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A HISTORY OF BEHAVIORAL TECHNOLOGY PRIOR TO 1938

DISSERTATION

Presented in Partial Fulfillment of the Requirements
for the Degree Doctor of Philosophy in the
Graduate School of The Ohio State University

By

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* * * * *

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INTRODUCTION

Behavioral techniques as a pedagogical approach, especially in the late sixties and early seventies, represented technical intervention in the classroom. To argue that techniques have always been a part of teaching is to miss the point. Programmed learning, teaching machines, contracts for grades, behavioral modifications, behavioral objectives, and later, accountability, and competency based education, are not innocuous techniques which may be used as part of a teaching process. These techniques, when employed, must alter the curriculum, and the style of the teacher must conform to them. When these techniques are employed systematically and seriously, they alone must define the relationship between student and the teacher.

This is not to say that many teachers and students avoid technical intervention in their classrooms. That students and teachers can and do avoid this intervention, however, does not negate it.
The practical application of behavioral techniques originated at the Metropolitan State Hospital in Waltham, Massachusetts, under a grant from the Office of Naval Research. This is a hospital for the mentally ill. The experimental work was done by Skinner and Lindsley. The purpose of the studies was to determine the applicability of operant conditioning techniques in the experimental analysis of psychotic patients. Small numbers of subjects were chosen; and in this study, and the ones following it, behavior modifiers brought about changes in specific target behavior.¹

In the early sixties at Anna State Hospital in Illinois, Allyon and Azrin introduced the technique which was used to modify the target behaviors in large groups of mental patients. This technique is called the token economy, and it has found widespread application in hospitals, prisons, and schools. The technology for dealing with large groups of people now began to develop.²

As in other areas, behavioral techniques did not enter the schools full-blown. The early modifiers started on the


²Ibid., p. 33.
rejects of the system. These included the brain damaged, the retarded, and the trouble-makers. The target behaviors the modifiers chose to work on were disruptive behaviors that upset classroom routine such as out-of-seat behavior, making noise, arguing, talking back to the teacher, fighting, and disturbing others. As elsewhere, when behavior modifiers demonstrated their ability to effect changes in the rejects, they were able to move into regular classrooms and beyond them into entire school systems.\(^3\)

It must be noted that at every stage of the development of these techniques, it is the expert who is called upon for a solution to the problem. Because of his mind set, the expert can formulate questions in only one way, namely what is the most efficient solution to the problem presented. In the case of the behavioral technologist, that which is most essentially human, the mental processes, must be discarded.

It was not long, however, before teachers were asked to assume the role of the expert. They were taught the basic rules by the experts, which have now become so familiar to most teachers and students in Education. Teachers were to ignore disruptive behavior, and reinforce the student when

\(^3\)Ibid., p. 89.
he acted properly. Another principle was to make reward contingent upon proper behavior. This principle has a corrolary, the Premack Principle. It states that behavior normally occurring at a low rate may be increased in frequency when followed by activities which are enjoyable to the child. Other principles such as gathering baseline data, designing effective units in terms of behavioral concepts, and specialized forms of evaluation were learned by the teachers. The thrust of all this was clear. The teacher was to internalize these principles, and himself become an expert.

The issues that are raised, when one considers the development of behavioral techniques, are issues of control and adaption. That is, given certain disruptive elements in a specific environment, how can one most efficiently adapt those elements to that environment, and what controls are necessary to achieve this adaption. The issue of control was the one raised most often in the late sixties and early seventies, and the attack usually ended in the annunciation of some vague conspiracy. In a certain sense, these critics were right. The issue is political, and in terms of the

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4Ibid., p. 90.
history of American thought, behavioral technology represents a conservative trend. By disregarding all mental activity, and ignoring history, this technology can only be conservative. Evidence of recent court decisions further supports this claim.\(^5\) In this sense the critics were right. In terms of a conspiracy they missed the mark. There was no conspiracy among behavioral technologists. There was no need for one. What was really happening, was that in a time of crisis and polarization, technical solutions were being offered to facilitate the adaption of dissident elements of society. Propoganda techniques, police techniques, military techniques, educational techniques, etc., all reflected the need for adaptation. But the fact that technical solutions, which represent a conservative trend in the history of American thought, were being advocated, did not mean there was a conspiracy. In a technological society such as ours, where practically everyone is convinced of the superiority and necessity of technology, there is no need to conspire on its behalf. Technology is endemic to our society.

\(^5\)Ibid., In several instances in recent years, various courts have ruled against the use of behavioral techniques on constitutional grounds. See pp. 42-45, and pp. 54-55, for example.
Another problem that arose when critics emphasized the issue of control was the ahistorical nature of the criticism. B. F. Skinner was often the person who received the criticism, and since he started publishing in 1938, behavioral psychology and the behavioral technology which evolved from it seemed to be recent developments. This is really not the case. There is a long history of the development of behavioral psychology, and the purpose of this dissertation is to trace that history, and by tracing it, to arrive at some deeper understanding of it. This method of investigation is called the sociology of knowledge, and it deals with mindsets or ideologies. Mannheim and C. W. Mills are useful in explaining this method of investigation. Mannheim has at least two conceptions of an ideology. The first he calls the particular conception of an ideology. This is used to denote the ideas and representations of an opponent when they are regarded as more or less conscious disguises of the real nature of a situation, the true recognition of which would not be in accord with this opponent's interests. It is not this notion of an ideology that I will be concerned with here.

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This notion leads quite easily to a conspiratorial explanation of events, and as stated earlier, this would miss the mark. Contrasted with this particular conception of ideology. Here he refers to the ideology of an age or of a concrete historico-social group. In this total conception an opponent's total world-view is called into question. Not only the content, but also the form and even the conceptual framework of an opponent must be questioned. While the particular conception operates primarily with a psychology of interests, the total conception uses a more formal functional analysis, without any reference to motivations, confining itself to an objective description of the structural differences in minds operating in different social settings.\footnote{Ibid., pp. 55-59.}

C. W. Mills explains further:

Many thinkers who have addressed themselves to the problem hold that the sociology of knowledge has no relevance for epistemology; that sociological investigation of inquiries have no consequences for forms of truth and validity. . . . It is true that from knowledge of the 'social position' of a thinker one cannot deduce that his statements are true or false. . . . But the matter is more complicated; the consequences are less direct.

. . . Criteria, or observational and verificatory models are not transcendental. They are not drawn
theoretically pure from a Greek heaven although 'choice' and usage of one set of them may be so justified. Nor are they part of an a priori, or innate equipment of 'the mind' conceived to be intrinsically logical.

On the contrary: the historical diversity of such models supports Dewey's view that they are generated by and are drawn from inquiries proceeding in given times and societies.

Those who contend that sociological investigations of thinking have no consequences for the truth or validity of that thinking misunderstand the source and character of the criteria upon which truth and validity are at any time dependent. They also overlook the fact that these criteria themselves are the selective acceptances and rejections of one or another of them by various elites are open to cultural influence and sociological investigation. .. This view is underpinned by a blurred theory of knowledge and mind that prohibits analysis at which extra-logical factors may enter and be relevant to the truthfulness of results.8

What I will attempt to show is that behavioral technology is one manifestation of an ideology or mind-set that is endemic to our society and age, the technological mind-set or ideology. This mind-set evolves from the verificatory model of physiology, and when the evolution begins in the United States, the historical conditions in which it develops play a crucial part. Behavioral techniques are really a theory of learning, and it is my contention that it is exactly these

extra-logical factors which give one a deeper understanding of this theory.

