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THE NATURE OF EXPERIENCE: PSYCHOLOGICAL POINTS OF VIEW

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PSYCHOLOGICAL POINTS OF VIEW

by

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The Nature of Experience: Psychological Points of View
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At the turn of the century, E.B. Titchener and J.R. Angell argued at some length about the problems of experimental psychology and philosophy. Titchener (1898,1910) expressed his views in a system that he called "structural" psychology, and Angell (1903,1907) expressed his views in a system that he called "functional" psychology. Titchener and Angell disagreed not only about the definition of the subject matter of scientific psychology, but also about the assumptions, experimental methods, and objectives that were required for psychology to be scientific. The two systems of psychology incorporated contrasting philosophical points of view, and Titchener and Angell discussed philosophical issues in detail. Their arguments about the relation of psychological to philosophical problems are written in a style appropriate to an earlier period. But in this dissertation, I demonstrated that these arguments are similar to arguments between contemporary psychologists who call their systems "cognitive" psychology and "ecological" psychology. The reason for the similarity in arguments is that the structural and cognitive systems are based on one set of assumptions, and the functional and ecological systems are based on another set of assumptions. Contemporary cognitive and ecological psychologists are arguing about some of the same things that Titchener and Angell argued about over seventy years ago.

INDEX WORDS: Structuralism, Functionalism, Information Processing, Ecological Psychology, Perception, E.B. Titchener, J.R. Angell, G.M. Murch, J.J. Gibson

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DEDICATION

This dissertation is dedicated with love to my wife, Marnette, without whom I never could have completed this five-year plan.

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I want to thank each of the committee members for their help with this project. Dr. Peacock's seminar on the history of psychology was my initial source of interest in historical systems. Dr. Wilcox' seminar on contemporary perception introduced me to the assumptions and methods of ecological psychology. Informal discussions with Dr. Katz helped me to keep on the right track through a jungle of philosophical arguments. Dr. Wilbanks' seminar on technical writing helped me to think more clearly. Informal discussions with Dr. Robinson helped me to realize the influence of the social context on psychologists in their development of systems of psychology.

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INTRODUCTION

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things that Titchener and Angell argued about over seventy years ago.

In the first two chapters, I will describe briefly the systems of psychology proposed by Titchener and Angell. The descriptions will begin with biographies indicating the formal academic training of the men and the influence that particular professors and writers had on them. To clarify the differences in views between Titchener and Angell, I will explain what each man meant by "psychology." The meanings were clearly different from those we give to the word today. I will describe each man's definition of the subject-matter of psychology. In these definitions, Titchener and Angell set guidelines for psychologists to follow in experimental work. The experimental methods that each writer thought were best for observing and analyzing the mind also will be described. Both Titchener and Angell used introspection in their research but they described the method differently. They also disagreed about the reliability, validity, and general usefulness of introspection.

In the third chapter, I will analyze the assumptions, both stated and implied, on which each writer based his system. Eleven pairs of opposing assumptions will be presented. In the first part of the chapter, four pairs of assumptions about the nature of consciousness will be compared. In the second part, seven pairs of methodological assumptions will be contrasted. With these eleven comparisons, I will demonstrate that by accepting certain theoretical and method-

ological assumptions, Titchener and Angell included philosophical problems in their systems of psychology.

In the fourth chapter, I will examine the differences in views of Titchener and Angell about the relation of psychological to philosophical problems. Based on his assumptions, Titchener thought that there was no relationship between problems in the philosophical disciplines of logic, ethics, aesthetics, metaphysics, and epistemology and problems in experimental psychology. Philosophers can solve their own problems. Angell, however, thought that psychology had to provide solutions to both philosophical and psychological problems. If psychology does not help with the problems of living described by philosophers, then it has no practical value.

In the final chapter, I will show how the arguments between Titchener and Angell about systems of experimental psychology and the relation of psychological to philosophical problems recur in the arguments between cognitive "information processing" psychologists such as G.M. Murch (1973) and "ecological" psychologists such as J.J. Gibson (1979). After describing briefly the systems of psychology proposed by these contemporary writers, I will compare the assumptions, views about philosophical problems, metaphors used to present these views, and the general goals described in the historical and contemporary systems. Although the systems are quite different, there are parallels between the structural system proposed by Titchener and the

information processing system proposed by Murch. There are also parallels between the functional system proposed by Angell and the ecological system proposed by Gibson. I will conclude that these parallels between the structural and information processing systems and the functional and ecological systems reflect the fact that the authors hold similar views about the relation of psychological to philosophical problems. These views are the result of common assumptions.

CHAPTER 1

E.B. TITCHENER AND STRUCTURAL PSYCHOLOGY

Biography

Titchener was born in 1867 at Chichester, in southern England. As a boy, he attended Prebendal School in Chichester, an institution that had been headed by a distant relative, John Tychenor in 1532. The family did not have much money when Titchener was young, and he had to rely on his exceptional ability to obtain scholarships for his education (Boring, 1950). When he was about fourteen, Titchener went on a scholarship to Malvern College, a public school in Worcestershire that offered "important" preparation for entrance to British universities (Boring, 1927). In 1885, after studying at Malvern for four years, he went to Oxford in defiance of his family who wanted him to go to Cambridge.

Titchener won a scholarship in classics and philosophy at Brasenose College, Oxford where he was a student of philosophy for his first four years. Titchener's study of British empiricism and associationism, the philosophical ancestors of modern experimental psychology, led to his interest in Wundt's new physiological psychology (Boring, 1950). He translated into English the third edition of Wundt's Physiological Psychology which had just been pub-

lished. Titchener spent the last year at Oxford as a research student in physiology under Burdon-Sanderson, a man Titchener greatly admired.

After receiving the A.B. degree in 1890, Titchener went to Wilhelm Wundt's laboratory at Leipzig to study experimental psychology. Titchener was interested in Wundt's theory that the "sciences" of psychology and physics could be separated by reference to "immediate" and "mediate" experience. Wundt (1896) thought that psychologists, by using the method of "Selbstbeobachtung" (defined by Titchener as introspection), dealt with experience immediately as it is given to the observing person. Physicists dealt mediately with experience forming it into stable objects by inferential procedures. Titchener was impressed, but he wanted to improve on the master's ideas.

Titchener found that the philosophical works of Mach (1886) and Richard Avenarius (1888) were very helpful to him in both improving Wundt's ideas and in developing his own system of psychology. In fact, Mach and Avenarius were more influential on Titchener's thinking than Wundt (Boring, 1950). Mach and Avenarius worked independently, but they both arrived at the same general philosophy of science. Mach thought that sensations are the data of all science. Boring (1950) stated that Mach's "positivism" was his reduction of all the phenomena of both physics and psychology to the immediate data of observation, to sensations. Avenarius worked out a philosophy of science that he called

"empiriocriticism." It was an attempt to speculate on the nature of science without reference to metaphysical assumptions. Basically, Avenarius assumed that when experience is regarded as dependent on part of the nervous system, then observation of that experience leads to descriptions of mental events. But when experience is regarded as independent of the nervous system (i.e., events exist in their own right) then observation leads to descriptions of the events and objects of physics (Herrnstein & Boring, 1965). Titchener (1910) later gave a very clear interpretation of these points of view in his formal description of the structural system of psychology. The influence of the writings of Mach and Avenarius on Titchener in his development of systematic assumptions will be discussed in more detail in the third chapter of this paper.

Titchener spent only two years at Wundt's laboratory. In 1892 he received the degree of Doctor of Philosophy after writing his dissertation on the binocular effects of monocular stimulation. Boring (1950) wrote that this topic was probably randomly assigned to Titchener by Wundt, the strict task-master, for Wundt had complete control over the research conducted in his laboratory. Titchener admired Wundt's careful attention to detail and his strict discipline with graduate students. Because of his experience at Leipzig as well as his education at Oxford, Titchener came to share these attitudes and put them into practice later in America.

Titchener returned to Oxford in 1892 where he lectured in biology for a few months. But the senior professors at Oxford were not enthusiastic about the new "science" of psychology (Boring, 1927). Titchener realized that he would have difficulty setting up a psychology laboratory, one of the chief missions of experimental psychologists at that time. And so in 1892, when Frank Angell (an American friend from the Leipzig laboratory) asked Titchener to take over the psychological laboratory at Cornell, Titchener agreed.

At Cornell Titchener started experimental work and writing immediately. He published sixty-two articles from 1893 to 1900. He also began to translate Wundt's major works including Human and Animal Psychology, Ethics, and another edition of Physiological Psychology. He translated some of Külpe's work and wrote his own Outline of Psychology (1898) and Experimental Psychology (1901-5).

In 1892, Titchener was elected to the American Psychological Association (APA) by its twenty-six members. He was present at the next meeting in the following winter but resigned over some APA action which he thought was a matter of honor (Boring, 1927). He hosted a meeting in 1897 but not as a member. He joined the APA again in 1910 but never attended a meeting after the one in 1897. Boring (1927) stated that in general Titchener felt rejected and isolated as a foreigner in America. But he had much to do with his own isolation. It seemed that the only time he interacted

with most of his American colleagues was in controversy.

In 1895, Titchener was made full professor at Cornell when he was only 28. In that year, he joined G.S. Hall on the staff of the American Journal of Psychology. This became the forum that Titchener and his students used for reporting experiments and presenting the ideas of structural psychology.

As early as 1895, Titchener began to draw the lines between his ideas of psychology and those of other American psychologists. It started innocently enough when a disagreement developed between J.M. Baldwin and Titchener concerning individual differences in response time on sensory-motor tasks. In these tasks, the subject was asked to press a switch in response to a visual or auditory stimulus. The subject was instructed to focus his attention either on the perception of the visual or auditory signal (sensory reaction) or on the movement of his hand to press the switch (motor reaction). Titchener (1895) claimed, from extensive data obtained in Wundt's Leipzig laboratory, that the sensory reaction is longer than the motor reaction by about one tenth of a second. This was important because it indicated that the processes of consciousness could be isolated for analysis. The basic difference between the sensory and motor reactions is obtained with practiced observers.

Baldwin (1895) obtained different results in reaction experiments and claimed that individuals vary in their general modes of responding according to their memory or im-

agery types. For example, if a subject relies mainly on visual or auditory imagery in his thinking, he responds more quickly to the sensory part of the reaction than the motor part. The individual differences are obtained with unpracticed subjects.

The arguments between Baldwin and Titchener about this problem of appropriate subjects for reaction experiments revealed basic philosophical differences between the two men. From Titchener's structural point of view, the concern of psychologists was the study of the generalized adult human mind. Laws about the elements of consciousness, using the structural approach, should be true for all individuals properly trained in introspection since findings are based on subjects who do not have unique mental components (Krantz, 1969). Therefore, Titchener stressed training in introspection as a requisite for reaction research. For Titchener, the reaction experiment revealed differences in sensory and motor reactions, and, thus, it was a method for determining the elemental constituents of the generalized mind.

Baldwin and the functionalists considered the structuralist's search for the laws of mental life in terms of a combination of mental elements to be of little use. Baldwin's findings of individual differences in reaction experiments indicated that the nature of mental life is not independent of the responder or the response (Krantz, 1969). Therefore, sensory and motor components of a reaction cannot

be isolated for study. Reactions have adaptive functions and individuals differ in their ways of adapting. As Krantz has stated, the valid concern of psychology for the functionalists was determining the regularity among such individual differences. For Baldwin, the reaction research method served primarily to distinguish individuals in terms of consistency of their memory or imagery type.

In 1896, John Dewey wrote an article that supported Baldwin's functional philosophy. In this article, Dewey analyzed the reflex-arc concept in psychology. Dewey wrote that the organism is not a passive receiver of stimuli but is active in perceiving. He stated that the reflex-arc idea, as commonly employed, "assumes sensory stimulus and motor response as distinct psychical existences." This was similar to the structural position based on Titchener's (1895) review of the results of reaction experiments. Dewey argued, as did Baldwin, that sensory stimulus and motor responses "are always inside a coordination and have their significance purely from the part played in maintaining or reconstituting the coordination." Dewey concluded that the terms "sensation" and "response" mean "distinctions of flexible function only, not of fixed existence."

Disagreement now became controversy in response to Baldwin's articles. Titchener included Dewey and the other functional psychologists at the University of Chicago as opponents in this controversy. Titchener (1898) attempted to formally differentiate the implicit viewpoints of the

structural and functional approaches to psychology. In "Postulates of a Structural Psychology" Titchener stated that the mind may be regarded on the one hand as a complex of processes, shaped and molded under the conditions of the physical organism. This is a structural point of view. The mind can be regarded, on the other hand, as the collective name for a system of functions of the psychophysical organism. This is the functional point of view. Titchener stated that functional psychology had not been worked out either with as much "patient enthusiasm or with as much scientific accuracy as the psychology of mind structure." Titchener concluded that "...no one who has followed the course of the experimental method in its application to the higher processes and states of mind, can doubt that the main interest throughout has lain in morphological analysis, rather than in ascertainment of function." Titchener's statements in "Postulates" introduced arguments that were developed later into the conception that structuralism is the "pure" scientific psychology of the generalized, normal, adult human mind and that functionalism is the psychology of individual differences, mental tests, applied psychology, and behaviorism (Boring, 1950).

Titchener not only drew the lines between structural and functional psychology but also between the psychology and philosophy departments at Cornell. Titchener began his career as a member of the Sage School of Philosophy at Cornell, but he quickly separated himself and his students

from the philosophers. He thought that the science of psychology had nothing to do with either philosophy or philosophers. Boring (1927) stated that Titchener struggled for fifteen years or more and finally won his fight for a separation of the departments of psychology and philosophy and for a division between the two departments of scholarships and fellowships.

Although Titchener did not participate in the activities of the APA, he wanted to form a group composed of psychologists and students (like that of Wundt) that he could lead in discussion and constructive criticism about laboratory research then in progress. In 1904 at Cornell he organized a group which has been called "the Experimentalists." This was an informal organization which reflected Titchener's conception of psychology laboratories. Titchener believed in the Wundtian tradition that a laboratory was composed of a man with his staff and his students, with psychological problems as the common property of all. The group met every spring and it was a bond more of men than of laboratories (Boring, 1927). It was a cohesive group, but it became smaller as Titchener attempted to isolate his structural psychology from the rest of American psychology.

In 1905, Titchener finished the four volumes of Experimental Psychology, popularly known as his "laboratory manuals." In this work, he wanted to establish psychology as a science by showing its scientific nature and introducing laboratory "drill courses" into university

instruction. In writing the books, Titchener worked out all of the experiments in the laboratory himself to make sure that the instructions were accurate. He put in a tremendous amount of tedious work in the laboratory, but, as a result of his Leipzig training, Titchener thought that progress by psychologists should be deliberate and that careful attention to detail was necessary.

After completing Experimental Psychology, Titchener became more interested in systematizing his structural point of view. He began writing the Textbook of Psychology, published in its completed form in 1910. It is the only full account of Titchener's structural psychology. He intended for the book to be a text for elementary university courses, but it was really a systematic work in brief form (Boring, 1927). It was printed seventeen years before Titchener's death, and he changed some of his ideas in those seventeen years. However, he maintained the basic structural point of view throughout his life (Evans, 1972). For this reason my presentation of Titchener's system will be based mainly on this 1910 work and on articles in which he elaborated some of the 1910 structural concepts.

After writing Textbook, Titchener's output declined. He wrote Beginner's Psychology in 1915 and began working on an expanded book on systematic psychology. In 1921 and 1922 when Titchener was sole editor of the American Journal of Psychology, he published two chapters of this systematic work. After this, however, he decided not to continue the

book beyond the first volume. It was published after his death as Systematic Psychology: Prolegomena (1929). It is not possible to conclude from this unpublished work how this new system would have differed from the 1910 view. Titchener did, however, discuss some of the changes in his ideas. For example, he became interested in phenomenology as an addition to carefully controlled introspection (Titchener, 1925). But he did not consider phenomenology to be a valid method in experimental psychology. Titchener's few statements about phenomenology indicate that he meant an informal description by the subject of the subject's own thoughts during an experiment. Titchener began to doubt whether the writing of a system of psychology was possible. In a letter to Boring in 1924, Titchener concluded:

> ...I thought it was irresponsible in our generation to write a system of psychology. That position I still adhere to. I have, however, never denied that we are now in a position to write a psychology systematically; and this is all that I myself have in mind to do. A system of psychology, full rounded out and complete, could hardly nowadays be more than philosophical, - at any rate that is my judgment still. But I think we have a large enough body of data to be able to present the subject in a systematic schema so that future generations may see that we had not been altogether dependent on philosophy for our conceptual scaffolding. (cited in Evans, 1972, p. 179)

This statement indicates that in 1924 Titchener still held the assumptions that he described and implied in 1898 and 1910. He tried to modify his structural point of view to include evidence from new psychological data. But as long as he ignored the implications of his philosophical assumptions of structuralism, the system remained limited. He was able to write systematically about psychology, but the scope of the system was considered narrow and its subject matter was considered trivial by American functional psychologists. A detailed description of the system Titchener described in 1898 and 1910 in the next section will indicate these limitations.

Titchener's Structural System of Psychology.

Subject matter. In a Textbook of Psychology (1910), Titchener stated that all the sciences have the same sort of subject matter. Scientists all deal with some phase or aspect of the world of human experience. From an interpretation of Mach's ideas, Titchener assumed that "all human knowledge is derived from human experience; there is no other source of knowledge." Titchener thought that by comparing physics with psychology, as Mach (1886) did, very diverse points of view about knowledge can be described. Physicists regard experience as altogether independent of any particular person. They assume that experience goes on whether or not anyone is there to have it. Psychologists regard experience as altogether dependent on the particular person. This experience goes on only when there is someone there to have it. Therefore, physicists and

psychologists deal with the same "stuff," the same material. The sciences are separated simply and sufficiently by their points of view.

Following Mach's reasoning, Titchener thought that each science consists of a large body of observed facts which are related to one another and are arranged under general laws. Each scientist assumes a certain attitude toward the world of human experience and regards it from a definite point of view. These points of view do not exist independently, but rather overlap and coincide. Scientists describe the same world of experience as it appears from their special standpoint. These points of view do not represent "separate blocks of knowledge." They are like successive chapters of a book which discusses a large topic from every possible angle.

Titchener stated that the advancement of these special sciences depends on the laws established by scientists. With enough observation and the use of proper methods, scientists can demonstrate that experience is regular and orderly. A scientific law expresses a regularity, an unbroken uniformity of some "aspect" of experience. Titchener stated that no science is yet complete. But when scientists formulate a law they mean that their science is complete up to a certain point. The law not only summarizes past observations but also serves as a starting point for new investigation. Scientific laws are important because they help to establish a point of view. What differentiates one science

from another is the difference in human interest. Thus, a science is "some man's consistent adherence to a definite point of view." Titchener was determined to establish a point of view for psychology, develop reliable methods of observation, and slowly and carefully describe scientific laws of the mind.

The mind and consciousness. Titchener defined the mind as "the sum total of human experience considered as dependent on the experiencing person." This idea is quite similar to the theory proposed by Avenarius in 1888. The experiencing person means the living body, the organized individual. For psychological purposes the living body may be reduced to the nervous system and its attachments. Therefore, the mind becomes the sum-total of human experience considered as dependent upon a nervous system. Titchener assumed that since human experience is always process and the dependent aspect of human experience is its mental aspect, then the mind is the sum-total of mental processes. He explained that "sum-total" means that psychologists should be concerned with analyzing all dependent experience and not just a part of it. The word "mental" implies that psychologists should be concerned with experience under its dependent aspect as conditioned by a nervous system. Titchener agreed with Avenarius' conception that the processes of the mind correspond to the processes or conditions of the nervous system. The word "process" implies that psychologists should look at mental activity as a stream, a perpetual flux and not as a collection of unchanging

objects.

The stream or flux of mental processes can be studied by examining consciousness. Titchener defined consciousness as the mind's awareness or inner knowledge of its own processes. The mind is that "inner self" which thinks, remembers, chooses, reasons, and directs the movements of the body. Consciousness is thus something more than mind. Titchener agreed with D. Stewart that consciousness is "the immediate knowledge which the mind has of its sensations and thoughts."

According to Titchener, there is a very important difference between consciousness and mind. Mind is more spread out. It is the sum-total of mental processes occurring in the lifetime of the individual. Consciousness is the sum-total of mental processes occurring at any given time. Therefore, consciousness is a section or division of the "mind stream." The subject matter of psychology is the mind, but the direct object of psychological study is always consciousness. Even though the processes of the mind are like a stream, the same pattern of processes is available to consciousness whenever the organism is placed under the same circumstances. Thus, through controlled experimentation, psychologists can observe a particular consciousness as often as they want.

Elements of the mind. Titchener stated that the structural psychologist seeks, first of all, to analyze mental experience into its simplest components. He takes a par-

ticular consciousness and works it over phase by phase until his analysis can go no further. He is left with a certain mental process which resists analysis. The psychologist continues this process until he can say with confidence that he has discovered the nature and number of the irreducible elementary mental processes.

The psychologist's next step is synthesis. He puts the elements (processes) together under experimental conditions. With this careful combination of elements, he "presently discerns the regularity and uniformity of occurrence that seem to be characteristic of all human experience." From the results of these experiments, the psychologist learns to formulate laws of connection of the elementary processes.

Titchener (1898) stated that there are only two content processes, sensations and affections. The class of sensations, however, includes both "sensation" and "idea." Titchener justified these processes as the last things of mind by pointing to three "valid criteria." First, sensation and affection are irreducible for introspection. Second, by looking at physiology, the structure of the mind is "conditioned" upon physical organization. Therefore, sensation and affection may be differentiated by reference to their physical substrates. Third, a descriptive formula can be applied by psychologists which completely sums up the characteristics of the two content processes.

Two of these characteristics, quality and intensity, are indispensable determinants of every psychical element.

Quality is specific and individual. It is quality that makes an elemental process a blue or a sweet, a "pleasant" or a "c" of the second octave. Intensity is a general attribute common to all modalities of sensation and all qualities of affection. Duration is a temporal attribute. It is the attribute which makes the course of a sensation or affection in time characteristically different from the course of another sensation or affection. It is "the rise, pause and fall" of the process in consciousness. In addition to these common attributes there are characteristics that may apply to sensations but not affections and vice versa. Clearness is the attribute which gives a sensation its particular place in consciousness. The clearer sensation is dominant, independent, and outstanding. The less clear sensation is subordinate, undistinguished, and in the background of consciousness. Extent is an attribute of certain sensations only, for example, color and pressure. Sensations of color are "spread out areally" into length and breadth and they appear as spatial extents. If one "thinks away" the spatial attribute of color, the sensation has disappeared with it. The same is true of pressure. A stimulus on the skin produces an extended sensation, diffused over a "mental area." Titchener concluded that the affective element consists of quality, intensity, and duration. The sense element (sensation or idea) consists of quality, intensity, duration, clearness, and in some cases extent.

Titchener stated that the characteristics of duration and extent are probably "extrinsic translations" into structure of the lowest terms of a functional series. This means that he thought that temporal and spatial characteristics are not constituents of elemental processes. The organism learns these characteristics by developing a context of meaning from environmental stimuli. Titchener and Angell disagreed about this idea in their philosophical discussions. Angell thought that there had to be some temporal and spatial characteristics of the mind in order for the organism to be able to learn to function in the environment. I will discuss this important difference of philosophical views in the third chapter.

Titchener concluded his 1898 article by stating that a corollary of structural psychology is that the "elements" of the experimentalists are "artifacts, abstractions, usefully isolated for scientific ends, but not found in experience save as connected with their like." It is the business of structural psychologists to study only these abstracted elements. When psychology involves more than the elementary processes it becomes an "anatomy" of functional complexes.

In 1910, Titchener refined his system by giving more specific definitions of the elemental processes of the mind. He divided these processes into three classes rather than two. Sensations and affections were still on the list. But the subclass of sensations that he called ideas in 1898

became the third class called "images." Images were the elements of ideas. In some unspecified way they represented patterns not actually present (Lundin, 1979). In describing these three classes Titchener was more specific about the role of mental processes in consciousness. He stated that sensations are the characteristic elements of perceptions, of the sights and sounds and similar experiences "due to our present surroundings." Images are the characteristic elements of ideas, of the mental pictures that memory furnishes of past and imagination of future experience. Affections are the characteristic elements of emotions, of love and hate, joy and sorrow. Titchener concluded that:

> It is our business, then, to describe and explain these elementary processes, and to show that, when grouped and arranged in certain uniform ways, they give rise to the different complex processes that constitute human consciousness. (Titchener, 1910, p. 48)

Meaning. In 1909, Titchener explained the development of complex conscious processes in his "context theory" of meaning. He stated that from the structural point of view, meaning as it finds representation in consciousness is always context. Context is simply the group of mental processes which accrue through association to a sensory core in any given situation. Originally this situation is physical and external to the organism. Therefore, meaning has its beginnings in "kinaesthesis." For example, the organism faces a situation with some bodily attitude. A perception

means danger if it occurs in a context of the kinaesthetic sensations that accompany the tendency to flee and the organic and affective processes that characterize fear (Heidbreder, 1933). Thus Titchener described meaning in terms of mental content.

This context law of meaning, however, holds only for new perceptions and ideas. In old, habitual perceptions and ideas, Titchener doubted "if meaning need necessarily be conscious at all, - if it may not be 'carried' in purely physiological terms." For example, when a musician plays a musical composition that he knows well, meaning does not have any kind of conscious representation. It is simply carried unconsciously.

The process by which context "accrues" to a mental process is association. In 1910, Titchener wrote that "whenever a sensory or imaginal process occurs in consciousness, there are likely to appear with it (of course in imaginal terms) all those sensory and imaginal processes which occurred together with it in any earlier conscious present." Titchener called this the law of association for conscious purposes. The pure perception is an association of sensations and the idea is an association of images.

