978). When a child is young and his or her neurons have not myelinated, it is possible for the child to learn several languages without too much difficulty. When an adult attempts to learn a foreign language, he or she will find it much more difficult to complete this task due to the fact his or her neurons are myelinated.

Implications of critical periods for human behavior. The case of Genie is an example of how critical periods come to fruition in human development (Curtiss, 1978; Fromkin, Krashen, Curitiss, Rigler, & Rigler, 1974). Genie was discovered at age 13, the victim of extreme environmental deprivation. Genie had been isolated by her father in a small room from about 20 months to 13 years, 9 months of age. Genie wore a harness as her only clothing to prevent her from handling her own feces, and was strapped to a potty chair for 24 hours a day. At the time she was found, "Genie was an unsocialized, primitive human being, emotionally disturbed, unlearned, and without language" (Fromkin et al., 1974, p. 84). Eaves noted that by age 17, Genie's mental age was determined to be 5 years, 8 months, a value that far exceeded her language skills. She had begun to develop language, though her speech was considerably different from that of normal children. For instance, she used no interrogatives, demonstratives, or rejoinders and negatives were added to the beginning of sentences (Curtiss, 1978; Fromkin, Krashen, Curitiss, Rigler, & Rigler, 1974). Genie illuminates the point that the environment is profoundly influential in human development, particularly during the early years of development.

Culture, Neurology, and Human Behavior

The socialization of a species. Animals which live in groups develop rules for behavior out of necessity. Among lower mammals, rules govern which individual gets the best food, the most comfortable resting place, or the opportunity for sexual fulfillment. These rules are learned through direct experience. Among humans, the social rules, or cultural norms, are more refined, but the system serves much the same purpose. Rules are

designed to reduce conflict and promote harmony and order within the group. Eaves (1993b) stated,

> One means by which humans impart cultural norms to their offspring is through the creation of myths designed to serve as models for behavior (Hirsch, 1987). Thus, children are taught virtuous behavior through stories about the legendary honesty of George Washington and Abe Lincoln, the bravery of American fighting men during war … (p. 23)

Eaves (1993b) described formal societal means for instilling cultural mores as consisting of: (a) parent training, (b) formal schooling, (c) influence from various members of the community and (d) societal groups (boy scouts, girl scouts, 4-H, etc.). Eaves noted another mechanism for ensuring law-abiding behavior is the legal system, including our laws, courts, police forces, and other elements of the criminal-justice system.

Eaves (1993b) stated,

> To the extent that individuals learn and conform to the socially expected, I propose that the neural mechanisms responsible for their storage and expression, are no different from other well-rehearsed routines handled by the left cerebral hemisphere. Once again, the distinguishing characteristic of left-hemisphere functioning is its virtually automatic expression of repetitiously practiced responses to highly familiar environmental stimuli. (p. 23)

Eaves (1993b) further asserted,

> One important implication of this hypothesis is the assertion that the left hemisphere does not specialize in language-oriented behavior, as it had often been

> argued; it handles any systematized responses that can be described as dealing with abstract, symbolic (i.e., cognitive) material. (p. 23)

Eaves noted the quantity and quality of a person's assimilation of cultural and social norms is a cognitive function and as such should have an orthogonal relationship with the affective domain, which is regulated largely by the limbic system. He referred to the notion of positive manifold (Jensen, 1980), and stated, "it also follows that the development of social skills should be positively correlated with standing on other cognitive achievements (e.g., speech, reading, arithmetic, etc.)" (p. 24).

Culture and the right hemisphere. Eaves (1993b) described how culture influences the function of the right cerebral hemisphere. The right hemisphere is purported to deal with relationships between complex and abstract variables. When an individual encounters stimuli in his or her environment that are novel, the right side functioning comes into play. Eaves asserted that body language can sometimes deviate from the previously encountered experiences. When traveling to Bulgaria, the uneducated American might find him or herself in a right brain moment when he or she discovers that the universal head nod, which represents a yes response in America, means no in Bulgaria. Conversely the universal shaking of one's head side to side, which represents a no response in America, means yes in Bulgaria. As in other mammals, it is adaptively beneficial for an individual to pay attention to his or her environment and note the behavior of others. Aggressive patterns are one example of behavior that would be adaptively important to note.

Eaves (1993b) noted the use of proverbs serves a right brain function. Wisdom is imparted upon others through the use of proverbs, which introduce an idiom that is global

in nature and can be applied to novel experiences. As a literal sentence, “Don’t count your chickens before they hatch” has no generalized implications; however, as a proverb it implies one should never behave as if an important event has occurred when it hasn’t. An example occurs when a gambler spends his winnings before he places his bets.

Eaves (1993b) outlined several aspects of adaptive living that through culture indicate both linguistic and nonlinguistic right-hemisphere functioning: (a) the use of verbal and figural analogies; (b) the production and interpretation of poetry, visual art, music, and dance; (c) the use of exaggeration and humor; (d) visual scanning (as in reading); (e) the formation of generalizations; (f) finding the main idea of an event or story; (g) the characterization of people and places; (h) decoding maps; (i) the use of synonyms and antonyms; (j) the prediction of outcomes; (k) evaluating a communicant’s purpose; (l) the classification of objects, events, and ideas; (m) drawing implications; (n) distinguishing fact from opinion; (o) problem solving; (p) the use of connotative language; (solving jigsaw puzzles and conundrums); (r) making comparisons; (s) determining causes and effects; (t) the use of syllogisms and other forms of logical reasoning; and (u) gestalt completion.

Summary of Eaves’ Integrated Human Behavior Theory

By applying Eaves’ (1993b) Integrated Theory of Human Behavior, one can test the hypothesis that arousal, affect, and cognition combined can produce a measure of an individual’s current level of functioning. Through measuring human behavior in this way, one would expect to have oblique factors: arousal (persistence and curiosity), affect (externalizing and internalizing), and cognition that while correlated, function in

characteristically different ways. Glen (1994), Eaves and Glen (1996), and Cox (2000) noted that arousal levels have been shown to be lower with regard to attention to novelty in individuals with lower cognitive abilities. Williams (1996) and Williams (2000) acknowledged that when the characteristic of low arousal is combined with high fear-anxiety levels (affect) within an individual, a propensity for conduct disorders may occur.

Consider Gray's (2000) behavioral inhibition system and behavioral activation system model, which proposed that when a state of equilibrium does not exist between the two systems, an individual might exhibit externalizing or internalizing behavior problems. If an individual exhibits high levels of inhibition as well as high levels of activation, then he or she may exhibit high levels of conduct disorders. Eaves et al. (2004) noted "…it seems possible that future adult psychopaths and neurotic extroverts may emerge from those infants who are born with a high need for stimulation and a low level of sustained attention for novel stimulus sets" (p. 5). Eaves et al. (2004) described the child, who possessed a high threshold for arousal, and as such constantly sought out novel stimulation, but due to poorly sustained attention for discrete stimuli, rarely acquired specific learning through his or her experiences. Thus, arousal not only plays a role in affect but also in cognition. Individuals with autism have been reported to have variable levels of arousal, affect, and cognition, which can be measured in order to provide educational guidance. As would be expected, individuals with autism fair better when cognition is higher coupled with moderate levels of arousal and affect. Eaves et al. (2004) acknowledged a second way in which poorly sustained attention can affect learning for individuals who live in primitive environments.

Taking into account Eaves and Awadh's (1998) hypothesis, that at birth, humans are genetically capable of adapting to a wide array of environments with each person having the potential to become many different sorts of people. Specific environmental events that individuals experience through their lifetime determines which particular traits ultimately characterize an individual. As noted earlier, affective routines are learned by humans and animals in an attempt to adapt to their environment. Eaves et al. (2004) noted that affective routines require an individual to learn directly from their own experiences which includes thinking concretely with regard to sensory representations of actual events; to responding expediently to short-term objectives such as the acquisition of food, water, and shelter; using simple signs to communicate; and to know when to respond to threatening events by fleeing or aggressing. As such, Eaves et al. (2004) speculated that humans developed those neurologically based routines, affective and cognitive, which closely conform to the demands placed on them by their environments. More primitive environments may induce more affective behavioral routines, which enable the individual to adapt to their environments. Conversely, highly developed, intellectually stimulating environments may induce more cognitive routines, which enable the individual to adapt to their environment.

In an effort to investigate the propositions of his theory, Eaves developed several instruments contrived to measure the three central nervous systems components of: (a) arousal, located in the reticular activating system and diencephalon, (b) affect, located in the limbic system, and (c) cognition, located in the cerebral cortex. Eaves hypothesized that while each component retained certain characteristics, they all functioned in a dynamic interdependent fashion. He asserted that arousal, affect, and cognition play an

intricate role in the everyday behavior of human beings. Eaves posed that one's level of arousal, and the interaction of arousal with environmental stimuli, could be used as a predictor for intelligence, emotional disorders, attention deficit disorder with hyperactivity, learning disabilities, and autism. Once an individual's level of arousal, affect, and cognition have been assessed, it is possible to design and implement intervention strategies tailored to the individual.

Eaves designed the *Visual Similes Test I and II* (1992, 1995) in an attempt to measure affective and cognitive arousal in individuals ages 5 to 21 years old. He developed the *Pervasive Developmental Disorder Rating Scale* (1993a) as a screening instrument for autism, which measured arousal, affect, and cognition. Eaves also developed the *Human Behavior Rating Scale* (2002), which measures arousal (persistence and curiosity), externalizing and internalizing affect, and cognition. A summary of the respective studies follows.

VST Studies

Visual similes test I. An earlier version of the *Visual Similes Test II* was the *Visual Similes Test I* (VST I; Eaves, 1992), which consisted of 20 items. Each item contained an image of a common object or event, which was occluded with a checkerboard pattern. The participant was asked to name verbally or describe each stimulus. The total raw score and mean response latency were calculated for each participant. The response latency was the length of time an individual spent on incorrect items.

Glen (1994) employed a causal-comparative design in order to investigate whether or not there was a relationship between IQ and arousal to novelty as measured by the *Visual Similes Test I*, mean response latency (MRL). Sixty-five subjects were drawn

from local public and private schools in Auburn, Alabama. They ranged in age from 5.5 to 17.2 years. Of the 65 subjects, 46 were male and 19 were female. Forty-nine of the subjects were white and 16 were African American. Data based on the occupation of the head of household (U.S. Bureau of the Census, 1963) indicated the socioeconomic status of the subjects was largely middle-class. Subjects were divided into high- and low-age groups based on the mid-point of chronological age and into high-and low-IQ groups based on the mid-point of their *Slosson Full-Range Intelligence Tes*t IQs (S-FRIT; Algozzine, Eaves, Mann, & Vance, 1993).

The results of a univariate analysis of variance revealed a main effect for IQ, when MRL was the dependent variable $F(1,61) = 4.40$, $p = .04$. Individuals with higher IQs relative to those with lower IQs spent more time on items that they answered incorrectly. The results demonstrated that the VST I could be used in further research as an investigative tool for Eaves' (1993b) Integrated Human Behavior Theory.

Eaves and Glen (1996) used the VST I once again to investigate arousal by measuring the preference for novelty of 86 school-aged children drawn from local public and private schools in Auburn, Alabama. Fifty-four participants were male and 32 were female; 70 were white and 16 were African American. The subjects ranged from 5 to 16 years of age with a mean of 9 years, 6 months (SD = 2 years, 5 months). The mean IQ of the group was 106.46 (*SD* = 16.93; range = 73 to 161) as measured by the S-FRIT. Three of the subjects were classified as gifted (IQ ≥ 132), while none were classified with the diagnostic label of mental retardation. Data based on the occupation of the head of household (U.S. Bureau of the Census, 1963) indicated the socioeconomic status of the subjects was largely middle-class with a mean of 78.39 (SD = 18.91; range = 31 to 98).

Subjects were divided into high and low groups using the median of the participants' ages. The midpoint of the S-FRIT scores produced high- and low-IQ groups. This study examined the correct response latency (CRL) which was the amount of time individuals spent looking at stimuli they correctly identified as well as error response latency (ERL), which was the amount of time individuals spent looking at stimuli they incorrectly identified. Percent novelty preference (%NP) referred to the total percentage of time individuals spent on items they did not know. The results of a univariate analysis of variance with ERL as the dependent measure indicated a main effect for IQ $F(1,82) = 7.67$, $p = .0007$. This significant difference demonstrated that children with higher IQs spent longer time on novel items than children with lower IQs. For %NP, a significant main effect was revealed for IQ $F(1,82) = 6.55$, $p = .01$. An interaction effect was shown for age X IQ $F(1,82) = 5.23$, $p = .02$. This indicated that as children with higher IQs get older, the extent to which they become aroused by unfamiliar cognitive stimuli increases.

Chronological age was parceled out and significant correlations were found for the total sample between S-FRIT scores and ERL ($r = .31$) and S-FRIT scores and %NP ($r = .32$). The S-FRIT scores for the high-age group were significant for both ERL ($r = .44$) and %NP ($r = .47$). The S-FRIT IQ and CRL correlation was significant for the low-age group ($r = .36$). The results indicated that children with high IQs spent significantly more time on unfamiliar items and appeared to be more aroused by unfamiliar items than children with low IQs.

Visual similes test II. The VST II is the second version of a research instrument designed for use with individuals ranging from 5 to 21 years of age. The instrument consists of two separate test booklets (VST II Affective Form and VST II Cognitive

Form), response sheets, and scoring manuals for each set of stimuli (affective and cognitive). The VST II Affective Form consists of a collection of 30 visual stimuli presented as black and white photographs with a checkerboard occlusion over each. The VST II Cognitive Form consists of a collection of 25 visual stimuli presented as black and white images with a checkerboard occlusion over each. The checkerboard occlusions, which obscure 50% of each stimulus, make each item more difficult to identify.

Examinees are instructed to take their time when looking at the stimulus. Each examinee is told to raise his or her hand when he or she is ready to respond. As the stimulus item is presented to the examinee, the examiner starts a stopwatch, which records the amount of time between stimulus presentation and a response. Once the examinee raises his or her hand, timing stops and the stimulus is taken away. The examiner then records the response. As Eaves and Williams (2004) noted, unlike most tests, examinees control the pace of the VST II administration.

The examiner intervenes in the examinee's responding in only three circumstances. First, when a response contains no flaws, but is incomplete, the examiner questions the examinee (e.g., "Tell me more about that"). Second, if 30 s pass without a response from the examinee, the examiner asks, "What do you think it is?" Finally, if 60 s have elapsed and the examinee is not actively responding, the examiner says, "Let's move on to the next item" (Eaves et al., 2004, p. 8). When a response is questioned by the examiner, the letter "Q" should be written in the blank line on the response form next to the corresponding item number. Next to the "Q" the examiner must estimate the number of seconds he or she devoted to the question (e.g., Q2). The duration of questioning time

should rarely exceed two seconds. The examinee must write the examinee's response in the blank line next to every item number. In each case, the examiner should fill in the box next to very item number to indicate whether or not credit was awarded for the item.

The response latency is defined as the time interval beginning with the presentation of the stimulus and ending when the examinee has completed a scorable response. If the examiner has questioned the response offered by the examinee, the estimated time (in seconds) devoted to the questioning by the examiner should be subtracted from the interval. That is, only the time spent by the examinee in generating a response contributes to the response latency. Experience with the VST II has shown that examinees rarely require as much as 60 s to produce a scorable response. Each stimulus may be scored as correct (1 point) or incorrect (0 points). An example of an item would be an occluded picture of a tiger. A correct response would be "a tiger". An incorrect response would be "a snake." Criteria for scoring each item and typical incorrect and correct responses are detailed within the scoring protocol.

Four scores can be derived from the VST II: (a) raw score for correct responses; (b) correct response latency (CRL), the average amount of time in seconds that it takes the examinee to identify stimuli correctly; (c) error response latency (ERL), the average amount of time in seconds that it takes the examinee to identify the stimuli incorrectly; and (d) the percentage of novelty preference (%NP), ERL divided by the total response latency multiplied by 100 (i.e., [ERL÷ [CRL+ERL]] x 100). Thus, %NP represents the average percentage of time, relative to the total time, that the examinee spent attending to unfamiliar, or novel stimuli.