In the first chapter of this work, I have presented in a general way, those ideas or intellectual developments which have at some time contributed to the development of a behavioral technology. In the second chapter, I have focused in on one aspect of the first chapter, the development of the physical sciences, in particular, the discovery of the anatomical components of the reflex action. In the third chapter, I have tried to show how once the anatomical components of reflex action are known, new questions are raised, and these new questions lead investigators to consider the possibility of investigating psychic phenomena by using the physiological model. Much of the material in the second and third chapters was gathered by G. S. Hall, and this is important. German physiological psychology, or structural psychology is being transplanted in America. In the fourth chapter, I have presented a brief historical sketch of the transformation American society undergoes following the Civil War. It is immediately following this transformation that the first big push for efficiency in the schools occurs. Since efficiency as the prime directive is a characteristic of technique, the technique is really a mind-set, I have
identified this mind-set using the notions of Ellul. One social manifestation of technique is the formation of a bureaucracy, and the schools at this time were being reorganized along bureaucratic lines. I have used the notions of Weber, in this chapter, to identify the characteristics of a bureaucracy. In the fifth chapter I have tried to answer the following questions. How early can the signs of a behavioral psychology be noticed in the investigation of selected literature of the N.E.A. Proceedings? Is there a connection, prior to 1938, that can be noticed in this literature, between education and behavioral psychology? If there is a connection, is it continuous? If this connection does exist, but is not continuous, does it appear at certain intervals? Is there some historical or sociological connection between these intervals?

The literature I have chosen to study in the N.E.A. Proceedings is the section for the Department of Superintendence, and the section for Child Study, from 1900 to 1938. I have chosen the literature from the Department of Superintendence, because much of the material Callahan uses in Education and the Cult of Efficiency comes from this section, and since technique according to Ellul must be considered
as an ensemble, it seemed logical to look for signs of behavioral psychology in an area where technical reorganization and application were already occurring. I have chosen the literature from the Department of Child Study, because this movement (the child study movement) is founded by America's first psychologist, G. S. Hall, and again, it seemed logical to look for signs of behavioral psychology in this area.

The use of the terms of behavioral psychology and behavioral technology was difficult, since I was dealing with a subject in its formative stages. I have used these terms interchangeably, where one or the other seemed more appropriate. I have justified this usage by saying, as does Ellul, that behavioral technology and behavioral psychology are essentially the same. That is, the very nature of behavioral psychology is technical.

It should be obvious that this dissertation is ideological, and the validity of my position can be attacked by using the same approach that I am using. I can only answer, as does Mannheim, that I must try to be aware of my biases and control them as much as possible, for I believe "The indirect approach to truth through social history will in the end be more fruitful than a direct logical approach."  

9Ibid., p. 456. (Mills is citing Mannheim.)
CHAPTER I

THE ORIGINS OF BEHAVIORAL TECHNIQUES

In order to understand behavioral techniques, it is necessary to understand how modern thought is possible. The most significant event in the emergence of modern thought is the demise of the medieval outlook, specifically the demise of the Catholic Church.

Four great movements mark the transition which follows from the decline of the Middle Ages to the great surge of the seventeenth century. The first is the Italian Renaissance. Dante, while still using medieval modes of thought, writes in the vulgar tongue, and makes the written word accessible to the layman. A rekindling of interest in the secular culture of the ancients takes place, and the emphasis in art and science shifts from God to man.

With this emphasis on man comes the second great movement, humanism. While the Renaissance affects the entire outlook on life, the Humanistic movement remains the domain of the thinkers and scholars.
When the Renaissance moves into the Low Countries, France, and especially Germany, humanism becomes contemporary with the third great movement of this transition period, the Reformation.

That reform in the church was needed had been recognized for some time. Humanistic thinkers had vehemently criticized the malpractices of Church government. When the reaction of the Church is hostile rather than conciliatory, the struggle, particularly in Germany, becomes political, and any chance of reconciliation is lost.

The fourth great movement begins with renewed interest in empirical studies. The outlook becomes like that of the Greeks and concerns itself with saving appearances. Of central importance is the rediscovery of the heliocentric system by Copernicus. *De Revolutionibus Orbium Coelesticium* was published in 1543, the year that Copernicus died. From the seventeenth century on, the mathematical and physical sciences make tremendous progress.

These four great movements, along with the rise of a middle class through the guilds, and the rise of a capitalistic spirit, effectively undermine the authority of the church.
Why is it necessary to understand this dissolution?

What did the church have to offer that needed to be replaced? Mannheim, in Ideology and Utopia, explains:

> The church offered a unitary world view. The Middle Ages not only believed in an unambiguous world-order, but the thinkers also thought they knew the 'existential value' to be attributed to every object in the hierarchy of things. There prevailed an explanation of the value of human capacities and thought which was based on the world of objects. After the breakdown, the conception of order in the world of objects became problematical, because the church could no longer guarantee this conception. The only answer to the epistemological problem caused by the demise of the church, is to take the opposite road. That is, to determine the nature and value of the cognitive act, the subject rather than the objects must be taken as the point of departure, and an anchorage for objective existence must be found in the knowing subject.¹

This form of thought fully emerges for the first time in the rationalism of Descartes, Leibnitz, through Kant, on the one hand, and in the empiricism of Locke, Berkely, and Hume on the other. It is in British empiricism, with Locke as its first thinker, that the germ of behavioral techniques is found. Gordon Allport in Becoming states: "The Lockean point of view... has been and still is dominant in Anglo-American psychology. Its representatives are found in..."

most of what is cherished in our laboratories as truly scientific."²

Locke published An Essay Concerning Human Understanding in 1690, when he was well over fifty. The Essay was begun around 1671. Why the space of nineteen years from the inception to publication? Did anything happen in those nineteen years of great significance? We know that Locke had a "corpuscular, mechanical view of the physical universe, which he took over from his contemporaries; his claim that our knowledge does not extend to the real essence of things; his firm affirmation of the reality of substances as entities causing our ideas, but not revealed in those ideas. These are just some of the assertions Locke makes that cannot be derived from...sense and reflection. These assertions constitute the conceptual background within which Locke thought and wrote."³

Who were Locke's contemporaries? Which one in particular presented a corpuscular, and mechanical view of the universe? The answer is obvious. In 1687, just three years prior to the publication of Locke's Essay, Isaac Newton published his


Principia Mathematica Philosophiae Naturalis. In it he sets out the three laws of motion, and develops a deductive account of the dynamic. The theory made it possible to calculate exactly the movement of orbits caused by other bodies, since every particle affects every other particle. The planets, their satellites, and even comets could all be accounted for in the smallest detail.

It is impossible to miss the significance of this theory. Here was the mathematical key to the universe. The form used to state these facts is differential calculus, which Newton called the theory of fluxions.