Attention. The arrangement of the contents of consciousness is determined by attention. For example, when someone is quietly reading and the telephone rings, the first thing that happens is a "redistribution" of the entire contents of consciousness. The voice on the phone provides

"incoming ideas" which "drive to the center" of consciousness and everything else, the ideas in the book and the "sensory surroundings" are banished to the outskirts. Therefore consciousness in attention is patterned into focus and margin, foreground and background, center and periphery. The difference between the processes at the focus and those at the margin is essentially a difference of clearness. The processes at the center are clear and those at the margin are obscure.

There are three stages of attention, according to Titchener, primary, secondary, and habitual. In the first stage, there is an attention that we are compelled to give and are powerless to prevent. There are "impressions" that we cannot help attending to. The intensive stimuli belong to this class of impressions. For example, loud noises, bright lights, strong tastes and smells, severe pressures, extreme temperatures, and severe pain all are intense and attract our attention immediately. The novel impression, the one that "finds no association when it enters consciousness," also becomes clear immediately.

The second stage occurs when we hold our attention on an impression by main force. This is secondary attention. For example, in working a difficult geometry problem there is a constant temptation to wander away from it and attend to something else. We continue attending but we must force ourselves to do it. This attention is active or voluntary. Titchener used it to describe the method of introspection

in which the subject must attend to an obscure organic sensation or a minute qualitative difference. Secondary attention is "attention under difficulty, attention in face of competitors, attention with distraction."

The third stage of attention is that of habit. This is simply a "relapse" into primary attention. For example, working on the geometry problem I gradually became interested and absorbed. The idea gains the same forcible hold over me that a loud noise "has from the moment of its appearance in consciousness." Titchener stated that this occurs when the competing impressions have been vanquished and the distractions have disappeared. In everyday experience, secondary attention is continually reverting to an habitual primary form.

Introspection. Titchener (1910) stated that the method used by all scientists can be summed up in the single word, observation. The only way to work in science is to observe the phenomena that form the subject matter of a particular science. Observation is both attention to the phenomena and a record of the phenomena. Titchener concluded that scientists design experiments which result in observations that can be repeated, isolated, and varied.

The method of psychology is observation, but it is different from the observation of the physical sciences. The observation of the physical sciences is inspection, a "looking at." Psychological observation is called introspection, a "looking within." Titchener stated that this

essential difference should not hide the fact that the two forms of observation are essentially similar. The major difference, once again, is point of view. For example, the chemist might observe the course of a chemical reaction and take notes on its phases. But a psychologist observes his own changes in consciousness and tries to describe them in words. The chemist is observing experience that is independent of himself, while the psychologist is observing experience that is dependent on himself.

In both inspection and introspection, the attention of the scientist must be at a high level of concentration. Also, the record of the observations must be "photographically accurate." Therefore, observation is difficult and fatiguing. Introspection, however, is much more difficult and fatiguing than inspection. The subject must be well rested and alert. Also, the reliability of instrospection depends on the impartial and unprejudiced attitude of the observer. He must describe the facts as they come and not try to fit them to any preconceived theory. The observer must be in good health, at ease in his surroundings, and free from outside worry and anxiety.

Titchener (1912b) maintained that introspection is the one distinctively psychological method. All objective data (e.g., observation of behavior) must be interpreted in the light of introspection if they are to become psychological. Without introspection there might still be a science of psychology, but such a science would require certain assump-

tions about the psychological facts obtained by objective methods. Unless the subjective experience of an observer is described, experimenters can only make inferences about consciousness based on that observer's actions. The inferences can only be made on the basis of the experimenter's own introspections. He has to ask himself what the observer must be experiencing in the experimental situation. With the method of systematic introspection, the experimenter gets a reliable description of the mental processes that the observer is experiencing.

Titchener distinguished between the precritical and critical use of introspection. Precritical introspection is the method that has been used for two thousand years by metaphysicians. Titchener quoted Comte who wrote that these speculative philosophers, "cannot yet agree upon a single proposition that is intelligible and solidly established... Introspection gives rise to almost as many divergent opinions as there are individuals who rely on it." Titchener concluded that there was a great deal of error in the pre-criticial and pre-experimental period. The error was due to the fact that the introspection was not a direct observation, but essentially a reflective interpretation in terms of some philosophical system. Philosophers devised certain theories and then looked for confirming evidence through introspection. Therefore, "psychologists" in the pre-experimental days had no criterion of general validity. They had no way to distinguish the universal from the particular or the objective-

ly observed from the constructively rationalized.

Psychologists who use critical introspection understand that the method can never give them a system of psychology. Titchener asked, how can a method in itself yield a science? Critical introspection is psychological observation, and observation is a way to get facts. These facts come from the observing and dissecting of experience. The facts are elementary mental processes and their attributes. Consciousness has been described when introspective "analysis" is qualitatively and quantitatively complete. The method of introspection is limited to what is observable. We cannot observe any "product" of logical abstraction. We cannot, therefore, observe relation, though we can observe content-processes that are given in relation. We cannot observe change, but we can observe changing content processes. Finally, we cannot observe causation, but we can observe content-processes that are "conditioned" by the nervous system.

Titchener (1912c) stated that all introspection presupposes the standpoint of descriptive psychology. The "empirical" results of introspection are logically prior to any sort of systematization of conscious phenomena. The data of introspection are never themselves explanatory. They tell psychologists nothing of mental causation, physiological dependence, or genetic derivation. Titchener stated that the ideal introspective report is an "accurate description, made in the interests of psychology of some conscious pro-

cess." The ideas of causation, dependence, and development are matters of inference.

According to Titchener inference should be strictly avoided in systematic introspection. The reason is that inference opens 'a wide door to the 'stimulus error'." The observer in a psychological experiment falls into this error when he exchanges the attitude of descriptive psychology for that of common sense or of natural science. Instead of attending to the sensation, the observer attends to the stimulus. In cases of color matching, it does not matter much whether the observer regards himself as matching color sensations or colored papers, sensations or stimuli. But Titchener stated that it does not take long for the experimenter to realize that even in the "simplest fields of sense" this confusion of attitudes has very serious consequences. For example, in establishing a two-point limen for the sense of pressure, it is important whether the subject observes "dependent" or "independent" experience. When he observes dependent experience he is set to introspect. If he feels one sensory pattern, he reports one. If the subject takes the other point of view and observes independent experience, he sometimes makes a judgment based on his concept of a stretched out pattern of "oneness" that means to him that the stimulus has two points (Boring, 1950). Then he reports two points of pressure, meaning one pattern but two points. This is a stimulus error from the psychological point of view. It is not an error from the point of view of the

physicist who observes independent experience. For Titchener, there was always a choice between viewing the world psychologically or physically, abstractly or objectively.

Goals. Titchener (1898) stated that the first goal of structuralists is to develop a descriptive psychology. A descriptive psychology is formed by answering the questions "what" the conscious processes are and "how" they work. Structural psychology is descriptive because it contains many facts and laws about mental elements. But in Textbook, Titchener did not stop at this first goal of description as he did in "Postulates," twelve years earlier. To stop at description, Titchener argued in 1910, would leave structural psychology without unity or a single guiding principle which "biology has, for instance, in the law of evolution." Structuralists also must attempt to answer the question, "why" in order to reach the second goal of establishing a guiding principle.

Answering the question "why," according to Titchener, is the psychologist's most difficult task. From the structural point of view there are two major difficulties that must be overcome. First, one mental process cannot be regarded as the cause of another one. This statement is based on the assumption that mental processes flow with time like a stream. Therefore, any change in one's surroundings "sets up" an entirely new consciousness. Mental processes that are down the stream cannot "cause" elements up the stream. The second problem is that nervous processes cannot be

regarded as causes of mental processes, either. This statement is based on the assumption of psychophysical paralellism. This assumption "lays it down" that the two sets of events, physical and mental processes," run their course side by side in exact correspondence but without interference." For Titchener, this was an "ultimate fact." The description of these two difficulties indicated that Titchener had written himself into a corner. His structural psychology had to be limited to description only, without a unifying principle, if these difficulties could not be overcome.

Titchener got out of the corner by giving structuralists a way to answer the question why. He used the philosophical writings of Avenarius to make this maneuver. It took Avenarius over ten years to write his philosophy in one work and he died shortly after finishing, perhaps because it took so much effort (Carstanjen, 1897). Titchener did not make use of all of the results of Avenarius' efforts, but he did use one of the major ideas in Avenarius' book. Titchener's answer to the question why in psychology was that the nervous system does not "cause" mind but it does "explain" it. Titchener used the analogy of a map. A map "explains the fragmentary glimpses of hills and rivers and towns that we catch when moving through it." In the same way, the nervous system explains the fragmentary glimpses we get of mental processes through consciousness. The nervous system is linked to the unbroken chain of physical events which

are independent of the experiencing person. The nervous system is part of the physical world. Mental processes, however correspond not to the whole series of physical events, but only to certain events within the nervous system. It is "natural" then that the mental phenomena described by structuralists should appear "scrappy, disconnected, and unsystematic." Titchener concluded that reference to the nervous system does not add any data to psychology, but it does furnish psychologists with an explanatory principle for structural psychology. The principle is based on the assumption that there is a correlation of mental processes (i.e., sensations, images, and affections) to part of the physical world.

In Textbook, Titchener wrote his way out of the corner created by statements he made in "Postulates" about structural psychology. But the escape was made at the cost of logic. Titchener stated that the mental processes that he described as "abstractions innocent of any sort of objective reference" in 1898, were real things ("stuff") in 1910. The sensations, images, and affections became "existential." By making this change, Titchener could claim that structural psychology was not just a purely descriptive science that answered the questions, what and how. It was also a science that could explain the way sensations are brought together in the mind and combined with images to form complex perceptions. Abstractions that had no meaning in 1898 could be put together into a meaningful pattern in 1910.

System. Titchener (1910) attempted to work out all of the details of an experimental science in his proposal of a structural system of psychology. He was strongly influenced by the personality and psychology of Wundt. Wundt worked out his psychology with very careful attention to details, just as a physicist worked out the details of his science. He demanded that his students work in the same way. Wundt described elemental processes of the mind and proposed laws for their operation.

Titchener continued Wundt's scientific psychology in America with missionary zeal. He tried to improve Wundt's psychology and establish a system of psychology that was separate form philosophy. He was partly successful in both endeavors but not without a long struggle. I say partly because his system included interpretations of the philosophical assumptions of Mach and Avenarius. Therefore, it is impossible to view his system as being free from philosophy. He made definite epistemological and metaphysical assumptions.

Titchener developed a system that was so restrictive to experimental work that it did not fit into the goals of American psychologists. By carefully abstracting, enumerating, and describing the characteristics of elements of the mind, Titchener thought that he was developing the only possible scientific psychology. He did not have to worry about philosophical problems because he was describing only observable "facts" of the mind. At first, he did not discuss the fact that his system was based on philosophical assump-

tions that limited both its reliability and validity. Toward the end of his life, he did state that it was probably impossible to write a scientific system of psychology. But he held that psychology could be written systematically and maintain its independence from philosophical speculation.

In contrast, in the next chapter I will show how Angell's education was more philosophical than Titchener's, and the system of psychology that he developed was broader in scope. Angell maintained that philosophical problems about the ultimate nature of reality were best left to philosophers. But he thought that philosophical problems of the nature of knowledge, truth, goodness, and beauty were related to problems of psychology. Like Titchener, he helped to develop a department of psychology separate from the department of philosophy. But he realized that psychological and philosophical assumptions were necessary as a starting point for psychological experimentation. Thus, the assumptions had to be carefully considered and the problems that developed from them had to be discussed. Therefore, Angell's scientific system of psychology was not as carefully worked out as that of Titchener. It was much broader in interest and method and as a result was more in line with the American frontier spirit (Boring, 1950).

CHAPTER 2

J.R. ANGELL AND FUNCTIONAL PSYCHOLOGY

Biography.

James R. Angell was born in 1869 in Burlington, Vermont, just two years after Titchener. Angell's father was a professor of modern languages at Brown University before being selected as president of the University of Michigan, a position he held for 38 years. Angell's early formal education was in the public schools of Ann Arbor, Michigan. In high school, Angell followed the "conventional classical" course, with Latin four years, mathematics three years, and Greek two years as the central core of the curriculum (Angell, 1930).

Angell entered the University of Michigan in 1886, where he continued the classical course of study. But after his freshman year, he began to have a choice in his studies and "seized the earliest opportunity to get into logic and psychology." It was John Dewey's (1886) Psychology, the first American volume devoted to the new science of psychology, that was the initial source of Angell's interest in the field. Angell (1930) stated that after reading Dewey's book, for the first time, he felt a deep and pervasive sense of the intellectual importance of the material he was studying. He viewed the reading of Psychology as the beginning

of his intellectual career.

Angell discovered that Dewey's book was a combination of fundamental principles and empirical material drawn from a wide reading of German, Scottish, and English sources. Dewey took the three "fundamental" psychological categories, thinking, feeling, and willing, and developed what Angell called an "intriguing dialectic" which suggested Hegel's Logic. Dewey accepted, as many other writers had before him, the irreducible character of these three modes of consciousness. Dewey wrote about the manner in which each mode not only involved but depended on the other two to effect the actual achievements of mind and conduct. Angell was impressed with the idea that the irreducible modes of consciousness were functionally related.

Angell pursued his interest in psychology as a graduate student in the philosophy department at Michigan from 1890-1891. He took a seminar with Dewey in which William James' (1890) Principles of Psychology was discussed. Angell (1930) stated that James' book "affected my thinking for the next 20 years more profoundly than any other." Principles was completely different from Dewey's Psychology. The dialectic of Dewey's thinking was "utterly alien" to the workings of James' mind. Angell stated that to a "youngster" brought up on Dewey where close knit, systematic, organization was the essence of thinking, the lack in James of anything which could be instantly recognized as system was highly disturbing.

Angell was particularly interested in James' "radical" points of view contained in such chapters as "Stream of Consciousness," "Habit," "Self," "Emotion," and "Will." Angell stated that although reading the book was somewhat shattering at first, it was extraordinarily stimulating. Angell was very impressed with James' description of the mind as an organ that functions in a variety of ways to help the organism to adapt to novel situations.

Angell earned his Master of Arts degree in philosophy at Michigan in 1891 by writing a thesis on imagery. He examined the imagery used by a group of nineteenth century English poets. Angell had not yet decided whether to make philosophy or psychology his predominant interest.

On Dewey's recommendation, Angell went to Harvard in 1891 to study in the graduate school under William James in psychology, and Josiah Royce and G.A. Palmer in philosophy. Angell's parents supported him during his college years so he did not have to worry about money as did Titchener. Angell divided most of his time at Harvard between work with James and Royce. He took a seminar given by Royce on Kant, a topic that he pursued later in Germany. He also took a seminar on abnormal psychology given by James. Angell worked in the newly established laboratory which James, "with great relief," had turned over to Herbert Nichols to run.

Angell had the opportunity to work closely with James when James turned over to him for study a great mass of material from the American Society for Psychical Research.

Angell's task was to secure reliable information regarding abnormal psychic experiences of normal adults (e.g., illusions). Angell stated that, "It also put me in contact with one of the most inspiring and beautiful human beings I have ever known."

In 1892, after studying at Harvard for a year, Angell decided not to accept a laboratory assistantship but rather to seek his doctorate in Germany. Unlike many other American students (e.g., G.S. Hall, J.M. Cattell, and his cousin F. Angell) Angell did not go to Leipzig to study (Hunter, 1944). Wundt's laboratory space was full and Angell had already "mastered" Wundt's Principles of Physiological Psychology. Another problem with studying at Leipzig was that there were no courses in philosophy that appealed to Angell. He went instead to Berlin where he studied one semester with Ebbinghaus and Paulsen. For his second semester, Angell transferred to Halle where he studied with B. Erdmann and H. Vaihinger. At Halle, he became a candidate for the doctor's degree presenting a thesis on the treatment of freedom in Kant's philosophy. Angell had not decided yet whether to work in psychology or philosophy.

Angell's dissertation was accepted in 1893 contingent upon revisions to improve its German. To make these revisions, Angell would have had to stay in Germany. He had been offered a job as instructor of psychology at the University of Minnesota for $1,500 a year. This was not a great deal of money even in 1893, but it was enough to

enable him to marry a fellow student from Michigan. Angell could not wait to be married, and as a result of this impatience never finished work on his Ph.D. The lack of the degree, however, certainly did not hinder his academic career. As a result of his university and government work, he received many honorary Ph.D. degrees during his lifetime.

Angell taught psychology at Minnesota for one year. In 1894 Dewey, a newly appointed professor of philosophy at the University of Chicago, brought Angell there as an assistant professor in charge of psychology. As soon as he arrived at Chicago, Angell began experimental work.

In 1896, Angell began to put the functional view of psychology that he discovered in the works of Dewey and James into practice. Angell, together with A.W. Moore, tried to find a way to resolve the Titchener-Baldwin controversy. Angell and Moore proposed a solution that differed from the position of both Titchener and Baldwin. However, Angell's and Moore's interpretation of the results of their own reaction experiments was made within the general functional framework set up by Baldwin in his type theory of reactions.

Angell and Moore viewed the simple reaction as an example of voluntary action in general, and thought that voluntary action was under the direction of attention. It seemed to them that the key to any explanation adequate to all of the facts, the individual differences found by Baldwin and the effects of practice found by Titchener, must be discovered in the "functions" of attention and habit and their relations

to each other.

Angell and Moore experimented with unpracticed subjects (themselves and an assistant) who had been separated on the basis of their types of reactions. One subject was faster when his attention was focused on the sensory stimulus and the other two were faster when their attention was focused on the motor response. Angell and Moore found that Baldwin's "reaction type" theory held during early trials. But under conditions of increasing practice, the classic difference between sensory and motor reactions was demonstrated (Krantz, 1969). Angell and Moore concluded that both Titchener and Baldwin were partly correct in their interpretations of reaction experiment results.

The two experimenters provided an interpretation that bridged the gap between the views of Titchener and Baldwin. Angell and Moore stated that "the time question is not a case of 'sensory versus motor,' but of a sensory-motor less habitual versus a sensory-motor more habitual." Krantz (1969) pointed out that this interpretation redefined the difference between sensory and motor reactions in the functional terms of changing habitual adjustment. Thus, Angell and Moore de-emphasized the structuralist's concern with the question of what differentiates the sensory elements from the motor elements. For Angell and Moore, the sensory-motor reaction should be considered as a whole act rather than as a series of individual elemental processes.

In 1901, Angell was promoted to associate professor of psychology at Chicago. In 1903, as a result of an offer of professorship at Princeton, Angell was promoted to full professor. In this year, Angell wrote an article about the relation of structural and functional psychology to philosophy. He pointed out some of the methodological and philosophical differences between the two new schools of psychology. Angell demonstrated that the assumptions included in systems of psychology have important philosophical consequences. He concluded that Titchener's structural assumptions lead to unsolvable philosophical problems in the interpretation of experimental results. Angell argued that functional assumptions, however, are carefully derived from philosophical principles. Although the functional interpretations of experimental results are not as detailed as structural interpretations, they are consistent with the interpretations of the philosophical disciplines of logic, ethics, aesthetics, epistemology, and metaphysics.

Largely through his efforts, psychology was established as an independent department at Chicago in 1904. As a result of his experimental work, Angell was made chairman of that department. Hunter (1949) wrote that under Angell's chairmanship, the psychology department rose in stature from near zero to one of the best three or four in the country.

Chicago became known for its broad investigation of all aspects of the human psychophysiological organism. The psychologists there did not limit themselves to the structural

analysis of consciousness as did the Titchenerians at Cornell. Graduate students at Chicago were encouraged to minor in biology, philosophy, or education (Hunter, 1949). Men such as C.J. Herrick in biology, G.H. Mead in philosophy, and F.N. Freeman in education cooperated with Angell to make psychology at Chicago a "fruitful science," one that provided solutions to social problems existing in America at that time. During Angell's chairmanship doctoral degrees were awarded for theses on a variety of experimental topics including: sex differences in mental traits, the psychology of meaning, animal behavior, volition, imagery, hearing, vision, social experiments, mental tests, memory and learning, space perception, and systematic theory.

In addition to Angell's general and sometimes specific guidance of research in the department, he also started something new in American psychology. He offered systematic seminars in the history of German, French, and American psychology. These seminars were devoted to the analysis of theories and concepts of psychology.

Angell expanded his own work in reaction time as a function of attention, and also did research in space perception, imagery, the monaural localization of sound (Angell was deaf in one ear), and the relation of organic processes to consciousness. Hunter stated that most of Angell's experimental work involved both objective data and introspective reports from the subjects, although the introspections were never of the Titchenarian element and attribute type.

Angell was more interested in obtaining informal reports from subjects and verifying these reports with objective methods of observation.

In 1904, Angell published Psychology, a textbook which gave the first comprehensive application of his concept of functionalism to psychology. He wrote the book originally to give structure to James' Principles so that college students could better understand a functional point of view about psychology. In the textbook, Angell stated that psychologists can use both introspective and objective methods in the study of consciousness. Angell thought that consciousness is a psychophysical process that has adaptive value in the adjustment of the organism to its environment. He made it clear in his textbook that there was room for the verifiable findings of Titchenarian structuralism. But experimentation was not limited to these findings. There was also room for mental tests, physiological studies, research on animal behavior, and objective methods in general (Hunter, 1949).

As Boring (1950) has pointed out, Angell's 1904 texbook illustrates but does not explicate the functional point of view in psychology. It was not until 1906, when Angell was made president of the APA, that he gave an explicit statement on functional psychology. Published in 1907 as "The Province of Functional Psychology," the paper was not as rigorously systematic as Titchener's 1898 paper and 1910 textbook, but it characterized his views of psychology in

broad outline. Psychologists, he argued, should not be content to count and describe mental elements but rather should study all of the functions of consciousness and behavior and the interaction of these functions.

In 1909 Angell published an article on the importance of Darwinian evolution in psychology, in which he expanded on the role of consciousness in the adaptation of the organism to the environment. In 1911, Angell was chosen as Dean of the Faculties at Chicago. In 1912, he published Chapters from Modern Psychology. These essays were written for general audiences as an introduction to the social application of the results of functional experimental research. Boring (1950) stated that they exhibit his "catholicity" of mind but not his views on functionalism.

By the beginning of World War I, Angell had become more of an administrator than an experimental researcher or teacher. In 1917-18 he was given leave of absence from Chicago to become a member of the Committee on Classification of Personnel in Washington, D.C. which advised the Adjutant General's Office. In that year he was also a member of the Committee on Education and Special Training which sought to integrate military and civilian training programs mainly through the establishment of the Student Army Training Corps. After World War I, Angell became chairman of the National Research Council during the year 1919-20. In 1920 he was invited to become President of the Carnegie Corporation. This was a big change for Angell who had spent all of his

life in universities and was then 51 years old. He accepted the post but held it for less than a year. He was offered the presidency of Yale University in 1921 and accepted it. It is a tribute to Angell's administrative ability that he was the first non-Yale man to be elected president of that institution (Hunter, 1949).

At Yale, Angell carried out a building program, strengthened the faculty, and established an Institute of Psychology in 1924. The idea for this Institute grew largely out of Angell's experience with the National Research Council. His plan for the Institute was to integrate psychobiological, biological, and anthropological research. Angell made three major appointments when the Institute was established: R.M. Yerkes for research in psychobiology and primate biology, R. Dodge for research in physiological psychology, and C. Wissler for research in racial psychology. Angell stated in a speech:

> The Institute is designed to achieve two principal ends: first to carry on research upon the basic problems of human nature and the social order; and second to train a skilled personnel for work in these fields. (cited in Hunter, 1949, p.444)

Later, the name of the Institute was changed to the Institute of Human Relations when its goals were broadened to include work in a variety of fields outside of psychology.

Although Angell was no longer active in research, his involvement with the Institute indicated that he was still

interested in a functional, applied science of psychology. He wanted psychologists and other professionals to focus their attention on problems that existed in American society. In order to do this, they would have to hold broad scientific interests and combine their efforts.

As an administrator, Angell helped to develop programs of applied psychology. He retained the basic assumptions and interests throughout his life that he outlined in 1903 and 1907 as his system of functional psychology. A detailed description of this system will indicate the origin and development of Angell's thinking.

Angell's Functional System of Psychology

Angell discussed four aspects of functionalism in his 1907 article, "The Province of Functional Psychology." First, he contrasted functionalism with structuralism. He stated that the functionalist tries to discover how a mental process operates, what it accomplishes, and under what conditions it appears (Heidbreder, 1933). The structuralist tries to analyze a state of consciousness into its elemental processes. Second, Angell wrote that functionalism is a general movement concerned with the utilities of mental processes. Therefore, functionalists study mental activity not in and by itself, but rather as a part of the whole range of biological activity, with a special emphasis on organic evolution. Third, Angell considered functionalism to be a characteristic method of dealing with the mind-body problem. Functionalists regard consciousness from the Darwinian point of view as having

some utility in adapting the organism to the environment. From this point of view, there must be some interaction between the psychical and the physical. Fourth, Angell discussed the close relationship between functionalism and disciplines of philosophy. Logic, ethics, aesthetics, epistemology, and metaphysics all provide information relevant to work in functional psychology. The details of each of the four aspects of functionalism described in Angell's article are summarized in this section.

Structural versus functional psychology. Angell began his discussion of the differences between structuralism and functionalism by stating that functional psychology is, at the time he is writing, little more than a point of view, a program, an ambition. It gains its vitality from the fact that it is a protest against the prominent school of structural psychology. Angell stated that the major difference between the two schools is that functional psychologists attempt to discover and describe the typical "operations" of consciousness under actual life conditions, while structural psychologists try to analyze and describe the elementary and complex "contents" of consciousness. The structural science of sensation seeks to determine the number and character of the various unanalyzable sensory materials, such as the varieties of color and taste. The functional psychology of sensation, however, seeks to determine the character of the various sense "activities" as they differ in their method of operation from one another, and from other mental pro-

cesses such as judging, conceiving, and willing. Therefore, functional psychology is synonymous with descriptions and theories of mental action as distinct from the materials of mental constitution.