Reliability. The consistent results shown by the Glen (1994) and Eaves and Glen (1996) studies led to the development of the *Visual Similes Test II*. Eaves et al. (2004) reported the split-half reliabilities of the VST II Affective and Cognitive Forms to be high. They employed yearly samples of children who were between 5 and 15 years (n = 366), the median split–half reliability for response latency was reported as .96 for the VST II Affective Form (range = .92 to .98). For the VST II Cognitive Form the authors reported the median split-half reliability for response latency was .94 (range = .85 to .96) for the VST II Cognitive Form. The split-half reliabilities were corrected using the Spearman-Brown formula. The items of the VST II Affective Form were reported by the authors to correlate more highly with the VST II Affective Form total score than with the VST II Cognitive Form total score. Correlations for the VST II Cognitive Form items were also determined to have a strong relationship with the VST II Cognitive Form total score.

Validity. Woods-Groves, Eaves, and Williams (2007) conducted a content validity study designed to examine the unoccluded affective and cognitive stimuli of the Visual Similes Test II. A sample of convenience, consisting of 54 Auburn University students, was used in this study. The participants, whose mean age was 27.0 years, (SD = 8.6), included 1 (2%) male and 53 (98%) females, who were enrolled in undergraduate and graduate special education assessment courses at Auburn University. The participants were asked to use their judgment to rate the affective and cognitive content of unoccluded stimuli from the *Visual Similes Test II*. Paired-sample t tests comparing the affective and cognitive ratings for each item were significant for 53 of the 55 stimuli. The mean effect size (Cohen's d) was 1.47 (range = .045 to 1.85). Two items did not have statistically

different means according to the judges ratings, an affective item, a photograph of cheese, $p = .8413$, and a cognitive item, an image of an angel, $p = .2655$. It is apparent that these items were too ambiguous and were not construed as definitively affective or cognitive by the raters.

Williams (1996) conducted a causal-comparative study of the effects of arousal on intelligence and conduct problems using the VST II. Eighty subjects were drawn from a sampling pool of adjudicated delinquents who resided in a local detention center in Opelika, Alabama and ranged from 13-to-17 years of age. Of the 80 subjects, 42 were African American and 38 were white; 24 were female and 56 were male. The mean SES score of the group was 42.16, revealing a low overall SES score and that the subjects came from a lower class background.

Data were collected on each subject for the *Revised Behavior Problem Checklist* (RBPC; Quay & Peterson, 1987), the S-FRIT, and the VST II. The two dependent variables in the study were the S-FRIT Full-Range IQ score and the RBPC scale, Conduct Disorder (CD) score. Affective error response latency (AERL) and cognitive percent novelty preference (C %NP) were obtained from the VST II and employed as two independent variables. The third independent variable was Anxiety-Withdrawal (AW) taken from the RBPC.

Based on the median scores for each of the three independent variables: AERL, AW, and C %NP, the subjects were divided into (high and low) groups. This resulted in the following: a high and low AERL group, a high and low AW group, and a high and low C %NP group. Multivariate and univariate analyses of variance (ANOVA) were conducted. A significant main effect was found for C %NP $F(1,78) = 4.04$, $p = .048$. A

statistically significant interaction occurred for AERL and AW F (1,76) = 8.44, p = .005. These results supported Eaves' theory by indicating that (a) subjects who spent more time on novel cognitive stimuli than their peers had higher IQs and (b) subjects with high levels of anxiety and low arousal to affective stimuli (AERL) had higher conduct disorder scores than their peers.

Williams (2000) examined the effects of affective arousal on conduct disorders by employing a causal–comparative design with a sample of 86 children in grades 5 through 8. The subjects were divided into low and high groups based on the Affective error response latency (AERL) of the VST II and low and high groups based on the combined Withdrawn and Anxious/Depressed scores of the *Teacher's Report Form of the Child Behavior Problem Checklist* (Achenbach & McConaughy, 1997). These measures were compared with the Aggressive Behavior, Delinquent Behavior, and Externalizing Behavior scales of the *Teacher's Report Form of the Child Behavior Problem Checklist* (Achenbach & McConaughy, 1997). A Univariate Analysis of Variance indicated that there was a significant interaction effect for level of Affective Error Response Latency and Fear-Anxiety on the dependent measure Externalizing Behavior F(1,86) = 3.83, p = .05. In other words, individuals who spent less time on affective items that they did not know also had significantly higher measures of externalizing behaviors. The results of this study offered support for Eaves' (1993b) Integrated Human Behavior Theory by revealing that the influences of affective arousal and fear-anxiety were interactive for conduct disorders.

Cox (2000) investigated the link between preference for novelty and intelligence by utilizing a causal-comparative design with a sample of 86 children in grades 5 through

8. Cognitive percent of novelty preference and gender were designated independent variables. The dependent variables were Vocabulary IQ and the Matrices IQ from the Kaufman-Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990). The subjects were assigned to low and high groups based on their percent of cognitive preference for novelty from their VST II scores. A significant interaction was found between cognitive novelty preference and gender and IQ $F(2,81) = 5.52$, $p = .006$. These results indicated that preference for novelty showed a positive relationship with intelligence in childhood. In other words, individuals who spent more time on novel cognitive stimuli (cognitive % novelty preference) also had higher IQs than individuals who spent less time on novel items.

Williams, Cox, and Eaves (2000) conducted an exploratory factor analysis using miniscales constructed from affective and cognitive items. The participants were placed in two groups: 8-to-9-year old and 10-to-11-year old children. Of the 116 younger participants, 63 were male and 53 were female; 77 were white, 36 were African American, 2 were Asian, and 1 was Pacific Basin/Aleut. The mean socioeconomic level of the sample was 68.34 ($SD = 24.76$) indicating that the sample was generally middle class. Nintey-seven of the subjects resided in a rural area, 10 lived in a suburban community, and 9 in an urban area. The mean IQ for this group was 103.27 ($SD = 15.6$). Ninety-nine subjects (85.34%) attended regular education classes. Six of those subjects (5.17%) were eligible for classes for gifted students. An additional nine subjects (7.76%) were classified with attention deficit disorder. The remainder were receiving special education services, for at least part of the school day, within the following disability

categories: emotional conflicts (*n* = 10, 8.62%), learning disabilities (*n* =5, 4.31%), and mild mental retardation (*n* = 2, 1.72%).

Of the 108 older participants (10-to-11-year olds), 57 were male and 51 were female, 69 were white, 37 were African American, 1 was Asian, and 1 was Pacific Basin/Aleut. The mean socioeconomic level of this group was 65.6 (*SD* = 25.7), again indicating that the majority of the sample was middle class. Ninety-two subjects resided in a rural environment, 10 lived in a suburban community, and 6 resided in an urban environment. The mean IQ for this group was 101.8 (*SD* = 19.21). Eighty-one subjects (75%) attended regular education classes while nine of those subjects (8.33%) were eligible for classes for gifted students. Eight of the subjects (7.41%) attended regular classes and were classified with attention deficit disorder. The remainder were receiving special education services for at least part of the school day within the following disability categories: emotional conflicts (n = 13, 12.04%), learning disabilities (*n* = 8, 7.41%), and mental retardation (*n* = 6, 5.56%). The authors reported a strong unrotated first factor, indicating that both subscales measure a behavioral dimension of arousal. When the variables were rotated obliquely, two factors emerged that corresponded exactly with the affective and cognitive forms of the VST II.

Williams, Eaves, and Cox (2002) conducted a confirmatory factor analysis of the VST II using a representative sample of (*n* = 216) children who were 10-to-12 years old. Of the participants, 103 were male and 113 were female; 134 were white, 79 were African American, 1 was Asian, 1 was native American, and 1 was Pacific Basin/Aleut. The mean socioeconomic level of the sample was 66.98 (*SD* = 24.14), indicating the sample was generally middle class. The mean IQ for the participants was 102.31 (*SD* =

17.74). Of the participants, 180 (83.3%) were attending regular education classes. Ten of those participants (4.6%) were eligible for classes for gifted students. The remainder of the sample attended special education classes for at least part of the school day, within the following disability categories: mental retardation (*n* = 13, 6%), learning disabilities (*n* = 12, 5.6%), and emotional disturbance (*n* = 11, 5.1%). A second-order model was selected. The normed fit index, Tucker-Lewis index, and comparative fit index values all exceeded .90. The root mean square error of approximation (RMSEA) value of .086 exceeded the accepted RMSEA level of .08. All measured variables loaded on their constructs with all critical ratios exceeding the minimally accepted value of 1.96.

Eaves et al. (2004) investigated the effects of novelty, fear-anxiety, and age on externalizing affect. A sample was separated into low- and high-scoring groups for each of the three independent variables. The mean socioeconomic status scores based on the occupation of the head of the household (U.S. Bureau of the Census, 1963), was 65.26 (*SD* = 17.73) indicating that the sample was largely from middle-class backgrounds. The mean IQ for the sample, as measured by the *Slosson Full-Range Intelligence Test*, was 101.38 (*SD* = 17.73). There were three independent variables: attention to novelty measured by the Affective ERL scores from the VST II, fear-anxiety measured by the Personality Problem (PP) subscale scores of the *Behavior Problems Checklist* (BPC; Quay & Peterson, 1979), and age. The following three dependent measures of externalizing affect were used; Conduct Problem scores from the BPC (Quay & Peterson, 1979). Conduct Disorder scores from the RBPC (Quay & Peterson, 1987), and Socialized Aggression scores from the RBPC.

A univariate ANOVA was computed using three independent variables (Affective ERL, PP, and age) and the dependent variable, Conduct Problem. The results indicated a significant three-way interaction, $F(1,360) = 8.51$, $p = .0037$. A multivariate ANOVA was computed using three independent variables (Affective ERL, PP, and age) and the two dependent variables, Conduct Disorder and Socialized Aggression. The three factor interaction was statistically significant, $F(2) = 6.56$, $p = .0017$. Upon submitting separate ANOVAs for each dependent variable, it was found that the three-way interaction was significant for Socialized Aggression $F(1,277) = 12.93$, $p = .0004$, but not for Conduct Disorder $F(1,277) = 3.24$, $p = .0731$. Thus, two out of three dependent measures showed that older participants with low attention to novelty as measured by Affective ERL and high levels of fear-anxiety to be associated with high conduct problems.

Pervasive Developmental Disorder Rating Scale Studies

Psychotic behavior rating scale. An earlier version of the *Pervasive Developmental Disorder Rating Scale* (PDDRS, Eaves, 1993a) studies was the *Psychotic Behavior Rating Scale* (Eaves, 1981) which consisted of 60 items derived from three sources: (a) case files of psychotic children served in diagnostic and treatment centers, (b) recollections of professional practitioners regarding children they had worked with, and (c) the professional literature. Eaves (1987- 88) reported that the first two sources contributed the majority of items and that professional literature was used to confirm the initial set of items and to add omitted items that appeared with consistency in the literature.

The rater was required to examine the 60 items and consider each one by rating the degree to which the behavior described by the item was manifested by the child. A

3-point Likert scale was employed with the following definitions: 1 = I have never seen the child exhibit this behavior, 2 = I have occasionally seen the child exhibit this behavior, and 3 = This behavior is characteristic of the child. After determining that the child had been diagnosed as psychotic, the rater was instructed to judge each item separately and to estimate the extent to which the child exhibited the behavior presented in the item. After emphasizing the need to complete every item, the rater was requested to complete his or her ratings.

Eaves and Hooper (1987-88) conducted an exploratory factor analysis to identify salient factors to develop an instrument designed to reveal the structure of psychotic behavior and to compare the results with existing instruments in an attempt to determine the extent to which they resemble the factor analytically derived scale. An available pool of children whose diagnostic histories included references to psychosis in any of several forms: early infantile autism, childhood schizophrenia, symbiotic psychosis, or atypical children were used. A sample of (n = 101) was identified over a period of 5 years (1981-1986). Eaves and Hooper noted that 76 subjects were receiving treatment services in specialized settings (i.e., schools for children who were severely disturbed), while approximately 25 were found in public school placements (e.g., multihandicapped classes, classes for children with emotional conflicts, etc.). The raters were special educators, classroom aides, and interns from a training program in emotional disturbance. The age of the subjects ranged from 3 to 17 years. The ratio of males to females was approximately 3 to 1. Eaves and Hooper (1987-88) acknowledged they were unable to obtain consistent information regarding other attributes of the sample including socioeconomic level, estimated intelligence, race, and cultural background.

A principal components analysis was conducted, squared multiple correlations were entered in the diagonal of the correlation matrix and the data were rotated using a varimax solution. Three criteria were used to select the number of factors to extract: (a) a minimum latent root 1.00, (b) the scree test, and (c) the clarity with which the resulting factors could be interpreted. Analyses were evaluated that employed four, six, eight, ten, and twelve factors. After careful evaluation, the eight factor solution was deemed to meet the combined criteria. The resulting 8 factors accounted for 58% of the item variance.

The authors noted that because the analysis was considered exploratory, a liberal criterion was selected to determine salient factor loadings. Thus, loadings equal to or exceeding .30 were noted. Communality estimates at or beyond .40 were judged to lend themselves to replication. The first five factors appeared to be robust. They contained a minimum of five items, the factor loadings were above the criterion of .30, the items generally loaded positively on only one factor, and the communality estimates provided some assurance that the results were reproducible. The authors assigned labels to seven of the eight factors: (a) response to sensory stimulation, (b) distorted affect/socially unacceptable behavior, (c) speech/unknown, (d) fear/anxiety, (e) stereotypic motor behavior, (f) autism/withdrawal, (g) ritualistic intellectualization, and (h) uninterpretable.

Pervasive developmental disorder rating scale. The Pervasive Developmental Disorder Rating Scale (PDDRS; Eaves, 1993a) is the second version of The *Psychotic Behavior Rating Scale* (Eaves, 1981). The PDDRS is a rating scale which contains 51 items that measure three dimensions: Arousal, Affect, and Cognition. The items were developed following an examination of the classic literature on autistic disorder and a

summation of behavioral characteristics drawn from the DSM-III-R (American Psychiatric Association, 1987), research literature, existing instruments, and the clinic files of individuals with autistic disorder. Raters were requested to evaluate each item independently using a 5-point Likert scale according to the degree to which the individual exhibits the behavior described. Concerning the three subscales: Arousal, Affect, and Cognition: Arousal contains 22 items, Affect contains 19 items, and Cognition contains 10 items. The total Score is obtained by summing the scores for the 51 items in the three subscales and is used as one indicator of autism.

Reliability. The reliability of the PDDRS was examined with a sample of 567 individuals labeled with some variant of PDD (Williams & Eaves, 2002). They were divided into two groups based on chronological age (CA). The low-CA group was made up of 456 individuals ranging in age from 1-to-12 years and the high-CA group ranged from 13-to-24 years. Alpha coefficients for the low-CA group ranged from .75 to .89 for the three subscales, with a Total Score coefficient of .89. Alpha coefficients for the high-CA group ranged from .77 to .89 for the three subscales with a Total Score coefficient of .89.

The test-retest reliability of the PDDRS was examined with a sample of 40 individuals who had been rated twice by the same rater (Williams & Eaves, 2002). The mean interval between ratings was 9.50 months (*SD* = 2.96; range = 24). Coefficients for test-retest reliability ranged from .86 to .92 for the three subscales, with a Total Score reliability of .92. The results of the reliability studies indicated that the internal consistency and stability of the PDDRS were adequate for research purposes, met or

exceeded the minimum requirements for screening purposes, and were stable over time for both the individual being rated and the rater.

Content validity. Eaves and Williams (2006) claimed content validity for the PDDRS items. The PDDRS items were constructed following an inspection of the classic literature on autistic disorder (i.e., Kanner, 1943, 1958; Lovaas, Freitag, Gold, & Kassorla, 1965; Rimland, 1964), summation of behavioral characteristics drawn from the DSM-III-R, research literature, theory, existing instruments used in the assessing PDD, and from the clinical files of children with autistic disorder (Eaves, 1990; Eaves, 1993b; Eaves & Hooper, 1987-1988).