Bronowski says the following about Newton's work:

As a system of the world, of course, it was sensational from the moment it was published. It is a marvelous description of the world subsumed under a single set of laws. But much more, it is a landmark in scientific method. We think of the presentation of science as a series of propositions, one after another, as deriving from mathematics of Euclid. And so it does. But it is not until Newton turned this into a physical system, by changing mathematics from a static to a dynamic account, that modern scientific method really begins to be rigorous.4

Locke undoubtedly wanted this study to be rigorous. In fact, he thought of his project as only an initial step. If

the project cleared up some misunderstandings, and paved
the way for further inquiry, it would have accomplished its
purpose. (In this respect he again resembles Newton.) In
his introduction Locke says:

... and in an age that produces such masters as
the great Huygenius, and the incomparable Mr. Newton,
with some others of that strain, it is ambitious
enough to be employed as an underlaborer in clearing
the ground a little and removing the rubbish that
lies in the way of knowledge. ... Vague and insignifi-
cant forms of speech. ... have so long passed for
science; and hard or misapplied words, with little or
no meaning, have by prescription, such a right to be
mistaken for deep learning and height of speculation,
that it will not be easy to persuade those who speak
or hear them, that they are covers. ... of true
knowledge.5

Given this background, what notions are present in be-
havioral techniques that are present in Locke? Allport states:

For Locke, the organism was reactive when stimulated. ... Another presumption is that what is external and
visible is more fundamental than what is not. ... it
is not the organism itself, but what happens to the
organism from outside that is important. A further
presupposition of Lockean empiricism is that what is
small and molecular (cf. Locke's simple ideas) is more
fundamental than what is large and molar. Another pre-
supposition that marks Lockean empiricism, is what is
earlier is more fundamental than what is late.6

Here, at the very beginning, we see the attempt at sci-
entific rigor that is to be so essential to behavioral

5John Locke, An Essay Concerning Human Understanding

6Allport, Becoming (New Haven: Yale University Press,
1955), pp. 7-10.
techniques. We also see Locke's notion of the mind as tabula rasa, and in time, the notion of mind will be completely discarded. This is the first step. Here, the subject as knower is the starting point, but what and how the subject knows, strongly reflects the scientific temper of England during this period.

Positivism is another attempt to answer epistemological questions, and it too has been influential in the development of behavioral techniques. In a sense, positivism as written about by Comte, is a continuation of British empiricism; and with its emphasis on classification, a successor of the encyclopedist movement in France. In one important respect, however, it is quite different from British empiricism. Comte, above all else, wanted to arrange the entire field of scientific study into a logical and comprehensive order. Like his English contemporaries, he rejected metaphysics, and insisted that we must begin with what is given by experience. In the end, however, this means that positivism cannot recognize the possibility of an introspective kind of psychology. In this respect, positivism differs sharply with British empiricism. (This is precisely what Watson publishes in his paper on behavioral psychology some eighty years later.)
Here, in Comte, it is not the knowing subject that is the starting point for epistemological questioning. Positive humanity will be ruled by the moral authority of a scientific elite, while the executive power will be entrusted to technical experts. In this respect, Comte is far ahead of his time.

In 1859, an event takes place that compares in the history of ideas with the publications of Copernicus and Newton. In that year, Charles Darwin publishes *The Origin of the Species*. Hofstatder says of the theory of evolution: "Many scientific discoveries affect ways of living more profoundly than evolution did; but none have had a greater impact on ways of thinking and believing. In this respect, the space age does not promise even remotely to match it."  

In fact, before Darwin's publication, it would make no sense to study animals for psychological reasons. Prior to 1859, animals were soulless creatures, and they had little in common with man, except for anatomists. As with human beings, the approach with animals was essentially the same. That is, the animal was regarded as a knowing subject.

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If mind could be shown to exist in animals, and if continuity of the animal mind with the human could be shown, such evidence would serve as a defense of Darwin's theory against the man-animal dichotomy espoused by Descartes. A great quest for evidence of mind in animals was begun.

Here, again, it is impossible to underestimate the influence of the theory of evolution on American psychology. One of the main notions in Darwin's theory is that of function. That is, as a species evolves, its physical structure is determined by its own requirements for survival. When psychologists began to consider mental phenomena in terms of function, an entirely new movement was created, namely functionalism.

In the history of psychology, functionalism is preceded by structuralism, and Fechner and Wundt are often considered to be the founders of this new psychology. Important publications were made by these two between the years 1858 and 1862. What distinguishes this new psychology is its break with philosophy and its emphasis on experimental investigation. The new experimental method in psychology attempts to emulate the physical sciences. More will be said about this in the following chapters.
In America, however, with the theory of Darwin providing the inspiration, it is functionalism that becomes dominant. The men who are important in the development of functionalism in America are well-known. Among them are Galton, Spenser, James, Cattell, Hall, Dewey, Carr, Woodworth, and Thorndike. James Angell, however, is one of the most interesting. In an address before the American Psychological Association, in 1906, Angell states succinctly the tension that exists between structuralism and functionalism.

If you adopt as your material for psychological analysis the isolated 'moment of consciousness' it is very easy to become so absorbed in determining its constitution as to be rendered somewhat oblivious to its artificial character. The most essential quarrel which the functionalist has with the structuralist in its thorough-going and consistent form arises from this fact and touches the feasibility and worth of the effort to get at the mental process as it is under the conditions of actual experience rather than as it appears to a merely postmortem analysis.8

Angell taught at the University of Chicago, and it was there that John Watson went to take his Ph.D. Watson is often credited with originating behavioral psychology in America, and his position is at least partially a reaction to the functional psychology.

In a paper entitled "Psychology as the Behaviorist Views It," Watson gives his view of psychology.

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

Here, one can see the influence of all the ideas previously mentioned. The British empiricism, the mechanistic model of Newton, Positivism, the evolutionary theory of Darwin, all combining in a reaction against functionalism. Here, as with Comte, the focus of the epistemological problem shifts. Since introspection is not allowed in this system, we must start with the world of objects. What can we know? That given a certain stimulus, a specific organism will produce a specific response. The stimulus and the response must be observable and quantifiable. In this way the behaviorist can predict and control behavior. It is in this sense that the stimulus and the response are objects.

9Ibid., p. 198.
Furthermore, when the gap between man and animal is narrowed by Darwin's theory, the study of animals for psychological reasons is allowed but only if introspection is not allowed. Some other way of investigation must then be found, since the emphasis cannot be on the "mind of the animal."

Watson in his address is aware of a possibly insurmountable problem in his system. To this day, it continues to cause trouble. He says:

The situation is somewhat different when we come to the study of the more complex forms of behavior, such as immagination, judgment, reasoning, and conception. At present, the only statements we have of them are in content terms. Our minds are so warped by the fifty-odd years which have been devoted to the study of states of consciousness that we can envisage these problems in only one way. We should meet the situation squarely and say that we are not able to carry forward investigations along all of these lines by the behavior methods which are in use at the present time.10

The man who is most famous in carrying on the behaviorist tradition is B. F. Skinner. Skinner learned about Watson shortly after graduating from Hamilton College. In "Dial" magazine, Bertrand Russell had published a series of articles, in which he criticized the theories of Watson. It was these articles that excited Skinner's interest in the study of

10Ibid., p. 198.
behavior. The Russian physiologist, Pavlov, was another source of inspiration for Skinner. When Pavlov, in his famous experiments with salivating dogs, discovered a new unit of behavior, which he called the conditioned reflex, many psychologists of the 1920's thought this might be the key to the study of behavior. Pavlov, in his studies was concerned with physiological processes, particularly the function of the cerebral cortex. Skinner, by concentrating only on observable behavior, particularly the response of the organism, developed a new theory of learning, operant conditioning. His theory, like Watson's, emphasizes prediction and control.

In 1938, Skinner published The Behavior of Organisms, his first major work on behavior. The book is divided into a theoretical section, and a section in which Skinner presents his research. In the theoretical section, Skinner explains the terms and structure of a science of behavior.