Until recently, Angell suggested, there was no formal separation between structural and functional psychology. Certain psychological categories were considered primarily structural, such as sensation, affection, and image, and other categories immediately suggested more explicit functional relationships, such as attention, reasoning, and volition. Angell stated that as long as these definitions of the terms of structuralism and functionalism were accepted, psychologists could treat every mental event from either point of view. But when Titchener described his postulates of a structural psychology, he tried to set structural and functional points of view apart by emphasizing that the elemental structures of the mind had to be studied before the description of mental functions could have any value.

Angell stated that Titchener's conception of the role of structural analysis of the mind is based on the conception of the "states of consciousness" doctrine. This doctrine is simply a contemporary version of Locke's "idea." When structuralists adopt as their material for psychologial analysis the isolated "moment of consciousness," it is easy to become absorbed in determining its constitution and to overlook its artificial character. Angell pointed out that this is the most essential quarrel that functionalists

have with structuralists. Functionalists maintain that it is important to get at mental process as it "is" under the conditions of actual experience rather than as it "appears" to a mere postmortem introspective analysis.

Angell stated that this postmortem analysis is unavoidable for both structuralists and functionalists when they use the method of introspection. Using this method, psychologists must always work with vicarious representatives of the particular mental process which they set out to observe. He meant that mental processes cannot be described at the exact moment they happen. It takes time for subjects to communicate their introspections. But Angell pointed out that it makes a great deal of difference whether the psychologist is using the method of introspection for discovering the ways in which mental processes operate, or whether he is engaged in merely "teasing apart the fibers of its tissues."

In order to tease apart the fibers, subjects must be trained to use certain categories of words for their introspective descriptions. In Titchener's laboratory, subjects were trained to use word categories such as colors, tones, and smells. But Angell wrote that functionalists largely dispense in their experiments with the usual direct form of introspection and try to determine what work is accomplished by subjects and what the conditions are under which it is achieved. Angell stated that many experiments in memory and association are of this character. Introspective as well as

objective methods of observation can be used in these experiments.

Angell stated that functionalists try to avoid what James called the "psychologist's fallacy." This fallacy is to attribute to mental states without due warrant, characteristics which subsequent reflective analysis leads psychologists to suppose they must have possessed. When this occurs, the mental conditions described contain more than they ever naturally would or could hold.

Angell did not think that structure was a valid category of mind. He stated that the sole appropriateness of the term "structure" hinges on the fact that any moment of consciousness can be regarded as a complex capable of analysis. The terms that structuralists use to resolve such complexes are the meager and defective analogues of the structures of anatomy and morphology. The reason that these analogues are not useful is that "no matter how much we may talk of the preservation of psychical dispositions or how many metaphors we may summon to characterize the storage of ideas in some hypothetical deposit chamber of memory, the obstinate fact remains that when we are not experiencing a sensation or an idea it is, strictly speaking, non-existent." Even when an experiment is exactly repeatable, there is no guarantee that that which is designated as the same sensation or the same idea is really a replica of the first. Angell's conclusion was that the original mental process never is and never can be literally duplicated.

Functions, however, persist in mental life as well as in physical life. We may never have an idea based on the same sensuous structure and composition. But we can have as often as we want contents of consciousness which "mean" the same thing. They function in the same "practical" way no matter how discrepant is their momentary texture. This is analogous to biology where different structures may under different conditions be called on to perform identical functions. For example, general functions like memory are persistent. Also, special functions such as the memory of particular events are persistent and largely independent of the speficic conscious contents that call them up.

According to Angell, the subject matter of functional psychology is consciousness. From the functional point of view, the problem is to discover "how" and "why" conscious processes are whay they are. Angell stated that the answer to the question "what" posed by structural psychologists implicates the questions how and why. For example, if a psychologist attempts to analyze any particular state of consciousness, he finds that the mental elements he notices are dependent on the particular circumstances which call them forth. The affective coloring of a psychical moment depends on one's temporary conditions, mood, and aims. Also, the sensations and ideas are determined in their qualitative texture by the totality of circumstances, subjective and objective, within which they arrive. You cannot get a fixed and definite color sensation without keeping constant the

external and internal conditions in which it appears. Thus, a particular sense quality is functionally determined by the necessities of the existing situation. It does not "exist" on its own.

Angell argued that if you inquire deeply enough what particular sensation you have in a given case you always find it necessary to take account of the manner in which and the reasons why it was experienced at all. When structuralists ignore these considerations, their analyses and descriptions are partial and incomplete. And partiality and incompleteness are the equivalents of errors in the world of practice. And even when structuralists attempt to describe certain sense qualities, they make their descriptions not in terms of the experienced quality itself, but in terms of the conditions which produced it. That is, they talk about the stimuli that produced a certain sense quality. Descriptions of sense qualities are also made in terms of some other quality with which it is compared. For example, when a subject feels a pressure on his skin he introspects and describes a "tickle" rather than a "neutral pressure." The subject has made a comparison with other members of the descriptive category. His decision is a function of the list of names in the tactile category. Finally, descriptions of sense qualities are made in terms of some more overt act to which the sense stimulation led. For example, the subject hears a specific tone and responds by pressing a button. The response is a function of the sense quality which cannot be isolated except

artificially. Angell concluded that the very description of sensations is functionalistic and must be so.

Angell stated that one of the most important differences between structuralism and functionalism involves the definition of introspection. He wrote that Titchener (1898,1899) set up arbitrary rules for introspection. The only data of introspection, according to Titchener, are mental contents. Mental functions are all logical abstractions and we cannot introspectively observe any product of logical abstraction. Titchener concluded that introspection approaches mind from the special standpoint of descriptive psychology. It gives data with which to describe objects, not relations.

Angell (1907) argued that Titchener's usages of the term are to some extent arbitrary. If we assume that introspection is the only psychological method of observation and accept Titchener's operational definition, then psychologists can be concerned only with mental contents. Meanings, values, and relations are data of a non-psychological character.

Angell stated that the definition of introspection given by functional psychologists, on the other hand, includes the observation of mental acts. Angell thought that the differences between the structural and functional definitions of introspection are really matters of terminology and not fact. Angell thought that questions of terminology should not be allowed to obscure questions of fact. Angell was not clear on this point, but he seemed to think that subjects should not be restricted in their introspection to sets of

words in structural categories (e.g., colors, tones, pressure, etc.). They should be able to describe complete mental acts in their own words. The phenomena of meaning, value, and relations cannot be excluded from psychology on the basis of their non-observability.

In Angell's system, mental activity is described as psychophysical. It is psychical in that the individual ordinarily has some knowledge of his mental activity. He does not reason and feel without being aware of the fact. Mental activity is physical in that it is a reaction of the physical organism. Heidbreder (1933) pointed out that Angell made no attempt to explain the connection between the psychical and the physical. The relationship is merely accepted as a characteristic of mental activity as it appears in experience. Carr (1930) made it clear that Angell did not identify mental acts with the purely psychical aspect of adaptive action. The term "mental" refers to the whole adaptive process, psychical and physical. The psychical as a separate entity is nothing more than an abstraction.

According to Angell, introspection can involve both the observation of mental contents and the observation of mental acts such as reasoning and judging. The experimenter can ask the subject how he made his judgment or how he solved a problem. However, functionalists are not restricted to even this broad definition of the method of introspection in their research. Since there is no separation between psychical and physical experience, objective observation is also an

accepted method of functionalism. The experimenter can observe how subjects act in certain situations. Therefore, once this epistemological assumption of mind-body unity is made, the scope of functional psychology becomes much broader than the scope of structural psychology. Children, non-human animals, and even social products (e.g., works of art) can be included in the subject matter of functional psychology. Objective and subjective observations are means of arriving at psychological knowledge. Scientific functional psychology differs from common sense because it is more careful and systematic. It uses the experimental method whenever possible, gathers its information from a greater variety of sources, and constructs a more adequate systematic framework for organizing its data.

Heidbreder (1933) concluded that for Angell, the approaches to psychological knowledge were numerous. Functionalism was not associated with a particular method, as structuralism was with a critical or systematic introspection. In practice, however, functionalists leaned toward objectivity. Much of the research at Chicago under Angell was carried on without using introspection. When introspection was used, it was checked by objective controls. The procedure, of course, depended on the type of research. But the most important task for the functionalists was to study a process in its setting from the standpoint of its utility. For this study, it was necessary to examine the mental process from the outside. Angell wanted to keep the study of conscious-

ness in scientific psychology and, therefore, did not advocate the discarding of introspection. But in experimental practice there was a marked shift in emphasis toward observation from the outside.

The biological utilities of mental processes. In the second part of his 1907 article, Angell described the scope of psychology in the "larger formulae of biology and particularly the evolutionary hypotheses." Functionalism has the same philosophical vitality as pragmatism and humanism. Angell did not assert that functionalism and pragmatism are ultimately one. There was too much metaphysical controversy associated with pragmatism. But Angell stated that the two movements have similar logical motivation.

The functional psychologist is not interested in mental processes by themselves, but rather as they function in mental activity as part of a larger stream of biological forces. The functionalist uses the basic conceptions of the evolutionary movement, that organic structures and functions have their present characteristics because of the efficiency with which they fit into the "extant conditions of life broadly designated the environment." The functionalist's main philosophical interest is in how the mind contributes to the furtherance of the sum total of organic activities. He is not interested only in the general mind but also in its particular activities (e.g., mind as judging, mind as feeling, etc.).

Angell stated that it is the assumption of every philosophy except outright ontological materialism that the mind plays the most important role in all the environmental adaptations of animals which possess it. But this assumption has usually been considered a truism or postulate rather than a problem requiring or permitting serious scientific treatment. Functionalists attempt to shed light, through observation and experimentation, on the exact character of the "accommodating service" represented by the various modes of conscious expression. Angell thought that this attempt will have practical consequences if it is successful. For example, "pedagogy and mental hygiene" depend on practical guidelines that can come only from a psychology of this type. For the purposes of teachers and psychiatrists, a structural psychology is as sterile in theory as they have found it to be in practice.

Functionalism is a transfer of attention from the more general phases of consciousness as accommodating activity to the particular features of the case. This transfer is apparent in three areas of research. First, Angell described a revival of interest in the "quasi-biological" field of non-human animal psychology. He stated that some of this research involves investigation of the mechanism of instinct, the facts and methods of animal orientation, the scope and character of the several sense processes, the capabilities of education, and the range of selective accommodating capacities among animals. Second, there is the study of

human genetic psychology. This research emphasizes the necessity of getting the longitudinal rather than the transverse view of life phenomena and stresses the significance of growth in mental processes. Third, there is the study of pathological psychology. Researchers in this area are interested in the way in which accommodating processes become inoperative. Angell concluded that all of these research areas fall under the general psychological theory of functionalism.

Angell pointed out that both psychologists and biologists treat consciousness as synonymous with adaptive reactions to novel situations. Functionalists assume that consciousness is constantly at work building up habits out of coordinations imperfectly under control. As soon as control is gained, this mental direction tends to subside and give way to a "condition approximating physiological automism." Following from these assumptions, consciousness can be defined as "accommodation to the novel." According to Angell, the selective variation of response to stimulation is the ordinary external sign indicative of conscious action.

Angell did not consider this "biological" view of consciousness to be the only approach to the study of the functions of the mind. He did not think that psychologists should limit their study only to accommodating behavior. He wanted to keep consciousness in psychological research, and to connect the broad biological ideal of functional psychology with the problem of discovering the fundamental

"utilities" of consciousness. He stated:

> If mental process is of real value to its possessor in the life and world which we know, it must perforce be by virtue of something which it does that otherwise is not accomplished...The functionalist's problem then is to determine if possible the great types of these processes in so far as the utilities which they pretend lend themselves to classification. (Angell, 1907, p.73)

Angell stated that these classifications should be based on functional conceptions. The Aristotelian divisions, the "so called" Kantian divisions, the divisions into higher and lower powers made by faculty psychologists, and Brentano's and Stout's classifications are all based on dynamic and functionalistic considerations. In contrast, Wundt and Titchener classify their material under the more static and mechanical categories of "elements and compounds" abstracted from objects in the environment. Structuralism may be a pure science, but its purity is bought at the price of "truth to life."

Angell followed up on this point by stating that all pure science must abstract some from the actual circumstances of life. But in the "exact sciences" the abstraction is always away from the irrelevant and disturbing. The way to decide whether an abstraction is significant and important is to take a teleological point of view. Angell stated that it is a commonplace of logic that classification is intrinsically teleological. This means that the merits of any special classification, if it does not distort or misrepresent the

facts, can be tested by judging the success with which it meets the needs for which it was devised. If the goal of psychology is to emphasize the taxonomic and morphological features of mentality, then a structural system using the "rubrics" of elements and compounds is preferable. However, if the goal of psychology is to emphasize the functional and dynamic features of mentality, then different classifications may be needed for the many distinct zones of interest. Functional psychologists in each of the general fields described by Angell would have to devise their own classifications and judge these classifications by the success with which they meet the needs of applied fields of study.

Darwinism and the mind-body relation. In the third part of his article, Angell stated that functional psychology is in reality a form of psychophysics. Its aim and ideals are not explicitly quantitative in the way that the science of psychophysics is commonly understood. But the major interest of functionalists is to determine relations to one another of the physical and mental "portions" of the organism.

Angell wrote that this interest does not mean that the functional psychologist is committed to any special theory of the character of mind-body relationships. He might be an interactionist or a parallelist or even an advocate of some totally outworn creed. The functionalist may accept any theory except the view of the mind as an epiphenomenon. If the mind is only a byproduct of neural activity, then it can have little effect on the adaptive activities of the organism.

Angell concluded that it would be very difficult to formulate a doctrine that is wholly acceptable to all functionalists. But he did attempt to describe some of the essentials of such a doctrine.

Angell stated that it is essential to regard the mind-body relation in psychology as a methodological distinction rather than a metaphysically existential one. No matter what approach to the problem a functionalist might take, he comes to the conclusion that the mind-body distinction has no existence at the lower developmental stages of experience. The distinction only appears on a relatively reflective level and then it must be treated as instrumental rather than existential to avoid "metaphysical nightmares." One advantage of this methodological distinction is that, in dealing with psychological problems, this view allows one to reject as at least temporarily irrelevant the question whether mind causes changes in neural action or neural action causes change in mind. If you trace the lineage of your idea of causality by examining your intellectual processes, you will always find that this question is inappropriate. The appropriate question for functionalists is, what are the precise conditions under which consciousness is present and under what conditions does it retire in favor of the more exclusively physiological? The information that is gained by answering this question is both scientific and practical.

Angell stated that functional psychology does away with the dualism which assumes that the physical and mental are

two different orders of events. It regards the distinction between mind and body as a convenience in the psychologist's thinking. The distinction is a "teleological weapon" to use James' (1890) words, a useful instrument for dealing with experience (Heidbreder, 1933). But this convenience should not prejudice psychologists toward the belief that mind and body are really two different entities.

Angell stated that this functionalistic metaphysics is almost inevitably interpreted in terms of current philosophical discussion about the essential nature of consciousness. Angell wrote that David Hume has been accused of destroying the reality of the mind because he exorcised from it relationships of various kinds. But if Hume was guilty of "pouring out the baby with the bath," the modern philosopher is guilty of pouring in again baby and bath and maintaining that baby and bath, mind and relations, are substantially one. This unity is not accomplished with assumptions of idealism such as those prescribed by Berkeley. Unity is accomplished with assumptions of realism. Therefore, the functionalist who emphasizes the instrumental nature of the mind-body distinction and the metaphysician who regards mind as a relation hold quite similar positions. For both theorists, the mind can be described in terms of the organism's relations with the environment.

Angell concluded that no courageous psychology of volition is possible which does not face the mind-body problem. In fact, every important description of mental life contains

doctrine of one kind or another on this matter. A literally "pure" psychology of volition would be inaccessible to psychologists. Functionalists insist that mental processes should be translated into physiological processes and vice versa.

The relation of philosophy to functional psychology. In the final part of his article, Angell wrote that functional psychology offers a reasonable and cogent account of the rise of reflective consciousness and its significance as manifested in the various philosophical disciplines. For example, from the functionalist point of view, logic and ethics are not mere disconnected items in the world of the mind. They take their place in the general system of control established by physiological organization and mental activity. From the structural point of view, the several divisions of philosophical inquiry are related in only a purely external and accidental way. They are "products" of mental processes. To the functionalist, however, the philosophical disciplines are vitally connected. It is in situations where the good, the beautiful, and the true have bearing on the success of accommodatory activity that the normative philosophical sciences become relevant. If good action has no significance for the enriching and enlarging of life, then philosophy is futile. Most people, of course, do not agree with this conclusion.

Angell stated that the close relationship of philosophy to functionalism broadens the science of psychology. Because

of this relationship functional psychologists cannot be accused of being so influenced by biological considerations that they sacrifice the "poise and balance of sanity of outlook which philosophy undertakes to furnish." Angell wrote that philosophy cannot dictate scientific method or determine the facts to be discovered. But philosophy will always be a more integral and significant part of functional psychology than of other psychologies. For functionalists, philosophy offers interpretations of the psychologist's achievements. Therefore, functional psychologists look out on the surroundings of their science and try to establish a continuity with other ranges of human interest. According to Angell, the moment functionalism becomes dogmatic and narrow, and takes unto itself the pretense of scientific finality, its "doom will be sealed."

The descriptions in this section indicate that Angell was interested in an applied science of psychology rather than a pure science advocated by Titchener. In general, Angell was interested in the usefulness of the mind to the organism as it adapts to the environment. He was also interested in the usefulness of the results of psychological research to solve personal and social problems. He wanted functional psychology to be helpful in the fields of education, mental hygiene, law enforcement, and other areas of social adjustment.

In order for functionalism to be helpful in these applied fields, psychologists had to demonstrate that the mind was a

useful organ that had a great deal to do with the organism's interaction with the environment. When the mind is described by structuralists as some sort of passive receiver of sensations in which a reality is created from sense data, then psychology has little to offer to people who need to know the answers to practical problems. Angell thought that the mind was active in the biological functioning of the organism as the organism behaves in the environment. In a sense, the mind adapts the environment to the needs of the organism. This teleological approach to the mind suggests that perhaps the mind and body can be considered separately for study but they must interact.

Angell did not know how the mind-body problem ultimately would be resolved. It was a difficult problem that awaited future research. Angell, however, did not abandon the problem because it was difficult. He sought answers to this and other psychological problems in a number of philosophical disciplines.

In the next chapter, I will demonstrate how Titchener's and Angell's assumptions about the nature of the mind and about experimental methods determined the scope of their systems of psychology and the relation of philosophical problems to these systems.

CHAPTER 3

THE ASSUMPTIONS OF STRUCTURALISM AND FUNCTIONALISM

In the first two chapters, I set forth the carefully detailed structural system proposed by Titchener and the more general system of functional principles proposed by Angell. I also suggested some of the reasons for the differences in views between the two men about experimental psychology. Basically, Titchener attempted to reduce all of the data of the science of psychology to sensations. His purpose was to establish a reliable classification scheme for the results of psychological experiments. Angell, on the other hand, attempted to include the science of psychology in the continuous range of human knowledge. He was willing to give up the reliability of structural classification for the validity and breadth and sweep of outlook provided by a more general system.

The structural and functional views are based on several major assumptions about the nature of consciousness and the way consciousness should be analyzed and classified. In many cases, the assumptions underlying the two views are diametrically opposed. In this chapter, eleven pairs of these opposing assumptions are analyzed. Four of the pairs concern the nature of consciousness. I have called them: Parallelism versus Interactionism, Passive versus Active, Representative Realism versus Direct Realism, and Stimulus-Response Arcs

versus Continuous Circuits. Seven of the pairs concern methodology. I have called these assumptions: Generalized Mind versus Individual Differences, Molecular versus Molar, Science versus Common Sense, Determinism versus Teleology, Facts versus Relations, Subjective versus Objective Methods, and System versus Eclecticism.

Assumptions Concerning The Nature Of Consciousness.

Parallelism versus interactionism. The relation of mind to body has been a major topic in the history of speculative philosophy. Descriptions of this relation were necessarily derived from untestable assumptions. These assumptions gradually evolved into distinctive philosophical points of view which in turn led to endless arguments about the pros and cons of each view. But a resolution remained elusive.

Titchener and Angell realized the importance of the resolution of the mind-body problem in the establishment of a science of psychology. How could psychologists obtain scientific facts if their systems contained untestable assumptions? For Titchener and Angell, the answer was to develop working hypotheses about the relation of mind and body. The two psychologists did not know how the mind-body issue would ultimately be resolved, but that was a problem for the metaphysician. For their part, they could study mental activity without the endless arguments by accepting temporary solutions. These temporary solutions, however, were quite different.

Titchener's (1910) solution was a psychophysical parallelism. He assumed that the brain is part of the physical world and that the physical world is a closed system. Mental phenomena form a second universe in a dualism and these mental phenomena coincide with brain phenomena or are parallel with them (Boring, 1950). Whenever the two aspects appear, any change that occurs in one, will be accompanied by a corresponding change in the other.

Titchener argued that this point of view is different from the common sense view. He stated that "common sense says that we cry because we are sorry, laugh because we are amused, run because we are frightened; that we feel gloomy and morose because we do not digest our food, go insane from softening of the brain, lose consciousness because we have inhaled ether." Mind influences body and body influences mind in the common sense view. This is the doctrine of interaction.

Titchener stated that from the point of view of psychophysical parallelism, it is not strictly true that we cry because we are sorry. Psychologists must differentiate the dependent and independent aspects of the experience. If the whole experience is viewed from its independent aspect, we find that certain physical events or stimuli affect the body. These stimuli set up certain physical changes in the body, especially in the nervous system. These changes "cause" the secretion of tears. This is a complete description of crying considered as experience independent of the experi-

encing person. If the whole experience is viewed from its dependent aspect we find that "our consciousness has been invaded by grief or remorse or some kindred emotion." This invasion leads to tears. This is a complete description of crying considered as experience dependent on the experiencing person. The two sets of events, physical and mental, are parallel, but they do not interact.

Titchener thought that this working hypothesis offered two advantages for scientific psychology. On the "positive" side, psychologists are able to do justice to all of the observed facts. There is never a contradiction with these facts. On the "negative" side, psychologists avoid questions that lead nowhere (i.e., philosophical speculation). The common sense view of interaction between mind and body seems to be natural. But this view raises many unanswerable questions. For example, where does the body end and the mind begin? Do the senses belong to the mind or body? Is the mind active and the body passive? Do body and mind ever act independently? For Titchener, parallelism had no logical pitfalls of this kind.

Titchener concluded that it is not the phrasing of statements such as, "we cry because we are sorry," that psychologists have to guard against. It is the interpretation of those statements. We would not cry unless we were sorry, because our sorrow is the mental aspect of those nervous changes that make us cry. Titchener stated that we only have to shift our point of view, and what appeared as ner-

vous change appears as emotion. But to assume that the sorrow is literally the cause of tears and bodily movements would be like supposing that "the idea of watering the lawn can literally and directly, turn the tap and set the sprinkler in motion."

Angell (1907) also treated the mind-body distinction as methodological rather than metaphysical. But he thought that there is an interaction between the psychical and the physical, just as there is an interaction between forces of the physical world. This idea was based on the assumption that there is no "real" distinction between mind and body.

Angell wrote that the psychology of volition offers an illustration of the necessity with which descriptions of mental processes lead to physiological and biological considerations. If the voluntary acts of adults are examined, the resulting descriptions indicate that "ideational activities" of an anticipatory or deliberate character serve to initiate immediately or remotely certain relevant expressive movements. Without the execution of these movements, the ideational acts would be as "futile as the tinkling of cymbals of Scripture." Therefore, there must be an assumption of interaction in any theory of mental life in which consciousness is more than a mere epiphenomenon. Under the influence of James' (1904) pragmatism, Angell regarded consciousness from the Darwinian standpoint as having some utility in adapting the organism to its environment.

Angell (1907) was aware that interactionism led to "cyclonic disturbances in the philosophical atmosphere." But he was not overly concerned with the metaphysics of the theory. He was concerned mainly with methodological considerations. He stated that even psychophysical parallelism, "that most insipid, pale and passionless of all the inventions begotten by man" did not pacify the philosophers. It is no wonder that a more vital and realistic theory like interactionism should fall under attack by philosophers. But such a theory is worth the attack because it offers a much wider range of methods for examining the mind than does parallelism. Both theories are only working hypotheses, but interactionism offers more room to work in psychology.

Angell was also concerned with philosophical problems, however, and did examine the metaphysical implications of interactionism. He agreed with an idea proposed by Dewey (1886) in Psychology, that there was a continuum of mind-body theories ranging from dualism to monism. Dewey thought that psychologists should make assumptions that establish a viewpoint somewhere in the middle of this continuum. Such a position avoids the idealism that results from dualistic theories and avoids the materialism that results from monistic theories.

Angell wrote that this position was merely one of convenience for psychologists. Interactionism was not the "metaphysical" solution to the mind-body problem. It was only a temporary methodological solution chosen by functional

psychologists because it allowed a wider range of interpretation of experimental results.

Passive versus active description. Both Titchener and Angell thought that mental processes are involved in the activity of organisms in the environment. They made different assumptions, however, about the nature of this involvement. Titchener (1909) gave a passive description of the relation of mental phenomena to the environment. He assumed that sensations "come in" to consciousness from the nervous system which is in contact with the real world. In consciousness, these sensations are combined into meaningful "patterns of conscious contents." Angell (1907) gave an active description of the relation of consciousness to the environment. Like James (1890), Angell assumed that the mind evolved to the point where it is able to help the organism to adapt to the environment. For Angell, consciousness is not an epiphenomenon of nervous activity. It is "selective accommodation" to novel situations.