Criterion-related validity. Eaves, Campbell, and Chambers (2000) investigated the criterion-related validity of the PDDRS and the *Autism Behavior Checklist* (ABC; Krug, Arick, & Almond, 1993). Data was compared for both instruments with a sample of 104 children known to be diagnosed with autism and 32 children who were diagnosed with disabilities frequently confused with autism. Teachers of children with autism know to the authors were solicited via telephone, mail, and face-to-face requests. In each case, the author making the request was, known to the rater and an informed-consent document was obtained for each participant. No rater refused to participate in the study. With the exception of six children who lived in Kansas and Georgia, all participants were residents of Alabama. Seventy-two participants were diagnosed with autism while an additional 32 children were diagnosed with disorders that were often confused with autism. Members of this group were residents of a community mental health center and were diagnosed by the attending psychiatrist using DSM-IV (American Psychiatric Association, 1994) criteria. Their diagnoses were Asperger's disorder (n = 1), childhood disintegrative

disorder (n = 14), moderate mental retardation (n = 4), pervasive developmental disorder, not otherwise specified (n = 9), severe developmental disorder (n = 2), severe mental retardation (n = 1), and Williams syndrome (n = 1). Males comprised 80% of the sample (n = 109). Sixty percent of the sample was white and 40% was African American. Of the 111 ratings reporting socioeconomic level, 18% of the participants were from upper-class families, 56% were from middle-class families, and 26% were from lower-class families. The mean chronological age of participants was 96.81 months, SD = 42.45 for individuals diagnosed with autism and 126.66 months, SD = 52.52 for individuals with non-autistic disorders.

Seventy-three different raters completed ABCs and PDDRSs for the study. No rater completed ratings for more than six children. Eighty-six ratings were completed by teachers and 32 ratings were completed by the professional staff of the community mental health center. Parents and other family members completed an additional 18 sets of data. The results for the total scores for the PDDRS and the ABC showed that the instruments measured similar constructs (r = .80). Both instruments also significantly discriminated between participants with autistic disorder and participants with disorders frequently confused with autistic disorder. The PDDRS had a classification accuracy rate of 88% and the ABC had an accuracy rate of 80%. The PDDRS and the ABC agreed in their classifications for 85% of the 139 participants.

Eaves, Woods-Groves, Williams, and Fall (2006) investigated the criterion-related validity of the PDDRS when compared to the *Gilliam Autism Rating Scale* (GARS; Gilliam, 1995). In this study, 66 participants rated 134 individuals either diagnosed with PDD [i.e., autistic disorder (n = 86), Asperger's disorder (n = 11),

pervasive developmental disorder-not otherwise specified (*n* = 15)], or some other disability that is often confused with PDD (*n* = 23). The second group included one child with cerebral palsy, four children with developmental delays, two children with middle mental retardation, seven individuals with moderate mental retardation, four individuals with multiple disabilities, one youngster with severe-profound mental retardation, and four children with severe communication disorders. The participants resided in one of five southeastern states or Washington, DC. Teachers of children with pervasive developmental disorders, college teaching interns, and parent and guardians participated in the study. Ninety-seven of the PDDRS and GARS ratings were completed by teachers (72.39%), nine ratings, were completed by graduate interns (6.72%), and 28 ratings were completed by parents and guardians (20.90%). The mean length of time that the rater had known the child was 2.82 years (*SD* =4.17). Signed informed-consent documents were obtained from the parents or legal guardians of the children rated.

Of the 134 participants, 17.16% (*n* = 23) were female and 82.84% (*n* = 111*)* were male. The ethnicity of two participants was not reported. Of the remaining participants, 59.85% were white (*n* = 79), and 40.15% were African American (*n* = 53). The participants ranged in age from 2-to-26 years, with a mean of 9 years, 8 months (*SD* = 4 years, 7 months). The socioeconomic states (SES) of the participants was 71.10 (*SD* = 24.13; range = 99), indicating that the sample was generally middle class.

The correlation between the total scores for the GARS and PDDRS was .84, which indicated a high degree of shared variance between the two instruments. The validity coefficients ranged from .09 to .84 (median *r* = .64). An analysis of variance for pervasive developmental disorders and non-pervasive developmental disorders group

scores obtained on the GARS and PDDRS resulted in all comparisons being statistically significant with the exception of the GARS Developmental Disturbances $F(1,80) = 3.28$, $p = .07$ and the PDDRS Cognition $F(1,132) = 6.43$, $p = .01$. Dunn's (1961) tables were used to adjust the alpha across 18 analyses of variance to maintain a constant alpha of .05.

The results of the GARS and PDDRS diagnostic classifications were compared to the participants' clinical diagnoses and applied a cut off standard score of 85 for the Autism Quotient (total score on the GARS) and for the Arousal score and Total score (PDDRS scores) as the criterion. The GARS produced sensitivity, specificity, and overall accuracy estimates of 87.21%, 47.92% and 73.13%, respectively. The PDDRS exhibited somewhat better classification accuracy for autism/non-autism decisions when compared to the GARS. The PDDRS analysis sensitivity was 93.02%, specificity was 47.92%, and overall classification accuracy was 76.87%.

When estimating PDD-non PDD classification accuracy, the GARS produced better results using the Autism Quotient criterion of 85 with sensitivity being 83.04%, specificity was 68.18%, and over all classification accuracy was 80.60%. The PDDRS accuracy estimated exceeded the GARS estimates for 11 of 12 comparisons (mean difference = 2.93%). When comparing the degree to which the GARS and PDDRS agreed with one another on the proper classification of the participants, it was found that the instruments concurred that 96 of 134 participants would appropriately be labeled as autistic disorder/PDD. The GARS and PDDRS agreed on the non-autistic/non-PDD label for 25 of the 134 participants. Thus, the two instruments agreed in their classifications for 122 participants (90.30%) and disagreed on just 13 participants (9.70%). The phi

coefficient, which measured the extent of association between two sets of attributes measured on a nominal scale, resulted in a high correlation between the GARS and PDDRS nominal classification, which was statistically significant (.74, p = .001).

Construct validity. The structure of the PDDRS was based on the factor analysis of 500 sets of ratings on children with pervasive developmental disorders (Eaves, 1990). Four hundred and thirty-six of the children were diagnosed with autistic disorder. Following a first- and second-order factor analysis of the data, the instrument was reduced to three factors: Arousal, Affect, and Cognition. It was proposed that these factors corresponded to functions associated with the reticular activating system, limbic system, and the cerebrum.

Williams and Eaves (2005a) conducted an investigation of the construct validity of the PDDRS through the employment of an exploratory and confirmatory factor analysis. The 362 participants for this study were drawn from local public and private schools and service agencies in the southeast. Informed consent was obtained from the participants' parents. Raters who knew the participants for at least 2 months supplied the data. The relationships of raters to the participants were as teachers and interns (62.1%), parents (28%), and other or no response (9.9%). Of the 362 participants, 288 (79.6%) were boys and 74 (20.4%) girls, 216 (59.7%) were white, 142 (39.2%) were African American, 3 (0.8%) were Asian, and 1 (0.3%) was native American. The group comprised children from 1 to 12 years of age, whose mean chronological age was 6.3 yr. (*SD* = 2.8). All the participants were diagnosed with autistic disorder by their local school system or service agency. The mean socioeconomic status of the sample was 73.4 (*SD* = 23; range = 12-99), indicating the sample was generally middle class.

An exploratory factor analysis was conducted on miniscales the authors constructed using mean scores of the items to sequence them. Raw scored for the miniscales were submitted to principal axis factor analysis with a promax rotation and user-specified one-factor, two-factor, and three-factor solutions. The Kaiser-Meyer-Olkin index of sampling adequacy was .87 for the sample. This indicated that the data represented a homogeneous collection of variables that were suitable for factor analysis. Bartlett's test of sphericity was significant for the sample [χ^2 (78) = 1892.17; $p < .0001$], which indicated that the set of correlations in the correlation matrix were significantly different from zero and suitable for factor analysis.

The results of the exploratory analysis supported the assertion that the three-factor structure was the best solution for the data, 63.8% of the total variance was explained as opposed to 54.1% and 37.8% for the two-and one-factor solutions, respectively. All factor pattern coefficients loaded saliently only on their respective constructs in the three-factor solution. Additionally the interfactor correlations in the three-factor solution were below .80, indicating that the factors were correlated but could be considered as separate factors. The correlations between factors were: arousal/affect $r = .64$, arousal/cognition $r = .18$, affect/cognition $r = .13$. The communality estimates for the three-factor solution exceeded .50 ($M = .55$) for ten of the 13 miniscales. In the one-and two-factor solutions the communality estimates were below .50. Thus, the three-factor solution was deemed the most stable.

A confirmatory factor analysis was conducted in which the goodness-of-fit of the proposed models was examined with multiple criteria. The goodness-of-fit (GFI; Takana & Huba, 1985), the root mean square error of approximation (RMSEA; Steiger, 1990),

and the standardized root mean square residual (SRMR), the comparative fit index (CFI; Bentler, 1990), and the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) were selected as measures of model-fit. Values of .90 or greater for the GFI, CFI, and TLI, and values between .05 and .08 for the RMSEA are generally considered an indication of acceptable model fit.

The results of the confirmatory factor analysis supported the hypothesized second-order model across all indices of model-fit. The RMSEA value was .07 and the SRMR value was .06. Both fell within the upper limits for acceptable levels for model fit. The GFI, TLI, and CFI values were .93, 92, and .93, respectively. The fit indices indicated that the model provided an acceptable level of model-fit for the PDDRS with data from a sample of children 1 to 12 years old with autistic disorder.

Williams and Eaves (2005) conducted a factor analysis of the PDDRS with teacher ratings of students with autistic disorder. The 168 participants for this study were drawn from local public and private schools, and service agencies in the Southeast. The students were drawn from the 1-to-12 year age group. Informed consent was obtained and teachers who had known the participants for at least 2 months supplied the data. All the participants had been diagnosed with autistic disorder through their local school system or service agency. Out of the 168 participants, 137 (81.55%) were male while 31 were female; 102 were white, 65 were African American, and one was native American. The mean chronological age of the sample was 6.32 years (*SD* = 2.79; range = 11 years). The mean socioeconomic status of the sample was 72.65 (*SD* = 23.22; range = 87), indicating the sample was generally middle class.

An exploratory factor analysis was conducted in which the Kaiser-Meyer-Olkin index of sampling adequacy was .86 for the sample, indicating that the data represented a homogeneous collection of variables that were suitable for factor analysis. Bartlett's test of sphericity was significant for the sample [χ^2 (78) = 895.74; $p < .0001$], indicating that the set of correlations in the correlation matrix was significantly different from zero and suitable for factor analysis.

In the unrotated three-factor solution, five arousal and five affect miniscales produced salient factor coefficients on the first factor; with one arousal miniscale and three affect miniscales crossloading on the third factor. The three cognition miniscales produced salient factor coeffieicnts only on the second factor. Following the oblique promax rotation, the five arousal miniscales formed factor 1, the five affect miniscales formed factor 2, and the three cognition miniscales formed factor 3. The miniscales loaded saliently only on their respective factors. The three factors accounted for 64.38% of the variance. The correlations between factors were arousal/affect $r = .62$, arousal/ cognition $r = .21$ and affect/cognition $r = .18$.

In the confirmatory analysis, the goodness-of-fit of the proposed models was examined with multiple criteria. The goodness-of-fit index (GFI; Takana & Huba, 1985), the root mean square error of approximation (RMSEA; Steiger, 1990), and the standardized root mean square residual (SRMR), the comparative fit index (CFI; Bentler, 1990), and the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) were selected as measures of model-fit. The results of the confirmatory factor analysis supported the hypothesized second-order model across all indices of model-fit. The RMSEA value was .07 and the SRMR value was .06. Both fell within the upper limits for acceptable levels

for model fit. The GFI, TLI, and CFI values were .90, .91, and .93, respectively. The fit indices indicated that the model provided an acceptable level of model-fit for the PDDRS with data from a sample of children 1 to 12 years old with autistic disorder.

Eaves and Williams (2006) conducted an exploratory and confirmatory factor analyses of the PDDRS for young children with autistic disorder. The participants in this study were 126 individuals who rated 199 children diagnosed with autistic disorder who resided in the Southeastern United States. The raters were comprised of teachers (71.86%), interns (15.08%), and parents (13.07%). Signed informed consent documents were obtained. All of the participants were labeled and being served as children with autistic disorder according to rater report. Of the 199 children, 21.11% (n = 42) were female and 78.89% (n = 157) were male. The race of one participant was unknown. Of the remaining participants, 57.29% were white (n =114), 41.71% were African American (n = 83), and 0.50% were Asian (n = 1). The children ranged in age from 1-to-6 years, with a mean of 4.26 years (SD = 1.48). The socioeconomic status (SES) of the participants was 72.61 (SD = 22.29; range = 87), indicating the sample was middle class.

An exploratory factor analysis was conducted on miniscales the authors constructed using mean scores of the items to sequence them. Raw scores for the miniscales were submitted to principal axis factor analysis with a promax rotation and user-specified one-factor, two-factor, and three-factor solutions. The Kaiser-Meyer-Olkin index of sampling adequacy was .87 for the sample. This indicated that the data represented a homogeneous collection of variables that were suitable for factor analysis. Bartlett's test of sphericity was significant for the sample [χ^2 (78) = 1117.95; p < .0001],

which indicated that the set of correlations in the correlation matrix were significantly different from zero and suitable for factor analysis.

The results of the exploratory analysis supported the assertion that the three-factor structure was the best solution for the data, 54.86% of the variance was explained as opposed to 48.14% and 35.96% for the two-and one-factor solutions, respectively. All factor pattern coefficients loaded saliently only on their respective constructs in the three-factor solution. Additionally the interfactor correlations in the three-factor solution were below .80, indicating that the factors were correlated, but could be considered as separate factors. The communality estimates for the three-factor solution exceeded .50 (M = .55) for ten of the 13 miniscales. In the one-and two-factor solutions more of the communality estimates were below .50. Thus, the three-factor solution was deemed the most stable.

The results from the confirmatory factor analysis indicated that the hypothesized second-order factor model was the best model for data from a sample of children 1-to-6 years old with autistic disorder. The second-order factor model consisted of five arousal miniscales, five affective miniscales, and three cognitive miniscales. Although the chi-square statistic was significant, all of the remaining fit indices met or exceeded the accepted values with this model

Conclusion

As noted earlier, despite all the technological advances of our day, researchers within the field of human behavior still grapple with the question: What are the primary building blocks of human behavior? It suffices to say that theories of human behavior should be based on empirical evidence and readily lend themselves to the testing of their

postulates. Disparity exists between theories of human behavior; this leads to confusion when attempting to construct an educational program based on theory. There exists a need for an integrated theory of human behavior to assist researchers and educators in deconstructing the concept of what makes up human behavior. Numerous theories have been reviewed, some have lent themselves to testing through empirical measures while others were purely theoretical in nature.

In 1993b Eaves published the Integrated Theory of Human Behavior. His theory integrated existing theories in a comprehensive fashion in an effort to explain human behavior. Eaves acknowledged that most of the theories incorporated in his theory are supported by empirical research. Eaves' theory focused on the theory of evolution, components of the central nervous system, the significance of neurological structures, memory, neurological behavioral control mechanisms, consciousness, critical periods, and cultural influences as the basis for explaining human behavior. Eaves acknowledged that humans are born with the biological capacity to adapt to a myriad of environments and as such physiologically, human beings possess the capacity to adapt to and survive in nearly any environment on the planet.

Humans possess a highly evolved central nervous system. The cerebrum in humans allows the use of language, planning, and complex problem solving. Even though the cognitive system of humans is more refined than that of other mammals, the limbic system and brain stem continue to influence human behavior. Humans, like other mammals, have critical periods which if missed, or delayed, can result in a delay in the development of specific human behavior. Culture also plays a significant role in the development of human behavior.

Eaves' (1993b) Integrated Theory of Human Behavior proposed that human behavior is the result of interacting influences of arousal, affect, and cognition. In order to investigate his theory, Eaves developed 3 psychometric assessment instruments. The Visual Similes Test, (VST II; 1995), measures affective arousal and cognitive arousal; the Pervasive Developmental Disorder Rating Scale, (PDDRS; 1993a) is an autism screener and diagnostic instrument that measures arousal, affect, and cognition; and the Human Behavior Rating Scale, (HBRS; 2002) is designed to measure arousal (persistence and curiosity), affect (externalizing and internalizing), and cognition.

The VST II has been used in research and has thus far supported Eaves' theory. Eaves and Glen (1996) and Glen (1994) used an earlier version of the VST to demonstrate the significant relationships between preference for novelty, chronological age, arousal, and IQ. Williams (1996) used the VST II to demonstrate the significant relationships of arousal on IQ and conduct problems. The VST II was employed by Eaves, Darch, and Williams (2004) to show the significant effects of attention to novelty, fear-anxiety, and chronological age on conduct problems. Cox (2000) revealed that preference for novelty showed a positive relationship with intelligence in childhood. Williams, Cox, and Eaves (2000) conducted an exploratory factor analysis of the VST II, that revealed the correlated two-factor model proposed by the authors. Williams, Eaves, and Cox (2002) conducted a confirmatory factor analysis of the VST II, which indicated the model with the best fit was the second-order model proposed by the authors.