In explaining and defining this method of investigation, Skinner attempts to answer two questions. These are: What will be the structure of a science of behavior? and How valid can its laws be made? Skinner says: "Behavior is only part of the total activity of an organism, and some formal delimitation is called for... Behavior is what an organism
is doing—or more accurately, what it is observed by another organism to be doing. . . behavior is that part of the functioning of the organism which is engaged in acting. . . upon the outside world.\textsuperscript{11}

That is, behavior is only that observable activity or motion of an organism that can be expressed in useful uniformities or lawful relations.

Here, again, the sources of influence are easy to discern. British empiricism, reliance on a mathematical model, positivism, Darwinism, negation of introspection, and Pavlov, can all be discerned. Further, the focus of epistemological inquiry, as for Comte and Watson, shifts from man as a knowing subject to the world of objects. The world of objects, in this case, consists of various external objects, or fields of force. More specifically, the world of objects is a class of specific stimuli, namely those which are reinforcing. The stimulus is the external agent and the behavior that is controlled by it is the response.

Here we see the hierarchical arrangement of objects, but it is no longer the Church, and therefore God, who guarantees the validity of the arrangement. It is the expert or specialist

who gives this guarantee. In this sense behavioral and all other modern techniques, when taken as an ensemble, can be said to be an aspiring religion. But is is a secularized religion with no room for either God or man. It is the religion of efficiency. Unlike Comte, Skinner was not far ahead of his time.

In this chapter, I have tried to show the origins, in very general terms, of behavioral techniques. The most important part of what I have said is the development of the physical sciences. Though there is a continual shift in mind-sets and ideologies that must not be underestimated, it is a particular branch of the physical sciences that is most significant in the development of behavioral techniques. This is the development that occurs in anatomy. This can be seen by Skinner's use of the term reflex as late as 1938. The second chapter will be devoted to the history of the study of the reflex.
CHAPTER II

G. S. HALL AND THE HISTORY OF REFLEX ACTION

G. S. Hall is generally credited with being the first psychologist in America. In 1871, Hall returned home from Europe for the first time and secured a position as "private family tutor of the five children of the eminent Jewish banker, Jesse Seligman."¹ It was while Hall was tutor for the Seligman family that James K. Hosmer offered him his chair at Antioch College. Hall accepted, and he spent four years at Antioch. It was during this period, probably between 1872-1874, that the "first volume of Wundt's Physiological Psychology was published,"² which Hall devoured. At the end of his third year at Antioch, Hall resigned, but he was persuaded to stay another year. At the end of his fourth year, however, Hall again resigned, and in 1876, he went abroad, but this time with a definite purpose in mind: "...to

²Ibid., p. 200.
study experimental or physiological psychology with Wundt at Leipzig."³

Wundt had only recently been elected full professor, and his laboratory was not yet organized when Hall arrived. Because of this, and because Hall felt it necessary to ground himself in physiology, he left Wundt, and "spent most of the day in the laboratory of Professor Ludwig, who gave me a problem of myology working with me a great deal. . . . Ludwig was one of the leaders and one of the founders of experimental physiology, and it was his students who filled most of the chairs in the great department not only in Germany but in other countries."⁴ It is while studying with Ludwig that Hall learned that physiology "of course, is entirely built upon experiments on living tissue and we have to have animals. . . ."⁵

More will be said later in this chapter about the evolution of this model; however, it is obvious that such a model, with its emphasis on verifiable, reproducible experiments with animals appeals to at least some behavioral psychologists.

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³Ibid., p. 204.
⁴Ibid., p. 205.
⁵Ibid., p. 206.
Hall continued to attend the lectures and the seminar of Wundt. During the two years at Leipzig, however, he had virtually no time for reading except in connection with his subject, "the physiology of the muscles, on which I focused as I had never done on any subject before."\(^6\)

When Hall left Leipzig, he spent a year in Berlin. He says of this period: "Here I undertook first to work with Helmholtz to determine from the study of the shadow of the retinal blood vessels whether the different rays were brought to a focus which coincided with the discs of the rods, and thus I came into slight contact with the great man who had already published his *Optics and Acoustics*. . ."\(^7\)

While in Berlin, Hall worked for a time with Du Bois-Reymond, who was presenting demonstrations in physiology. Hall says:

> My own special work here was with his chief assistant, Hugo Kronecker, on reflex action (where, again, the frog was chiefly used) the history of which I studied very carefully one summer, even visiting the great library at Paris, and the British Museum for material, proposing to publish a comprehensive memoir on the subject, which was, however, never quite completed although I later utilized some of it, as did also my Clark colleague, Professor Hodge.\(^8\)

\(^6\)Ibid., p. 208.

\(^7\)Ibid., p. 208.

\(^8\)Ibid., p. 209.
As Hall's stay abroad came to a close, and he had no prospect for obtaining work, he says: "...I became very anxious about my future, and finally decided...that the most promising line of work would be to study the applications of psychology to education. With this in view, and also with the desire to see something of the great men in other institutions, I spent the last months of this period in travel and in visiting schools." Here, before Hall even returned, he was formulating a union of psychology and education. As Wundt had sought a union of physiology and psychology, so Hall was considering a union of psychology and education. What is significant is that this will be a union of a new type of psychology and education. Further, the union will come to fruition in the special historical circumstances of the United States.

When Hall returned home, he was invited by President Eliot of Harvard to present a series of lectures on education. In Eliot's introduction of Hall, as the series began, Hall says: "...he stated that Harvard had never been much impressed with pedagogy but that I was a young man who had studied it abroad and this course had been instituted as an experiment. In concluding he invited the audience to decide

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9Ibid., p. 215.
whether Harvard was right in ignoring it or I was right in advocating it."\textsuperscript{10}

So Hall presented his Harvard lectures and they were moderately successful. He was asked again the following spring to present the lectures again, and he did. But Hall was profoundly changed by his European experiences. In addition to the studies already mentioned he says:

\begin{quote}
I had felt the charm of pantheism. . .especially through the medium of poetry, in those whose creed abhore it; of agnosticism, more or less common but so strangled by religious affirmations; of even materialism, for I had read Buchner and Moleschott; and had wrestled with Karl Marx and half accepted what I understood of him; thought Comte and the Positivists had pretty much made out their case. . .
\end{quote}

But the only whole-hearted scheme of things which I had accepted with ardor and abandon was that of an evolution which applied no whit less to the soul than the body of man. This was bedrock. Darwin, Haeckel, and especially Herbert Spencer seemed then to me to represent the most advanced stage of human thought.\textsuperscript{11}

In 1881, Hall was invited by Johns Hopkins to deliver a series of twelve lectures on psychology. This opened the possibility of a permanent position, and he readily accepted. After the lectures, he was asked to teach half a year, and at the end of this period, he was appointed full professor for five years.

\textsuperscript{10}Ibid., p. 217.

\textsuperscript{11}Ibid., p. 222.
Against his wishes, "my title was professor of psychology and pedagogy although my activity at the Hopkins in the latter was limited to semipublic Saturday lectures to which teachers were admitted. I think that at the time there had been no chair of pedagogy in the country save at Michigan, and of the many patterns Johns Hopkins set to other institutions this one was destined to remarkable development."\(^{12}\)

While Hall was at Johns Hopkins he was given money for a psychology laboratory, and it was among the first in the country. Hall says: "My chief time and effort, however, were focused on psychology. I was given a laboratory in the physiology building, and then a more generous one in the physics building. I was enabled to develop not only the first but by far the largest and most productive laboratory of its kind up to the time of my leaving. . . ."\(^{13}\)

The psychology that Hall taught was the new structural variety, which he had studied extensively in Germany. He says: "The psychology I taught was almost entirely experimental and covered for the most part the material that Wundt had set forth in the later and larger edition of his

\(^{12}\)Ibid., p. 226.