In their descriptions of the relationship of mental processes to the environment, both writers discussed the importance of the concept of attention. Titchener (1910) described attentional phenomena in the passive voice. For example, he stated that in primary attention, the first thing that happens is that sensations, or images "come in" to consciousness. When this occurs, there is a "redistribution" of the entire contents of consciousness. Consciousness in attention is "patterned or arranged" into focus and margin.

Titchener's use of the passive voice indicates that something is doing the redistribution of mental contents and arranging them into focus and margin. But he does not identify this thing. What is this redistributer and arranger, and how does it know what to do? Titchener thought that whatever attention is, it must be described in terms of mental processes (sensation, images, and affections) and explained by reference to its physiological conditions. Titchener attempted to make a description, but did not follow through with an explanation. Psychophysical parallelism offered a good way out of a very difficult situation. Physical explanation awaits future discoveries, while psychological description can be made now.

Titchener did speculate about physical explanations for primary attention, however. He stated that any nervous system will be powerfully "impressed" by intensive stimuli. Any organism that has "risen high enough in the scale of evolution to have a consciousness made up in part of ideas, of memories and imaginations, will be powerfully impressed by stimuli that are congruent with those ideas: it is precisely to such stimuli that the gates of the nervous system are open." Titchener seemed to think that the organism gets in the way of stimuli and lets certain of them in. Then something decides whether the "incoming" stimuli are "congruent" with certain ideas, memories, and imaginations. From this point of view, consciousness is passive in its relation to the environment but has an active mechanism

which decides what to do with sensations.

In his discussion of the combination of mental elements to form context or meaning, Titchener (1910) described the way that this passive mechanism, consciousness, operates in the organism's perception of the environment. He stated that in the earliest form of perception there is some "sensory complex in a kinaesthetic setting." Then "comes the invasion of consciousness by images, which modify both complex and setting, and may, in course of time, largely replace the sensory elements of the one and actually displace the other." Titchener concluded that "a sort of symbolic shorthand supersedes the earlier picture-writing of mind." All of these operations seem to happen in the mind in a passive way.

In 1909, Titchener had been more specific in the analogies he used to describe these mental operations. In discussing imagery, he stated that visual images are "vehicles of logical meaning." For example, Titchener could not only "see" gravity and modesty, but stated that he could "feel or act them in the mind's muscle." Titchener stated that he represents the meaning of affirmation by the "image of a little nick felt at the back of the neck, - an experience which, in sensation, is complicated by pressures and pulls from the scalp and throat."

Titchener (1909) assumed that all knowledge originates in sensations. All cognitions, even reflective ideas and intuitions can be traced back to elementary sensations. He described this as a theory of knowledge and not a theory of

thought. Titchener stated that this was an important distinction because "sensationism" is not the same as British associationism. He did not agree with the associationists' position that all genesis of new mental products is due to the combination of pre-existing elements. The associationists dealt with logical meanings. They dealt not with sensations, but with "sensations of." The structuralists aim to describe the contents of consciousness "not as they mean but as they are." These contents of consciousness are processes that come to have meaning from the context in which they occur. Sensations are received passively in consciousness and then are organized into patterns of meaning.

Angell (1907) thought that there was nothing at all passive about the mind. He stated that consciousness is constantly at work building up habits out of coordinations imperfectly under control. This is the primary goal of attention. As soon as control is gained, the "mental direction" tends to subside and the coordinations become automatic. Therefore, consciousness is an active "accommodation to the novel." Selective variation of response to stimulation is the ordinary external sign indicative of conscious action. This is the sign of the relationship of consciousness to the environment.

Angell wrote that it is possible to describe the mind in the same way that James (1890) did, as a general organ that contributes to adjustment to the environment. But it is important for experimental psychologists who take a func-

tional point of view of mind to examine the actual contributions to organic adjustment of the many varieties of conscious processes. This is not easy because there is a "paucity of the basic modes in which these utilities are realized." For example, memory and imagination are, functionally, only variants of a single and basal type of control. To separate these variants for study is to strip them of their role in "actual vital service."

Angell stated that ultimately, all of the utilities of consciousness can be reduced to selective accommodation. Selective accommodation can be further reduced to two categories of mental activities. The first category includes instincts or unreflective forms of selective response. Angell (1909) wrote that at first inspection, it might seem that instinct is only a matter of muscular activities and neural mechanisms and that mentality has very little to do with it. But closer inspection indicates that human and animal instincts are variable and adaptive to specific situations in ways that must be interpreted as conscious adjustment. The second category of mental utilities includes those under the influence of the mediating effects of previous experience. The utilities here either inhibit action or enhance it by adding their own dynamic tendencies. This last variety of action is the peculiarly human form of mediated control. Angell concluded that all the familiar psychological processes are subordinate to one or both of these categories. Conception, judgment, reasoning, emotion,

desire, aversion, volition, etc., simply designate special varieties in which these generic forms appear.

Angell wrote that functions seem to be the most stable characteristics in the biological field. They extend in a practically unbroken line from the highest to the lowest levels of life. Psychologists who stress the observation of behavior only, protest against including consciousness in the list of functions. But Angell thought that consciousness is the most important feature in the adaptation of the higher forms of life to the environment. He admitted, however, that functions are not always as useful as structures for classification purposes. They do not fit neatly into separate classes. But this, Angell argued, reflects the aims and limitations of classification.

Angell (1907) concluded that consciousness is primarily a control phenomenon. He stated that just as behavior is the most basic category of biology in its functional phase, so control can be considered the most fundamental category in functional psychology. The special forms and differentiations of consciousness simply constitute particular phases of the general process of control. The mechanism of control undoubtedly depends on the "cognitive processes." From the "vitalistic" point of view, the final interpretations of cognitive processes must be made within the general category of control. This is necessary if one regards the "furtherance of life in breadth and depth and permanence as an end in itself..." Even knowledge itself is built up under the

control mechanism represented by selective attention and "apperception." Angell thought that the mind is an organ that is active in the organism's relation to the environment. Conscious processes are active attempts to control the environment and adapt it to the needs of the organism. If one takes evolution seriously, the mind must be active rather than passive, an agent of control rather than a mere epiphenomenon.

Representative versus direct realism. Titchener and Angell had different ideas about the way to describe conscious phenomena. I presented evidence in the last section that Titchener described consciousness as a passive receiver of sensations while Angell described consciousness as the active part of the relation of the organism to the environment. From the passive point of view, perception of the environment is indirect. Based on Titchener's descriptions, perceptions are combinations of sensations that have no reference to the objects and events from which they originate. Titchener assumed that research on the nervous system will someday provide a map for the way sensations are combined in consciousness. From the active point of view, the perception of the environment is more direct. Based on Angell's descriptions, perceptions are not mental representations but rather have direct reference to objects and events in the environment. The evidence for this is observed in the successful outcome of an organism's selective accommodations to novel situations.

The assumption of mental representation of the environment is evident in Titchener's (1910) description of perceptions. He described perceptions as "selected groups of sensations" in which images are incorporated as an integral part of the whole process. These images are the "mental representations" of objects in the environment. Therefore, perceptions have meaning. Titchener wrote that, "No sensation means; a sensation simply goes on in various attributive ways, intensively, clearly, spatially, and so forth." All perceptions mean. They also go on in various attributive ways but always "meaningly."

Titchener (1910) stated that psychologists have no reason to believe that mind began with meaningless sensations, and progressed to meaningful perceptions. Titchener assumed that mind was meaningful from the beginning. The meaning of the mind is the organization of the nervous system. This inherited organization makes it possible for organisms to respond to stimuli received from the external world. The organism "selects, unifies, focalizes, supplements, and, if need be, acts upon" these stimuli.

The mental or internal situation is like the physical or external situation. Titchener stated that "some imaginative or memorial complex is fitted, under the conditions obtaining in the nervous system, to dominate consciousness, to maintain itself in the focus of attention, to serve as the starting-point for further ideas or for action." Titchener stated that perception is a mental representation of parts of the

physical world. The whole external world, as an organism takes it, is the meaningful experience of a conscious present. The mental representation is related indirectly to the physical world.

Titchener stated that if we describe perception in "genetic" (developmental) terms, we have as the earliest form of perception some sensory complex in a kinaesthetic setting. In course of time, these images largely replace the sensory elements of the complex and displace the setting. These images tend to fade away and are reduced to the common denominator of verbal ideas.

Titchener cautioned the psychologist not to confuse the analytic with the genetic points of view about perception. We cannot generate a square from four lines or a melody from rhythm and scale. The square and the melody are given as perceptions. The structuralist's task is to analyze these given perceptions, to discover their elements, and to formulate the laws under which the elementary processes combine. Once this is done, he can write for square and melody that certain mental elements are connected in certain ways. Then he can go on to search the map of the nervous system for parallel physiological conditions. From this description, it is increasingly clear that Titchener viewed the mind as passive with respect to the environment but active in combining mental elements.

Angell's pragmatic view of the mind led him to reject any notion of the mind as an epiphenomenon, a position that

he believed Titchener held. He thought that in order for the mind to have any value to the organism, it has to have a more direct connection with the physical environment. Angell (1903) stated that most psychologists would agree that consciousness "is not merely epiphenomenal, but is really an efficient agent in the furtherance of the life activities of the organism." Given this assumption, psychologists must realize that one of the ways that consciousness is most obviously valuable is in cognitive functions. The most important of these functions is selective attention. It is through the process of selective attention and other cognitive processes that the organism "recognizes" the beneficial or harmful and thereby regulates its conduct. Angell argued that "it is not for a moment a matter of indifference whether or not the results of the exercises of these processes are true or false." This is obviously the case in everyday practical problems. An organism must be able to attend to and perceive an obstacle in order to successfully avoid it, whether it has seen it before or not. But it is also true in every possible case of reasoning, no matter how remote that reasoning is from the immediate interests of the life process.

The mental processes are valuable because they help the organism to distinguish the harmful from the helpful. But this is not their primary organic value. The major function of the mental processes is to help in the adjustment of the organism to changing environmental conditions. The truth and falsehood of the results of mental processes are simply

other names for the successful or unsuccessful functioning of the organism in the total process of adaptation. This statement indicates that for Angell, consciousness is the selective accommodation of the organism to its environment. It selects aspects of the environment in relation to the needs of the organism.

Angell wrote that in his view it is not necessary to refer to immediate overt failure or success in the individual's adaptive activities when evaluating the usefulness of mental processes. There is no doubt that organisms make mistakes and are sometimes deceived by events in the environment (e.g., illusions). The reasons for mistakes in the higher mental processes, however, are often so veiled as to "baffle confident detection." But in such cases, there is the formation during all reflective activity of generally trustworthy or untrustworthy habits of mind. Therefore, even though these higher mental processes often may seem to have little survival value, the same sort of pragmatic evaluation can be applied to them as to the more basic processes like perception.

Angell concluded that unless one regards the cognitive function as a mere luxury of the organism, it is difficult to escape from the functional viewpoint. If knowledge-processes are of value to the organism, it obviously must be because of what they do. Everyone assumes that the knowledge processes serve primarily to "reflect and mediate the external world; and this they can only do effectively pro-

vided they distinguish the true from the false." Therefore, direct perception of the environment is a requirement of the functional point of view.

Stimulus response arcs versus continuous circuits. The assumptions about the passive or active nature of consciousness determined the way that Titchener and Angell interpreted the results of reaction experiments. I have described Titchener's assumption that consciousness passively receives sensations, which are combined into meaningful patterns, and then initiates a response. From this point of view, an act is a discrete unit or arc that can be analyzed into separate phases. There are initial phases in which mental elements are received and compounded and a resulting phase in which a series of motor responses are initiated.

Titchener (1910) thought that a good method for studying this typical "action consciousness" was with the reaction experiment in which very simple actions could be studied. The first phase of action consciousness corresponds to the fore-period of the reaction environment. The kinaesthetic contents of this phase are mainly "sensations of intended movement." There may also be kinaesthetic sensations from actual, anticipatory movements and there may be kinaesthetic memories involved. The idea of result is determined by the instructions the experimenter gives to the subject. This idea may be carried in visual images, internal speech, etc. The second phase of action consciousness involves the "release" of movement, in accordance with the experimenter's

instruction, after the perception of the stimulus. The final phase is the perception of the result. This result, with its "kinaesthetic halo, is at once the terminus of action consciousness, emotive or other." Therefore, the action consciousness has a beginning, a middle and an end. It is a discrete unit that becomes a kinaesthetic memory.

The most important feature of action consciousness is its predetermination in the sense of idea of result. The presentation of the object arouses associative tendencies to act. But only those tendencies are acted out which are in accordance with the idea of result. Titchener translated this "fact" into physiology by stating that "excitatory processes underlying the idea of end set up determining tendencies; they open certain nervous channels, as it were, and close others; so that the consequent excitations find their path laid out for them." So, for Titchener, physiological determining tendencies correlate with impression and associative tendencies in consciousness.

Titchener concluded that an action involved in a reaction experiment can be reduced to "skeleton form." The action is artificial in that it is made up for study under experimental conditions. But it is still an action, and the consciousness that Titchener found to characterize it is an action consciousness. This action consciousness can be analyzed as an isolated unit.

I have described Angell's assumptions that consciousness is active because it seeks ways to coordinate new actions of

the organism. From this point of view, an act is like a circuit that cannot be analyzed into separate phases. Stimuli, responses, and ideas all provide continuous information for the accommodation of the organism to the changing environment.

Therefore, Angell's view of the reaction experiment was different from that of Titchener. He stated in 1898 that his work with Moore on reaction time had been interesting, but the significance of the work had not been described adequately. All voluntary action, he believed, reaction included, requires for its execution an interrelated series of sensory and motor activities. Angell gave the example of placing a book on a table. This requires a complex interlinking of muscular contractions with articular and tactile sensations. The execution of general acts like this develop early in childhood and become relatively automatic or habitual. In a similar manner, listening and watching, involving the straining of attention toward an expected stimulus, indicate the pressure of habit in characteristic bodily attitudes. Attention can be described as habitual sensory-motor coordinations of a less overt type than the placing of a book on a table.

When this view is applied to the reaction experiment proper, Angell concluded that movement of the hand in response to a stimulus of sound involves both habitual contractions of the muscles of the hand and habitual attitudes of attention. The attitude of listening will be "vitally" influenced by considerations of the situation as a whole. For example, listening will not be done in quite the same way if the result

of hearing is to be a movement of the foot instead of the hand. Conversely, the movement of the hand, as an habitual act will not follow in an identical manner on the stimulus of a light as it does on a sound. Angell concluded that the reaction experiment represents an act in which there are two interrelated groups of habitual coordinations, one sensory and one motor.

Angell stated that the sensory and motor groups cannot be considered as separate sets of elements in the reaction experiment. He agreed with Dewey's (1896) discussion concerning the "circuit" character of all reactions. Dewey argued that the entire organic situation preceding the particular stimulus enters into the picture. This situation determines what the stimulus will actually be and do. Also, the reaction itself is reflected back into the stimulus and thus conditions the succeeding stimuli. Thus, the organism continuously adapts stimuli to its purposes. This point of view contrasts with Titchener's assumption of the arc character of the reaction in which termini are fixed and final.

From Angell's (1907) functional point of view, there are two types of circuits involved in selective accommodation to the environment. The first type represents the "short-circuit" unreflective forms of selective response. A short-circuit response is usually called an instinct. Instincts represent "racially hereditary utilities," many of which are extremely anomalous in their value under the existing conditions of life. Instincts are not completely automatic, but

can be modified by consciousness, especially in the higher species. The second type of selective accommodation represents "long-circuit" responses under the influence of the mediating effects of previous experience. Experience serves either to inhibit the "propulsive power" intrinsic to the stimulus, or to reinforce this power by adding to the stimulus its own dynamic tendencies. This last variety of action is a peculiarly human form of mediated control.

Angell concluded that even the simple action observed in the reaction experiment involves a complex interrelationship of attentional and motor coordinations. The action observed by the experimenter cannot be reduced through analysis to "skeleton form " without artificially breaking up these coordinations and interrelations. And without these attributes of actions, it would be impossible to explain the selective accommodations of the organism to a changing environment.

Methodological Assumptions

Generalized mind versus individual differences. Earlier, in the description of the Titchener-Baldwin controversy, I introduced the respective programs of the structuralists and functionalists. As a structuralist, Titchener wanted to develop a general classification scheme for the mind. To do this, he proposed that the adult human mind should be observed using a cross-sectional or transverse approach. The idea was that with enough practice in introspection, subjects in psychological experiments would be able to des-

cribe common elemental processes. Titchener assumed that these processes have nothing to do with capacities of individuals since all human adult minds are made up of these processes. Capacities are measured at a higher level when elemental processes are "synthesized." As a functionalist, Angell also wanted to develop a general classification scheme of the mind. But he proposed that the capacities or utilities of the mind should be observed using a developmental or genetic approach. Angell thought that, with both introspective and objective methods, the various styles of adaptation to the environment can be differentiated. This approach gives psychologists information about the way the individual mind develops during a lifetime. It also gives information about the different capacities for mental functioning between individuals.

Titchener (1910) assumed that in general and in detail, normal human minds are similar. He stated that "we have every reason to believe, not only in general that our neighbors have minds like our own, that is, are able like ourselves to view experience in its dependent aspect, but also in detail, that human minds resemble one another precisely as human bodies do." Titchener supported this argument by stating that the major social institutions are based on the assumption that individuals in society have minds that are of the same sort. Language, religion, law, and custom all rest on this assumption.

Since the assumption is "self-evident," the psychologist is justified in believing that other men have minds of the same kind as his own. Therefore, structural psychology can be based on the introspective reports furnished by a number of different observers. Titchener stated that extensive experimentation indicates there is a fundamental agreement on a great variety of details. Examination of the results shows that "mental differences (group) themselves, as we have seen that physical differences group themselves, about a central type or standard." Titchener cautioned, however, that there is no such thing as a collective mind or national mind that might be considered some immaterial being. But there is a collective mind if it is considered the sum total of human experience considered as dependent on a social group of similar individuals. It is the goal of structural psychology to describe the elemental processes of this experience and to formulate laws of synthesis.

Starting with the assumption of the generality of the human adult mind, Titchener (1912c) thought that it was possible to take a cross-sectional approach to the study of the mind. For example, in the study of perception, psychologists can seize on a particular moment of consciousness and regard it as typical of the whole course of perception. This moment can be described without reference to "past or future, or the rise and fall of total process." Titchener stated that psychologists here are describing a phase of the perception and not the perception itself or the percept

abstracted from the perception. Titchener's analogy indicates that this phase is like a frame from a motion picture film that is frozen in time. This is the best method to conceptualize perception because it allows for reduction to structural elements. In "Postulates" (1898) Titchener stated that in order to transform psychology from philosophy to science, problems like perception should be formulated explicitly or implicitly as static rather than dynamic, structural rather than functional.

Angell (1904) did not think that the structuralists' abstraction from process was justified, because as we have seen, he assumed that the mind functions as a unit. He stated that the mind "seems to be the master device by means of which these adpative operations of organic life may be made most perfect." The best way to study the mind is not to freeze process in time, bur rather to "see in what particulars the various features of consciousness contribute to this adaptive process." Therefore, Angell regarded all operations of consciousness, all sensations, emotions, and acts of will, as so many expressions of organic adaptation to the social and physical environment. Evidence of the supposed structure of the mind offers very little information about these adaptive functions.

Angell (1907) stated that much more information about the mind can be gained with a "genetic" approach, by which he meant a developmental approach. He wrote that psychologists must work toward the completion of adequate genetic

methods which will ensure really stable scientific results. But Angell thought that general psychological theory already had been vitalized and broadened by the results of existing genetic methods. These methods "constantly emphasize for us the necessity of getting the longitudinal rather than the transverse view of life phenomena and they keep immediately in our field of vision the basic significance of growth in mental process." Angell stated that nowhere is the difference between functional and structural psychology more obvious than in the genetic and transverse approaches to the study of mind. Angell wrote that one has only to compare the genetic studies of functionalists with the static studies of structuralists to feel the difference and "the immensely greater significance for both theory and practice which issues from the functional and longitudinal descriptions." Angell was arguing that mental processes have psychological meaning only as they exist and develop over time, and the development is different in each individual.

Angell (1930) agreed with James (1890) that however correct might be the introspective analysis of the adult consciousness into simple sensations of color, taste, sound, etc., with their attributes of duration and intensity, the actual genetic beginnings are to be found elsewhere. These beginnings are to be found in "one great, blooming, buzzing, confusion out of which little by little as the infant nervous system matured, emerged first one and then another psychological mass in its turn to be further disintegrated

by the analytic-synthetic efforts of experience " (James, 1890).

These general approaches to the study of the mind follow from Titchener's and Angell's assumptions about the passive and active nature of consciousness. If consciousness can be considered a passive receiver of sensations from the nervous system, as Titchener assumed, then basically all human minds are structured in the same way. Over time, through movement and language, a context of sensations, ideas, and feelings develops in the mind. Titchener thought that all normal adult human beings experience the same mental processes even though the context of these processes may differ because of varied developmental histories. If consciousness can be considered to be active in adapting the environment to the needs of the organism, as Angell assumed, then all human minds are different. As the organism matures, conscious capacities for adaptation develop. Angell thought that each individual has a different history of capacity development, and psychologists can measure the differences.

Molecular versus molar. Both Titchener and Angell discussed at length the kind of unit the psychologist should study. Titchener argued that consciousness should be broken down into separate component parts, a molecular approach. Angell, on the other hand, argued that psychologists should study aspects of consciousness, keeping in mind that these aspects are meaningful only when consciousness is considered as a whole organ functioning over time. This of course is a

molar approach.

Titchener's (1898) molecular assumption was that a particular experience can be analyzed into its most basic elements of sensations, images, and feelings. Every experience is composed of these interrelated but separable mental processes. The value of such an analysis is that the last things of the mind can be described using a subjective but highly controlled method of introspection. Titchener assumed that this method is the only valid one for psychologists to study consciousness because experience is dependent on the person having it. Only the individual can know what is going on in his own mind. Any interpretation of a subject's actions is speculation based on the experimenter's own introspections.

Titchener (1898) stated that the structural psychologist tries to discover first of all what there is in consciousness and in what quantity. He stated that "the fewness of the mental elements, is a fact of extreme importance." Titchener maintained that for psychology to be a science, it has to work with facts of the mind, and facts are mental elements. He used the term "process" to describe the elements of consciousness. However, he thought that these processes should be fixed at a particular moment through introspection as if they were separate frames of a movie. The reader will recall that Titchener (1910) stated that introspection must be "photographically" accurate for it to be reliable. If psychologists can get accurate snapshots of subjective

mental processes, they can analyze the component parts, the molecular structure, and develop reliable classifications of these parts.

Titchener (1898) stated that he agreed with Külpe's functional classification scheme. Külpe reduced all the "higher" processes to two structural patterns. These patterns are mixtures of intensities and qualities (fusions), and connections of spatial and temporal attributes (colligations). Titchener stated that this "reduction" makes a decided step in advance. But the chief value of the classification lies in the suggestion of a plan of arrangement for the results obtained by analysis of the basal functions. The agreement with Külpe indicates Titchener's views on the relation of structural to functional analysis. Functional analysis depends on the building blocks discovered in structural analysis.

Angell (1903) stated that it is certainly possible for structural psychologists to "hypostatize" sensation and to dissociate it from its particular surroundings if they so wish. It then becomes a simple matter to classify it as a type of relatively static structural element for which specific function is a secondary and unimportant consideration. But Angell argued that the actual sensory experience which is the "prototype" of this abstracted sensation cannot be correctly viewed or accurately described except in terms of function. A sensation, in other words, can never be isolated. It is never a general sensation but always a specific sensa-

tion produced by particular momentary organic conditions.

Angell (1907) thought that the functions of consciousness always take place in some general context. He stated that the forty thousand sensory qualities that "the psychologist" describes (he is referring to Titchener, 1902) have no actual existence apart from his classification, except when there is a functional demand for them. Consciousness for Angell is not a complex arrangement of isolable elemental processes. It is like a functioning organ that helps the organism to accommodate to its physical and social environment.

Angell stated that the smaller the segment of consciousness that is observed through introspection, the easier it is to emphasize the structural features of such segments. When a small segment is isolated, it is hard to do justice to the functional aspects of consciousness. The reason for this is that such isolation makes the element remote from actual life conditions. Angell concluded that the structural elements on which there is greatest agreement, sensation and affection, are the products of elaborate analytical simplification. These elements do not correspond in an exact sense to any actual moment of conscious experience. The more complex the mental activity under examination, the more readily is one directed to the functional activity involved and the more difficult it becomes to distinguish the structural characteristics of the activity.

The two opposing assumptions, which I labeled molecular and molar, effectively define the scope of structuralism

and functionalism. Titchener wanted to limit this scope to the classification of elements of consciousness. The elements are processes, but they can be fixed or made static through introspection, abstraction, and classification. Angell wanted to expand the scope of psychology by examining all of the possible functions of consciousness in the physical and social world. The functions can be described dynamically through introspection and objective observation. The circumstances within which these functions appear must be taken into account in order for the classification to be valid.

Science versus common sense. Psychology as common sense is naturally much older than the scientific psychology of the laboratory. As long as there have been societies, there has been opportunity for an individual to learn informally a great deal about other human beings. The trouble with common sense, Titchener (1910) argued, is that it is not likely to be questioned. It is taken for granted as something that needs no discussion. Titchener cautioned that in theoretical matters, common sense is an unsafe guide. He thought that common sense simply sums up the thoughts of former generations. A brilliant speculation of one age may become the common sense of the next, but this does not make it any less speculative. In the translation to common sense, the original speculation loses much of its logical structure.