The PDDRS was developed as a screening instrument for autism and is based on Eaves' Integrated Theory of Human Behavior. Autism is measured through the central nervous system components of arousal, affect, and cognition. Hooper and Eaves (1987-

88) employed an exploratory factor analysis that revealed eight factors and led to the development of the current PDDRS. Williams and Eaves (2002) investigated the reliability of the PDDRS and noted that the internal consistency and stability of the PDDRS were adequate for research purposes and, met or exceeded the minimum requirements for screening purposes, while exhibiting stability over time for both the individual being rated and the rater. Eaves and Williams (2006) claimed content validity for the PDDRS items.

Eaves, Campbell, and Chambers (2000) investigated the criterion-related validity of the PDDRS and the *Autism Behavior Checklist* (ABC; Krug, Arick, & Almond, 1993) and acknowledged that the instruments measured similar constructs and both significantly discriminated between participants with autistic disorder and participants with disorders frequently confused with autistic disorder. The criterion-related validity of the PDDRS was further investigated by Eaves, Woods-Groves, and Williams (2006). The authors compared the PDDRS with the *Gilliam Autism Rating Scale* (GARS; Gilliam, 1995) and found the total scores for the GARS and PDDRS indicated a high degree of shared variance between the two instruments.

Williams and Eaves (2005a, 2005b) and Eaves and Williams (2006) conducted an investigation of the construct validity of the PDDRS through the employment of an exploratory and confirmatory factor analysis, which indicated that the proposed 3-factor model was the most sailent for each sample investigated.

Eaves' (1993b) Integrated Theory of Human Behavior has been supported by empirical research through the use of the VST I and II and the PDDRS. Eaves, has developed the Human Behavior Rating Scale (HBRS; 2002). The HBRS is designed to

measure arousal (persistence and curiosity), externalizing and internalizing affect, and cognition. The reliability and construct validity of the HBRS will be investigated.

III. METHOD

This chapter contains details about the methodology that was employed to conduct this research study. Descriptions of the sampling plan and subjects, instrument, research design, variables, procedures, data analysis, and research questions are included in this chapter.

Sample

Sampling Plan

The investigator obtained signed letters from school superintendents and principals that granted permission to collect data at their schools. The investigator then submitted an application to the Internal Review Board (IRB) for permission to conduct this research project. After approval was obtained from the IRB, meetings were scheduled with the classroom teachers in Chambers County to explain the purpose of this research project and to gain teacher cooperation. The Chambers County teachers were told in their faculty meetings that their participation was voluntary. Parental informed-consent and child-assent forms were sent home for parents and the child to sign if they were willing to participate in the research study.

Dr. Tom Bice, the superintendent for Alexander City met with his sixth-, seventh- and eighth- grade principals and obtained their permission to conduct the research study.

He asked all his sixth-, seventh-, and eighth- grade teachers to participate in this research study. In both counties, the parental informed-consent and child-assent forms were disseminated by the homeroom teachers. The investigator collected the signed parental informed-consent and child-assent forms from the teachers following a 1-week interval. Parents were provided a copy of the parental informed-consent and child-assent forms to keep. Students whose parents returned signed informed-consents and who themselves signed the child-assent forms represented the sample of participants.

Participants

The sample employed in this study consisted of 320 school-aged children drawn from local schools in Alabama. One hundred and eighty-five (57.8%) students were from Alexander City, while 135 (42.2%) students were from Chambers County. One hundred and sixty-four (51.2%) of the participants were in sixth grade, 99 (30.9%) were in seventh grade, and 57 (17.9%) were in eighth grade. Alexander City had 111 (60%) sixth grade, 32 (17.3%) seventh grade, and 42 (22.7%) eighth grade students participate. Chambers County had 53 (39.3%) sixth grade, 67 (49.6%) seventh grade, and 15 (11.1%) eighth grade students participate.

The total sample consisted of 160 females (50%) and 160 males (50%). Ninety-three (50.3%) females and 92 (49.7%) males participated from Alexander City. Chambers County had 67 (49.6%) females and 68 (50.4%) males participate. The ethnicity of the total sample was described as 178 (55.7%) white, 135 (42.2%) African American, 3 (.9%) Asian, and 1 (.3%) native American. Three (.9%) individuals did not report their ethnicity. Alexander City had 61 (33%) African American, 3 (1.6%) Asian, 1 (.6%) native American, and 117 (63.2%) white participants. Three (1.6%) individuals did not

report their ethnicity. Chambers County had 74 (54.8%) African American and 61 (45.2%) white participants.

The participants ranged from 11 to 16 years of age with a mean of 12 years, 4 months (*SD* = 1.04). The total sample was examined according to diagnostic labels: 24 (7.5%) learning disability, 1 (.3%) mental retardation, 2 (.6%) speech language impairment, 1 (.3%) other, and 292 (91.3%) regular education. Alexander City participants were examined according to diagnostic labels: 12 (6.6%) learning disability, 1 (.5%) mental retardation, 171 (92.4%) regular education, and 1 (.5%) did not report diagnostic label. Chambers County participants were also examined according to diagnostic labels: 12 (8.9%) learning disability, 2 (1.5%) speech language impairment, and 121 (89.6%) regular education. The residency for all the subjects was described as rural.

The socioeconomic status (SES) of the sample was estimated using scores based on the occupation of the head of household (U.S. Bureau of the Census, 1963). The U.S. Bureau of Census scores for particular occupations were constructed on the basis of the following elements: (a) perceived prestige of the job title, (b) years of education typically required for access to the job, (c) average salary of individuals within the occupation, and (d) the average value of the residence of individuals within the occupation. Scores range from 1 (undefined personal services) to 99 (physicians). Examples of occupational scores include 89 for teachers, 50 for brick masons and carpenters and 75 for bank tellers. This sample's socio-economic levels were calculated on 306 participants who had a mean level of 63.34 (*SD* = 22.14). Fourteen (4.6%) of the sample had no occupational information. The sample was described as a relatively low socioeconomic sample.

Forty-four teachers completed 320 rating scales for this study for their sixth-, seventh-, eighth- grade students from whom parental informed-consent and child-assent had been obtained. Of the total sample 37 (84.1%) raters were female and 7 (15.9%) were male. With regard to ethnicity, 8 (18.2%) were African American and 36 (81.8%) were white. Alexander City had 27 teacher raters. Twenty-one (77.8%) of the teachers were female, while 6 (22.2%) were male. Six (22.2%) of the teachers were African American and 21 (77.8%) were white. Chambers County had 17 teacher raters. Sixteen (94.1%) of the teachers were female and 1 (5.9%) was male. With regard to ethnicity, 2 (11.8%) were African American and 15 (88.2%) were white.

Instrument

Eaves' (2002) Human Behavior Rating Scale (HBRS) was completed by each homeroom teacher for the students in grades six, seven and eight for whom parental informed-consent and child-assent were obtained in Chambers County and Alexander City public schools. A description of the instrument and the results of preliminary studies of the HBRS are presented below.

The current HBRS was derived from the earlier versions of the instrument. It was designed as a research tool to aid in testing Eaves' (1993b) Theory of Human Behavior. Eaves' theory hypothesizes that human behavior is a result of the interaction of the central nervous components of arousal, located in the reticular activating system and represented by persistence and curiosity; affect, located in the limbic system and represented by externalizing and internalizing affect; and cognition, located in the cerebral cortex. In the HBRS (2002) the dimensions of: persistence, curiosity,

externalizing affect, internalizing affect, and cognition are measured through a 94-item rating scale completed by a parent or teacher. The individuals rate the behavior of their child or student by comparing them to their same-aged peers, using a Likert scale ranging from 1 to 5. The HBRS items were written to reflect the full range of human behavior. For example, the positive externalizing affect of a child is measured (e.g., the child who does what is asked of him or her, feels appropriate guilt when he or she misbehaves), as well as the negative externalizing affect of a child (e.g., the child who strikes his or her classmates, or the child who lies and cheats). The HBRS is intended to provide the investigator with a full range of human behavior represented by a normal distribution scale.

Pilot Study

The HBRS (2002) was investigated through a pilot study that examined 1,137 school-aged children drawn from local and private schools in the southeast. Five hundred and one (44.1%) of the participants were female and 635 (55.8%) were male. One (.1%) of the participants did not have data for gender. The ethnicity of the sample was 814 (71.6%) white, 295 (25.9%) African American, 9 (.8%) Asian, and 6 (.5%) native American, 10 (.9%) classified as other. Three (.3%) of the participants did not have data for ethnicity. The participants ranged from 5 to 18 years of age with a mean of 11 years, 3 months (SD = 3.97).

The sample was examined according to diagnostic labels: 10 (.9%) attention deficit hyperactivity disorder, 30 (2.6%) autistic, 4 (.4%) chapter one, 34 (3%) emotional disturbance, 13 (1.1%) gifted, 98 (8.6%) learning disability, 108 (9.5%) mental retardation, 25 (2.2%) other, and 811 (71.3%) regular education. Four participants (.4%)

had missing values for the diagnostic label. Before proceeding with the data analysis, all variables were screened for possible missing values and outliers.

The reliability of the sample HBRS scores was investigated by applying Cronbach's alpha for the 5 factors: persistence, curiosity, externalizing affect, internalizing affect, and cognition for each age group. This resulted in the following reliability coefficients for all age groups: Persistence, r = .88 to .95, Curiosity, r = .88 to .95, Externalizing Affect, r = .96 to .97, Internalizing Affect, r = .90 to .95, and Cognition, r = .96 to .99. Table one provides reliability coefficients for each dimension for each age. Sixty-five of the 70 reliability coefficients met the criterion for diagnostic purposes, which, according to Salvia and Ysseldyke (2004), requires a reliability coefficient of .90. The remaining five coefficients met the criterion for screening purposes with reliabilities of .88 to .89.

A Bonferroni adjustment was applied and separate one-way ANOVAs were conducted with age as the independent variable and the five dimensions of persistence, curiosity, externalizing affect, internalizing affect, and cognition as the dependent variables in an attempt to detect any significant differences between age and the dimensions on the HBRS. With regard to age comparisons and the dimensions of the HBRS, the Box's Test of Equality of Covariance Matrices was violated for the dimension of curiosity and Dunnett's T3 was applied. This indicated that with regard to this sample, no significant main effects existed between ages and the dimensions on the HBRS for the dimensions of persistence, curiosity, externalizing affect and internalizing affect.

A significant main effect was noted for cognition $F(13,1121) = 1.93$, $p = .02$. No significant simple effects were noted for cognition once Bonferroni was applied. This

preliminary analysis of the HBRS pilot data supported the selection of sixth, seventh, and eighth graders for the proposed study.

Table 1

Reliability Coefficients for the Dimensions of the Human Behavior Rating Scale

n	Ages in Years	Persistence	Curiosity	Externalizing Affect	Internalizing Affect	Cognition
39	5	.94	.89	.97	.90	.98
90	6	.89	.91	.96	.93	.96
117	7	.93	.95	.96	.92	.98
103	8	.94	.94	.96	.93	.98
83	9	.91	.92	.96	.92	.98
82	10	.93	.93	.96	.94	.98
88	11	.93	.91	.96	.93	.98
78	12	.92	.90	.97	.94	.98
93	13	.93	.92	.96	.95	.98
59	14	.92	.94	.97	.94	.98
54	15	.89	.94	.96	.94	.99
74	16	.91	.93	.96	.94	.98
86	17	.88	.88	.97	.93	.98
90	18	.95	.95	.97	.95	.99

Procedure

After the investigator collected the signed parental informed-consent and child-assent forms from Chambers County and Alexander City, a code list was created for each homeroom teacher. The code list contained each child's name and a corresponding code number for the child. The code number for each child was placed on a HBRS. Every homeroom teacher who participated in the study received an envelope with instructions for completing the HBRS, a code list, and an HBRS with a code number for each student in the place of a name. The child's name was never placed on the HBRS. The sixth-, seventh-, and eighth- grade homeroom teachers were instructed to complete the rating scales within a 2-week period of time. The investigator returned and collected the rating scales at the end of 2 weeks.

The instructions on the envelope given to each homeroom teacher asked the teachers to please, not skip any items on the HBRS and to complete the following information for each child: (a) birth date, (b) mother and father's educational levels, and (c) mother and father's occupations. The instructions on the envelope also stated that the investigator would be happy to come to the teachers' homerooms and ask the children the demographic information for them.

The directions on the HBRS stated that the teacher was to read an item then choose a rating from 1 to 5 using the following guidelines: (a) Ask yourself, is this child's behavior about like other children his or her age? If the answer is yes, place an X on the 3 in the left hand column and move on to the next item, (b) If the answer is no, ask yourself, does this child display the behavior to a lower degree than other children his or her age? If the answer is yes, then place an X on the 1 or 2. Use the 2 when the choice

between 1 and 3 is difficult, and (c) If the answer to question two is no, then the child displays the behavior to a higher degree than other children his or her age. Therefore, place an X on the 4 or 5. Use the 4 when the choice between 3 and 5 is difficult. Please do not skip items.

The following ratings were explained: (a) 1 = The child never exhibits this behavior or attribute, (b) 2 = (Use this number when the choice between 1 and 3 is difficult), (c) 3 = The child displays this behavior or attribute about the same as other children his or her age, (d) 4 = (Use this number when the choice between 3 and 5 is difficult), and (e) 5 = The child displays this behavior or attribute to a very high degree.

Out of the potential pool of 61 sixth-, seventh-, and eighth- grade Chambers County teachers, 17 (27.9%) completed HBRS protocols. Out of the potential pool of 53 sixth-, seventh-, and eighth- grade Alexander City teachers, 27 (50.9%) completed HBRS protocols. The investigator returned to the teachers' homerooms 2 weeks after they had been given the HBRS protocols to complete. The investigator collected the HBRS protocols. Out of the 44 teachers who completed HBRS protocols, approximately 33 (75%) did so within the 2-week period of time while, 11 (25%) completed the rating scales within 3-weeks. The investigator communicated with the teachers via e-mail to arrange pick-up times for the rating scales that were returned after the 2-week period. Two teachers who originally agreed to participate, returned signed parental informed-consent and child-assent forms, and who received the coded HBRSs and envelope with the instructions and code list, did not complete the rating scales or communicate any further with the investigator.

Before proceeding with the data analysis, all variables were screened for possible missing values and outliers. The data were examined with regard to item skewness and kurtosis, raw score minimum and maximum ranges, and z-scores. All variables were examined for missing values. According to Curran, West, and Finch (1996) univariate variables were suspect when skewness exceeded 2.0 and kurtosis exceeded 7.0. The HBRS item skews ranged from -1.59 to .31, M = -.28 while, kurtosis values ranged from -.68 to 1.66, M = .03. Three item parcels were created for each of the five dimensions: persistence, curiosity, externalizing affect, internalizing affect, and cognition. A total of 15 item parcels were created for the analysis. With regard to the 15 parcels, skewness ranged from -1.00 to .39, M = -.24 while kurtosis values ranged from -.01 to .37, M = .18. All skews and kurtosis were within the Curran et al. (1996) criteria.

Data Analysis

The data were analyzed using SPSS 11.0. Separate univariate analyses of variance were used initially to analyze the demographic data. Cronbach's alpha was employed to assess the internal consistency and thus, reliability of each grade for each dimension: persistence, curiosity, externalizing affect, internalizing affect, and cognition. An exploratory factor analysis was conducted.

Reliability

Cronbach's alpha was used to assess the reliability of this sample for each group: sixth, seventh, and eighth graders. The data gleaned from this sample using the HBRS were examined by conducting a reliability analysis of the 5 dimensions: persistence, curiosity, externalizing affect, internalizing affect, and cognition using Cronbach's alpha.

According to Salvia and Ysseldyke (2004), reliability coefficients that meet the .90 or above criterion could be used in diagnostic decisions. Whereas, reliability that meet the .80 criterion could be used in screening decisions.