\(^{13}\)Ibid., p. 227.
Physiological Psychology. Here I spent much time in my laboratory, where there were always students engaged upon specific problems of research, some of the first of which were published in "Mind" and most in the later years in the early volumes of my "American Journal of Psychology."\(^{14}\)

It was toward the latter part of Hall's stay at Johns Hopkins that he was approached about founding a journal of psychology. He says:

I had a memorable call one Sunday afternoon from J. Pearsall Smith, an entire stranger to me who had learned something of the Hopkins work in psychology. He suggested that I found a journal and then and there gave me a check for five hundred dollars 'as a starter.' I had long desired to do this. . . for the establishment of departmental journals was one of the prominent items in the program of the Johns Hopkins, so that at last, with great trepidation, I printed and circulated a prospectus, gathered material, and issued the first number. . .\(^{15}\)

It is here, in The American Journal of Psychology, Volume III, Numbers 1 and 2, that Hall and Hodges use the material which had been gathered from the great libraries of Europe, concerning the history of the reflex action. This material will be presented in detail, and it is warranted for three reasons. First, the material is

\(^{14}\)Ibid., p. 234.\(^{15}\)Ibid., p. 227.
significant. It is an accurate, informative history of the development of the anatomical and physiological model, which ultimately is applied to the study psychic phenomena. Second, the data is not gathered by just anyone. It is gathered by G. S. Hall, America's first psychologist, and given the detailed nature of this information, it is easy to see how much importance Hall attached to this material. The significance of this cannot be missed. It is the physiological psychology, and it is the physiological model that is a powerful inspiration for behavioral psychology. That is, both the man and the material are significant. Concerning the third reason, Hoffstadter says:

Indeed, in all modern history there have been only a few scientific theories whose intellectual consequences have gone far beyond the internal development of science as a system of knowledge to revolutionize the fundamental patterns of thought. Discoveries of this magnitude shatter old beliefs and philosophies; they suggest (indeed often impose) the necessity of building new ones. They raise the promise. . .of new and more complete systematization of knowledge. They command so much interest and acquire so much prestige within the literate community that almost everyone feels obliged at the very least to bring his world-outlook into harmony with their findings, while some thinkers seize upon and enlist them in the formulation and proppogation of their own views on subjects quite remote from science.16

16 R. Hoffstadter, Social Darwinism in American Thought (Boston: Boston Press, 1944), p. 3.
This is the case with the discovery of the anatomical components of the reflex action, although the discovery of these components is more of an evolution, than a sudden, great discovery, and many men are ultimately responsible. This is also the case with Pavlov's work, and the history which Hall and Hodges provide illustrates how Pavlov's work is even possible.

In the beginning of his section on the history of the reflex, Hodges says the following:

But, as often happens in science, when a need is felt, that several persons take up the work independently, Eckhard had been for a number of years collecting data for this very subject. His admirable book was published in 1881, and seemed to meet the demand so fully that Dr. Hall laid his work aside for the time.

The two works were somewhat different in scope. With the one, interest centers about the facts of nerve physiology, with the other attention is directed to the psychological development which underlies the appreciation of facts and recognizes the value of experiment. . . Thus, the reader is led to see how the mind, from rejoicing in fanciful explanations of things, comes step by step to appreciate nature as it is, and to prefer plain reality to its own imaginings.17

Thus we are given the third reason in the words of Hodges. Hall and Hodges are presenting the development of a mind-set, which is necessary for the development of a behavioral technology.

The history of the reflex is important to the history of behavioral techniques, because the discovery of the anatomical components of the reflex is impossible without the evolution of a new method of investigation. This new method evolves very slowly, and it evolves in a very haphazard manner. The struggle to identify the anatomical components of the reflex is a long, and sometimes dangerous struggle. When at last the components are finally identified, and they seem to explain so much, it is easy to see why men seek to extend the method into other areas.

Briefly, the simplest form of a reflex action is called a reflex arc. The surface of the skin is touched creating an impulse. The impulse travels down a sensory nerve to the nerve center. The fibers of this center interlace with the fibers of the motor nerve cell. The impulse travels to the motor nerve and down to the muscles, which contract, causing movement.

Therefore, to produce a reflex action, the following components are necessary:
1. A sensitive surface (in the case of this example, the skin).

2. A sensory nerve.

3. A motor nerve connecting with a muscle, gland, or blood vessel.

4. A nerve center connecting the sensory and motor nerves.

I have used the term "anatomical components," with good reason. Even today, there are many physiological processes that occur in even the simplest reflex that are not understood. For example, we know that certain chemical processes are important if a muscle is to function properly, but virtually nothing is known about these processes. No one can explain how a muscle functions. It is, therefore, the anatomical components that I will be concerned with in this chapter.

A number of phenomena that are now grouped under the category of reflex action are noted in the earliest medical literature. The Hippocratic writers not only knew of a general consensus or sympathy between different parts of the body, but in their sections on sacred disease, or madness, it is plain that various forms of reflex cramps had been observed.\textsuperscript{18}

\textsuperscript{18}Ibid., p. 71.
Here at the very beginning we see the problems that for so many hundreds of years prevent the discovery of the true anatomical components of the reflex. In addition to very little anatomical knowledge, the belief in an immaterial, psychic principle pervading the body, and mediating freely between its parts, without necessitating a direct connection of the tissues, is assumed. This is spiritualism, or animism, or dualism, in which a refined essence with a distant animating principle is separate from the body. The history of this line of thought is a long one, and it survives to this day.\(^{19}\) Here it is enough to state some historical motifs as they relate to the topic of the reflex.

In the physiology and pathology of nearly all the Greek philosophers, the psyche plays the chief role. Plato, the greatest protagonist of all modern dualism, conceived the soul, as, at the same time, the principle of life, and as independent of the body. It thought in the head, felt in the breast, and desired in the belly. It was closely connected with the world soul, while over in the material world, the idea or form reigned supreme.\(^{20}\)

\(^{19}\)Ibid., p. 71.

\(^{20}\)Ibid., p. 72.
Aristotle, who may be said to have given form to the medieval Christian philosophy, recognized a nutritive soul in plants, a sensory soul in animals, and a thinking soul in man. As the principle of life it was inseparable from the body, while the thinking was immortal. It was the sufficient cause of all the phenomena of life. Its chief seat was the heart, and it was mediated by fire, air, or ether.\textsuperscript{21}

The Stoics, and the pneumatic school of medicine, believed the body to be pervaded through all its faculties by vital or intelligent forces. Even Galen believed in this notion.\textsuperscript{22}

The cabalistic systems of emanation, which effectively undermined medical knowledge and art after Galen, taught that fallen demons pervaded all nature, giving it harmony, as the human body is pervaded by the sympathies. Diseases, especially of the nervous system, were caused by the presence of devils. The physician did not need to study magic, which was suspected as science would later be, but he needed to struggle up by prayer, asecticism, and ecstasy to gain the purifying power of exorcism, by knowledge of, and living

\textsuperscript{21}Ibid., p. 72.