Titchener believed that the philosophical source for the common sense notions of psychology are the writings of the French philosopher Rene Descartes. According to

Descartes, brain and the mind are distinct substances, one extended and the other unextended, which interact at a specified place. Titchener stated that this is also the common sense view. Mind influences body, and body influences mind.

As I described earlier, Titchener assumed that the brain is part of the physical world and that the physical world is a closed system. Mental phenomena form a second universe in a dualism, and these mental phenomena coincide with brain phenomena or are parallel with them. Given this assumption, the task of the psychologist is not to describe relationships between the mind and actions of the body, but rather to describe and analyze the composition of experience as dependent on the nervous system. For Titchener, this latter view identifies the scientific method of psychology.

In 1915, Titchener stated that the functionalists' common sense approach to psychology is actually the examination of the "products" of consciousness. With such an approach, the "form" of a visual perception may become the "content" of an experimental consciousness. For example, a subject may say that he "sees" an apple rather than a patch of red. The image of an apple is actually a product of a combination of sensations in consciousness. A subject may also describe a complete conscious attitude. But these introspections do not make up a psychology of visual perception or of conscious attitude until psychologists have analyzed consciousness into its constituent processes and have brought these simpler processes under the terms of

ultimate classification. Titchener stated, for example, that the "differences between the common sense and psychological observation of visual form is in the first place a difference between the existential determination of science and the interpretive of everyday life, and secondly just this difference of ability or inability to reduce experience to its lowest observational terms." Science for Titchener was the reduction of common sense notions about consciousness to irreducible elements of consciousness.

Angell (1903), on the other hand, thought that by getting away from common sense, psychologists were making psychology nonsensical. Angell's philosophical ties with pragmatism led him to question the logic of Titchener's assumptions. Angell stated that "when we rigorously distinguish the non-introspective experience which belongs to every-day life, from the post mortem type of experience with which the psychologist commonly deals, we find...that the significance of the structural elements of consciousness is increasingly circumscribed and artificial." Therefore, the fact that structural psychology involves rigorous analysis does not necessarily make it scientific.

Angell (1907) stated that the structuralists have tried to follow the lead of the natural scientists (e.g., physicists, chemists) by rigorously "delimiting" consciousness as an independent "realm." This procedure has resulted in a focusing of scientific attention and endeavor on a relatively narrow range of problems, and the discovery of many

facts. But Angell cautioned that psychologists must not forget the arbitrary and self-imposed nature of the boundaries within which structuralists work when they try to eliminate all reference to the physical and physiological. Functionalists do not place artificial boundaries on their field of study. They do not deliberately try to disprove common sense as if this would make psychology scientific. But they do make common sense more scientific.

Angell concluded that these arguments may give the impression that functional psychology is a name for a group of vague ambitions and good intentions. But there is nothing vaguer in the program of the functionalist than there is in that of the structuralist. The functionalist enters the laboratory with the same intention of discovering facts and new relationships and verifying previous observations. The functionalist, however, approaches the science of psychology with a more "articulate purpose to see the mind which he analyzes as it actually is when engaged in the discharge of its vital functions." Therefore, functionalism is scientific, and the results are verifiable in part by the reasoning of common sense.

Determinism versus teleology. A deterministic view of consciousness depends on the assumption that any conscious event at the moment is the result of events that happened earlier in the history of the organism. Titchener's context theory of meaning, described in Chapter 1, is an example of this view. A teleological view is based on the assumption

that the future affects the present. Angell's ideas about the "utilities" of consciousness is an example of this view. The reason for the difference between these two views is that Titchener thought that consciousness could be classified in terms of reactions while Angell thought that consciousness could be classified in terms of purposive actions, passive versus active descriptions once again.

Titchener (1915) assumed that any event in consciousness is the result of elemental processes and combinations of those processes. In the case where consciousness is composed of a single elementary process, "some of the aspects of the process will be clear and others obscure; which clear and which obscure is a matter of determination." There is a phase of excitation that corresponds with clearness of sensations. For example, excitation is the "release of a relatively constant amount of energy, the greater part of which flows freely in the course favored by determination, while the remainder flows less freely in the other, associated courses of the excitatory system." These passages indicate that Titchener considered the pattern of any conscious event to be determined by past events, through excitation of the nervous system and association of corresponding processes.

Titchener (1898) thought that functional psychology is teleological, and teleology is nonscientific. In his opinion, psychologists should study the "Is" of consciousness and not the "Is for." He stated that "if function is

studied before structure has been fully elucidated, the student may fall into that acceptance of teleological explanation which is fatal to scientific advance." Such explanation is "fatal" because it puts psychology "for the second time and no less surely though by different means, under the dominion of philosophy." Titchener (1921) later clarified what he meant by this criticism. He stated that functional psychology was developed when there was great enthusiasm for Darwin's theory of evolution. This theory was supposed to answer all the riddles of the universe. Functionalism borrowed evolutionary analogies from a "loose and popular biology and therefore adopted teleological interpretations which had no scientific basis."

A major problem, Titchener (1912a) pointed out, is that functionalists are inconsistent in their teleological interpretations. They do not give a teleological interpretation to every mental item. Thus, the functionalist may answer any number of whys, but he is still faced with a number of why nots which shed doubt on his explanations. For example, how has the development of red-green vision aided man in the struggle for existence? This and questions like it are not considered by functionalists using a teleological approach.

Angell (1907) disagreed with Titchener's criticism and his deterministic assumptions. Angell took a pragmatic view that "it is a commonplace of logic that classification is intrinsically teleological and that the merits of any special classification, assuming that it does not distort

or misrepresent the facts, is to be tested by the success with which it meets the necessities for which it was devised." As far as functionalists were concerned, conceptions based on teleology are involved in all statements concerning use, utility, adaptation, purpose, and means and ends. Angell thought that these terms imply a functional or contingent relationship in classification as opposed to a non-contingent taxonomy of conscious processes proposed by structuralists (Carr, 1930).

In describing his earlier work, Angell (1930) wrote that if a mental process is of real value to its possessor it must be by virtue of what it does. This is based on the assumption that there is a necessity for adaptive behavior. The essence of functionalism is to discern what "peculiar" service conscious processes render in these adaptive acts, both social and physical. A functional psychologist "desires to understand how the psychical contributes to the furtherance of the sum total of organic activities, considered as adaptive, and not alone the psychical in general, but especially the particular modes in which it appears, e.g., mind as judging, feeling, etc." Angell wrote that functionalists want to discover the exact "accommodating service" represented by the various phases of conscious expression. Teleology is justified from the functional point of view because the dominance of social and physical situations as stimuli, as objects toward which purposive action is directed, is always evident.

In 1909, Angell clarified his early views in an article about the influence of Darwin's theory of evolution on psychology. He stated that for the structuralist interested in the narrow analytic problems of mind, "Darwinism has had little immediate bearing and has exercised only the smallest fructifying influence." In contrast, the assumptions of the theory of evolution are central to functional psychology.

Angell stated that Darwinism had a very potent influence on functional psychology. In the matter of general method, Angell attributed to Darwinism the major responsibility for bringing into prominence genetic methods (including non-human animal experimentation), which set functionalism apart from the older and more analytic psychology. Angell acknowledged that the analytical methods of structuralism will always remain useful and in part indispensable. But the more significant generalizations and the more practically important forms of control over mental life are going to issue from the Darwinian principles. Acceptance by functional psychologists of these principles establishes for psychology cardinal factors of growth, development, and the influence of environment, both social and physical.

Facts versus relations. Both Titchener and Angell worked hard to separate the study of psychology from the study of philosophy, for they wanted to establish psychology as an independent science. Titchener, influenced by Machian positivism, attempted to restrict the goals of experimental psychology to the discovery of "facts" of experience. He

assumed that once these facts are established, laws of the mind can be written. Angell, influenced by James' form of pragmatism, attempted to broaden the goals of psychology to include the description of "relations and meanings" of experience. Titchener (1898) thought that relations and meanings were speculations based on the experimenter's own introspection. Angell (1907), in his turn, thought that the structural facts of experience were artificial and offered little help in understanding consciousness.

Titchener believed that there is an apparently universal tendency to help out description of facts by formulation of meaning. In 1912c, he stated that the difference between the world of practical life and the world of science is reflected in their respective languages. In scientific description, words are labels for facts, but in daily life, they are "signs of import." This distinction is important in experiments involving introspection. The facts and only the facts should be reported, even if they seem disjointed, incomplete, and meaningless.

Titchener (1912c) stated that scientific description is always an instrument of reconstruction. Psychological observation is individual observation, and only the subject can know what is going on in his own consciousness. The reader of the subject's report must be able to reconstitute, to reconstruct the complexity of the event, precisely as it was lived. The only way the reader can accomplish this is if the subject uses terminology which consistently describes

the irreducible and unchangeable facts of sensation, ideas, and affections. The ultimate test of the factual nature of description is the ability of the reader to expand the observer's terms to a descriptive formula, or at least to trace it back in descriptive fashion to the conventional starting point of the discussion. The untrained observer uses terms that are not descriptive in fact or intention. Therefore, the reader has no guide to descriptive reconstruction. The untrained observer tries to express the "import of the situation rather than its experienced 'quale'; he has not realized the difference between psychologizing and behaving."

For Angell (1903), it was just this "behaving" that was important in scientific psychology. He thought that a strict use of terms that have only a structural connotation biases an introspective description. Angell stated that "if there was nothing beyond the mere verbal identity in the terms applied to structures and functions, one might regard this fact simply as evidence of linguistic inadequacy, implying nothing positive as to the relations among psychical facts themselves." Angell concluded that the available terminology applied to consciousness is defective. But this is not the only problem with a descriptive approach. The actual sensory experience cannot be viewed or accurately described in any other way than as an expression of functional activities. The sensation is produced by certain particular momentary organic conditions. Sensory experience must always be

described in terms of what it means to the organism. Sensation only has meaning in terms of functional relations of the organism to the environment.

Angell thought that the question "why" was much more important than the questions "how"or "what" in the scientific study of consciousness. To answer the question why, it is important to examine the contingent relation of meaning to content. Functional psychologists study acts whose unity is a matter of reference. The reference of acts of the organism is the environment. Structural psychologists, on the other hand, study complex contents, and describe blends, fusions, combinations, and patterns of contents. But what is the reference for these descriptions? What is the distinction between one pattern and two? What is the criterion of unity here? There is no unity except in terms of meaning and reference. When Titchener used terms like perception, imagination, and ideas he was differentiating the mental elements on the basis of meaning and reference. For example, only certain elements combine to make certain complex perceptual patterns. Angell argued that these elements must be related in some way before they can accrue to form a context of meaning. Therefore, Titchener did not limit his descriptions to purely abstract elements of consciousness.

Angell (1903) assumed that meanings, values, and relations are important because they are necessary for conscious adaptation to the environment. But as Titchener had pointed out, these acts are not introspectable. Only contents of

consciousness can be introspected. But Angell (1907) stated that many modern investigations of an "experimental kind" largely dispense with the usual direct form of introspection. These experiments involve a determination of what work is accomplished and what the conditions are under which it is achieved. Angell wrote that many experiments in memory and association are of this functionalistic character. Many experiments involve phenomenological reports backed up with objective methods of observation. Phenomenological reports are not given in terms of structural category terms but rather in the subject's own words. Angell argued that instead of attempting to eliminate meaning from description to make it "scientific" as the structuralists do, functionalists keep the meaning in description and verify it with objective methods.

Subjective versus objective scientific methods. Titchener and Angell were interested in studying "consciousness." Their use of this term indicated that in both structural and functional psychology, at least part of the data obtained in the laboratory was subjective. Only the individual can observe and describe his own consciousness. The self-knowledge about consciousness is strictly subjective. The question facing both Titchener and Angell was, how can this subjective data be used to form a science of psychology? Titchener assumed that by developing a classification of descriptive terms that is free from meaning and interpretation, the subjective data could be described reliably. A psychologist

familiar with these terms could reconstruct the elements of consciousness based on an introspective report by a trained subject. Angell assumed that this strict definition of introspection limited its usefulness. He thought the phenomenological reports of subjects and objective reports by psychologists of the actions of subjects could provide additional and more important data for psychology.

Titchener (1912a) stated that functionalists maintain that certain psychological facts must or may be obtained "otherwise than (directly or indirectly) by way of introspection." Although he thought that this position was logically defensible, Titchener was not sure that any psychological data could be identified as facts obtained by objective methods. The reason for the doubt was that, "The facts and uniformities due to objective observation appear to be, in every case, psychophysical or physiological." Psychophysical and physiological facts are not data for psychology as far as Titchener was concerned. He rigorously distinguished between psychology, psychophysics, and physiology because he assumed that these terms, strictly used, stand for three different attitudes toward experience and for three different forms of scientific investigation. To run these three together "is not to escape pedantry, but is rather to lapse from clear thinking." With objective methods, the psychologist must observe the actions of organisms. Titchener thought that the psychological facts which are supposedly derived objectively are obviously colored with

empathy or introspective analogy. Systematic introspection, on the other hand, is no less objective to psychology than is the field of external observation to physics or biology.

Titchener (1912b) stated that functionalists argue that introspection is often unreliable. For example, in the study of perception, subjects often miss much of what is there and may misrepresent the little that they really perceive. Functionalists claim that introspection adds, subtracts and distorts. But Titchener argued that the validity of introspection is not dependent on whether the reports tally with the stimuli, but whether they give accurate descriptions of the observer's experimental consciousness. The observer is trying to describe a consciousness, not certain objective letters or figures used by the experimenter as stimuli. Titchener concluded that a subject's description "may be mistaken or inadequate, and we must use every possible methodological means to discover its mistakes and to supplement its omissions; but we cannot gauge the method by reference to stimuli."

Titchener (1915) recognized that a description based on introspection is always "clumsy and long-winded" compared with a functional intimation of meaning. But he assumed that psychology "is under no obligation to reconstitute at the end of an investigation, the continuum of psychical experience; it is enough to have shown that its contributions to the analysis of that experience are valid." He thought that if the data of the science of psychology are conscious

processes and these processes can be described reliably, then the descriptive science of psychology cannot be asked to give information about the relation of the data to the environment.

Angell (1904) argued that conscious processes and certain nervous processes are "indissolubly" bound up with one another in the human being. He assumed that the "real" human organism is a psychophysical organism and that the "mental portion of it is not to be completely or correctly apprehended without reference to the physiological portion." The real organism, as opposed to the abstraction considered as a collection of mental processes, operates on the environment, perceives objects, and uses consciousness to survive.

Angell stated that observation of others often makes us aware of psychological processes in ourselves which we should otherwise overlook. This does not make objective observation invalid. In 1907 he argued that as long as the procedures used by psychologists are in no way unreliable or unverifiable, then psychologists can delve into regions which are not at first glance properly mental. In fact they have to do this to get a correct understanding of mental phenomena. The relation of mental processes to the stimuli in the environment is the conscious phenomenon. Angell (1930) concluded that functional psychologists want to point out the actual living relationship between the mind and the environment which only an objective observation can verify.

The reader will recall that Angell (1907) thought that the functionalist enters the laboratory with just the same resolute interest to discover new facts and new relationships and to verify and confirm previous observations as does the structuralist. But the functionalist looks at the science of psychology as continuous with other ranges of human interest. He is interested in the mind as it "actually is when engaged in the discharge of its vital functions." If the functionalist sacrifices some of the "petty exactitude" of the structuralist, he has for compensation "the power which comes from breadth and sweep of outlook." Functionalism has a greater environmental validity.

In 1930, Angell concluded that psychology is a branch of biological science. As such, psychologists should use any methods which result in knowledge about the mind in its relation to the physical organism and its environment. He thought that introspection in one form or another is indispensable in psychology because the original conception of the field derived from the method, and it is an important method for studying consciousness. Looking back from 1930 he thought that this was a correct view. Exclusive methods like Watsonian behaviorism simply beg the question and tacitly assume data which, without reference to consciousness, would be "paralyzed and wholly sterile." He thought that there had been significant objective methodological contributions by behaviorists, but that some form of introspection is also needed. It is not simply the body-environment relation that

is important but rather the mind-body-environment relation.

System versus eclecticism. Titchener and Angell worked to establish a science of psychology that could hold its own in a university setting. They were both instrumental in establishing independent departments of psychology, Titchener at Cornell and Angell at the University of Chicago. They accomplished this goal by proposing systems of scientific psychology. Their systematic writings, however, were quite different. Titchener wrote a very careful and self-contained description of experimental psychology. Angell wrote a far-reaching description of psychology that included activities ranging from laboratory experimentation to the treatment of mental illness. Do the differences in descriptions indicate that one system was more scientific than the other? Titchener thought that structuralism was more scientific and reliable than functionalism, and doubted that functionalism was systematic. Angell insisted that functionalism was more than a collection of generalizations. He thought that functionalism was more scientific because it had biological and environmental validity as well as reliability.

In 1921, in a criticism of functional notions in Ladd's Psychology, Titchener wrote, "it is one thing to affirm broadly that the stream of consciousness appears...as a current designed from the beginning...to the fit performance of a certain work, and quite another thing to build psychological facts and laws into a coherent system of means and

ends." He thought that the teleology which is used in functional psychology has nothing to do with the facts of a science of psychology. The functionalist may insist on final causes, as do biologists, but he cannot make them adequate to the refinement of observation. Psychology must have its own claims on every item of its subject matter. Other scientific points of view should not be included in a scientific system of psychology.

Titchener (1921) concluded his criticism of the system of functionalism by writing that functionalism appears to be transitional, like a stage in an approach to philosophy or the beginning of various attempts at application of psychological knowledge. Therefore, functionalism is like a "halfway house" on the journey to somewhere else, and not as an abiding place. No matter how serious functional psychologists are in their work, they seem to do the work not for its own sake, but for the "attainment of some foreign end."

Titchener did not suggest that the author of a scientific system of psychology should shut himself up within the four walls of his specialty. This narrowness if vision often leads to confusion of thought. But the system of functional psychology as described in textbooks is different from the systems described in the textbooks of other sciences. The textbooks of functional psychology try to make psychology an introduction to philosophy or an aid to individual and social welfare. Titchener thought that the real danger of this eclectic approach to the development of a system of

functional psychology is that it dilutes the science of psychology. Then the work and seriousness of psychologists in the development of a science is withdrawn from psychology and expended in other fields of study.

Angell (1907) conceded that the structuralists' effort to follow the lead of the natural sciences and delimit rigorously (if artificially) the subject matter of psychology has led to a large amount of "excellent" work. He agreed with Titchener that the limit of profitable research using a structural framework has not been reached. But when explicit reference to the physical and the physiological is eliminated, arbitrary boundaries are established within which psychologists must work. The structuralist limits the freedom of psychologists to develop their science. Psychology then becomes an elite endeavor which goes against the democratic goals of American education. The eclectic approach, on the other hand, makes functional psychology more relevant to the problems of human beings functioning in the social and physical world. Angell concluded that "the moment [functional psychology] takes unto itself the pretense of scientific finality its doom will be sealed."

Angell (1930) pointed out the usefulness of an eclectic system of psychology in a discussion of his role in establishing the Institute of Psychology at Yale. He stated that it was possible to set up "fruitful cooperation" between psychology and a large group of closely related interests, such as psychiatry, neurology, physiology, biology, anthro-

pology, and the social sciences in general. The Institute brought together a number of scholars from a variety of fields of study for the purpose of solving existing social problems. The Institute was not as successful in reaching its goals as Angell anticipated, probably because the scholars were more interested in furthering their own research with Institute money than in solving social problems (Hunter, 1949).

Angell (1907) also believed that the development of an eclectic system of psychology was inevitable because of the successful work in comparative, genetic, and abnormal psychology. He thought that the work in these various fields was more interesting and the results provided much more information to help with practical problems than the systematic work of structural psychologists. Structuralism was limited to the study of the adult human mind while functionalism included the study of animals, children, and mentally ill adults. Angell concluded his argument for eclecticism by pointing out the applications of results of functional psychology. Comparative studies are interesting because the results support evolutionary theory. Experimental work with children is important in the development of new theories of education. Finally, research with the mentally ill helps therapists to formulate new programs of treatment. These practical applications support the eclectic, functional point of view.

Titchener's and Angell's assumptions established not only psychological points of view about experience, but also points of view about certain philosophical issues. The

structural and functional systems of psychology included ideas about philosophical topics such as the nature of knowledge (epistemology), the perception of reality (metaphysics), the relation of psychology to the normative philosophical disciplines (e.g., logic, ethics, and aesthetics), and the criteria for reliability and validity of data. Titchener had made it clear that when the data of psychological experiments are considered to be separate from a psychological system, then that system is nothing but a complex argument which is open to criticism.

We have seen that Titchener and Angell argued about the psychological problems resulting from their assumptions. But they also argued about the philosophical problems involved in their systems. For Titchener, these two types of problems were solved by adopting some of the complex arguments of Machian positivism. If the data of all the sciences can be reduced to sensations, then these sensations can be considered the last things of mind from a psychological point of view. The task of psychology then is to simply identify and classify these mental elements. No further reference to philosophy is needed when this structural point of view is strictly maintained, because philosophical problems are irrelevant.

For Angell, it was important to solve both the psychological and philosophical problems included in his system, because these problems are closely related if not identical from the standpoint of Jamesian pragmatism. Angell thought that ultimately, psychologists had to answer the question,

what value does psychology have for people in their daily lives? If it is a system of pure scientific abstraction, then the facts and differences it describes have little practical value. For Angell, the only valid criterion for psychological data is their relation to the universe of practice.

In the next chapter, the "complex arguments" of Titchener and Angell are compared. These philosophical arguments concern the validity of structuralism and functionalism as complete systems. The major issue is the relevance of the science of psychology to people in their understanding of the world and their solutions of social problems. These are important arguments, because, as we will see in Chapter 5 relevance has become a major issue in the arguments among modern psychologists.

CHAPTER 4

ARGUMENTS ABOUT THE RELATION OF PROBLEMS IN PSYCHOLOGY TO PROBLEMS IN PHILOSOPHY

The comparison of major assumptions of structuralism and functionalism in Chapter 3 indicates that Titchener wanted to separate completely the science of psychology from the speculation of philosophy. He did not think that his own tacit assumptions led to philosophical problems within his structural system. Angell, however, wanted the science of psychology to be consistent with all forms of human interest, including disciplines of philosophy. Angell realized that his assumptions created philosophical problems that had to be solved before psychology could have any practical value. These two positions on the relationship of psychological to philosophical problems do not appear to be mutually exclusive. Conceivably, psychologists could work from either point of view. But Titchener and Angell argued about the psychology-philosophy relationship just as they argued about every other aspect of their systems.

The positions of Titchener and Angell on the relation of psychological to philosophical problems led to perhaps the most interesting of all the arguments between the two men. These arguments were important, because they concerned the validity of structuralism and functionalism as whole sys-

tems. Titchener and Angell were not discussing details of their systems such as the relative merits of systematic versus phenomenological introspection, or psychophysical parallelism versus interactionism. They were arguing about the value of structuralism and functionalism in understanding the results of psychological research. Titchener argued that functionalism was only an introduction to philosophy and would never be valuable for scientific classification. The mixture of philosophy and scientific methods made functionalism an illogical system. Angell thought that structuralism provided a reliable scientific classification system. But he argued that the facts that were classified were abstract and made no practical sense in describing the role of consciousness in the daily life of organisms.

With the basic goal of showing the complete lack of validity of the opposing system, Titchener and Angell argued about the relation of psychological to philosophical problems. The arguments focused on the relation of psychological problems of cognition, volition, feeling, perception of reality, and knowledge to respective philosophical problems of logic, ethics, aesthetics, metaphysics, and epistemology. Titchener argued that the relation was only a matter of inference and not based on any scientific evidence. Angell argued that the relation was necesary if the results of experimental psychology were to make any sense at all.

Titchener's Arguments.

Metaphors. Titchener (1898) developed his arguments with the use of a biological metaphor. He wrote that biology, defined as the science of life and living things, may be approached from three points of view. First, the structure of an organism may be studied by analysis and synthesis. With analysis, the biologist determines the component parts of the organism. With synthesis, he demonstrates how the organism is a formation of these parts. Second, the function of the various structures that have been revealed by analysis may be described. This includes a description of the interrelation of functional organs. Third, the changes of form and function over time due to the phenomena of growth and decay may be examined. Titchener stated that these three points of view represent three "mutually interdependent" sciences of biology: morphology, physiology, and ontogeny.

Titchener wrote that modern psychology can be represented as the exact counterpart of modern biology. There are three ways of approaching one as there are three ways of approaching the other. First, there is a parallel to morphology "in a very large part of 'experimental' psychology." According to Titchener, the primary aim of the experimental psychologist is to analyze the "structure" of the mind. Analysis involves the unravelling of the "elemental processes from the tangle of consciousness." The psychologist is like a "vivisectionist" who tries to find, first of all, what is there and in what quantity, not what it is there for.

Titchener stated that many critics of experimental psychology question the use of the adjective "experimental." They argue that an experiment is something more than a measurement made with the help of delicate instruments. Titchener replied that these writers do not understand the "morphological character" of psychology. For example, they state that the experimental psychologists' treatment of feeling, reasoning, and the "self" is inadequate. The introspective method is valuable only for the study of "sensations" and "ideas." Titchener answered that the results gained by dissecting the "higher" mental processes will always be disappointing to those who do not take the dissector's point of view. But taken in its appropriate context, mental anatomy which implies the "fewness" of the mental elements is a "fact of extreme importance." The basic building blocks of the mind must be found before conscious processes can be adequately described.