Construct Validity

In order to conduct an exploratory factor analysis, Gorsuch (1983) suggested a minimum ratio of five individuals to every variable, with preferably 10 to 20 individuals per variable. He noted a minimum of 100 subjects should be adhered to. In this research study, the Human Behavior Rating Scale, HBRS items were grouped into sets of 3 parcels per dimension; persistence, curiosity, externalizing affect, internalizing affect, and cognition. A total of 15 parcels were submitted to factor analysis instead of individual items. A total of 320 students had HBRS rating scales completed for them by their teachers. Therefore, this sample consisted of approximately 21 individuals per parcel.

An exploratory factor analysis was conducted using the 94 items from the HBRS that were organized into five parcels for each hypothesized construct: persistence, curiosity, externalizing affect, internalizing affect, and cognition. A principal axis factor analysis was employed using a Promax rotation (kappa = 4) of the parcels. The scree plot was used to estimate the number of factors to extract. The Kaiser-Meyer-Olkin measure of sampling adequacy was examined in order to determine whether or not the data were suitable for principal axis factor analysis. Bartlett's test of sphericity was examined. A significant ($p < .001$) result would indicate there was an adequate correlation between the variables to justify factor analysis. Based on the scree test and Eaves' assertion that the HBRS contained five correlated factors, the number of factors to be extracted was set at

five. The resulting factors were examined in order to determine how much of the total variance was accounted for. Communalities were examined for each parcel and the range noted. Communalities above .40 were considered adequate and provided an indication of the stability of results. Extractions of communalities of .70 and above indicated a high probability of replication of the results.

Research Objectives

Several research objectives were investigated. The internal consistency of the five dimensions of the HBRS when explored through Cronbach's alpha was expected to result in reliability coefficients for sixth, seventh, and eighth grades of .80 to .99 for each dimension. Two arousal factors, two affective factors and one cognitive factor were expected to emerge from an exploratory factor analysis when an oblique rotation was applied. Finally, it was expected that the three parcels would load according to expectations and load saliently only on their respective factors.

IV. RESULTS

This section presents the results of this study. Included in this section are univariate analyses of variance of the demographic variables, Cronbach's alpha reliability analysis of the HBRS dimensions for sixth, seventh, and eight grades, an exploratory factor analysis of the HBRS conducted with the 320 participants, and a summary of the results. Tables for the means and standard deviations of the demographic variables and the exploratory factor analyses conducted in this study are also included.

Descriptive Statistics

The following demographic variables were examined through one-way ANOVAs with the following independent variables: grade, county, gender, race, and socioeconomic status. The dependent variables examined separately for each independent variable were: persistence, curiosity, externalizing affect, internalizing affect, and cognition. The means and standard deviations are displayed for each variable in Table 2. The significant main and simple effects were noted in the discussion following the table.

Table 2

Means and Standard Deviations (SDs) of the Demographic Variables for this Sample

	Group				
Variable/ Statistic	Persistence	Curiosity	Externalizing Affect	Internalizing Affect	Cognition
Grade					
6 (*n* = 164)					
Mean	35.59	60.70	89.37	73.92	62.99
SD	6.62	13.62	15.47	12.64	15.38
7 (*n* = 99)					
Mean	31.55	60.89	81.07	70.20	57.57
SD	9.85	15.01	23.78	15.16	19.45
8 (*n* = 57)					
Mean	33.70	62.39	94.30	78.21	63.72
SD	8.14	13.53	13.99	13.13	16.28
School District					
Chambers (*n* = 135)					
Mean	31.58	60.90	85.40	72.71	59.73
SD	8.86	12.79	21.05	14.71	17.98
Alex City (*n* = 185)					
Mean	33.12	61.17	89.36	74.15	62.71
SD	7.31	14.90	16.80	13.06	16.24

(table continues)

Table 2, *continued*

Variable/ Statistic	Group				
	Persistence	Curiosity	Externalizing Affect	Internalizing Affect	Cognition
Gender					
Male (*n* = 160)					
Mean	32.47	62.48	86.61	74.60	60.24
SD	8.24	14.28	19.91	12.78	17.15
Female (*n* = 160)					
Mean	32.46	59.64	88.75	72.47	60.64
SD	7.82	13.65	17.60	14.67	16.95
Race					
White (*n* = 178)					
Mean	33.65	62.97	92.01	74.83	64.79
SD	7.39	14.29	15.71	13.78	16.63
African American (*n* = 135)					
Mean	30.37	58.07	81.78	71.78	56.33
SD	8.18	13.24	20.64	13.23	16.28

(table continues)

Table 2, *continued*

Variable/ Statistic	Group				
	Persistence	Curiosity	Externalizing Affect	Internalizing Affect	Cognition
Socioeconomic Level					
High (*n* = 133)					
Mean	34.24	64.45	89.53	75.02	66.41
SD	7.54	14.55	17.25	13.88	16.33
Low (*n* = 174)					
Mean	31.19	59.03	85.84	72.41	58.21
SD	8.14	13.12	20.16	13.33	16.76

With regard to grade comparisons and the dimensions of the HBRS, the Box's Test of Equality of Covariance Matrices was violated and Dunnett's T3 was applied. Externalizing affect for sixth, seventh, and eighth grades exhibited a significant main effect, $F(2,317) = 10.96$, $p = .0001$. Significant simple effects were noted for Externalizing Affect for the following grade comparisons: sixth, seventh ($p = .007$), seventh, eighth ($p = .0001$). The mean raw score for Externalizing Affect was 8.30 points higher for sixth grade than seventh grade. The eighth grade mean raw score was 13.23 points higher than seventh grade. Internalizing Affect exhibited a statistically significant difference between seventh and eighth grade. The mean raw score for Internalizing Affect was 8.01 points higher for eighth grade and was considered statistically significant when compared to seventh grade, $F(2,317) = 6.46$, $p = .002$.

With regard to race, white and African-American groups exhibited a significant difference in all comparisons. The mean raw score for Persistence was 3.28 points higher for whites, which was statistically significant, $F(1,311) = 13.78$, $p = .0001$. The mean raw score for Curiosity was 4.90 points higher for whites and was statistically significant, $F(1,311) = 9.58$, $p = .002$. The mean raw score for Externalizing Affect was 10.23 points higher for whites and was statistically significant, $F(1,311) = 24.81$, $p = .0001$. The mean raw score for Internalizing Affect was 3.05 points higher for whites and was statistically significant, $F(1,311) = 3.89$, $p = .049$. Furthermore, the mean raw score for Cognition was 8.46 points higher for whites and was statistically significant, $F(1,311) = 20.23$, $p = .0001$.

Finally, high and low socioeconomic levels exhibited significant differences when compared on Persistence, Curiosity, and Cognition. The mean raw score for Persistence was 3.05 points higher for High SES and was statistically significant, $F(1,305) = 11.28$, $p = .001$. The mean raw score for Curiosity was 5.42 points higher for High SES and was statistically significant, $F(1,305) = 11.64$, $p = .001$. The mean raw score for Cognition was 8.20 points higher for High SES and was statistically significant, $F(1,305) = 18.48$, $p = .0001$. Ultimately, 19 out of 30 comparisons did not exhibit statistically significant differences while, 11 comparisons were statistically significant.

Reliability

Cronbach's alpha was used to assess the reliability of the HBRS for grades six, seven, and eight for each dimension: persistence, curiosity, externalizing affect, internalizing affect, and cognition. This resulted in the reliability coefficients for each

grade for Persistence, *r* = .91 to .94, Curiosity, *r* = . 93 to .95, Externalizing Affect, *r* = .95 to .98, Internalizing Affect, *r* = .93 to .94, and Cognition, *r* = .97. Table 3 displays reliability coefficients for each dimension for each grade. All 15 reliability coefficients examined met the criterion for diagnostic purposes, which, according to Salvia and Ysseldyke (2004) requires a reliability coefficient of .90. Reliability coefficients set a cap on the range available for validity coefficients; therefore, it is advantageous for reliability coefficients to be high.

Table 3

Cronbach's Alpha Reliability Coefficients for Each Grade and Dimension

		Dimension				
n	Grade	Persistence	Curiosity	Externalizing Affect	Internalizing Affect	Cognition
164	6	.91	.95	.96	.93	.97
99	7	.93	.93	.98	.93	.97
57	8	.94	.94	.95	.94	.97

Construct Validity

Analysis of the HBRS began by creating item parcels for each of the five dimensions. Fifteen item parcels were created for the analysis and were used in lieu of individual item ratings in exploratory factor analysis. Item parceling was used because, according to Gorsuch (1983), when items for each dimension are compiled into several

parcels, the instability of individual items is overcome. He noted that, due to the fact that items selected for rating scales often include items that have either high or low means, they produce negatively and positively skewed distributions, respectively. Item parceling can produce more normal distributions among the variables and possibly reduce the production of difficulty factors. Gorsuch (1983) noted that parcels submitted to factor analysis are more likely to produce replicable and potentially, interpretable factors.

The parcels for the five hypothesized dimensions varied in the number of items they contained. The items were sequenced according to skewness, highest to lowest within each dimension, and were placed into their respective parcels according to Gorsuch's (1983) guidelines. For the Persistence dimension, the item with the highest skew was placed in the first parcel; the item with the second highest skew was placed in the second parcel, and so on until the ten items in the Persistence dimension were exhausted. The same process was used to construct the Curiosity, Externalizing Affect, Internalizing Affect, and Cognition parcels.

The result was such that two Persistence parcels contained three items and one parcel contained four items. Two Curiosity parcels each had seven items, while one parcel had six items. Two of the Externalizing parcels each had seven items, while one parcel had eight items. Also, two Internalizing parcels each had six items, while one parcel had seven items. Finally, two Cognition parcels each had seven items, while one parcel had six items.

Table 4 shows the mean scores, standard deviations, skewness, and kurtosis for each of the 94 items. Table 5 shows the mean, standard deviation, skewness, and kurtosis for each of the 15 parcels. The HBRS item skews ranged from -1.59 to .31, M =

-.28, while kurtosis values ranged from -.68 to 1.66, *M* = .03. With regard to the 15 parcels, skewness ranged from -1.00 to .39, *M* = -.24 while kurtosis values ranged from -.01 to .37, *M* = .18. All skews and kurtosis were within the criteria of Curran et al. (1996), who noted that univariate variables were suspect when skewness exceeded 2.0 and kurtosis exceeded 7.0.

Table 4

Means, Standard Deviations, Skewness, and Kurtosis for HBRS Items

Items	*M*	*SD*	Skewness	Kurtosis	**Items**	*M*	*SD*	Skewness	Kurtosis
1	3.18	1.02	.12	-.30	**12**	3.22	.84	.31	1.09
2	2.97	1.06	.05	-.42	**13**	3.00	1.05	.04	-.19
3	3.19	.98	.13	-.07	**14**	2.64	1.17	.17	-.59
4	3.27	1.08	.03	-.47	**15**	3.01	1.02	-.11	.03
5	3.00	1.11	.03	-.44	**16**	2.97	1.05	.09	-.12
6	2.68	1.17	.15	-.62	**17**	3.31	.98	-.10	.13
7	2.95	1.12	.13	-.52	**18**	3.27	.94	.23	.08
8	3.33	.90	.12	.36	**19**	3.41	.96	.15	-.18
9	3.33	.93	.08	.19	**20**	3.10	1.04	.11	-.14
10	3.33	1.06	.05	-.49	**21**	3.12	1.00	.24	.18
11	2.93	1.09	.16	-.38	**22**	3.11	1.04	.00	-.13

Table 4 *continued*

Items	*M*	*SD*	Skewness	Kurtosis	**Items**	*M*	*SD*	Skewness	Kurtosis
23	3.22	.91	.20	.25	**35**	2.68	1.18	.05	-.61
24	2.99	1.02	.02	.11	**36**	3.36	.95	.18	-.03
25	3.18	.98	-.16	.23	**37**	3.25	1.01	.12	-.01
26	3.20	.95	.10	.21	**38**	3.55	.99	.06	-.68
27	3.36	1.05	.01	-.46	**39**	2.95	1.09	-.09	-.19
28	3.29	1.06	.02	-.46	**40**	2.83	1.14	-.10	-.47
29	3.27	1.00	.11	-.19	**41**	2.96	1.00	-.16	.36
30	2.89	1.12	.09	-.44	**42**	3.20	1.00	.06	.05
31	3.07	.95	-.09	.57	**43**	3.02	1.00	.14	.07
32	3.21	.98	.07	.16	**44**	3.17	1.01	.09	.05
33	3.11	1.05	.10	-.15	**45**	3.11	1.05	-.05	-.09
34	3.11	1.05	.09	-.23	**46**	3.26	1.01	.14	-.09

Table 4 *continued*

Items	*M*	*SD*	Skewness	Kurtosis	**Items**	*M*	*SD*	Skewness	Kurtosis
47	3.28	1.03	.12	-.20	**59**	3.00	1.09	.01	-.27
48	3.28	.87	.12	.70	**60**	3.17	.98	.04	.29
49	3.23	.97	.08	.18	**61**	2.72	1.13	.12	-.44
50	2.70	1.13	.02	-.54	**62**	2.78	1.10	.15	-.36
51	3.17	.99	.16	.06	**63**	2.88	1.04	-.10	-.05
52	3.05	1.00	.14	-.15	**64**	3.89	1.22	-.82	-.30
53	3.23	.87	.23	1.01	**65**	4.00	1.23	-.92	-.33
54	3.09	.92	-.04	.92	**66**	4.14	1.05	-.96	.12
55	3.39	.90	.09	.40	**67**	4.06	1.26	-1.08	.01
56	3.28	.93	.09	.35	**68**	4.10	1.20	-1.01	-.25
57	3.17	1.05	-.01	-.14	**69**	4.23	1.13	-1.22	.35
58	3.19	1.10	.04	.-39	**70**	4.25	1.14	-1.27	.43

Table 4 *continued*

Items	*M*	*SD*	Skewness	Kurtosis	**Items**	*M*	*SD*	Skewness	Kurtosis
71	4.22	1.17	-1.21	.20	**83**	4.33	1.10	-1.45	.94
72	4.38	.94	-1.19	.21	**84**	4.08	1.27	-1.04	-.25
73	4.14	1.04	-.91	-.09	**85**	4.02	1.13	-.80	-.41
74	4.15	1.20	-1.13	.09	**86**	4.27	1.01	.-1.09	.23
75	3.97	1.19	-.84	-.32	**87**	4.40	.99	-1.47	1.21
76	4.21	1.16	-1.17	.11	**88**	4.25	1.07	-1.23	.54
77	4.18	1.11	-1.06	.03	**89**	4.36	.97	-1.31	.85
78	4.14	1.16	-1.06	.00	**90**	4.40	1.02	-1.59	1.66
79	4.32	1.08	-1.43	1.02	**91**	4.23	1.04	-1.06	.05
80	3.99	1.22	-.92	-.27	**92**	4.28	1.11	-1.38	.82
81	4.23	1.14	-1.19	.17	**93**	3.98	1.24	-.88	-.39
82	4.29	1.07	-1.23	.30	**94**	4.02	1.21	-.85	-.46

Table 5

Means (M), Standard Deviation (SDs), Skewness, and Kurtosis for Item Parcels of the HBRS

Parcels	*M*	*SD*	Skewness	Kurtosis
1Persistence	13.46	3.41	-.24	.05
2Persistence	9.54	2.60	.17	.17
3Persistence	9.46	2.51	.23	.11
1Curiosity	21.13	5.06	.24	.37
2Curiosity	21.33	5.22	.39	.33
3Curiosity	18.59	4.45	.27	.32
1Externalizing Affect	31.94	6.71	-.96	.06
2Externalizing Affect	27.76	6.22	-.99	.11
3Externalizing Affect	27.97	6.24	-1.00	.32
1Internalizing Affect	27.21	4.96	-.80	.28
2Internalizing Affect	22.49	4.44	-.72	-.01
3Internalizing Affect	23.84	5.00	-.91	.17
1Cognition	21.22	6.18	.18	.11
2Cognition	21.48	6.12	.29	.02
3Cognition	18.75	5.10	.19	.27

Raw scores for the 15 parcels were submitted to principal axis factor analysis with the Promax rotation for a user-specified five-factor solution. Principal axis factor analysis was used in lieu of principal components. The assumptions underlying principal axis factor analysis are more consistent with what is known about social science, due to the fact that all measurement contains error and there is virtually no instance where error variance is eliminated. With regard to principal components, unities are placed in the

diagonal, which is based on the assumption that all variance can be recovered. In principal axis multiple correlations are placed in the diagonal before factoring commences.