\textsuperscript{22}Ibid., p. 72.
union with the Word of God. Meanwhile, devastating plagues and horrible neural diseases were explained by this principle.\footnote{Ibid., p. 72.}

According to the Rosicrucians, medicine rests on a knowledge of universal harmony. Plants suffer our diseases, and all diseases have their real seat, not in the material organism, but in an animating principle. The sympathy of medicines of which they wrote, was not a metaphor to them. Not only was the existence of a panacea, as the counterpart of poisons universally deadly, asserted, but it was assumed that all diseases had one occult, immaterial cause, and must also have one cure which was to be spiritually sought, discerned, and applied.\footnote{Ibid., p. 73.}

Cardanus (1501-1576) was an Italian mathematician, physician, and astrologer. He did significant work with deaf mutes, and aroused interest in their education. At the same time, while lecturing on mathematics and physics at several Italian universities, he taught that there was a sympathy between certain parts of the body, and certain planets.\footnote{Ibid., pp. 72-73.}
Paracelsus (1493?-1541) was a Swiss physician who suffered a martyr's death. It is believed that he was thrown from a window by his rivals. While some of his work led to the application of chemistry to medicine, and some of his theories were incorporated into modern medical practice, some of the vagaries that he taught helped to undermine the authority of Galen. For example, he asserted that the soul had a soul, and that that had another. He avoids a vicious infinite regress by asserting that this continues only to the fifth potency, or the quintessence. He asserted the existence of a sidereal and an astral, as well as a material body. He asserted a conscious vegetative principle which separated the good from the bad in food, fed the various organs and kept them at work, and needed occasionally to be roused by medicine or otherwise from forgetfulness of its duties.

With the revival of interest in anatomy under Vesalius (1514-1564), and its further progress under Dulaurens (1550-1564), by the close of the sixteenth century the nervous system had been fairly-well distinguished from the other tissues, and in a theoretical way, it had been given certain functions of the soul. For example, Dulaurens, writing in 1595, ascribes the sympathy between the breasts
and the uterus in part of the "intercostal nerve," and in part to the azygans vein.

It is with Descartes, however, that we have the tangible beginning of what is the science of the reflex.

Here are the general neurological conceptions of Descartes:

Although the soul is united with the whole body, its principle functions are, nevertheless, performed in the brain; it is here that it not only understands and imagines, but also feels; and this is effected by the intermediation of the nerves, which extend like delicate threads from the brain to all parts of the body without setting the extremity of some nerve in motion. This motion passes through the nerves to the part of the brain which is the common sensorium...and the movements which thus travel along the nerves to that part of the brain with which the soul is closely united, awaken by reason of their diverse characters different thoughts in the mind.26

Thus, Descartes makes the brain the organ of the soul.

Contemporaries do not receive this opinion favorably, but because of his dissections, Descartes is able to state the following:

The opinion of those who think that the soul receives its passions in the heart is of no value; for it is founded only upon the fact that the passions cause a change to be felt in that organ; and it is easy to perceive that this change is felt, as if it were in the heart, only by the intermediation of a little nerve

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26 Ibid., p. 151.
which descends from the brain to it; just as pain is felt, as if it were in the foot, by the intermediation of the nerves of the foot; and the stars are seen as if they were in the heavens, by the intermediation of their light and the optic nerves. So it is no more necessary for the soul to exert its functions immediately in the heart, than it is necessary that it should be in the heavens to see the stars there.27

Here, it is plain that Descartes had a clear idea of the sensory function of nerves. His conception of the motor function of the nerves is also clear, although the ideas of his time cause a bias. He says:

All the movements of the limbs, moreover, depend on the muscles; and finally we know that all these movements of the muscles, as well as all the senses, depend on the nerves, which are like little threads or tubes, all come from the brain, and like it, contain a very subtle air or wind called animal spirits.28

This leads to Descartes' notion of the reflex process, which is probably as good as any existing today. Essentially a sensory impulse is carried to the brain and there, it may be, unconsciously or even in spite of the will reflected ("reflechie") to the motor nerves and causes a coordinated contraction of the muscles.

27 Ibid., p. 152.
28 Ibid., p. 152.
Descartes suggests that the reflected movements, effected by a corporeal machine, may act in direct opposition to the volition of the soul when he says the following:

... If someone moves his hand rapidly toward our eyes, as if to strike us, although we know that he is a friend, that he does it only in jest, and that he will be very careful to do us no harm, nevertheless it is difficult to refrain from closing them. And this shows that it is not by the agency of the soul that the eyes close, since this action is contrary to that volition, which is only, or at least the chief function of the soul; but it is because the mechanism of our body is so constructed that the motion of the hand toward our eyes excites another movement in our brain, and this sends the animal spirits into those muscles which cause the eyelids to close.\(^29\)

Further, Descartes anticipates Pavlov, and outlines the great field of involuntary action in general, including actions which become reflex by habit and education. He says:

Yet I will say further that it appears to me a very remarkable circumstance that no movement can take place, either in the bodies of animals, or even in our own, if these bodies have not in themselves all the organs and instruments by means of which the very same movements could be accomplished by a machine. So that, even in us, the spirit or the soul, does not directly move the limbs, but only determines the course of that very subtle liquid called animal spirits, which, flowing

\(^{29}\) Ibid., pp. 152-153.
continually from the heart through the brain into the muscles, causes all the movement of our limbs, and often may affect many different motions, one as easily as the other. And the mind does not even always determine these movements, for among them are many which do not depend upon the mind at all, such as the beating of the heart, the digestion of food, the nutrition, the respiration, of those who sleep; and, even in those who are awake, walking, singing, and other similar actions, when they are performed by the mind without thinking about them. And when one who falls from a height throws his hands forward to save his head, it is through no process of reasoning that he performs this action; it does not depend upon his mind, but takes place merely because his senses being affected by the present danger, some change arises in his brain which determines the animal spirits to pass thence into the nerves, in such a manner as in required to produce this motion, in the same way as in a machine, and without the mind being able to hinder it.30

Here from the thought of Descartes, freed from the traditionality of an immaterial principle acting lawlessly in the body, come the principles of mechanical physiology, and with it that of the reflex action. Of course, Descartes cannot furnish proof for all of his statements. Crucial gaps in anatomical knowledge and insufficient technical advances make this impossible. Men always live in a particular time and place, and even a philosopher as great as Descartes cannot escape this limitation entirely. What to us are shadows or myths were the soliddest realities to the men of his time. The soul as a separate entity was as real to

Descartes as his own body, and animal spirits as a subtle liquid was as familiar to the philosophers of that time as blood is to us today. The views of Descartes, however, are amazingly accurate, and they are quite clear when compared with the vagaries of his contemporaries.\footnote{Ibid., pp. 153-154.}

A transition in the history of the reflex gradually occurs, and the emphasis shifts from philosophy to verifiable experimentation. Reflex phenomena begin to come to the attention of a number of investigators.

Swammerdan (1637-1680) notices the reflex movements of sleeping animals and men when the skin is gently stimulated.\footnote{Ibid., p. 154.} Francesco Redi (1626-1694) in Pisa notices the movements of animals after decapitation. Boyle (1626-1669) in England describes the same phenomena in decapitated serpents in the following manner:

\begin{quote}
The body of vipers may be sometimes, two or three days after the skin, heart, and all the entrails are separated from it, seen to move in a twining or wriggling manner, nay, may appear to be manifestly sensible of the punctures, being put into a fresh and vital motion, when it lay still before, upon being pricked especially on the spine or marrow, with a pin or needle.\footnote{Ibid., p. 154.}
\end{quote}
Here it is apparent that the power of responding to outside stimuli by reflected contractions does not reside wholly in the brain. The question now becomes: does this power reside in the body generally? or is it in the spinal cord? As decapitation had proved that it did not reside exclusively in the brain, so the removal of the spinal marrow would have proved that it is not present in the body generally. A century goes by, however, before this simple experiment is tried. Meanwhile, the fight continues about the soul, its location in the body, its connection and relation to it, and its divisibility. Added to this is the question of whether sympathy depended on the union of the nerves in the spinal cord, their union at the periphery, or on blood vessels and continuity of tissues.