The second way of approaching psychology using the biological metaphor is to look at the functions of the mind. Instead of regarding the mind as a structural complex of processes shaped and molded under the conditions of the physical organism, it may be regarded as the collective name for a system of functions of the psychophysical organism. Titchener stated that just as experimental psychology is concerned with problems of structure, so is speculative psychology, ancient and modern, chiefly occupied with problems of function. For example, memory, recognition, imagination,

conception, judgment, attention, apperception, volition, and a host of other "verbal nouns" used in the discussion of speculative psychology connote functions of the total organism. Titchener stated that from the functional point of view whether the underlying processes of these functions are psychical in character is "so to speak an accident." For all practical purposes, these functions are considered to be on the same level as digestion and locomotion, secretion and excretion. It is the ogranism that remembers, wills, judges, recognizes and so forth, and is helped in the life struggle by these functions. Such functions can be included in mental science because they constitute in sum the actual working mind of the individual. They are not functions of the body, but are functions of the organism. Therefore, they must be examined by the methods and under the principles of a mental "physiology."

The third way to approach psychology using the biological metaphor is ontogenetic. Titchener described this point of view in one sentence. He stated that, "Ontogenetic psychology, the psychology of individual childhood and adolescence is now a subject of wide interest and has a large literature of its own."

It is clear that Titchener developed his version of a biological metaphor for psychology to differentiate the structural from the functional point of view. With this metaphor, Titchener could completely separate his experimental psychology from what he considered to be an interpre-

tive psychology. Thus, he could argue that structuralism was free from all of the speculation of philosophy while functionalism was intimately related to it. Based on this metaphor, Titchener concluded that structural psychology was the only scientific psychology.

Logic, ethics, and aesthetics. Titchener (1909) took a specific stand against the philosophical disciplines of logic, ethics, and aesthetics. He assumed that psychologists should attempt to pick their way between logic or theory of thought, on the one hand, and common sense on the other. For example, in the study of sensation and the simpler "sense complexes," structural psychologists have to take a middle course between physics (under which Titchener included physiology) and common sense. The psychological process, from a structural point of view, is so unlike both the nerve- process on the one hand and the "thing" of common-sense thinking on the other that this course should be easy. But it is not, because "the solid palpable facts of natural science and the prejudices of common-sense are for ever in the way."

Titchener stated that this difficulty is increased "tenfold" in the case of thought. The psychology of thought leads straight to "functional logic," a theory of knowledge. In fact, it is often difficult to be sure that you are on "your own side of the line." It is difficult to tell whether a subject is reporting what actually exists in consciousness or what logically should be there. Common sense tempts us to make logical connections rather than systematic

observations. Titchener concluded that common sense is very fond of logic even though it is often illogical. When common sense "joins forces with logic it tends to wean you from your psychological allegiance."

Titchener's specific arguments against common-sense and logic originated in an (1899) article. In "Structural and Functional Psychology" he wrote that systematic introspection, the method used to discover facts about the structure of the mind, is very helpful in separating the problems of structural psychology from the problems of logic discussed by functional psychologists. We have seen that introspection from the structural standpoint is observation of an "Is." Introspection from the functional standpoint is observation of an "Is for." The Is consists of the psychological processes of sensations, images, and affections. The Is-for consists of "extra psychological functions," the Is-for-thought and the Is-for-conduct. Thus, functional introspection is an observation not of psychological material but rather of meanings (logical functions) and values (ethical and aesthetic functions).

Titchener argued that introspection of the Is-for must be the introspection of the Is-for-the organism. This is a teleological view which involves speculation by the observer rather than pure observation. Speculation does not provide scientific answers to psychological problems. What are the organism's mental tools? To what simplest type or types may they be reduced? How delicate is their work and

how wide their limits of efficacy? Titchener thought that these were psychological problems. The problems of how and to what extent the tools are used to get results in the worlds of truth, goodness, and beauty are questions of logic, ethics, and aesthetics, disciplines which have points of view which are completely different from the psychological point of view.

Titchener concluded that it is hard to draw a rigid line between the work of functional psychologists and the work of students of philosophy. Part of the reason for this is that functional psychologists will not refrain from "psychologizing" until they have "traversed the domain of thought to its uttermost boundary." But there surely must be a point at which the psychology of cognition, will, and feeling ends and the "sciences" of logic, ethics, and aesthetics begin. There must be a point where general value for the organism, "function" in the widest sense, is replaced by special value, i.e., value for knowledge or conduct or art.

Titchener (1912c) agreed with Münsterberg that every investigation in a special science presupposes universal logical function. Therefore, no psychological method can lead to a fully developed science if the psychologist does not form judgments, concepts, and inferences from his data. He must also be able to develop his thoughts deductively and inductively, and to formulate classifications and demonstrations. Titchener thought that while psychology presupposes logic, it may also consider logic from its own point

of view. Introspective accounts of the content-processes can be obtained that correspond to logical operations.

The "fact" that logical operations can be structurally analyzed makes it natural for the psychologist to confuse description and explanation. It tempts him to apply the abstractions of logic to the content-processes revealed in introspective reports. He may "invent" content-processes of relation, of judgment, etc., and in this way secure a "phenomenological agreement" between psychology and logic. The psychologist also may overlook real psychological problems. For example, in many psychological descriptions the term "greater" or some more specific "equivalent" is used by the subject. Titchener stated that we are so accustomed in adult life to using these terms that the comparative form of the adjective like "greater" may pass for a descriptive term like "red." But this adjective, as psychophysical usage implies, is the expression of a judgment of comparison not a description of content-processes. Titchener concluded that at any stage of description, psychologists may bring logic to bear on introspective material, but they must not read logic into that material.

Titchener (1915) clarified his position by describing a clear "line" between scientific facts and logical abstractions. He stated that in any system of science, two factors are distinguishable. The first factor includes the facts, the data of observation which are obtained by the methods peculiar to the science in question. The second factor is

the scaffolding of the system which is obtained by the logical method of reflection. We have seen that Titchener concluded that a system of science considered apart from the facts which it embraces, is in reality a "complex argument."

Titchener (1912a) stated that "real" thinking does not move with the "wearisome parade march" of formal logic. Therefore, the psychologist must use the "logical schematism" of structural psychology to unravel the closely packed tissue of thought. The practical thinker does not laboriously abstract the particular from the universal. In a single act, he apprehends the universal and the particular in the universal. Titchener wrote that the concept of thinking as a complete act may lead to a more realistic presentation of logic in textbooks. But it contributes nothing to a psychological description of an experience of apprehension of relations between particular and universal. Titchener concluded that the problem of the psychologist is to show the characteristics of all of the acts of thought, not by reference to what is apprehended in them but by demonstration of their proper nature. Logic can be applied to the development of a system of psychology, but it cannot be read into facts obtained through introspection.

Titchener (1922) argued that functional psychology appears as an exercise in applied logic, stamped with the personality of individual authors. The various descriptions of functional psychology will remain interesting to many

students of psychology, because "mind in use" will always have its fascination. But these accounts do not describe a science of psychology.

Titchener stated that functional psychology is a completely teleological discipline that, through biological analogy, directly or indirectly describes general norms of philosophical theory for the right conduct of our practical life. In order to maintain a logical continuity with philosophy above and everyday practice below, functional psychologists "sever psychology from the other sciences, and redefine 'science' to suit their case." Titchener could understand how current philosophy (e.g., logic, ethics, aesthetics, metaphysics, and epistemology) looks with favor on a functional system and with disfavor or indifference upon a truly scientific, structural system of psychology. But this stands to reason since current philosophers have much to say about popular psychology and very little to say about physics and chemistry, the disciplines most closely related to structural psychology. Titchener could also understand how psychiatrists and educators, eager to turn psychology to practical ends, should appeal to systems that are already "technological" and disregard the bare impersonal facts of the existential science of structuralism. However, physics, chemistry, and even biology seem to be going their own theoretical way without looking aside either to philosophy or to application. These special sciences are achieving results which are at once finding technical application. Titchener concluded

that these arguments encourage the acceptance of a truly scientific psychology, independent of philosophical considerations. He stated that psychology fairly challenges us to attempt its "systematic exposition on an existential basis."

Titchener (1921) wrote that a description of the four major characteristics of functional psychology indicates that functionalists are more concerned with applying philosophical tenets to consciousness than they are to the development of a logical system of psychology. First, functionalists divide consciousness into content and function, though function of course is emphasized. Second, they assume that consciousness is a solver of problems. Third, functional psychologists look at the whole course of mental life teleologically. Finally, they write psychology as a preface to philosophy or to some practical discipline. Titchener stated that these characteristics are not logically coordinate. He concluded that it is plain that functional psychology has its roots in Aristotelian empiricism and that while it has taken the "color of modernity" from the surrounding special sciences, it has not adopted the modern conception of science itself. Titchener thought that reliance on the constructions of prescientific thinking has caused functionalists to develop an illogical system of psychology and to point to the facts discovered by structuralists as illogical.

Epistemology and metaphysics. Although experimental psychology had its roots in British empiricism and associa-

tionism, Titchener (1909) attempted to show in general that structuralism had come to deal with problems that were different from those described by the older British philosophy. He stated that structuralists differentiated the sensationalism of psychology from the epistemological doctrine of associationism developed by British philosophers.

Titchener pointed out three important ways that these two concepts differ. First, the associationists did not distinguish theory of knowledge from theory of thought. Therefore, they developed a system in which philosophy and psychology were inextricably mixed. Problems of logic and epistemology were mixed up with more proper psychological problems. The reason for this confusion was that associationists dealt, on principle, with logical meaning, a theory of knowledge. A theory of thought is different from a theory of knowledge. They did not describe sensations or ideas but rather "sensations of" and "ideas of." Then they left this "plane" of meaning and moved it to the plane of existence and assumed that mental development consists solely or mainly of meaningful sensory and ideational elements. These elements combine according to certain laws of association. The experimentalists, on the other hand, try to describe the contents of consciousness not as they mean but as they are. For example, the associationists thought that the idea of Napolean calls up the idea of Julius Caesar because both men were great generals. This is a case of association by contiguity. But when the experimental psychologist Ebbinghaus

began his work on the study of memory and association, he mentioned as his materials nonsense-syllables, contents that presented themselves simply as "existential." Titchener stated that these nonsense-syllables helped psychologists to gain knowledge about the mechanics of mental "reproduction." He concluded that Locke's idea and James Mills ideas, were meanings, thought-tokens, and bits of knowledge. In contrast, the sensations and ideas of modern structural psychology are data of immediate experience.

The second major difference between sensationism and associationism concerns the concepts of time. Meanings are stable and may be discussed without reference to time. Therefore, a psychology whose elements are meanings is atomistic. The elements join like blocks of mosaic to give static formations or connect like the links of a chain to give a discrete series. But from the structural psychologist's point of view, experience is continuous and a function of time. Therefore, a psychology whose elements are sensations in the structural sense of the term is a process psychology, without metaphors of mosaic construction or chain-linking. Titchener stated that the structural description of psychology can be traced to Wundt, who thought that an "idea" must be regarded as a "process, no less variable and transitory than a feeling or a volition." Based on this conception, Wundt thought that the old doctrine of association was no longer tenable for psychology. Titchener concluded that experimental psychology has "in the main, transcended the

doctrine of mental chemistry." Psychologists have better means than a false chemistry analogy for explaining what cannot be explained in terms of a straightforward associationism. Structural psychologists can abstract from actual, existential experience mental processes and "build up" descriptions of complex mental states from these elements. These elements are processes whose "temporal course is of their very nature, and not substances, solid and resistant to the lapse of time."

The final difference between sensationism and associationism involves the interpretation of the results of psychological analysis. The sensationism of modern psychology is simply a heuristic principle accepted and applied for what it is worth in the search for mental elements. Associationism, however, was a preconceived theory that required the facts to conform to it whether they would or not. The "composition" theory of mind proposed by associationists was the hypothesis that mental states are the result of various combinations of "primitive" elements. In the extreme form, this psychological theory of association assumed that the ultimate units of mental composition are all of one kind, namely sensations. Titchener thought that sensation, affection, and image were separate processes and could not be constructed with a mosaic of "primitive" sensations. He concluded that British associationism is a preconceived theory and its sensations are accordingly productive and generative elements. These elements are first terms in a

logical construction of mind. Titchener stated that, "Associationism, in other words, puts sensations together, as physical atoms or chemical molecules, while modern psychology finds sensations together in the given mental process."

Titchener argued that the associationist works forward from theory while the structuralist works backward from observation. The associationist determines in advance what he will find in the mind (i.e., a mosaic of primitive elements). The structuralist observes consciousness through introspection and abstracts "elemental processes" for scientific classification. The description of patterns of observed processes allows the structuralist to write laws for their combination. The associationist, however, develops laws prior to observation (e.g., contiguity) and then looks for supporting evidence.

Titchener thought that the "popular" psychology of functionalism is the mixture of associationism and faculty psychology that passes for common sense. Structural psychology, however, tries to save what is psychological from associationism on the one hand and from "physiological" sensationism on the other. It transforms and reinterprets associationism from beginning to end. It accepts the view from physiology that sensations are the outcome of analysis. But it rejects or modifies the concrete form in which the view is presented, namely the naive doctrine of psychical organs and centers. Titchener concluded that because structuralism obeys the "law" of parsimony, it is accused of resurrecting old philosophical doctrines. He answered this

criticism by stating that structural psychologists prefer to work with as few "tools" as possible. Sensation, affection, and image seem to give structuralists all that they require for the work of analysis. Titchener thought that this work of analysis is completely separate from any philosophical doctrine.

Titchener (1902) cautioned psychologists not unwittingly to include philosophical interpretations in their experimental work. This mistake can occur when an experimenter goes beyond systematic introspection and draws inferences from the "phenomena" of consciousness. This causes him to accept the existence of something behind consciousness which introspection does not reveal. When he does this, the psychologist appeals for help to a science which is not psychological, but rather metaphysical. The structuralist appeals to a three-part biological metaphor which he considers to be much more relevant to experimental psychology.

Titchener defined metaphysics as the discipline which unifies and harmonises the principles and laws of all the other sciences. Therefore, the discussions of metaphysics are always couched in general and abstract terms. It is wrong to appeal to the discipline for an explanation of a single concrete fact. Titchener gave an example of the analysis of an emotion of hope. From a structural point of view, it is wrong to observe mental constitution, state that a subject is normally sanguine, and then look around for special conditions of a particular hope. Following

this reasoning, it is wrong within the limits of science at large to explain the appearance of a single phenomenon of mental constitution by appealing to metaphysics. Titchener argued that mental constitution is one particular scientific fact, and the emotion of hope is another. Both must be explained scientifically and not by metaphysics. By scientific, Titchener meant that both phenomena must be explained by a statement, in terms of some special science, of the conditions under which they appear.

Titchener concluded that it is important that the difference between inferred mental activity (metaphysical) and experienced activity should be fully understood. He stated that the metaphysical view is the common sense view. For example, functionalists argue that there is a permanent mind behind the various manifestations of mind in conscious processes. They believe that this mind is active and directive. From this point of view, the permanent and active mind must manifest itself in some specific conscious process. There must be something other than sensations and affections to be found in mental experience. The functionalist looks at evidence from introspection and finds that there are two conscious processes which give him a direct experience of activity or spontaneity: conation and attention. He assumes that this is evidence that the functional inference was correct. Not only must psychologists infer that the mind is active, they argue, but there is proof of a direct experience of mental activity in certain well-marked conscious

processes.

Titchener pointed out that this argument is based on the faulty assumption that mental activity is no longer a metaphysical inference from the facts of mind but rather is an item of mental experience. The acceptance of this assumption leads psychologists carefully to examine the processes which support the idea of the reality of an active permanent mind. Titchener stated that this is a confusion of metaphysics with science. Systematic scientific introspection does not reveal an active and permanent mind. It reveals only sensations, ideas, and affections. Experiments designed to prove that an active mind exists are based on speculative philosophy. For Titchener, the scientific value of a system of psychology depends on the decision to include or exclude metaphysical speculation. He claimed that structuralism excludes speculation and, therefore, gives valid descriptions of facts of consciousness. Functionalism, on the other hand, includes speculation and therefore does not describe any facts of consciousness. Titchener concluded that structuralism is a valid special science, while functionalism is not a valid scientific system at all.

Angell's Arguments

Metaphors. Angell (1903) stated that the tendencies of psychologists to make psychology independent of philosophy are identical with those which have brought it under the guiding influence of biology. This is evident in the use by structural psychologists of biological metaphors. The use

of biological patterns as analogies of mental operations is based often on preconceived notions about the mind. In other words, biological metaphors are adopted by structural psychologists to prove a point, not to provide understanding of the relationship between the mind and the organism.

Angell wrote that structuralists treat the mind as an organism and assume that it may be studied in the same way that biologists study physical organisms. With this metaphor, psychologists can construct a mental anatomy dealing with the facts of psychical structure and a mental physiology dealing with psychical function. Structuralists assume that there is a legitimate distinction between the structure and function of consciousness and claim that this distinction is self-evident. Angell pointed out, however, that structuralists have not followed consistently the example of the biologists who have developed morphology and anatomy on the one hand and physiology on the other as relatively independent sciences. Structural psychologists claim that they are concerned only with the structure of the mind, and yet they do not stop at mere classification. They try to reconstruct mental functions with the abstractions from consciousness that they have classified. Therefore, it is not self-evident that there is a legitimate distinction between mental structure and function as there is between anatomy and physiology. Angell concluded from the biological metaphor that psychology appears as a science engaged with both the anatomy and the physiology of the mind, considered

together.

Angell further criticized the structuralist's use of a biological metaphor by stating that systematic introspection is essentially a "constructive process, producing a novel state of consciousness, which serves to represent ordinary experience." This method is quite different from that of the biologist who dissects an organism and describes the tissues and organs he discovers. Thus, there is an important disparity between the psychological form of the structure concept and that current in biology. Angell argued that the concept of psychical structure only indicates the complexity manifested by states of consciousness. This is a complexity of reference beyond the psychical moment, rather than a complexity felt as inherent in consciousness itself. Viewed dynamically from without consciousness appears to have many parts. Viewed dynamically from within, however, it is ordinarily a unitary process. Beyond this concept of complexity, psychical structure is irrelevant and inapplicable.

Angell argued that it is hardly open to question that the biological idea of function is applicable in a general way to the life of consciousness. The precise classification used in biology (e.g., functions of adjustments to the external environment, functions of internal organic metabolism, functions of reproduction, etc.) may not be immediately available to psychologists. But the general biological notion of organic activity certainly requires no

essential transformation for psychology as does the structural notion.

Angell wrote that it is possible to include both structural and functional ideas within a framework of a biological metaphor if the metaphor is carried out to its fullest extent. In biology, every function involves a structure, an organ, for its execution. Biologists have found that functions modify these structures. This is especially true of the molecular arrangements in nervous tissue. Angell stated that in psychology, it might almost be said that functions produce the structures. For example, a specific structural content of a state of consciousness, like a sensation, is always determined by the demands on the organism by the environmental situation. This structural content is functionally determined and it will vary with each specific situation with which the organism has to cope. A sensation may be abstracted from the situation and classified as structuralists assert. But the actual sensory experience is not only capable of being viewed as an expression of functional activities, it cannot be correctly viewed nor accurately described in any other way. Therefore, Angell concluded, there is not a need in psychology for a metaphorical distinction between psychical structure and function but rather a further development of both branches of inquiry with a clear recognition of the real relation between the two.

Logic, ethics, and aesthetics. We have seen that Angell was not interested in completely separating psychology from philosophy as was Titchener. This attitude can be traced to Angell's formal education which included a great deal of work in philosophy. The reader will recall that Angell studied a wide range of philosophical thought as an undergraduate. As a graduate student in America, he was largely influenced by the philosophies of Dewey and James. At Halle, Angell studied with Erdmann who stressed the relation of logic to experimental psychology. Angell wrote both his masters thesis and doctoral dissertation on philosophical topics. It was important for Angell to establish psychology as a separate academic department, both for his own administrative ambitions and to obtain separate funds for his research and students. But he included philosophical considerations in all of his psychological work.

Angell made his clearest statement of the relation of philosophical to psychological problems in his 1903 article, "The Relations of Structural and Functional Psychology to Philosophy." In this article, Angell argued that a truly functional psychology cannot be separated from the philosophical disciplines of logic, ethics, aesthetics, metaphysics, and epistemology. Structural psychology, however, can be separated from these disciplines, but the result is an abstract model which only indicates the complexity of consciousness as viewed from the outside. Angell presented his ideas about the functional-philosophical relations in a

very clear dialectic, similar to that of Dewey in his Psychology.

Angell first discussed the relation of problems in logic to problems in psychology. He stated that logic and psychology obviously have their immediate point of contact in the cognitive processes. The psychological problem of cognition is assumed to be solved when an account has been given of the constituents of the knowledge-process and the modes in which these processes function. Angell wrote that structuralists consider the truth or falsehood of any cognitive process to be a secondary consequence, and, therefore, there is a practical boundary between psychology and logic. From the structural point of view, the goal of formal logic is to investigate the same cognitive process that psychology does, but now from the standpoint of its consistency, its production of valid conclusions, and its avoidance of fallacy.

Angell argued that if psychology could confine itself exclusively to structural problems, there would be no theoretical difficulty in distinguishing its field from that of logic. Conversely, so long as logic restricted itself to the problems of determining the conditions under which valid thought processes occur, "it need not traverse any territory preempted by structural psychology." But Angell maintained that any systematic development of a functional psychology must inevitably result in the creation of a logic. This is precisely what logic is, the functional, applied psychology

of reasoning.

Angell contrasted modern ideas of logic with older conceptions. He wrote that there is a tendency in modern logic to place the criteria of validity and truth within the limits of the purely practical. The older idea of truth as an absolute is chiefly the possession of the metaphysician and epistemologist. From the modern logician's point of view, truth or "consistency" is primarily resident in practice. The formulation that works in practice is the true and valid thing. Angell agreed with James (1898) that truth has to be verified in experience. For example, ulterior and supposedly absolute guarantees of truth have never been the basis of common sense when they do not conform to the facts of practice. Rather than attempting to prove the misconceptions of the "plain man," modern logicians often look to him as an arbiter in philosophic disputes.

Angell wrote that more is implied in his argument than the establishment of the practical as a mere category of the work-a-day world. The issue involved in the relation between logic and psychology concerns a larger dynamic conception of experience itself as a universe or system in which truth is ultimately synonymous with the effective. In this system, error is not only identifiable with partiality and incompleteness of individual acts but also with the failure of practice when considered in it entirety. This means that the truth as a criterion in the universe of experience is the successful adaptation of the organism to its environment.

This adaptation depends on cognitive processes. From this point of view constructive thought is practice in its most intelligently creative and formative stage. Modern logic and functional psychology are therefore in perfect agreement that the validity of the thought processes cannot be investigated or formulated apart from the actual facts of experience.

As proof of this close agreement, Angell stated that the accounts of reasoning contained in functional psychology textbooks are closely comparable to the accounts found in the corresponding chapters of books on logic. In books of both types, the mechanisms of inductive and deductive modes of thought are described, and the evolution of the judgment and the relation are set forth. It is only by virtue of the authors claiming a distinction between the psychology and logic of cognition that the reader even suspects that there is a radical difference. No effort to preserve the structuralist's distinction that psychology and logic treat a common subject matter from different points of view can be maintained by functionalists.

Angell wrote that the functional psychologist adopts the view that consciousness is not merely epiphenomenal, but is really an efficient agent in the furtherance of the life activities of the organism. We have seen that Angell assumed that there is a general relation represented in the cognitive processes through which the individual recognizes the beneficial from the harmful and thereby regulates its

conduct. Therefore, it is important that the results of these exercises are "true." Angell concluded that if psychology is permitted to discuss function at all, and this cannot be avoided without psychology being artificially truncated, then the truth or falsehood of logic must be relevant to psychological description. The logician's terms of truth and falsehood are simply impressive names for relatively complete (i.e., successful) and relatively incomplete (i.e., unsuccessful) operations of adaptation.

Angell maintained that since functional psychology and logic are concerned with the same issues, structural psychology may be considered an illogical system based on abstraction. "Modern" logic shows an increasing tendency to locate truth in practice and to make it primarily "immanent" rather than "transcendental." Thus, truth is something which belongs to the reflective "faculty," not as this appears when abstracted from practice and made purely theoretical by structuralists, but as it really is when viewed amid its normal surroundings. Truth is an integral part of the universe of practice. The functional psychologist tries to understand how truth and falsehood, consistency and inconsistency, practical success and practical failure are attained through the various modes of consciousness. This is true of any psychology which goes beyond mere description of the elements of the process. And, Angell concluded, we have seen the logical difficulty if not impossibility, of stopping short at this elemental description.

Angell wrote that the structuralist's statement that logic, ethics, aesthetics, and psychology treat identical subject matter from different points of view proved to be a useful hypothesis in the past. But on the basis of Angell's present arguments, this hypothesis is certainly not accurate. A complete psychology must ultimately lead to investigations which in the past were considered exclusive possessions of logic, ethics, and aesthetics. Angell expanded this point of view with a brief consideration of the relation of ethics and aesthetics to psychology.

Angell stated that precisely as in the case of logic, in ethical doctrine (the philosophical inquiry into the nature of right and wrong, the good and the bad) there is a large amount of material which is obviously psychological in nature. For example, the early chapters in almost all modern textbooks on ethics are dedicated to an investigation of impulse, desire, conscience, motive, ideal, etc. These are discussed from the standpoint of the actual psychological processes involved in aspects of the ethical life. Angell maintained that logically considered, this mode of attacking the problem immediately suggests the localization of the good somewhere in practice, and not in some remote ideal which can never be attained. Thus, modern writers in ethics have emphasized the essentially social nature of the good and the right. Ethical value has come to be considered not simply something at which practice ought to aim, but like logic, as resident in practice itself. This point of

view is characteristic of Spencer and other "evolutional ethical writers." And, of course, it is "peculiarly" identified with the functional psychologist's standpoint.