A Promax oblique rotation was applied because Eaves' (1993b) theory proposed that the central nervous system components of arousal, affect, and cognition are interrelated systems that work together but, still retain a level of independence. The oblique Promax rotation ($k = 4$) with Kaiser normalization was selected because any factors resulting from the analysis were hypothesized to be positively correlated.

Hair, Anderson, Tatham and Black (1998) noted factor loadings greater then $\pm$ .30 are considered to be adequate; loadings of $\pm$ .40 are considered important; and loadings are $\pm$ .50 or greater are considered practically significant. Hair et al. (1998) noted factor loadings are influenced by sample size and significance. Sample sizes of 250 require minimum factor loadings of .35 for significance at the .05 level, whereas, sample sizes of 350 require minimum factor loadings of .30 for significance at the .05 level (Hair et al., 1998).

Exploratory Analysis

The Kaiser-Meyer-Olkin index of sampling adequacy was .90 for the sample, indicating that the data represented a homogeneous collection of variables suitable for factor analysis. Bartlett's test of sphericity was significant for the sample χ^2 (105, N = 320) = 6961.33, $p < .0001$, which indicated that the set of correlations in the correlation matrix was significantly different from zero and suitable for factor analysis. Table 6 displays the correlation, covariance, and variance matrix for the 15 parcels.

Communalities were examined for the 15 parcels and the range noted. Communalities ranged from .85 to .96. Extractions of communalities of .70 and above indicated a high probability of replication of the results.

Table 6

Correlation and Covariance Matrix for the HBRS 15 Parcels

Item Parcel	1per	2per	3per	1cur	2cur	3cur	1ext	2ext	3ext	1int	2int	3int	1cog	2cog	3cog
1per	**11.64**	.83	.81	.51	.45	.60	.63	.65	.68	.52	.57	.48	.71	.72	.75
2per	7.36	**6.76**	.85	.61	.61	.71	.52	.54	.58	.47	.53	.39	.73	.75	.78
3per	6.94	5.55	**6.31**	.70	.68	.77	.46	.46	.50	.42	.47	.32	.79	.83	.84
1cur	8.86	7.99	8.88	**25.63**	.89	.84	.14	.11	.18	.32	.40	.17	.63	.65	.67
2cur	7.99	8.22	8.94	23.50	**27.23**	.84	.10	.06	.13	.32	.38	.19	.63	.64	.65
3cur	9.06	8.19	8.66	19.00	19.42	**19.83**	.24	.20	.29	.31	.38	.16	.73	.73	.73
1ext	14.47	9.02	7.67	4.75	3.36	7.14	**44.97**	.94	.95	.46	.47	.48	.35	.38	.40
2ext	13.77	8.68	7.21	3.34	1.82	5.64	39.21	**38.69**	.94	.49	.48	.51	.33	.37	.40
3ext	14.39	9.47	7.85	5.63	4.16	8.00	39.63	36.44	**38.89**	.48	.50	.49	.40	.42	.45
1int	8.71	6.09	5.19	8.08	8.39	6.75	15.44	15.21	14.97	**24.58**	.88	.90	.34	.34	.37
2int	8.69	6.16	5.27	8.92	8.79	7.54	13.88	13.37	13.79	19.38	**19.69**	.84	.42	.42	.44
3int	8.14	5.03	4.00	4.36	5.02	3.48	15.98	15.90	15.16	22.26	18.64	**25.00**	.25	.26	.28
1cog	14.92	11.70	12.29	19.65	20.41	20.00	14.43	12.73	15.43	10.28	11.61	7.63	**38.18**	.94	.92
2cog	15.10	11.96	12.78	20.23	20.58	19.79	15.45	14.20	16.11	10.36	11.53	7.97	35.64	**37.49**	.95
3cog	13.03	10.33	10.75	17.23	17.22	16.67	13.50	12.54	14.23	9.32	9.95	7.09	29.09	29.57	**26.03**

Note.Variances are in bold on the diagonal. Correlations are above diagonal and covariances are below the diagonal.

A five-factor solution was selected for extraction based on Eaves' (1993b) Integrated Theory of Human Behavior that proposed human behavior is a combination of an interaction of the central nervous system components of arousal (persistence and curiosity), affect (externalizing and internalizing), and cognition. The scree plot also suggests that 5 factors should be extracted. Table 7 displays the five-factor unrotated solution five parcels (persistence, curiosity, externalizing affect, internalizing affect, and cognition) loaded robustly on one factor and recovered 57.56% of the variance. Curiosity, Externalizing Affect, Internalizing Affect and two Cognition parcels cross-loaded on the second factor and recovered an additional 19.28% of the variance. Externalizing Affect and Internalizing Affect cross-loaded on the third factor and recovered 9.98% of additional variance. Two curiosity parcels and one cognition parcel cross-loaded on the fourth factor and recovered 4.33% of the variance. No variable loaded robustly on factor 5 which recovered 2.31% of the variance.

Following the Promax oblique rotation of the five-factor solution each of the three parcels for Persistence, Curiosity, Externalizing Affect, Internalizing Affect, and Cognition loaded robustly on their respective factors. No factor cross-loaded on a secondary factor. Table 8 displays the variance recovered by each factor before and after rotation. After the Promax rotation, the persistence factor recovered 21.63% of the variance, the curiosity factor recovered 17.39% of the variance, the externalizing affect factor recovered 15.58% of the variance, the internalizing affect factor recovered 14.37%, and the cognition factor recovered 21.26% of the variance. The five-factor solution accounted for 90.24 % of the total variance. Pattern Matrix coefficients displayed in Table 9, ranged from .56 to 1.03 with values below .295 omitted. According to Hair et al.

(1998) the pattern matrix coefficients met the criterion of sample sizes of 250 required minimum factor loadings of .35.

Table 7

Factor Matrix Coefficients and Communalities (h^2) for the Five-Factor Unrotated Solution for HBRS Item Parcels

Item Parcel	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	h^2
1Persistence	.87					.85
2Persistence	.88					.85
3Persistence	.89					.88
1Curiosity	.70	-.50		.31		.88
2Curiosity	.68	-.53		.30		.90
3Curiosity	.77	-.46				.85
1Externalizing Affect	.64	.61	-.35			.95
2Externalizing Affect	.64	.64	-.33			.94
3Externalizing Affect	.68	.58	-.34			.95
1Internalizing Affect	.64	.43	.57			.92
2Internalizing Affect	.69	.34	.50			.85
3Internalizing Affect	.55	.54	.54			.90
1Cognition	.84	-.32		-.30		.92
2Cognition	.86	-.31				.97
3Cognition	.87					.93

Note: All values less than .295 were omitted.

Table 8

Eigenvalues and Variance Recovered in the Unrotated Extraction and Oblique Rotation

	Extraction			Oblique Rotation	
Factor	Eigenvalues	Percent of Variance	Cumulative Percent	Eigenvalues	Percent of Variance
1	8.63	57.56	57.56	7.00	21.26
2	2.89	19.28	76.84	5.10	15.58
3	1.50	9.98	86.82	5.70	17.39
4	.65	4.33	91.15	4.71	14.37
5	.35	2.31	93.46	7.09	21.63

Table 9

Factor Pattern Matrix Coefficients and Communalities (h^2) for the Five-Factor Oblique Rotated Solution for HBRS Item Parcels

Item Parcel	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	h^2
1Persistence	.68					.85
2Persistence	.70					.85
3Persistence	.56					.88
1Curiosity		.95				.88
2Curiosity		.97				.90
3Curiosity		.74				.85
1Externalizing Affect			1.03			.95
2Externalizing Affect			.91			.94
3Externalizing Affect			.95			.95
1Internalizing Affect				.95		.92
2Internalizing Affect				.85		.85
3Internalizing Affect				.97		.90
1Cognition					.98	.92
2Cognition					.99	.97
3Cognition					.87	.93

Note: All values less than .295 were omitted.

The correlations between the five factors were persistence/curiosity r = .63, persistence/externalizing affect r = .64, persistence/internalizing affect r = .52, persistence/cognition r = .76, curiosity/externalizing affect r = .15, curiosity/internalizing affect r = .30, curiosity/cognition r = .70, externalizing affect/internalizing affect r = .52, externalizing affect/ cognition r = .41, internalizing affect/cognition r = .36 (see Table 10). Correlations ranged from .15 to .76, *M* = .50. The interfactor correlations in the five-factor solution were below .80, indicating that the factors were correlated, but could be considered as separate factors.

Table 10

Factor Correlation Matrix

Factor	Persistence	Curiosity	Externalizing Affect	Internalizing Affect	Cognition
Persistence	1.00	.63	.64	.52	.76
Curiosity	.63	1.00	.15	.30	.70
Externalizing Affect	.64	.15	1.00	.52	.41
Internalizing Affect	.52	.30	.52	1.00	.36
Cognition	.76	.70	.41	.36	1.00

Note. Principal Axis Factoring method was employed. Promax rotation method with Kaiser Normalization was used

V. DISCUSSION

This study investigated several research objectives. The internal consistency of the 5 dimensions of the HBRS when explored through Cronbach's alpha was expected to result in reliability coefficients for sixth, seventh, and eight grades of .80 to .99 for each dimension. Two arousal factors, two affective factors and one cognitive factor were expected to emerge from an exploratory factor analysis when an oblique rotation was applied. Finally, it was expected that the three parcels would load according to expectations and load saliently only on their respective factors.

The sample employed in this study consisted of 320 children drawn from local schools in Alabama. Forty-four sixth, seventh, and eighth grade teachers completed HBRSs on their students who had returned signed parental informed-consent and child-assent forms. Cronbach's coefficient alpha was used to examine the internal consistency of the instrument for grades six, seven, and eight for the five dimensions of the HBRS: persistence, curiosity, externalizing affect, internalizing affect, and cognition. Reliability coefficients ranged from .91 to .98, indicating a high degree of consistency for each grade group with regard to the five dimensions of the HBRS.

A five-factor solution was chosen for two reasons. First, Eaves' (1993b) Integrated Theory of Human Behavior suggests that human behavior is a combination of arousal (persistence and curiosity), affect (externalizing and internalizing), and cognition.

The HBRS was constructed to measure the five components of human behavior hypothesized by Eaves. Second, the scree test identified five factors. The scree test was chosen in lieu of using eigenvalues greater than one due to the fact that when eigenvalues are employed some factors which would be included in methods such as the scree test are often omitted (Hair et al., 1998). Eaves (Personal communication, 2007) noted that when a considerable amount of factor intercorrelation is expected, eigenvalues may be larger; thus, the eigenvalues greater than 1 criterion generally provides an underestimate of the correct number of factors to extract. Eaves further noted the scree test may identify factors that appear small before the oblique rotation, but become robust after the oblique rotation.

The 94-items of the HBRS were used to construct three parcels for each of the five dimensions. The 15 parcels were then submitted to an exploratory factor analysis where principal axis analysis was employed. As noted earlier, the scree plot identified five factors. Communalities ranged from .85 to .96. An oblique Promax rotation was applied and a five-factor solution was revealed that recovered 90.24% of the total variance. Table 7 indicates that after rotation, the eigenvalues changed from 8.63 to 7.00 for factor 1, 2.89 to 5.10 for factor 2, 1.50 to 5.70 for factor 3, .65 to 4.71 for factor 4, and .35 to 7.09 for factor 5. The percent of variance recovered for each factor also changed after the oblique rotation. Before the oblique rotation, factor 1 recovered most of the variance, 57.56%, after the rotation the variance was more evenly distributed with 21.26% recovered for factor 1, 15.58% for factor 2, 17.39% for factor 3, 14.37% for factor 4, and 21.63% for factor 5. Each of the three parcels loaded saliently on its

respective factor and no others: persistence, curiosity, externalizing affect, internalizing affect, and cognition. Pattern coefficients ranged from .56 to 1.03.

The relationship between factors can be examined by noting their correlations with each other. The factor correlation matrix shown in Table 10 indicates that intercorrelations between factors ranged from .15 to .76, which indicated that while related, each factor retained a degree of specificity from the other factors. Due to the high correlation between Persistence and Curiosity (.63), one could argue that Persistence and Curiosity should be collapsed into one factor called Arousal. However, further examination of the factor correlation matrix indicates only Persistence has much to do with Externalizing Affect, while Curiosity does not appear to correlate significantly with Externalizing Affect. If an Arousal factor is used in lieu of Persistence and Curiosity the relationship with Externalizing Affect is lost.

Persistence was highly correlated with Cognition (.76). Curiosity was also highly correlated with Cognition (.70). This could indicate that individuals in this sample invested their arousal (persistence and curiosity) in cognitive endeavors. Persistence was also highly correlated with Externalizing Affect (.64), and with Internalizing Affect (.52), while Curiosity correlated (.15), with Externalizing Affect and (.30), with Internalizing Affect. This would seem to indicate that individuals in this sample invested some of their arousal (persistence) in externalizing and internalizing endeavors. It would also indicate that with regard to this sample, Curiosity was correlated with Internalizing Affect more so than Externalizing Affect. In other words, the results support the notion that different types of arousal may exist. Persistence and Curiosity appear to be measuring at least psychometrically somewhat different dimensions.

The original research objectives of this study were obtained. Cronbach's alpha was used to examine the internal consistency for each grade: for the five dimensions of the HBRS: persistence, curiosity, externalizing affect, internalizing affect, and cognition. Reliability coefficients ranged from .91 to .98. With regard to this sample, two arousal factors (persistence and curiosity), two affective factors (externalizing and internalizing), and one cognitive factor emerged after the Promax rotation was applied. Furthermore, each of the three parcels loaded saliently on their respective factors. The results of the current study lend support to the reliability and construct validity of the HBRS with regard to this sample.

Speculative Implications for the Integrated Theory of Human Behavior

Lacey (1960) proposed that there were different types of arousal and as such, they could be measured. Eaves' (1993b) Integrated Theory of Human Behavior combined existing arousal, affect, and cognition theories into one comprehensive theory. Eaves proposed that human behavior was a combination of the interaction of central nervous system components that were created through evolution: arousal (persistence and curiosity) located in the reticular activating system within the brain stem and diencephalon, externalizing and internalizing affect located in the limbic system, and cognition located in the cerebral cortex.

Eaves (1993b) highlighted the importance of evolutionary accretion and acknowledged that newer structures in the human nervous system perform regulating functions involving older structures, which possess a significant degree of independence in directing behavior. Each of the components of arousal, affect, and cognition perform in

this manner. The reticular activating system is responsible for arousal and serves the function of alerting the rest of the brain when relevant stimuli are encountered. Individual sensory systems also convey specific information directly to their associated cortical and limbic sensory reception areas. The important point is without the arousal forthcoming from the reticular activating system neither the limbic system nor the cerebral cortex will respond to such stimuli adaptively. Individuals rely on arousal for survival.

As noted earlier, Williams, Eaves, and Cox (2002) acknowledged that arousal has been investigated and implicated in a wide array of phenomena: the orienting response (Spinks & Siddle, 1983), the defensive response (Mogenson, 1977), curiosity (Berlyne, 1960), habituation and perception (Sokolov, 1963), attention (Rose, Feldman, Wallace, & Cohen, 1991), motivation (Revelle & Loftus, 1992), vigilance (Kinormura, Larsson, Gulyas, & Roland, 1996), preference for novelty (Thompson, Fagan, & Fulker, 1991), stimulation seeking (Zuckerman, 1979), and persistence (Lindsley, 1958). O'Gorman (1983) noted that arousal levels are constitutionally and probably genetically variable. Eaves (1993b) acknowledged that infants vary virtually from birth in their capacity to actively attend to and explore novel stimuli in their environment.

While there is no argument concerning the adaptive importance of arousal for individuals, a state of confusion does exist in defining and measuring arousal. The HBRS was proposed to measure two types of arousal (persistence and curiosity). The current study attempted to measure the psychometric properties of the HBRS. The results supported a five-factor solution. One proposed factor was persistence. Examples of HBRS items that were designed to measure persistence included: (a) Perserveres, even in difficult circumstances, (b) Can sustain interest over a satisfactory period of time, and (c)

Is not easily distracted by unimportant events in the environment. Another proposed factor was curiosity. Examples of HBRS items that were designed to measure curiosity included: (a) Is inquisitive about unfamiliar things, (b) Is attracted to novel situations, and (c) Takes things apart to find out how they work.