Thomas Willis (1622-1675) is generally credited with originating the erroneous theory of peripheral nerve anastomoses. In this theory, various instances of sympathy between different parts of the body are explained by the connection or communication of those parts of the body. Willis writes his Cerebri Anatome in 1664. Thirty-six years earlier Harvey had published his work on the circulation of the blood. Three years before Willis publishes, Malpighi

34 Ibid., p. 155.
supplies the one remaining link in Harvey's theory by dis-covering the capillaries. It is a time when everything possible in the body must circulate, and in order for the 'subtle liquid' within the nerves to do this, peripheral connections must exist between different nerves as between arteries and veins.

In the matter of the reflex action, Willis follows Descartes in the use of the term reflexa, and he likens the reflex process to that of reflected sound in an echo. But he differs from Descartes in making the periphery as well as the brain the seat of the reflex process.35

After Willis, Astruc of Montpelier (1648-1766) carried out the suggestions of Descartes in a most rigidly mechanical manner. He grouped sympathies, however, into several classes according to how he supposed them to be explained by anastomoses of veins, continuity of tissue, anatomical resemblance, or by the nervous system. Astruc thought that the brain was formed of tubes, which were closely pressed together, and often interrupted by columns of tendinous fibers. Against these columns the nerve tubes opened, and the 'animal spirits' beat upon them causing sensation and motion. As with light, angles of incidence and reflection are equal, so that a

35Ibid., p. 156.
sensation produced by a concussion of 'animal spirits' against the fibrous columns is reflected and causes motion in those nerve tubes which happen to be placed in the line of reflection. The force with which the animal spirits impinge, however, may be so great as to cause motion in the nerve tubes on the outer side of a column, thus producing an irradiation of reflected motion which might change the angle of reflection one hundred and eighty degrees.\textsuperscript{36}

The work of Astruc was published in 1743. In 1751, the work \textit{Vital and Other Involuntary Motions of Animals} is published by Robert Whytt. Section one begins with the following:

A certain power or influence lodged in the brain, spinal marrow, and nerves is either the immediate cause of the contraction of the muscles of animals, or, at least necessary to it.

The truth of this appears from convulsive motions and palsies affecting the muscles when the medulla cerebri, medulla oblongata, and spinalis are pricked or any other way irritated or compressed; as well as from observing that animals lose the power of moving their muscles, as soon as the nerve or nerves are strongly compressed, cut through, or otherwise destroyed. The tying or cutting of the blood vessels had no such effect on the muscles.\textsuperscript{37}

\textsuperscript{36}Ibid., pp. 157-158.

\textsuperscript{37}Ibid., p. 157.
As proof of this, Whytt cites the case of a dog which continued to use its leg, after the cural artery had been tied until the member was almost dead.

It is in a later work that Whytt gives his theory of reflex or sympathetic action. Here, he gives instances of normal and morbid sympathy, by which a stimulus applied at one part of the body causes motion in a distant part. He calls attention to the fact that this may occur where no neural connection exists between the parts except through the brain and spinal cord. These, he suggests, cannot be explained on the theory of anastomoses; and although he doesn't deny the existence of such connection, he gives a number of facts to disprove their effectiveness.

But all of this amounts to very little as compared to the fundamental and crucial experiment that Whytt performs. In describing this experiment, Whytt says the following:

When any of the muscles of the leg of a frog are pricked, most of the muscles of the legs and thighs contract, even after cutting off the head, if the spinal marrow be left entire; but when that is destroyed, although the fibers of the stimulated muscles respond with a week tremulous motion, the neighboring muscles remain wholly at rest. There is no sympathy between the different muscles or other parts of the body as was observed while the spinal marrow was entire; from whence it seems to follow that the nerves distributed to the several parts of the body have no communication, but at their
termination in the brain or spinal marrow, and that to this, perhaps, alone is owing the consent or sympathy between them.38

The name of Dr. Hales is often coupled with this experiment and justly so, from Whytt's own account.

The late reverend and learned Dr. Hales informed me that having many years since tied a ligature about the neck of a frog to prevent any effusion of blood, he cut off its head, and thirty hours after, observed the blood circulating freely in the web of the foot; the frog also at this time moved its body when stimulated but that on thrusting a needle down the spinal marrow, the animal was strongly convulsed and immediately after became motionless.39

Besides these, Whytt makes some less spectacular contributions to the subject. He notices that, in the frog, a segment of the spinal cord may serve to produce 'consent' between the muscles to which it supplies nerves. He is also the first to notice that immediately after decapitation, no sympathetic contractions could be called forth. Finally, he is the first to bring the action of the glands, the secretion of tears and saliva, into the category of reflex action.

With all this, however, Whytt seems to have failed in his understanding of an important part of the subject. He repudiates the efficiency of the mechanism entirely, and opts

38Ibid., p. 159.
39Ibid., p. 159.
for a vital principle which is behind all the phenomena of life. He says the following: "The more probable opinion seems to be that the soul is equally present in the extremities of the nerves through the whole body as in the brain. In these it is only capable of feeling, or simple sensation; but in this it exercises its power of reflex consciousness and reason." Here, it is apparent that he believed in consciousness of different degrees, and further, that no motion can take place in the body without consciousness. Yet he distinctly rejects the theory that the soul directs all the bodily functions with a full degree of consciousness.

These views bring Whytt into a direct conflict with Haller, who had become imbued with the idea that there was a power inherent in a living muscle, namely irritability, which was independent of the sensibility of the nerves. And although Haller takes for granted the existence of animal spirits, he seems to have been the first to discern inherent in living nerves a something inexplicable in the then existing theories, and to this something Haller first applied the term "vis nervosa."  

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40 Ibid., p. 160.
41 Ibid., pp. 160-161.
Haller makes a further contribution to the subject.

People had lately become interested in the rate of a nerve impulse, and some rather amazing figures were being suggested. For example, David Hartley in 1649, suggested that the rate of a nerve impulse equaled the velocity of light. Haller, by a simple experiment, checked the tendency toward such fantastic ideas, and instilled a spirit of moderation into the subject. Haller's method was to read a number of lines from The Aeneid, measure the time elapsed, count the letters read, and measure the length of the nerve traveled by the impulse in speaking. The notions of centrifugal and centripetal were not so clearly defined then, and Haller made his computation on the assumption that the nerve current passed to and from the brain at each effort. But the rate which he obtained (150 ft./sec.) was not far from correct as compared with the result of Helmholtz's measurement on the nerves of the frog (90 ft./sec.).

For all this, Haller like Whytt misses a crucial point, for he maintains that the processes in the movements of an animal with and without brain were essentially the same, when actually, here is the chief difference.

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42 Ibid., p. 163.

43 Ibid., p. 163.
Johann August Unzer (1727-1799) published Grundriss in 1768, and Physiologie in 1771. By calling attention to the fact that artificial stimulation, whenever applied to the nerve trunk, produces the same effect as normal irritation, he could point out more clearly than had been done before, the path of a sensory impulse from the periphery to the brain. Here, according to Unzer, it is transformed into a material idea, which gives rise to an image in the soul; and from the brain it may pass as a motor impulse to the appropriate nerves, and from there, to the muscles to give rise to what Unzer calls motion with consciousness. From this, he distinguishes unconscious movements, in which the sensory stimulus is "reflected" to the proper motor nerve without going up to the brain.