Angell argued that if consciousness is valuable to the organism it must be so in "volition." Consciousness is valuable because it is able to select the beneficial. Moral value gets expression in the practical values represented by the activities of the developing individual in the changing environment. Therefore, moral action becomes, like logical truth, the practically effective action as opposed to the partial and incomplete which accordingly represent badness and error. Angell concluded that the so-called ethical examination of the element of value in conduct (which is simply an examination of the conditions of greatest effectiveness in conduct) belongs in reality to the field of functional psychology.

Angell wrote that the case of aesthetics is more complicated than that of either ethics or logic because of the relatively unformulated condition of aesthetic doctrine. It seems to be a matter of individual caprice whether aesthetics is defined as a criticism of taste, an attempt to form cannons for the production of art, the philosophy of beauty, or an analysis of the psychology of aesthetic appreciation. But Angell argued that when used in connection with properly philosophical subjects, the most appropriate definition is that aesthetics is the scientific theory of "value in feeling." This correlates it immediately with

logic, which is devoted to the examination of value or validity in the knowledge process, and with ethics, which is concerned with value in conduct.

From his study of philosophy, Angell accepted Kant's view of the immediacy of value in aesthetic feeling. And, if feeling does have its essential value immediately in itself, it is clear that it can be understood only when it is given its "proper setting in the totality of conscious operations, i.e., when it has been analyzed by a psychology of function." As soon as someone inquires into the value of feeling and the criteria of such value, he is doing precisely what any functional psychologist must do. The function of feeling cannot be described in "organic life" without attempting to discover how it operates and why.

Angell concluded that logic, ethics, and aesthetics are simply systematic developments of problems primarily belonging to a functional psychology. Conversely, functional psychology must result in a logic, an ethics, and an aesthetics if it is not stopped short of its goal. The questions raised by these normative philosophical disciplines are in every instance of vital practical significance for the current understanding of ordinary psychic activities. No account of conscious function can disregard them without remaining obviously defective and incomplete.

Metaphysics and epistemology. In describing the relations of functional psychology to metaphysics and epistemology, Angell (1903) defined metaphysics as any inquiry

which undertakes to solve the problem of reality, to ascertain its nature and content. Epistemology is the problem of the nature and limits of knowledge in its most general and fundamental apsects. Angell pointed out that when metaphysics and epistemology are defined in this way, they are radically opposed to one another. For the metaphysician who postulates a given form of reality, knowledge is already accounted for inside his scheme. The epistemologist, on the other hand, has "tucked reality - along with unreality - into his little bundle of knowledge..." But Angell thought that this radical opposition disappears when metaphysics and epistemology are considered to be parts of a functional psychology.

Angell stated that is is fairly clear that epistemology represents an effort to carry out to the last possible point the program of logic in its most inclusive conception. The psychology of the cognitive processes may be even more closely conncected with epistemology than with logic. Angell wrote that functional psychology claims to investigate the knowledge process taken at its face value. This conscious process is directly related to the world outside of itself. Epistemology is an inquiry into the ulterior significance and warrant of this process, an examination really of the foundation on which rests the tacit assumption in the psychology of cognition. Angell was referring to the assumption that conscious processes have value in helping the organism to adapt to its environment. Angell pointed out that epistemological doctrine is not free from similar tacit

assumptions of the nature of the process it examines. A good example of this was provided by Titchener's discussion of sensationalism. Titchener's differentiation of his concept of sensationalism from that of the British associationists was based on the difference between the two theories in tacit epistemological assumptions. Both structuralists and associationists called themselves sensationalists, but they had quite different assumptions about the nature of knowledge.

Angell stated that much of the interest in modern logic is epistemological in character. Interest among logicians has shifted from a determination of the mere mechanical details of the cognitive processes to a study of the activities and goals of the whole cognitive function. Therefore, Angell concluded, if a functional psychology cannot be distinguished from logic, it is equally difficult to draw any sharp line of distinction between epistemology and either logic or psychology. In order to follow with sufficient persistence and thoroughness the question of the validity of thought processes and the mechanism by which these processes arrive at what we call truth, functional psychologists must solve the problem of the ultimate nature, warrant, and significance of knowledge.

Angell suggested that the basic assumptions of any system of psychology determine the methods, results, and interpretations of psychological inquiry. He stated that a common criticism of psychology is that it rests, like all other

would-be natural sciences, on a foundation of unexamined assumptions and presuppositions. It is the philosopher's task to analyze and criticize these assumptions. Angell conceded that psychology as actually carried on, certainly does make such assumptions and philosophers do examine them. However, functionalism, unlike structuralism, includes both psychological and philosophical investigation. Angell argued that if psychologists start with functional assumptions, they cannot stop short of logic, ethics, and aesthetics except by purely arbitrary limitation. Also, the same movement that carries the functionalist into logic inevitably draws him back into epistemology. Angell insisted that philosophical problems cannot be avoided simply by changing one's attitude toward a fixed material, the technique of structuralists. For the functionalist, the attitude remains the same throughout, the attitude of really understanding the structure and function of consciousness.

Angell stated that metaphysics is related to the logical and psychological problems of cognition in the same way as epistemology. Metaphysics represents the last step in the effort to completely rationalize thought and conduct. The metaphysical problem may fall within the problem of epistemology on the ground that reality is a category intrinsically subordinate to knowledge. Or it may include the epistemological problem on the ground that reality must transcend knowledge in the sense that reality must contain knowledge as one among other elements. Of course, both

problems may be regarded as unsolvable and essentially futile. But Angell argued that these alternatives do not effect the functionalist at all. Functional psychologists are merely concerned with the "psychological reality" of these problems and point out that we must inevitably encounter them in any system of functional psychology. In other words, the assumptions involved in systems of psychology inevitably result in philosophical problems which must be resolved. The practical test of psychological assumptions is the effective resolution of these problems.

Angell concluded that it is not possible to separate psychological from philosophical problems, or to regard the fundamental philosophical "sciences" as merely incidental to one another. These problems and disciplines are "irrepressible outgrowths" from a central and basic problem, which is the problem of the structure and function of consciousness. They are organic developments from a common root and represent stages of a single complex problem. Functional psychology may be considered a "center of gravity" for the detached portions of philosophy because it is explicitly devoted to the study of the individual, "from whom all philosophical problems emanate and to whom all solutions of them revert." When this psychological study is interpreted in a functional sense, the theoretical distinctions between psychology and philosophy cease to exist.

The difference in Titchener's and Angell's views about the relation of psychological to philosophical problems is

the result of their acceptance of opposing theoretical and methodological assumptions. What goals did the two psychologists have in mind when they made these assumptions? Clearly, the major goal of each man was to establish a psychological point of view that had some relevance to existing knowledge. For Titchener relevance was determined by the similarity of the methods, facts and laws of psychology to the methods, facts and laws of the physical sciences. This similarity depended on the reliability of the data of psychological experimentation and the validity of the method of systematic introspection. If structuralists could develop a system to classify reliable data obtained with valid methods (similar to the systems of the physical sciences) then psychology would be relevant to the universe of scientific knowledge. For Angell, however, relevance was determined by the usefulness of the results of psychological research in the solution of the problems of the individual, the source of all practical problems. Reliability and validity could be established through application of psychological data in the solution of such problems, with success or failure as criteria. If functionalists could develop a system to successfully solve both psychological and philosophical problems (i.e., problems of the individual in his adaptation to the environment) then psychology would be relevant to the whole range of human knowledge.

In the next chapter, I demonstrate that this search for relevance continues among modern psychologists. The reader

will see that some of the same philosophical arguments presented by Titchener and Angell are made by Murch and Gibson in defense of their psychological systems of perception. I demonstrate that the assumptions on which a psychological system is built determine the relevance of that system to human knowledge. If there are philosophical problems within a system that are not considered, this is a good indication that something is wrong with the starting point of that system, the theoretical and methodological assumptions. When there is something wrong with the system, it is quite difficult to explain that system's relevance to human knowledge. We have seen that Titchener spent his entire career trying to show the relevance of his system. It was a losing battle, and Titchener lost most of his support from other psychologists. For Angell, on the other hand, practical relevance was a criterion for proposing each of his assumptions, for establishing a valid starting point for psychology. Many of his assumptions were incorporated into other systems of psychology (e.g., behaviorism, gestalt psychology, learning theory, and, as we will see, ecological psychology).

CHAPTER 5

INFORMATION PROCESSING AND ECOLOGICAL SYSTEMS OF PERCEPTION

Modern psychologists do not attempt to develop systems to include the whole range of psychological problems as Titchener and Angell did when scientific psychology was just beginning. The scope of psychology has broadened so much since the turn of the century that the development of a general system would be a formidable task indeed. In fact, most psychologists today do not even attempt to systematize their specialty area. Not only is the quantity of research enormous, but few psychologists have thought very much about the theoretical and methodological assumptions that underly their work.

In spite of this, however, two modern psychologists have developed complete systems of perception. G. Murch (1973) proposed an information processing system and J. Gibson (1979) proposed an ecological system. My discussion of these is not as detailed as the discussion of Titchener's and Angell's systems. It was important to give a detailed account of the older systems because many psychologists are not familiar with them. Also, most historical accounts of these systems are inadequate, and none of them discuss all of the stated and implied assumptions I have identified. I give concise presentations of the two modern systems in

sufficient detail to do justice to the ideas of Murch and Gibson. In these presentations, I point out parallels between the old and contemporary systems. I compare the assumptions made by each writer using the eleven categories I developed for the assumptions of Titchener and Angell. In these eleven comparisons, I describe the similarities between the modern and historical assumptions. After demonstrating that Titchener and Murch based their systems on some of the same assumptions and that Angell and Gibson did likewise, I describe some of the modern philosophical arguments which have developed from these opposing groups of assumptions. I conclude that some of the assumptions lead to more philosophical problems than others. The relevance of systems of experimental psychology to human knowledge can be determined by a careful analysis of the underlying assumptions.

Murch's Information-Processing System

Murch (1973) defined the psychology of perception as the study of the way an observer relates to his environment. This relation involves gathering and interpreting environmental information by the observer. It is the result of a continuing process of learning, judging, interpreting, and reacting to the environment which begins at birth and continues throughout the lifetime of the individual.

Murch described five channels which convey information about the external environment to the individual. These are vision, audition, gustation, olfaction, and tactile-kinaes-

thesis. Murch pointed out that the most information can be obtained through the visual channel. He stated that the other senses often "modify their responses" in accordance with the visual input.

Murch discussed the concept of stimuli as sources of information available to sense channels. He described Helmholtz' (1866) notions of distal stimulus, the external object or event, and proximal stimulus, the sensory representation of the stimulus created by the nervous system. For example, in vision the distal stimulus is a pattern of ambient light reflected from objects in the environment, and the proximal stimulus is a pattern of neural responses within the visual system initiated by that ambient light. Murch wrote that this distinction, however, left an unsolved problem. For example, in the Müller-Lyer illusion, both the distal and proximal stimuli should indicate horizontal lines of equal length. But, of course, the resulting percept is one of unequal horizontal lines. Murch developed his perceptual model from assumptions related to this argument from illusion. He concluded that the distal stimulus gives rise to the proximal stimulus which in turn contributes to the building of a percept "representative" of the initial distal stimulus.

Murch stated that J.J. Gibson (1960,1967) offered a clearer distinction between distal and proximal stimuli by introducing the terms "potential stimulus" and "effective stimulus." Any object or event in the environment is a

potential stimulus. According to Gibson's definitions, when such a potential stimulus stands in constant relationship with a given response, it is an effective stimulus. Murch wrote that these definitions allow psychologists to describe the environment independently of the responses of an observer. Murch concluded that the environment contains a continuous flow of potential stimuli some of which are or will become effective stimuli and some which will not. For Murch, the determination of which objects or events will become effective stimuli and which will not is central to the understanding of the process of perception.

Murch (1973) used Gibson's conceptions of stimuli in a detailed description of an information processing system of perception. This system was derived from a model of memory developed by Shiffrin and Atkinson in 1969. Murch presented his ideas in the form of a flow chart of the processing pathways of perceptual information (see Figure 1). This is analogous to a flow chart of the operations of a computer.

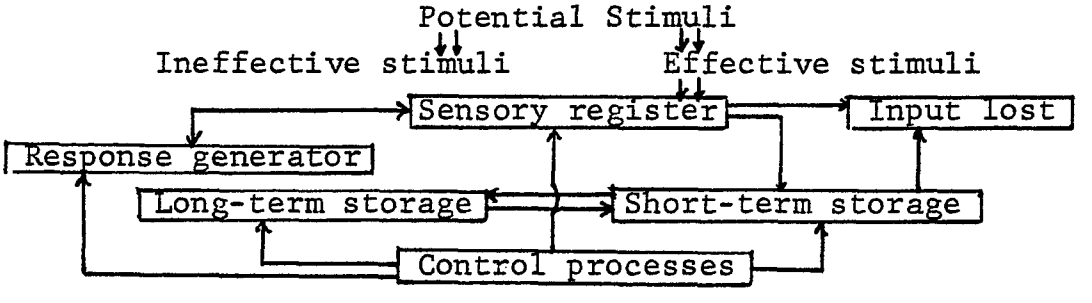

Figure 1. A model of the perceptual process (From Murch, 1973)

According to this model, a potential stimulus can follow three possible pathways. First, it can fail to enter the system and end up in the ineffectual stimuli category. Second, it can enter the sensory register but then flow to the input lost category. Third, it can enter the sensory register and pass on to short-term storage. Similar to Titchener's structural system, the passive nature of Murch's model is evident. The organism somehow gets in the way of these discrete stimuli causing a reaction in hypothetical mechanisms. Murch's model is simply a conceptualization of processes based on a computer metaphor.

Murch discussed each step or stage in his model of perception. In the sensory register, potential stimuli in the external environment which evoke a response are stored briefly in the form of "sensory representations." The nervous system encodes sensory input in the sensory register and these stored inputs are maintained as residual traces of the external stimuli. Murch pointed out that the sensory trace must be considered a representation and not a faithful reproduction of the external world. This is similar to Titchener's theory of mental elements abstracted from the environment. The nature of this representation is dictated by the manner in which the nervous system translates the sensation to a nervous impulse. This corresponds to Titchener's concept that the nervous system is like a "map" that describes how mental elements are combined.

In his description of short-term storage, Murch stated that the organism actively selects certain items for further processing from among the stimuli reaching the sensory register. This is accomplished by first retrieving memories from long-term storage that have physical features common to the input held in the sensory register. Then an interpretation of the input is made. Finally, the interpretation is "combined" with input located in short-term storage. During this interpretation and combination, the control processes also influence the selection of input by assigning incoming stimuli pertinence values. Murch wrote that the combination of input plus "information" from long-term storage "produces" the initial perception, i.e., the stimuli take on meaning. To this, additional information from long-term storage may be added modifying the percept. In short-term storage a heretofore meaningless configuration of sensory data becomes recognizable as an object existing in the environment. This description is quite similar to Titchener's theory that meaningless sensory elements are combined and interpreted with reference to "ideas" or memories in the form of "short-hand" codes of prior events.

Murch explained that in long-term storage, input is stored in the form of "processed percepts" (coded representations) of past experience. The strength of these memories depends on their pertinence values. Pertinence values correspond to Titchener's "ideas" which determine through association what aspects of the environment will be meaning-

fully combined. Some memories have low values, and it is more difficult to retrieve them from the memory "banks." Retrieval affects input in the short-term storage area through a comparison process.

The control processes are connected to all of the other mechanisms. Drive level, need state, and general body equilibrium are important factors influencing these control processes. Murch stated that much additional physiological information is needed about emotion and motivation before the influence of control processes can be assessed. Titchener implied a control process in his system. It was the active combiner of mental elements in consciousness. But he never directly discussed this controlling mechanism as did Murch.

Finally, there is the response generator. The afferent nerves bring sensory input into the information processors. The efferent nerves coming from the response generator produce the observer's motor responses. Many responses occur only after a clear percept has been developed. But some responses can be generated directly from the input in the sensory register that has not undergone cognitive processing. Both Titchener and Murch considered a reaction to be a discrete unit starting with environmental stimuli, continuing with combination and interpretation of sensations, and resulting in a motor response. For both psychologists, this unit could be studied in segments.

There are many parallels between Titchener's structural system of general psychology and Murch's system of perception. The major idea of both systems is that the organism passively receives environmental stimuli, and then actively combines and interprets sensory representations of these stimuli to produce meaningful information. An analysis of Murch's assumptions, both stated and implied, that I will present later in this chapter will indicate just how closely these two systems are related.

Gibson's Ecological Perceptual System

Gibson (1979) presented a theory of perception based on the concept of perceptual systems rather than senses. The major difference is that a system is active while a sense is passive. The perceptual systems include activities of looking, listening, touching, tasting, or sniffing. These systems are five modes of overt attention. They have overlapping functions and all are subordinate to a central orientating system. Angell, the reader will recall, described the functions of consciousness as modes of overt attention. A system has organs while a sense has receptors. People can orient, explore, investigate, adjust, optimize, and come to equilibrium, but a sense cannot. Activity and perception over time are the most important aspects of this theory as they were in Angell's functionalism.

Like Angell, Gibson spent a good deal of time criticizing what he considered to be opposing systems. Gibson compared his theory of a perceptual system with a sensory model

like that of Murch by pointing out five fundamental differences. First, in a sensory model, a bank of receptors is connected by nerves to a central information processor. Local stimuli at the receptor cause local firing in the processor. This concept leaves out the adjustment of the organ in which the receptors are incorporated. A perceptual system, on the other hand, is defined by an organ and its adjustments. The incoming and outgoing nerve fibers are considered together and are conceptualized as a continuous "loop." We have seen that Angell considered this process to be a continuous "circuit."

The perceptual system is hierarchical and can be analyzed at different levels of organ functioning. For example, the lens, pupil, chamber, and retina can be considered an organ. At this level, adjustments of accommodation, intensity modulation, and dark adaptation are made. At a higher level, the two eyes in a mobile head can be considered an organ for the pickup of information in what Gibson calls the "ambient optic array." At this level, adjustments of the eyes, head, and body are made. Adjustments of organs at these and other levels of analysis all serve to pick up environmental information. This idea corresponds to Angell's concept of the practical function of consciousness in directing the organism in its relations with the environment.

The second difference is that a special sense has receptors that can only receive stimuli passively. The activity is assumed to occur at the level of information

processing. In a perceptual system, the input-output loop is active at any level of analysis. Activity allows the system to obtain information. Of course, Angell stressed the active nature of consciousness in obtaining "true" information from the environment.

A third difference is that a special sense is limited to a set of innate sensations. No new sensations can be learned. The activity of a perceptual system allows for maturation and learning. The information that is picked up by this system becomes more subtle, elaborate, and precise with practice. Learning can continue throughout life. This is similar to Angell's idea that consciousness is the selective adaptation of the organism to novel situations in the environment.

A fourth difference is that the special sense has qualities of the receptors being stimulated. The achievements of the perceptual system, on the other hand, are specific to the qualities of things in the environment. If all we know is specific nerve energy, then we can never know the real world. This implies some sort of recognition process, and the argument is circular. For example, what recognizes this energy as part of the environment and how does it accomplish this recognition? But if the assumption is made that sensations triggered by light, sound, pressure, and chemicals are incidental, the perceptions of the qualities of the world can be considered as direct experience in relation to the needs of the observer. The organism sees the "affordances"

of things in the environment relative to its needs. This corresponds to Angell's theory that consciousness helps to adapt the environment to the needs of the organism through direct perception of the environment.

The final difference described by Gibson involves the concept of attention. For the special sense, attention occurs in the central nervous system. It is the mechanisms of consciousness that can be focused. To describe this attention, physiological metaphors are used such as, "filtering of nervous impulses." For the perceptual system, attention is involved in the whole input-output loop. Therefore, attention is a skill that can be educated. Metaphors such as resonating, extracting, and optimizing are more appropriate. In addition, acts such as orienting, exploring, and investigating can be described. This idea corresponds to Angell's emphasis on functions of consciousness rather than on abstract structures of the mind.

At first, Gibson's definition of visual perception appeared to be a new theory of input processing at a level more complex than that of traditional theories. Gibson denied this and stated that new assumptions about what is perceived are involved in his theory. These assumptions involve the pickup of two kinds of information that are always available to the organism. The first is information about the environment, and the second is information about the organism itself. Traditional perceptual theorists described information as being specific to the receptors of

the sense organs. Gibson pointed out that organisms can never really "know" their senses. The qualities of objects in the environment are specified by information. The qualities of the receptors and nerves are specified by sensations. Information about the world cuts across the qualities of sense.

This theory assumes that the information available to the visual system is much more complex than simply the wavelength and intensity of light. For Gibson, visual information is in the structure of ambient light. Ambient light is structured by the environment which is composed of places, surfaces, layouts, motions, events, animals, people, and artifacts. This information is always available, but it is only "picked up" by an organism living in the environment. In other words, the environment is defined or given meaning with reference to the organism.

After giving a detailed description of available environmental information, Gibson defined visual perception. First, it is an achievement of the individual, not an appearance in the theater of his mind. There is no homunculus in the head to see a retinal image. Perception is an active "keeping in touch" with the world. It is active in that the organism experiences things rather than passively having experiences. It is an awareness of something in the environment, in the observer, or both. There is no content of awareness that is independent of that which the organism is aware. There are no discrete sensations of light in awareness, but rather

there are the affordances of things in the environment. An affordance is an invariant combination of stimuli that has meaning for an organism. Awareness is a "psychosomatic" act, not of the mind or the body, but of a living organism. This position is similar to Angell's theory that the mind and body function together.

Second, the act of perception or the pickup of information from the environment is continuous. It takes place over time. The energy around organisms flows and changes without breaks. The energy that affects the receptors is a flux, not a sequence. Visual information picked up by the organism unfolds in time and is not passively received as separate "snapshots." This is similar to Angell's criticism of Titchener's system.

Finally, the continuous act of perceiving involves the co-perceiving of the self. A perceiver is aware of his experience in a persisting environment. He is also aware of his movements in the environment and the movement of objects in the environment. Gibson defined awareness as the direct pickup of information and did not mean to imply only consciousness. This corresponds to Angell's idea that consciousness is withdrawn from adaptations to the environment when those acts are no longer novel but have become habitual.

As was the case with Titchener's and Murch's systems, there are many parallels between the systems of Angell and Gibson. The major idea of both functional and ecological psychology is that the organism is active in seeking infor-

mation in the environment and uses consciousness for adapting novel situations in the environment to its needs. The presentation of Gibson's assumptions in the next section indicates the close similarity of the functional and ecological points of view.

THE ASSUMPTIONS OF MURCH AND GIBSON

It is apparent from the brief presentations of Murch's and Gibson's systems that many, though not all, of their assumptions fit into the opposing categories I developed for the assumptions in Titchener's and Angell's systems. In this section I present descriptions of Murch's and Gibson's assumptions in each category and point out the similarities and differences between the old and contemporary assumptions.

Assumptions Concerning The Nature Of Consciousness.

Parallelism versus interactionism. The relation of mind to body is not a major subject for discussion between Murch and Gibson. However, they each made statements which suggest points of view on this issue. Murch wrote that "...perception can be interpreted as the description of the relationship between some physical element of the environment and a subjective percept developed from the element." This statement suggests that there is a separation between the physical world and the mental world. Although there is no indication that this is an assumption of a psycho-physical parallelism, the statement is similar to dualistic statements made by Titchener on the mind-body problem.

Gibson (1979), the reader will recall, considered perception to be an accomplishment of the organism. Awareness is "a psychosomatic act, not of the mind or body, but of a living organism." This position is similar to that of Angell who thought that the interaction of mind and body was the best working hypothesis for psychologists. For Gibson, however, the mind-body distinction is inappropriate even as a working hypothesis. Gibson stated that to perceive the world is to co-perceive oneself. This is inconsistent with dualism in any form either mind-matter dualism or mind-body dualism. In Gibson's system the awareness of the world and of one's complementary relations to the world are not separable.

Passive versus active description. Both Murch and Gibson thought that mental processes are involved in the activity of organisms in the environment. As was the case with Titchener and Angell, however, Murch and Gibson made different assumptions about the nature of this involvement. Murch gave a passive description of the relation of mental phenomena to the environment. Using some of the same words as Titchener, Murch stated that "incoming stimuli" are processed by mental mechanisms into subjective information. These mechanisms are active in processing information but passive in relation to the environment. For example, the eye may be aimed at a tree like a camera. It does not actively "look" at the tree but rather passively receives stimuli which are then actively interpreted by mechanisms

in the brain.

Gibson gave an active description of the organism's relation to the environment. We have seen that Gibson considered the five perceptual systems to be five modes of overt attention. These modes have overlapping functions and are more or less subordinate to an overall orienting system. Using some of the same words as Angell, Gibson stated that a perceptual system can actively "investigate, adjust, optimize, resonate, extract, and come to equilibrium" in its relation to the environment. Gibson argued that an information processing system cannot perform these activities.

Representative versus direct realism. If the nature of the perceptual process is passive, as Titchener and Murch assumed, then perception of the environment is indirect. For Murch, information about the environment is obtained by comparing incoming stimuli with "coded representations" of the environment. This implies that there are some rules inside the head for the interpretation of meaningless environmental stimuli. Thus, the interpretation depends on the qualities of the receptors being stimulated. This means that sensations are constant. The organism interprets these sense data by developing a meaningful context inside its head.

If the nature of the perceptual process is active, as Angell and Gibson assumed, then perception of the environment is direct. For Gibson, perceptual information is in the structure of the environment. The organism "picks up"

this information directly, rather than forming mental representations of things in the environment. Gibson concluded that achievements of the perceptual systems are specific to the qualities of things in the world, especially their affordances. Sensations are only incidental to these achievements.