As noted earlier, arousal was parceled into the two dimensions of persistence and curiosity. Statistically, the results indicated that persistence parcels loaded saliently with themselves and no other, and curiosity parcels loaded saliently with themselves and no other. Once one reads the different types of items, one could propose that they are attempting to measure different aspects of human behavior, perhaps two types of arousal. According to Eaves' (1993b) theory, arousal invests itself in affect and cognition. It is the basic drive and source of energy for organisms. Eaves attempts to measure arousal as it comes to fruition in the forms of affect and cognition. He and other theorists acknowledge that there may be many forms of arousal that have not been thoroughly researched. The HBRS is one attempt to investigate two types of arousal (persistence and curiosity).

Eaves (1993b) described the limbic system as being "largely responsible for the selection and display of primitive survival behavior, much of which can be classified as emotional in nature" (p. 7). He noted that usually the limbic system does not usurp the regulatory functions of the brain stem and that in times of immediate peril the normal function of the limbic cannot easily be overridden by the cortex. In these instances the limbic system will usually produce the most advantageous outcome rather than any behavioral strategy devised by the cortex. As noted earlier, Eaves (1993b) described behavior that is limbic in nature: (a) eating, procuring food (through exploration), (b)

rage, aggression, (c) fearful behavior such as running away, (d) sexual behavior such as masturbation and intercourse, (e) temperature regulation, (f) respiration regulation, and (g) feelings of pleasure and pain. He noted that all the behaviors listed clearly deal with survival. Humans could also deal with the same topics in a cognitive fashion such as having discussions about the aesthetic value of a plate of food.

With regard to this study, the HBRS was designed to measure aspects of externalizing and internalizing affect. Examples of HBRS items that were designed to measure externalizing affect included: (a) Is compliant with reasonable requests from authority figures, (b) Teases and bullies others, and (c) Physically attacks others. Another factor proposed was internalizing affect. Examples of HBRS items that were designed to measure internalizing affect included: (a) Worries a lot, (b) Is brave; controls his or her fear, and (c) Is easily frightened.

Statistically, the results indicated that externalizing items loaded saliently with themselves and no other factor, and internalizing items loaded saliently with themselves and no other factor. The factor correlation matrix indicated that aspects of arousal, such as persistence, were highly correlated with externalizing and internalizing affect while another aspect of arousal, curiosity, was moderately correlated with internalizing affect, and poorly correlated with externalizing affect.

Cognition deals with stimuli in a symbolic, and abstract way, rather than in an affective, emotional, and concrete way. Sokolov (1963) and Berlyne (1960) noted the cortex attempts to make the best match between the current stimulus set and some generalized stimulus-response scenario previously stored in long-term memory. Eaves' (1993b) theory proposed that the cerebral cortex, as well as the arousal and affective

systems, have a left and right side that function differently. He proposed, left side functioning deals with language and highly routinized behavior that is learned in a sequential fashion such as, driving a car, tying one's shoe, etc. Right side functioning was proposed to deal with novel stimuli and function in a simultaneous way. It serves as the problem solver.

According to Eaves' (1993b) theory, arousal can invest itself in limbic and cortical ways. One factor proposed by HBRS was cognition. Examples of HBRS items that were designed to measure cognition included: (a) Deals with measurement problems (e.g., length, weight) satisfactorily, (b) Organizes ideas and information satisfactorily, and (c) Can describe the author's purpose after reading an editorial. The results of this study indicated after the oblique rotation was applied, the cognitive items loaded saliently with themselves and no other factor. Upon further examination of the factor correlation matrix, persistence and curiosity are highly correlated with cognition while, externalizing and internalizing correlated with cognition low to moderate. Arousal (persistence and curiosity) appears to influence cognition more than affect with regard to this sample.

Limitations

There were several limitations with regard to this study. First, exploratory factor analysis is useful in testing the item construction and psychometric properties of an instrument. However, in order to test the theoretical underpinnings of the HBRS, which propose that human behavior comes to fruition through the interaction of central nervous system components: arousal (curiosity and persistence) located in the reticular activating system, externalizing and internalizing affect located in the limbic system, and cognition

located in the cerebral cortex, a confirmatory factor analysis needs to be conducted. The construct validity of the HBRS was supported in that five robust factors were revealed. The factors while interrelated, still maintained a degree of specificity as was evident by their inter-factor correlations. While useful in identifying the five-factor solution, the process of exploratory factor analysis does not aid in defining or actually naming the factors.

The second limitation of this study was the lack of equal sample sizes in each of the grades investigated. This sample consisted of 164 sixth grade, 99 seventh grade, and 57 eighth grade students. If sample sizes had consisted of a minimum of 100 participants for each grade, then separate factor analyses could have been conducted that would have allowed the construct validity for sixth, seventh, and eighth grades to be investigated.

A third limitation of this study was the fact that the sample consisted of individuals from rural areas. It would have been advantageous to have participants from urban and suburban areas as well. The external validity of the study is limited due to the fact that a rural sample was employed. The results of this study could not be applied to southeastern urban or suburban sixth, seventh, and eighth grade students.

A fourth limitation of this study was that out of the potential pool of 114 sixth-, seventh-, and eighth- grade Chambers County and Alexander City teachers, only 44 (38.6%) completed HBRS protocols. More teacher participants would have increased the variance of the measures and perhaps the reliability and validity of the HBRS.

Future Research

The sample used in this study could be submitted to a confirmatory factor analysis. As noted earlier, a confirmatory factor analysis would be useful in investigating the components of Eaves' (1993b) Integrated Human Behavior Theory. If subsequent reliability and validity studies continue to support the HBRS, then it could be used to measure persistence, curiosity, externalizing affect, internalizing affect, and cognition in the general population.

In order to fully investigate Eaves' (1993b) Integrated Human Behavior Theory a battery of reliable and valid assessment instruments must be constructed. The instruments must measure aspects of arousal, affect, and cognition. Reliability studies such as, test-retest and internal consistency must be conducted for each instrument. In addition, content validity, criterion-related validity (concurrent and predictive), and construct validity of the respective instruments must be examined. After a battery of psychometrically sound instruments designed to measure aspects of arousal, affect, and cognition is identified, the next step is to design research studies that investigate their influence in the general population.

One such study could examine individuals who have diagnostic labels such as autism, attention deficit hyperactive disorder, mental retardation, learning disabilities, gifted, and individuals with no diagnostic label. The arousal, affect, and cognition of these individuals could be measured and compared to their diagnostic labels. Individuals with labels, such as mental retardation, would be expected to have lower arousal and cognition levels than individuals with attention deficit hyperactive disorder. If there were

a certain degree of classification accuracy with regard to diagnostic labels and levels of arousal, affect, and cognition, then this would lend support to Eaves' theory.

As mentioned earlier, historically, research has indicated that arousal measures do not intercorrelate very highly (Lacey, 1967). This has led to problems in investigating arousal. Future studies could investigate: Why do arousal measures not correlate with one another? How many facets of arousal are there? Could the reason arousal measures do not correlate highly be because each individual reacts to stimuli through a combination of his or her own genetics, experiences, and previous or current environmental influences?

Lacey (1967) described the process of different individuals reacting to the same stimulus in different physiological ways as "situational stereotypy." He noted that an individual's physiological reaction to a stimulus was directly related to his or her previous experiences with or memories of that stimulus. An individual could look at a spider and be struck with fear, while another individual may have a great love of spiders and want to investigate the creature. Fowles (1980) noted that Lacey argued that at the very least, two arousal systems exist: one in the reticular activating system and one in the limbic system, which was more closely tied to an organism's behavioral activation. Eaves (1993b) acknowledged that memory provides the material from which an individual can select strategies or responses to their ever changing environment.

If this is true then a battery designed to investigate arousal and how it influences affect and cognition would need to contain some way of measuring the different components of genetics, experiences, and environmental influences. This battery would need to contain instruments such as: (a) performance measures, (b) teacher, parent, and self-report rating scales, (c) systematic observations, and (d) physiological measures such

as galvanic skin conductance, vagal tone, respiration, and impedence as it relates to the thorax.

Currently, studies investigating Eaves' (1993b) Integrated Human Behavior Theory have shown a correlation between cognitive arousal and intelligence (Cox, 2000; Eaves & Glen, 1996; Glen, 1994). Eaves, Darch, and Williams (2004) used the VST II to show the significant effects of attention to novelty, fear-anxiety, and chronological age on conduct problems. The authors acknowledged that when the characteristic of low arousal is combined with high fear-anxiety levels (affect) within an individual, a propensity for conduct disorders occurred.

Eaves, Campbell, and Chambers (2000) investigated the criterion-related validity of Eaves' Pervasive Developmental Disorder Scale (PDDRS; 1993a) and the Autism Behavior Checklist (ABC; Krug, Arick, & Almond, 1993) and acknowledged that the instruments measured similar constructs and both significantly discriminated between participants with autistic disorder and participants with disorders frequently confused with autistic disorder. The PDDRS has been found to measure arousal, affect, and cognition in individuals with autism (Eaves & Williams, 2006; Eaves, et al., 2006; Williams & Eaves, 2005a, 2005b). The PDDRS studies have indicated that arousal is highly correlated with affect in individuals with autism, especially if they have lower levels of cognition. Future studies could investigate individuals who live in more primitive or affective environments to determine if affective environments would cause humans to invest their arousal in a more affective way. Previously studies have been conducted mostly with students engaged in modernized settings. Pockets of the

population that are not engaged in structured cognitive surroundings, such as attending school have as yet not been investigated.

Examples of populations who exist in a more affective environment include individuals who live in isolated tribal villages in underdeveloped areas, prison populations, or remote areas of the United States where individuals engage in many affective types of employment and live a more affective life than one you would see from a college population. Luria (1979) studied the isolated Siberian villagers whose environment was about to change from rural and non-mechanized to modern and technological. He described the villagers as illiterate and noted they solved tasks in a practical, concrete manner relying on direct experience to help them reason. Luria described the villagers' behaviors as categorizing objects according to their experiences with the objects and related to them in a very direct concrete manner. The population Luria described was a group of individuals who grew up in an affective environment. They were born with the genetic capacity to adapt to any environment; however the villagers adapted to their affective environment in an affective, concrete, and direct manner. In order to investigate the facets of Eaves' theory, studies need to be conducted in order to determine if this affective population does indeed exist today.

If measures of arousal, affect, and cognition are collected with reliable and valid instruments for a specific population such as sixth, seventh, and eighth grade students in a rural setting, then a snapshot of current levels of functioning are created. The next step would be to examine arousal (persistence and curiosity), externalizing and internalizing affect, and cognition measures for each grade and create interventions designed to address areas of need. If an individual had below-average arousal scores, and below

average cognitive scores, which influenced the child's level of academic performance an intervention could be designed. The intervention could be as simple as the teacher providing a form of verbal encouragement throughout the day by saying, "Don't quit" or "You can do it." If the child increases their level of persistence, it is possible that his or her cognitive performance may improve as well.

An individual with attention deficit disorder may have difficulty controlling his or her arousal as it comes to fruition in his or her externalizing affect. The individual may have a low level of persistence, but and an extremely high level of curiosity; this may be coupled with problems in attending to stimuli and staying on task. Externalizing problems may ensue resulting in the individual getting up and wandering around the room or interacting inappropriately with classmates instead of listening to the teacher. An appropriate intervention could include increasing the child's persistence and differentially rewarding incompatible or appropriate behavior while ignoring and extinguishing inappropriate behavior. This could be accomplished by establishing a behavior plan and enlisting a token economy system.

Implications

Thorndike (1911) was optimistic in his statement concerning the future ability of man to measure human behavior. He stated man would be able to

> ….tell every fact about every one's intellect and character and behavior, would tell the cause of every change in human nature, would tell the result which every educational force, every act of every person that changed any other or the agent

himself would have.... We shall become masters of our own souls as we now are masters of heat and light. (p. 6)

Researchers, teachers, parents, and individuals still grapple with the complexities, and sometimes simplicity, of human behavior.

Originally, the importance of teachers developing their teaching strategies or philosophies on a comprehensive theory was discussed. Difficulty arises when teachers have no organized systematic body of information to access. A comprehensive theory of human behavior can provide one with a scaffold upon which one can construct a personalized teaching philosophy and arsenal of cognitive or affective strategies. As mentioned earlier, doctors have a vast knowledge of medical information undergirded by empirical support they access on a daily basis. The field of special education has its core components, definition of disabilities, eligibility criteria, interventions, and assessment methods influenced by federal and state governmental entities and public sentiment.

A comprehensive classification system could be beneficial to current and future educators and researchers. With dispute over current diagnostic labels becoming ever more pronounced, Eaves' (1993b) Integrated Theory of Human Behavior could provide support for or against existing labels. All individuals have levels of arousal, affect, and cognition, which exist on a normal distribution curve and as such, can be measured. Educational programs could be designed to address deficits in arousal, affect, and cognition and also build on an individual's strength in the respective areas.

Perhaps future studies will help verify the psychometric properties of Eaves' assessment instruments. Hopefully a comprehensive battery of assessment instruments will be assembled that can measure arousal, affect, and cognition. Once such a battery is

in place, the next step is to begin investigating arousal, affect, and cognition in the general population.

Currently assessments are conducted in one or all of the following areas: screening, diagnosic, and follow-up or program planning for individuals who are at risk or suspected to have a disability. Many times assessments are chosen as a result of availability, cost, and examiner familiarity with the instrument. Oftentimes, the requirements of federal guidelines are the only determinates in what domains of the individual are assessed. Within the field of assessment contention grows as proponents of norm-referenced intellectual and academic assessments argue with advocates of curriculum-based or criterion-referenced assessments as to which is the most informative.

Many in the field of education, psychology, and sociology feel that current diagnostic labels provide a self-fulfilling prophecy where if a child is labeled with mild mental retardation the child will in fact be perceived by others as a low achiever. Others continue to advocate for the use of labels yet, become fixated by one particular aspect of assessment such as the child's intellectual quotient (IQ). Anastasi's 1958 Presidential Address to APA called for a departure from the current practices of trying to determine how much variance was accounted for by genetics and environment. She encouraged researchers to investigate how phenotypes develop in human beings and what major determinants cause significant qualitative differences in human intelligence. Eaves' (1993b) Integrated Theory of Human Behavior takes into account the effect that an individual's environment can have on their physiological and psychological development.

An assessment model based on Eaves' Theory and consisting of psychometrically sound instruments could help guide researchers and teachers in the complicated process

of assessing human behavior. Within the area of emotional disturbance great confusion exists on how to assess, correctly diagnose, and plan programs for individuals with behavior disorders. There does not seem to be any consensus as to how one differentiates between individuals with behavior disorders and individuals who are socially maladjusted. Reliable and valid instruments are desperately needed within this field. One advantage of the HBRS is that it has items designed to measure positive as well as negative externalizing and internalizing affect.

Many behavior rating scales used by practitioners today provide a negatively skewed distribution and have items only designed to measure negative instances of externalizing and internalizing affect. Coupled with types of measures mentioned earlier: (a) performance measures, (b) teacher, parent, and self-report rating scales, (c) systematic observations, and (d) physiological measures such as galvanic skin conductance, vagal tone, respiration, and impedence as it relates to the thorax, the HBRS could help improve the reliability and validity of current assessments for emotional disturbance.

Once an individual has been appropriately identified as having a behavior disorder or emotional disturbance, the teacher or practitioner could select which domains need to be addressed through academic and or behavioral interventions. An intervention program could be developed based on the key goals and objectives selected. Once this occurs, the teacher or practitioner would begin a cyclical process of applying the intervention, collecting data, evaluating the progress or lack of progress, and adjusting the intervention.

Eaves' (1993b) Integrated Theory of Human Behavior could potentially be beneficial to the field of assessment and teaching. There is much work to be done. This

current study is promising in that it provides support for the reliability and construct validity for the HBRS with regard to this sample. However, it is but one small piece to a much larger puzzle. Many years of instrument development, psychometric testing, and research into existing populations is ahead.

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APPENDICES

APPENDIX A

THE HUMAN BEHAVIOR RATING SCALE

The Human Behavior Rating Scale

Ronald C. Eaves © 2002

Name: _____ **Date:** _____

Grade: 6 7 8

Birth Date: _____ **Chronological Age:** _____

Parents' Occupations

Father: _____ Mother: _____

Parents' Education

Father: 1 2 3 4 5 6 7 8 9 10 11 12 **College** 1 2 3 4 5 6 7 8 >8

Mother: 1 2 3 4 5 6 7 8 9 10 11 12 **College** 1 2 3 4 5 6 7 8 >8

Race ☐ Afro-American ☐ Asian ☐ Native American ☐ Pacific Basin/Aleut ☐ White

☐ Other _____

Gender ☐ Male ☐ Female

School Services: ☐ Regular Ed ☐ Chap I ☐ MR ☐ LD ☐ ED ☐ Other _____

About the Rater:

Name: _____ **Sex:** ☐ Male ☐ Female

Race: ☐ Afro-American ☐ Asian ☐ Native American ☐ Pacific Basin/Aleut ☐ White

☐ Other _____ **Relationship to child : <u>Teacher</u>**

Directions: Judge each item separately from every other item. After reading an item:

1. Ask yourself, is this child's behavior about like other children his or her age? If the answer is yes, place an 'X' on the '3' in the left-hand column and move on to the next item.

2. If the answer is no, ask yourself, does this child display the behavior to a lower degree than other children his or her age? If the answer is yes, then place an 'X' on the '1' or '2.' Use the '2' when the choice between '1' and '3' is difficult.

3. If the answer to question 2 is no, then the child displays the behavior to a higher degree than other children his or her age. Therefore, place an 'X' on the '4' or '5.' Use the '4' when the choice between '3' and '5' is difficult. Please do not skip items.

1 =	**The child has never exhibited this behavior or attribute**
2 =	(Use this number when the choice between '1' and '3' is difficult)
3 =	**The child displays this behavior or attribute about the same as other children his or her age**
4 =	(Use this number when the choice between '3' and '5' is difficult)
5 =	**The child displays this behavior or attribute to a very high degree**

This child:

1	2	3	4	5	1.	Perseveres, even in difficult circumstances
1	2	3	4	5	2.	Deals with measurement problems (e.g., length, weight) satisfactorily
1	2	3	4	5	3.	Pays close attention to important events in the environment
1	2	3	4	5	4.	Shows satisfactory persistence in completing jobs that are started
1	2	3	4	5	5.	Grasps abstract, symbolic material readily
1	2	3	4	5	6.	Enjoys repairing or fixing broken things
1	2	3	4	5	7.	Can solve word problems satisfactorily
1	2	3	4	5	8.	Is curious about new things
1	2	3	4	5	9.	Has a wide variety of interests
1	2	3	4	5	10.	Is outgoing and not withdrawn
1	2	3	4	5	11.	Can estimate the answers to arithmetic problems before calculating them
1	2	3	4	5	12.	Notices subtle movements or sounds in the environment
1	2	3	4	5	13.	Can synthesize the elements of a problem to find a solution
1	2	3	4	5	14.	Takes things apart to find out how they work
1	2	3	4	5	15.	Shows courage when faced with threatening situations
1	2	3	4	5	16.	Understands the relations between sets of concepts (e.g., three branches of government, classification of animals)
1	2	3	4	5	17.	Doesn't let others push her or him around
1	2	3	4	5	18.	Has a lot of energy
1	2	3	4	5	19.	Is compliant with reasonable requests from authority figures
1	2	3	4	5	20.	Can deal with complex information
1	2	3	4	5	21.	Shows appropriate remorse following misbehavior (e.g., hurting someone)
1	2	3	4	5	22.	Can describe the author's purpose after reading an editorial
1	2	3	4	5	23.	Is not easily intimidated by others
1	2	3	4	5	24.	Makes up new ways to use available materials
1	2	3	4	5	25.	Is fearless when dealing with scary circumstances
1	2	3	4	5	26.	Is always ready to try something new
1	2	3	4	5	27.	Shows good self-control
1	2	3	4	5	28.	Becomes highly focused on things that really matter
1	2	3	4	5	29.	Can sustain interest over a satisfactory period of time
1	2	3	4	5	30.	Has a satisfactory understanding of geometry concepts
1	2	3	4	5	31.	Is brave; controls his or her fear
1	2	3	4	5	32.	Is inquisitive about unfamiliar things
1	2	3	4	5	33.	Understands whole numbers and place values
1	2	3	4	5	34.	Can analyze a problem to identify its important elements
1	2	3	4	5	35.	Watches animals to see what they will do
1	2	3	4	5	36.	Is an unselfish person
1	2	3	4	5	37.	Organizes ideas and information satisfactorily
1	2	3	4	5	38.	Is friendly and easy to get along with
1	2	3	4	5	39.	Is a risk taker; willing to undertake an activity that may not succeed
1	2	3	4	5	40.	Likes to explore (e.g., woods, old trunks, rivers)
1	2	3	4	5	41.	Obtains satisfactory tactile information through the fingers and hands
1	2	3	4	5	42.	Shows poise and self-confidence
1	2	3	4	5	43.	Is not easily distracted by unimportant events in the environment
1	2	3	4	5	44.	Can classify information presented in a written passage
1	2	3	4	5	45.	Would find a way to survive if left on a desert island
1	2	3	4	5	46.	Recalls facts and details from a written passage
1	2	3	4	5	47.	Can find the main idea in a story
1	2	3	4	5	48.	Gets excited about doing things he or she hasn't done before
1	2	3	4	5	49.	Can predict the outcome of a partially completed story
1	2	3	4	5	50.	Is not afraid of snakes, spiders, etc.
1	2	3	4	5	51.	Shows good impulse control
1	2	3	4	5	52.	Seldom makes the same mistake over and over
1	2	3	4	5	53.	Likes to go places she or he hasn't gone before
1	2	3	4	5	54.	Shows satisfactory care around dangerous circumstances
1	2	3	4	5	55.	Prefers "hands-on" experience to "book learning"
1	2	3	4	5	56.	Shows satisfactory empathy for the difficulties of others
1	2	3	4	5	57.	Can interpret graphs, charts, maps, and tables accurately
1	2	3	4	5	58.	Seldom gives up on a challenging activity

1	2	3	4	5	59.	Has a good grasp of real numbers (e.g., fractions, proportions)
1	2	3	4	5	60.	Generalizes skills from one task situation to another
1	2	3	4	5	61.	Always seems to be tinkering with things he or she doesn't understand
1	2	3	4	5	62.	Understands complicated figures and arrays
1	2	3	4	5	63.	Is attracted to novel situations

The following items represent behavior that is considered undesirable in our society. Use the same code found on page 1 for judging this child's status on each item. Remember, **if the child's behavior is about the same as other children his or her age,** you should place an 'X' on the '3.' I**f the child does not display the attribute or behavior at all**, you should place an 'X' on the '1.' **If the child displays the behavior at a very high rate or degree**, you should place an 'X' on the '5.'

1 = The child has never exhibited this behavior or attribute

2 = (Use this number when the choice between '1' and '3' is difficult)

3 = The child displays this behavior or attribute about the same as other children his or her age

4 = (Use this number when the choice between '3' and '5' is difficult)

5 = The child displays this behavior or attribute to a very high degree

This child:

1	2	3	4	5	64.	Quits, gives up easily
1	2	3	4	5	65.	Is always in the middle when things start to happen
1	2	3	4	5	66.	Is fearful and anxious
1	2	3	4	5	67.	Sometimes gets so mad that she or he loses control
1	2	3	4	5	68.	Has trouble dealing with authority figures
1	2	3	4	5	69.	Enjoys breaking the rules
1	2	3	4	5	70.	Likes to live on the edge
1	2	3	4	5	71.	Knowingly ignores the rights of others
1	2	3	4	5	72.	Is afraid of harmless animals, people, or situations
1	2	3	4	5	73.	Worries a lot
1	2	3	4	5	74.	Is a thrill seeker; quick to take a dare
1	2	3	4	5	75.	Is inhibited; shy
1	2	3	4	5	76.	Deliberately disobeys rules for behavior
1	2	3	4	5	77.	Is nervous
1	2	3	4	5	78.	Feels inferior
1	2	3	4	5	79.	Lies to others frequently without guilt
1	2	3	4	5	80.	Is timid and bashful
1	2	3	4	5	81.	Teases and bullies others
1	2	3	4	5	82.	Seems coldly indifferent to other's difficulties
1	2	3	4	5	83.	Is reckless
1	2	3	4	5	84.	Exhibits conduct problems
1	2	3	4	5	85.	Is easily embarrassed, self-conscious
1	2	3	4	5	86.	Is easily frightened
1	2	3	4	5	87.	Doesn't hesitate to cheat others
1	2	3	4	5	88.	Is withdrawn
1	2	3	4	5	89.	Startles easily
1	2	3	4	5	90.	Physically attacks others
1	2	3	4	5	91.	Is easily intimidated
1	2	3	4	5	92.	Exhibits problems in aggression
1	2	3	4	5	93.	Is sensitive; his or her feelings are easily hurt
1	2	3	4	5	94.	Lacks confidence

APPENDIX B

PARENTAL CONSENT/CHILD-ASSENT FOR ALEXANDER CITY

Auburn University

Auburn University, Alabama 36849-5226

Department of Rehabilitation & Special Education

1228 Haley Center

Telephone: (334) 844-5943
Fax: (334) 844-2080

Parental Consent and Child Assent for Child's Participation in a research study entitled, "An Exploratory Factor Analysis of the Human Behavior Rating Scale."

You are invited to have your child participate in a study on the Human Behavior Rating Scale (HBRS). This study is being conducted by Suzanne Woods-Groves, a doctoral student at Auburn University, under the direction of Dr. Ronald C. Eaves in the Department of Rehabilitation and Special Education. The purpose of this study is to investigate how well the HBRS measures how children think and behave by having classroom teachers complete a rating scale on sixth, seventh, and eighth grade students. Your child was selected as a possible participant because he or she is a sixth, seventh, or eighth grader. Your school superintendent and principal have agreed to cooperate in this study.

If you decide to allow your child to participate, you are allowing his or her teacher to complete a 94 - item Human Behavior Rating Scale about your child. This will not affect your child's academic performance or his or her grade. Participation is completely voluntary. The rating scale will have a code number on it instead of your child's name in order to eliminate the possibility that someone would see your child's name on the rating scale. Your child's name will never appear on the rating scale. The master code list with children's names and codes will be locked in a secure location accessible only to the teacher completing the Human Behavior Rating Scale, in order to protect the confidentiality of the children. The master code list with your child's name will be destroyed by the researcher when the Human Behavior Rating Scales are collected by the researcher. This will help insure that your child's name will remain confidential. Any information obtained in connection with this study and that can be associated with your child, will remain confidential. There are no benefits to your child by participating in this study. Information collected throughout the study may be published in a professional journal or presented at conferences. If so, none of your child's identifiable information will be included. Data will be kept in a locked cabinet within my locked office at Auburn University, 3010 Haley Center.

You may withdraw your child from participation at any time, without penalty, and you may withdraw any data that have been collected about your child. However, after your child's identifying information has been removed by destroying the master code list I will have no way to withdraw your child's data.

Your decision whether or not to participate will not jeopardize your future relations with Auburn University, Alexander City Schools, or your teachers. If you have any questions please contact me, Suzanne Woods-Groves or Dr. Ronald Eaves at 334-844-5943, we will be happy to answer any questions.

You will be provided a copy of this form to keep. For more information regarding your child's rights as a research participant you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334) 844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO HAVE YOUR CHILD PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE AND YOUR CHILD'S SIGNATURE INDICATES YOUR WILLINGNESS TO HAVE YOUR CHILD PARTICIPATE. If YOU DECIDE TO HAVE YOUR CHILD PARTICIPATE, PLEASE REVIEW THIS INFORMATION WITH YOUR CHILD.

Parent's or Guardian Signature	Date	Parent's Name	
Child's Signature	Date	Child's Name	
Investigator's Signature	Date		

A LAND-GRANT UNIVERSITY

HUMAN SUBJECTS
OFFICE OF RESEARCH
PROJECT #07-002 EP 0701
APPROVED 1/19/07 TO 1/18/08

APPENDIX C

PARENTAL CONSENT/CHILD-ASSENT FOR CHAMBERS COUNTY

Auburn University

Auburn University, Alabama 36849-5226

Department of Rehabilitation & Special Education

1228 Haley Center

Telephone: (334) 844-5943

Parental Consent and Child Assent for Child's Participation in a research study entitled, "An Exploratory Factor Analysis of the Human Behavior Rating Scale."

You are invited to have your child participate in a study on the Human Behavior Rating Scale (HBRS). This study is being conducted by Suzanne Woods-Groves, a doctoral student at Auburn University, under the direction of Dr. Ronald C. Eaves in the Department of Rehabilitation and Special Education. The purpose of this study is to investigate how well the HBRS measures how children think and behave by having classroom teachers complete a rating scale on sixth, seventh, and eighth grade students. Your child was selected as a possible participant because he or she is a sixth, seventh, or eighth grader. Your school superintendent and principal have agreed to cooperate in this study.

If you decide to allow your child to participate, you are allowing his or her teacher to complete a 94 - item Human Behavior Rating Scale about your child. This will not affect your child's academic performance or his or her grade. Participation is completely voluntary. The rating scale will have a code number on it instead of your child's name in order to eliminate the possibility that someone would see your child's name on the rating scale. Your child's name will never appear on the rating scale. The master code list with children's names and codes will be locked in a secure location accessible only to the teacher completing the Human Behavior Rating Scale, in order to protect the confidentiality of the children. The master code list with your child's name will be destroyed by the researcher when the Human Behavior Rating Scales are collected by the researcher. This will help insure that your child's name will remain confidential. Any information obtained in connection with this study and that can be associated with your child, will remain confidential. There are no benefits to your child by participating in this study. Information collected throughout the study may be published in a professional journal or presented at conferences. If so, none of your child's identifiable information will be included. Data will be kept in a locked cabinet within my locked office at Auburn University, 3010 Haley Center.

You may withdraw your child from participation at any time, without penalty, and you may withdraw any data that have been collected about your child. However, after your child's identifying information has been removed by destroying the master code list I will have no way to withdraw your child's data.

Your decision whether or not to participate will not jeopardize your future relations with Auburn University, Chambers County Schools, or your teachers. If you have any questions please contact me, Suzanne Woods-Groves or Dr. Ronald Eaves at 334-844-5943, we will be happy to answer any questions.

You will be provided a copy of this form to keep. For more information regarding your child's rights as a research participant you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334) 844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO HAVE YOUR CHILD PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE AND YOUR CHILD'S SIGNATURE INDICATES YOUR WILLINGNESS TO HAVE YOUR CHILD PARTICIPATE. If YOU DECIDE TO HAVE YOUR CHILD PARTICIPATE, PLEASE REVIEW THIS INFORMATION WITH YOUR CHILD.

Parent's or Guardian Signature	Date	Parent's Name	
Child's Signature	Date	Child's Name	
Investigator's Signature	Date		

APPENDIX D

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD (IRB)

APPROVAL LETTER FOR STUDY

Auburn University

Auburn University, Alabama 36849

Office of Human Subjects Research
307 Samford Hall

Telephone: 334-844-5966
Fax: 334-844-4391
hsubjec@auburn.edu

January 22, 2007

MEMORANDUM TO: Suzanne Woods-Groves
RSED

PROTOCOL TITLE: "Exploratory Factor Analysis of the Human Behavior Rating Scale"

IRB AUTHORIZATION NO: 07-002 EP 0701

APPROVAL DATE: January 19, 2007
EXPIRATION DATE: January 18, 2008

The above referenced protocol was approved by IRB Expedited procedure under Expedited Category #7. You should report to the IRB any proposed changes in the protocol or procedures and any unanticipated problems involving risk to subjects or others. Please reference the above authorization number in any future correspondence regarding this project.

If you will be unable to file a Final Report on your project before January 18, 2008, you must submit a request for an extension of approval to the IRB no later than January 3, 2008. If your IRB authorization expires and/or you have not received written notice that a request for an extension has been approved prior to January 18, 2008, you must suspend the project immediately and contact the Office of Human Subjects Research for assistance.

A Final Report will be required to close your IRB project file. You are reminded that you must use the stamped, IRB-approved information letter when you consent your participants.

If you have any questions concerning this Board action, please contact the Office of Human Subjects Research at 844-5966.

Sincerely,

Peter W. Grandjean, Chair
Institutional Review Board for the Use of Human Subjects in Research

cc: Dr. Philip Browning
Dr. Ronald Eaves

Enclosure