Stimulus-response arcs versus continuous circuits. Murch assumed that in perception, motor activity changes as a function of sensory input and sensory input varies as motor direction changes. Therefore, a feedback system tests and modifies its direction with respect to representations of the environment. Because Murch assumed that the perception of the environment is indirect, however, there seems to be a number of discrete acts or stimulus response arcs involved. Stimuli come in to the system, are combined and interpreted, and a response is initiated. The process is repeated from beginning to end as adjustments are made by the organism. This, of course, is quite similar to Titchener's notions that perceptions have a beginning, middle, and end and can be studied as discrete arcs.

Gibson assumed that a perceptual system is defined by an organ and its adjustments at a given level of functioning, subordinate or superordinate. With Gibson's and Angell's assumptions that the perception of the environment is direct, the adjustments of an organ can be considered as a continuous circuit. Gibson stated, "At any level, the incoming and outgoing nerve fibers are considered together

so as to make a continuous loop." Gibson pointed out that in a sensory system like that proposed by Murch, the adjustments of the organ in which receptors are incorporated are not included within the definition of a sense. Only sensations are processed, not movements of the entire organ. Therefore, a stimulus response arc must be completed before new adjustments can be made by the organ.

Methodological Assumptions.

Generalized mind versus individual differences. Murch wanted to develop a complete classification scheme for perceptual processes just as Titchener wanted to create a scheme for the mind. Both theorists assumed that adult human subjects should be studied with a cross-sectional experimental approach. Murch described two methods that are most commonly used by perceptual researchers. Murch called the first method a "functional" approach in which relationships between effective stimuli and overt observable responses are "mapped" using a large number of subjects. The second approach is to use a small number of highly trained observers who have practiced accurate reporting in unambiguous terms. This is similar to Titchener's systematic introspection. Subjects are trained to attend to "important" aspects of a stimulus and to communicate their perceptions. Murch described the goal of these approaches as the development of a general, exhaustive classification of perceptual information processes. Murch advocated the use of a much broader range of experimental designs than did Titchener who restricted his methods

only to introspection.

Gibson, on the other hand, attempted to develop a general classification scheme of the environment based on the functions of organisms. This was a significant improvement over Angell's functional system. The reader will recall that Angell stated that functions were difficult to classify and that researchers in each specialty area had to develop their own classification scheme. Gibson tried to discover what invariant information organisms pick up in their adaptation to the environment. Gibson was not interested in classifying generalized perceptual processes as was Murch. For Gibson, direct perception of the environment is given and therefore information for survival is in the environment, not inside the head of the organism. He assumed that there are individual differences in the ways organisms pick up this information, i.e., that there are successful and unsuccessful adaptations to the environment. Gibson assumed that a longitudinal approach is the best method for studying perception. He was interested in the ways organisms learn how to pick up new information throughout their lifetimes. Thus, it is not important for subjects to be highly trained or that experimenters conduct an exhaustive search for the limitations of the sense organs. Subjects should be free to use all of their perceptual systems in an experiment and to demonstrate their individual capacities for picking up information as it exists in their environments.

Molecular versus molar. Both Murch and Gibson discussed at length the kind of unit that perceptual psychologists should study. Murch argued that perception ought to be broken down into component parts, a molecular approach similar to Titchener's. Murch's assumption was that various stages of information processing can be distinguished in an experimental situation. The stages of long-term storage, sensory register, etc., can be isolated and timed and the limitations of these processes can be described and classified. This was an improvement over Titchener's theory which only implied certain processing mechanisms in the nervous system.

Gibson, however, argued that perception should be studied as a whole, a molar approach similar to Angell's. He assumed that the whole perceptual system should be studied as the organism functions normally in the environment. The psychologist cannot isolate hypothetical parts of the perceptual system for study without putting artificial limitations on psychological experimentation. This, of course, was Angell's conclusion in his 1907 article.

Science versus common sense. Murch assumed that a scientific approach to the study of perception was the best way to get molecular data about the generalized perceptual information processes. His book is filled with studies of subjects looking into tachistoscopes, strapped into adjustable chairs, and staring at projections on screens. The results of these studies are plotted on graphs and described

in terms of statistical significance. One of Murch's conclusions from this research is that subjects can be fooled by illusions and often do not perceive all of the stimuli presented to them. Therefore, Murch argued that perception is "subjective" and the common sense notion that organisms perceive the environment directly is not valid. As we have seen, Titchener reached the same conclusion with more detailed arguments.

Gibson assumed that common sense must be a practical guideline to scientific perceptual research. Common sense indicates that if the subject is forced to look into a tachistoscope, or allows himself to be strapped into a chair, or agrees to stare at a screen, he will not be able to use his perceptual systems to pick up all of the information from the environment that he normally does. Some of Gibson's experiments involve subjects walking around in fields observing the environment. When subjects are free to move and explore apparatus, they are not fooled by illusions and they usually pick up the most important "invariant" information from the environment. Perception is not a subjective interpretation of the world that can be scientifically classified. Common sense indicates that we walk around a tree, not a processed representation of that tree. Like Angell, Gibson thought that the validity of scientific research is determined in the universe of practice, the world of common sense.

Determinism versus teleology. Murch's information processing system is based on the assumption that mental representation of the environment at any moment is the result of events that happened earlier in the history of the organism. Stimuli change in character from potential to effective when they enter the information processing system. The effective stimuli determine the actions of mechanisms within the system. Any perceptual event is determined further by the nature of the hypothetical information processors. The rules or program inside the head determine how information stored in memory will be compared with incoming sensations to construct a meaningful perception of things in the environment. This corresponds to Titchener's theory that the nervous system is like a "map" for the combination of mental processes.

Gibson's ecological system is based on the teleological assumption that perception of the environment depends on the needs or purposes of the organism. Perception is an active search rather than a passive reaction. The organism picks up certain invariant information from the environment in order to reach some goal. Organisms do not live on the "razor's edge" of the present with the past stored in memories. Gibson assumed that past, present, and future are simply words for an unfolding history of the organism. The organism's perception of the environment depends on its past, its present needs, and its future goals. This unfolding purposeful history of the organism cannot be dichotomized

with a deterministic approach because the past, present, and future are simply separate words for the temporal aspect of perception. Angell also thought that the functioning of the organism over time could best be studied with a teleological approach.

Facts versus relations. Based on his molecular assumptions, Murch described the facts of perception as the relationships between "subjective percepts" and "external stimuli." For example, points of light can be varied along any one of a number of dimensions (e.g., size, brightness, etc.) and subjects can be asked to report when the lights are different or the same. The results of this research provide interesting information about the way the eye works when subjects stare at lights on a screen. Specific limits of the human eye for perceiving changes in light can be measured with scales developed by physicists. Murch assumed that the relationship between subjective percepts and these physical measurements are indisputable facts of science. This assumption is similar to Titchener's assumption that elements of consciousness can be measured and classified.

Based on his molar assumption, Gibson described perception as the pickup of information from the environment in the form of "invariants" and "affordances." Organisms do not use the measurements and laws of physics in understanding the environment. They perceive relations or meaningful parts of the environment, not facts based on just noticeable differences. For Gibson a relation (or invariant) is

itself a fact. For example, when subjects are asked to estimate distance in an open field, they use certain environmental invariants (e.g., the horizon, the texture of the ground, etc.) to make their decisions. Once again, Gibson concluded that meaning for the organism is in the environment, and it is not built up inside the head. Angell also assumed that meaning is the relation of the organism to the environment. But he was not as clear on this point as was Gibson.

Subjective versus objective scientific methods. Both Murch and Gibson suggested and developed objective methods for psychological research in their systems. There is no large contrast in this category of assumptions as there is for Titchener and Angell. Subjects may be asked to introspect in some of Murch's and Gibson's experiments. But these reports are useful for the development of new hypotheses, not as data.

System versus eclecticism. Murch wrote a very careful and self-contained description of the psychology of perception in his book. He created a system in order to tie all of the assumptions, experimental procedures, and research data together. Murch's goal for describing perceptual psychology was much like that of Titchener in describing all of experimental psychology. Both men proposed systems that established boundaries within which psychologists could work. All of the facts and laws within these boundaries should be established and classified so that psychology can be con-

sidered a discipline similar to the physical sciences.

Gibson, on the other hand, wrote a wide-ranging description of the environment in the development of his theory of perception. He assumed that the environment is structured in a meaningful way. Given this assumption, there is no need to establish facts based on laws of physics to explain what the organism perceives in the environment. An approach to psychology can be taken using ecology as a frame of reference. Gibson's theory of visual perception has implications for all of psychology. If his assumptions are accepted, alternative points of view from the traditional can be established in the study of memory, learning, and other specialty areas of psychology. Gibson's theory is broad in scope like that of Angell, but it is better organized than Angell's eclectic, functional theory. Ecological theory provides a framework for functional assumptions.

CONTEMPORARY ARGUMENTS ABOUT THE RELATION OF PSYCHOLOGICAL TO PHILOSOPHICAL PROBLEMS

The comparison of major assumptions of the information processing and ecological systems of perception indicates that Murch was not as concerned with philosophical problems as was Gibson. Like Titchener, Murch discussed at length the reliability and validity of experimental methods and of the classification scheme for perceptual data. He did not discuss the fact that his stated and tacit assumptions created philosophical problems within his information processing

system. Gibson, however, discussed the philosophical implications of both his own assumptions and those of traditional systems of perception. Like Angell, Gibson thought that psychological assumptions create philosophical problems that have to be solved before researchers can gain a valid understanding of perception.

The positions of Murch and Gibson on the relation of psychological to philosophical problems led to arguments about the validity of information processing and ecological perception as whole systems. Murch did not argue much about this relation, but simply stated the way he thought organisms perceive things in the environment. He assumed that when more is learned about the physiology of the brain, the persistent problems in understanding perception will be solved. Other theorists have argued for Murch's position, however, and I present some of the major ideas in this section. Gibson, on the other hand, argued against a variety of traditional and modern theories of perception. He pointed out that certain traditional assumptions lead to specific philosophical problems. Thus, the metaphors used by perceptual theorists like Murch have no "ecological validity." These metaphors are not helpful in understanding what it is that organisms perceive in the environment in their continuing struggle for survival.

Murch's Arguments

Metaphors. Murch developed his point of view about perception with the use of a computer metaphor. It is a

theory which describes hypothetical "hardware" in the nervous system that processes perceptual information. He stated that this model of perception is "purely theoretical," but it does attempt to "tie together" the varied observations on perception presented in his book. The reader will recall the various stages of Murch's computer analogy of information processing which supposedly occur in the head of the perceiver. As an abstract theory, this is an interesting metaphor that may have some heuristic value. But, like Titchener, Murch gave ontological status to the "purely theoretical" model. He assumed that these mechanisms not only explain perception but actually exist.

Philosophical problems. Rorty (1977) discussed three potential philosophical problems involved in an information processing system of perception like that of Murch. First, there is the "no private language" problem. Traditionally, perceptual psychologists have assumed that we can identify mental entities apart from the behavior and circumstances attendant on them. It was as if we could simply introspect and christen the occupants of the mental arena. This was Titchener's approach to the analysis of consciousness. But once we realize that such christening is impossible and it is not introspectable qualia which make something count as a thought or a belief or a recognition, we see that there is nothing inner to investigate.

Murch (1973) did not think this problem was serious, because he maintained that his model was purely theoretical.

He considered the model to be a good working hypothesis for perception which could lead to new research programs. The implication in Murch's writing is that it is the task of the psychophysiologist to explain the neurophysiological aspects of perception. Murch's model was designed to predict perceptual behavior. The information processing model of perception contains conceptions of "hardware" that are only placeholders for the results of future neurophysiological research. Therefore, private language is not a problem as long as it is useful in developing a model which accurately predicts behavior.

Second, there is the problem of "infinite regress." Rorty stated that any postulated mental entity will stand to some "inner self" as something in the physical world stands to a person. For example, if we say that the way in which a person knows that something in front of him is a teacup is by seeing that the object "fits" his idea of a teacup, then we need to ask, "How does he know that this is an example of fitting?" What guides his judgment? Does he not need a second-order Idea which shows him what it is like for something to fit an idea? An infinite regress has been generated and nothing has been explained.

Murch did not discuss this problem in his system, but according to Rorty, there is a solution. Suppose a model like that of Murch is considered to be a series of subroutines of a master program. Rorty argued that any perceptual model building must grant that nature has wired in some unacquired

abilities to perform higher-order mental operations. At least some of those "little men" performing subroutines in various brain centers will have been there since birth. The subroutines are neither introspectible nor physiologically decipherable. But whether or not hardware-correlates for these subroutines are ever discovered, the experimental success in prediction and control of behavior of such subroutines would be more than enough to show the reality of the objects of psychological inquiry. Rorty concluded that the infinite regress argument has little power. It is only a reaction against the notion that psychology can succeed in solving problems which philosophers have posed. The infinite regress argument demonstrates that psychologists cannot solve philosophical problems. But it cannot show that psychologists like Murch may not do a great many other things, and it cannot show that cognitive process and structures are mythical.

Third, there is the "no foundations" argument. This states that the notion of "immediately known particulars" (e.g., sense, data, clear and distinct ideas) is inherently confused. For nothing can be known except a fact, and to speak of knowing a particular is to speak obliquely of knowing some fact about a particular. This means that one will not be able to know anything without the mediation of a lot of other knowledge. The notion of "elementary data of consciouness" is based on a confusion between a particular (the physical stimulus, or some physiological state

produced by that stimulus) and some fact about a particular. Thus, there can be no such activity as the mind's application of rules to non-propositional data in order for the mind to become aware of a proposition for the first time. And without this idea of "immediate data of consciousness" there will be nothing for psychological "processes" to process, and no content to fill psychological "structures." The notion of such processes and structures, posed by Murch and Titchener, must be rejected for the same reason that we reject the notion of "a foundation of knowledge."

Once again, Murch did not address this problem directly, but Rorty did propose a solution. Rorty stated that nothing in research programs based on information processing models depends on whether the "data" are "truly datal" or not. Nothing depends on whether or not empirical knowledge has "foundations." In fact, no research program could tell us what such foundations might be. The notion of a datum that is processed according to some "sub-routine" is just a "harmless and handy" metaphor. Rorty concluded that this idea should not have to help us to understand the "nature of the relation between mind and body," the "mystery of consciousness," the "nature of knowledge," or anything else that "smacks of philosophy." As Murch concluded, his model is useful in describing and predicting behavior, not solving philosophical puzzles.

These three arguments against a relationship between psychological and philosophical problems stated and implied

in Murch's information processing system, are quite similar to those of Titchener. The arguments are based on the idea that mental contents and processes can be described and classified in abstract or metaphorical terms. Experimental data can be predicted on the basis of these abstractions. Therefore, are these abstractions not "existential" as Titchener argued and "hardware" as Murch claimed? If Titchener's "laws" of elemental processes and Murch's "programs" of information processing reliably predict psychological data, then there is reason for concluding that rules ("little men" as Rorty wrote) exist inside the head, and that these rules are "mapped" into the nervous system. Therefore, psychologists can continue research programs using "models" as placeholders for physiological processes. It is up to philosophers to solve the philosophical problems of perception. Psychologists can effectively avoid such problems by staying within the limits of their metaphors or psychological points of view.

Gibson's Arguments.

Metaphors. Gibson developed his point of view about perception with a general ecological metaphor. He chose to treat perception as a biologically adaptive activity first, and as a study of "interesting phenomena" later, if at all (Mace, 1977). Theories of perception should do justice to the everyday perceptual accomplishments that contribute to the survival of the species. If we take the theory of evolution seriously, then there must be a way for organisms

to achieve "veridical perception." This perception is a "keeping in touch" with the world. It involves "awareness of" instead of just awareness. And this awareness of or knowledge of the world is gained by looking, along with listening, feeling, smelling, and tasting. It is fallacious to assume that "inputs" that convey no knowledge can be made to yield knowledge by "processing" them. Gibson concluded that knowledge of the environment "develops as perception develops, extends as the observers travel, gets finer as they learn to scrutinize, gets longer as they apprehend more events, gets fuller as they see more objects, and gets richer as they notice more affordances."

Philosophical problems. The philosophical point of view most closely related to Gibson's view of perception has been called "naive" or "direct realism." This is the alleged creed of the plain man, or the common sense point of view. Hirst (1959) pointed out three assumptions involved with common sense notions which lead to philosophical problems. First, it is believed that we live in a world of persons, animals, plants, and material things, and that perceiving is the way we find out about this world and its contents. Second, perceiving seems to be straightforward confrontation or direct awareness, a simple looking or hearing and so on. Third, it is held that by perception we can ascertain the real nature and characteristics of entities in the world.

Hirst pointed out philosophical problems that develop from these assumptions. First, there is a problem of the

trustworthiness of the senses as a source of objective knowledge. A study of the errors and relativity of perception has convinced philosophers of the unreliability of perception. Second, illusions and hallucinations are a problem for common sense. The ordinary notion of perception cannot account for what is seen or heard or felt by people who experience these phenomena. Third, there is a problem of the relativity of perception, the fact that the qualities of objects perceived vary with the position and subjective state (mental or physical) of the perceiver. For example, the same water will feel warm if you are cold or cold if you are warm. Also a drug like mescaline will make you see brilliant colors that other people cannot see. These philosophical problems are inherent in the common sense notion of perception.

Hirst (1965) pointed out that the great majority of philosophical (and scientific) writing on perception has sought to show or has assumed the falsity of Naive Realism. The facts of illusion, hallucination, and perceptual relativity force philosophers and psychologists alike to conclude that in perception we are never directly or immediately aware of external physical objects. Hirst stated that strictly speaking our immediate awareness is limited to what he calls "sense-data" (e.g., sounds, tastes, smells, feelings of pressure or warmth and, above all, the colored expanses of varying shapes and depths which make up the field of vision). Though we attribute these to external objects, they are strictly private and subjective data.

If they are the sum total of our immediate knowledge, no public external world is directly observed, and naive or direct realism is based on faulty assumptions. Titchener gave the same arguments using some of the same words in the early 1900s.

Gibson stated that the solution to the philosophical problems involved in a perceptual system based on direct realism is to redefine the environment. He wrote that the world of physical reality does not consist of meaningful things. The world of ecological reality does. He argued that if what we perceived were the entities of physics and mathematics, meanings would have to be imposed on them. But, if we perceive the entities of "environmental science," their meanings can be "discovered."

Gibson's solution to the philosophical problem of untrustworthiness of the senses was to point out that sensations triggered by light, sound, pressure, and chemicals are merely incidental to perception. It is environmental information that is available to a perceptual system. The qualities of the world in relation to the needs of the organism are experienced directly. When psychologists present isolated physical stimuli, such as points of light, to a subject, they restrict the available environmental information to the point where the subject's perception is "untrustworthy." In many traditional experiments, psychologists fixed the eye and exposed the retina to brief stimuli. Gibson argued that the data these experimenters obtained were the peculiar result of

trying to make the eye work as if it were a camera at the end of a nerve cable. The visual system continues to operate at this photographic level, but the constraints imposed on it are so severe that very little information can be picked up. The artificially produced "glimpse" is an abnormal kind of vision, not the simplest kind on which normal vision is based.

Gibson's solution to the philosophical problems of illusions and hallucinations was to describe these experiences as examples of abnormal perception. Illusions are not explained by the concept of "misinformation," but rather by the fact that the organism has failed to pick up all of the available information from "the inexhaustible reservoir that lies open to further scrutiny." Hallucinations can be explained as imaginary perceptions which are separate from real perceptions. Traditional perceptual theorists claim that perception and imagery cannot be separated because "tests for reality" are intellectual. They assume that a percept cannot validate itself. Gibson suggested that there are perfectly reliable and automatic tests for reality involved in the working of a perceptual system. For example, an object can be scrutinized, but an hallucination cannot, except perhaps in an imaginary investigation. If more information can be obtained from an object (i.e., more can be seen through a process of investigation) then it is a "real" object. Imaginary objects cannot pass this test.

Gibson's answer to the philosophical problem of the relativity of perception was to state that the affordances of objects in the environment are invariant combinations of variables. It is easier to perceive such an invariant unit than it is to perceive each of the variables separately. It is never necessary to distinguish all of the features of an object and in fact it would be impossible to do so. Perception is economical. Gibson concluded that "the features of a thing are noticed which distinguish it from other things that it is not." It is not the relative features of an object that are important but rather the affordances of it, the invariant combination of variables.

These three arguments for a relationship between psychological and philosophical problems are similar to those of Angell. The arguments are based on the idea that the function of perception is to adapt the environment to the needs of the organism. In order for the organism to be successful in the universe of practice, it must be able to obtain correct information directly from the environment. The organism actively explores the environment for this information. It does not rely on intellectual tests of reality but rather actively seeks verification of its perception of things. Abstract information processing models offer little help in studying this active perception. The valid study of perception can only come from redefining the environment in terms of the needs of organisms. As

Mace (1977) suggested, "Ask not what's inside your head, but what your head's inside of."

CONCLUSION

Both Titchener and Murch proposed systems of psychology which included models of mental processing. For Titchener, consciousness was a structure of elemental processes, including sensations, ideas, and affections. He thought that this structure could be dissected, that the elements could be reliably classified, and that laws could be formulated to describe how these elements are "built-up" into complex mental functions. For Murch, perception was the result of a series of information processing stages. He thought that these stages could be described in terms of hypothetical mental mechanisms. Programs could be written to predict reliably how these mechanisms operate.

I have demonstrated that these two structural theories were based on some of the same psychological assumptions about the nature of experience and about methods of experimentation. These assumptions created certain philosophical problems in each system of psychology. Titchener and Murch argued that as long as psychologists stayed within the boundaries set by their abstract models, their systems of psychology were scientific, and the philosophical problems inherent in other systems were avoided. Both psychologists, however, gave ontological status to their abstractions when they tried to

explain how mental processes work. By giving such explanations, Titchener and Murch included the very philosophical problems within their systems that they were trying to avoid. They were not satisfied with merely classifying abstractions, but tried to describe the abstractions as the "stuff" of experience.

Both Angell and Gibson proposed systems of psychology which included general biological metaphors emphasizing the relation of the organism to the environment. For Angell, consciousness was like an organ which functions in many ways to help the organism satisfy its needs. This hypothetical organ cannot be dissected, but can only be studied by observing its many complete adaptive functions. For Gibson, perception was the purposeful pickup of information from the environment which depends on the needs of the organism. He developed an ecological model to describe "what" the organism perceives in the environment rather than a mental model of "how" the organism perceives. For both Angell and Gibson, the question "how" an organism experiences the world was inappropriate. The organism is simply directly aware of things and events in the environment. Awareness is the relation of the organism to the environment.

As with Titchener and Murch, I have demonstrated that the functional models of Angell and Gibson are based on some of the same psychological assumptions. These assumptions create certain philosophical problems in each system of psychology. Angell and Gibson were aware of these problems

and attempted to solve them. They did not think that a valid system of psychology could be developed by setting artificial structural boundaries. This is too limiting to psychological research. Even with such boundaries, psychologists inevitably make conclusions about what mental mechanisms exist in the brain. For Angell and Gibson, the relation between problems in psychology and philosophy is a dynamic conception of experience itself as a universe or system in which adaptation to the environment is synonymous with the effective. In such a system, error is identified with the partiality and incompleteness of individual acts and with the failure of practice when considered in its entirety. Therefore, in order to establish a valid system of psychology, both psychological and philosophical problems must be solved.

In this dissertation, I have described and analyzed four systems of psychology, but only two points of view about the nature of experience. The four theorists developed their systems with different terminology, metaphors, experimental methods, and research goals. They also described their systems at different times in the history of experimental psychology. Therefore, it is remarkable that only two points of view about experience are represented in the four systems.

The similarity of points of view between diverse systems indicates the importance of epistemological and metaphysical assumptions underlying those systems. Often, revolutionary theories of psychology which generate a great volume of research can be shown to rest on philosophical assumptions

that were proposed and debated generations ago. Psychologists have simply developed new metaphors for understanding old research problems. This is not to say that new metaphors do not help to increase our knowledge in psychology. Murch's information processing perceptual metaphor provides for a much broader range of experiments than Titchener's mental structure metaphor. And Gibson's ecological metaphor provides new experimental scope to Angell's mental function metaphor. One of the general goals of experimental psychology is to develop increasingly powerful metaphors for describing the ways organisms interact with the physical and social environments. We understand the world with theories, and experiments are pointers to theory.

There must be a method for judging whether our pointers, our experimental results, are trivial or important. We cannot evaluate our systems of psychology by looking only at the quantity of experiments that they generate. If the system, or metaphor, has little power, it can offer only a small amount of new understanding of the organism's interaction with its environment. If this new understanding is incorrect, our pointers are indeed trivial.

A method for assessing the validity of systems of experimental psychology is to examine the underlying epistemological and metaphysical assumptions, the points of view about the nature of experience included in those systems. This is not an easy task since many theorists do not present their assumptions clearly and in detail. But I demonstrated in

this paper that both the stated and implied assumptions can be found in any system. These assumptions can be compared and evaluated with reference to the philosophical problems they generate. I have used this method in my dissertation.

My evaluation of the structural and functional points of view about the nature of experience can now be completed. The structural view includes unsolvable philosophical problems. This indicates that systems of psychology developed from the structural assumptions described in this paper have little environmental or ecological validity. Structural systems may have some predictive validity, but this does not mean that they provide a correct understanding of the organisms interaction with the environment. Since the structural point of view is at least partly incorrect, the experiments generated by structural models are indeed trivial. They do not point to theories which can help us to understand ourselves and the world.

The functional view, however, contains no unsolvable philosophical problems. This indicates that systems of psychology developed from the functional assumptions described in this paper have construct validity. Functionalists carefully examine their assumptions to discover what philosophical problems are created by those assumptions. As a result, functional systems contain no philosophical inconsistencies. Since the functional view is correct in this regard, the experiments generated by functional models are not trivial.

They point to theories which can help us to understand ourselves and our relation to the world.

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