Unzer did not understand the significance of Whytt's experiment with the spinal marrow, and he, therefore, taught that the reflection took place in the ganglia, where the spinal roots diverge to enter the cord. 44

A man who is a contemporary and follower of Unzer, and who works more specifically in the field of the reflex action is George Prochaska (1749-1820). Many other writers

44Ibid., pp. 163-164.
have praised Prochaska's work. Longet credits him in classifying reflexes as a distinct class of movements.

Prochaska's first important work was published in 1784, and the following indicates his views of nervous action, and method of investigation:

At length we abandon the Cartesian method of philosophizing in this part of animal physics, and embrace the Newtonian, being persuaded that the slow, nay, the most uncertain road to truth is that by hypothesis and conjecture, but by far the more certain, more excellent and the shorter way is that, quae a posteriori and causam ducit. Newton distinguished the inscrutable cause of the physical attractions by the name 'force of attraction'; he observed its effects, arranged them, and detected the laws of motion, and thus established a useful doctrine, honorable to human genius. In this way, we ought to proceed with the study of the nervous system; the cause latent in the nervous pulp, which produces certain effects and which hitherto has not been determined, we shall call the vis nervosa; its observed effects, which are the function of the nervous system, we shall arrange, and expose their laws.45

Prochaska uses the term vis nervosa in a broader sense than Haller, who confined it to the power with which a nerve caused a muscle to contract. Prochaska's first law is that the vis nervosa requires for its action a stimulus, as a blow is necessary to elicit sparks from flint. Stimuli which call

the vis nervosa into activity may be material or mental. The vis nervosa may be more active or passive, requiring stimuli to produce the same effects. It is augmented or diminished by influences which tend to elevate or depress the powers of life.

Prochaska favors an electrical explanation of nervous phenomena early in his career, before the discoveries of Galvani were known. He recognizes the influence of nerves upon the blood supply to a region, as in blushing under emotion. To account for these facts, he suggests the theory that the augmentation of the vis nervosa in any part attracts the fluids of the body there, as sealing wax when rubbed with cloth becomes electrical, and attracts small particles to itself.

Perhaps the most important contribution Prochaska makes to the subject is the definition of the term "sensorium commune," an expression which had been used since Descartes with almost no significance. Here, Prochaska elaborates on the nature of the reflex action. He says:

External impressions made on sensitive nerves are propagated with great velocity throughout their entire length to their origin, where, when they have arrived, they are reflected to a certain law, and pass into certain and corresponding motor nerves, by which again being very quickly propagated to muscles they excite certain and determinate movements.
This place, in which, the impressions of sensitive nerves are reflected into motor nerves is called by a term already received by most physiologists the sensorium commune.\footnote{Ibid., p. 165.}

In 1786, Galvani's discoveries in electricity are made known, and Prochaska was the first to work the new discoveries into an explanation of reflex action. He maintains that any irritating body brought into contact with a living organism forms a new link in the Galvanic circuit of solid and fluid parts, which constitutes the organism. This causes a quantitative and qualitative change in electric tension which is conducted by the nerves to the brain where it produces sensation. "The changed tension of the brain acts as a reflex of the irritation upon the other organs and excites them to peculiar activities adapted to remove the unpleasant irritation and to retain those which are pleasant."\footnote{Ibid., p. 166.}

For Prochaska, reflexes have for their general law the preservation of the organism, and they are founded on electrical attraction or repulsion of advantageous or injurious irritations according to the polarities of the organ and the irritation. Prochaska tries to explain too much with electricity. Still, the contributions he makes are important.
The century closes with the beginning of some good experimental work in reflex action. Sir Gilbert Blane (1747-1834) on kittens, and Legallois (1770-1814) on rabbits redemonstrated the experiments Whytt had made on frogs, thereby proving that the cord in these animals could function as reflex centers for the corresponding parts of the body.48

In 1791, a new direction is given to physiological physics when Galvani theorizes that the animal body, particularly the nerves, is the seat of a peculiar and independent sort of electricity, probably secreted chiefly in the brain. He believed the inner substance of the nerves to consist of a very subtle and fluid lymph peculiarly adapted to conduct electricity, and this was enclosed in a non-conducting substance. This electricity was stored up in the muscles, to which the nerves were attached as conducting wires. The outer surface of the muscles was negative, the inner surface, where the electricity was accumulated, was positive. Motion was caused when this fluid was drawn from the interior to the exterior of the muscles along the nerves so that the cause of every contraction is like the discharge of a Kleist jar, the negative surface fibers of the muscles

48Ibid., P. 166.
being particularly irritable. Although Galvani's theory was not strictly in accordance with the facts he had observed, popular interest was aroused by it. Physiologists believed that the ancient idea of a vital force had become tangible. Physicians, influenced by Galvani's attempts to explain all sorts of nervous diseases, thought that no cure for any disease was impossible.\(^49\)

Volta, who was already an experienced electrician, demonstrated that the electricity which Galvani had at first observed came from metals, not the animal. Volta had the best of the argument, until Galvani found that when the sciatic nerve was brought into contact with the muscle, a contraction occurred without metals. Volta still insisted that the current was not pre-existent in the animal, but was developed by the contact of different fluids in the tissues.\(^50\)

With the excitement caused by the controversy, there arose a mass of speculations which again involved the subject of reflex action in lawless confusion. Even Alexander von Humboldt, as late as 1797, in spite of the experimental evidence of Whytt, uses two volumes\(^51\) in a most laborious

\(^{49}\)Ibid., p. 83.

\(^{50}\)Ibid., pp. 83-84.

\(^{51}\)Ibid., p. 167.
attempt to explain sympathy between different nerves by conduction and anastomoses, and proximity of origin of nerves, and by the fact that one nerve lies in the "sensible atmosphere" of another.

This confusion ends, and the modern history of the nervous system begins when Charles Bell demonstrates the law which bears his name. This law is simply, the posterior roots of the spinal nerves are sensory, and the anterior roots are motor. 52

Bell complained that the anatomists of his day had become disheartened by the seemingly irregular and lawless complexity of neural fibers. To those who knew the least, the prevailing theories seemed most ample and satisfactory; while those who studied the deepest and most fully only discovered error and confusion. What caused the confusion was this: no one could understand how the same small nerve could carry a motor impulse one way, and a sensory impulse the other, at the same time. 53

Bell was accused of dissecting brains to find the seat of the soul. He denies this in his first work on the subject,

52 Ibid., p. 342.

53 Ibid., p. 342.
stating that his only wish is to investigate the structure of the brain, as we examine the structure of the eye or ear.

Nowhere in this paper is the Law formally stated, but it is apparent that Bell understands many of the ideas which form the basis, for not only his Law, but also for the modern physiology of the nervous system. He says the following: "The nerves of motion, the nerves of sensation and the vital nerves are distinct throughout their whole course." 54

"The nerves which we trace in the body are not single nerves possessing various powers, but bundles of different nerves whose filaments are united for convenience in distribution; but which are distinct in office as they are in origin from the brain." 55

Here, Bell also outlines the theory of specific energy of nerves. "An impression made on two different nerves of sense, though with the same instrument, will produce two distinct sensations, and the ideas resulting will have their relation to the organs affected. Piercing the retina with a cataract needle gives a flash of light, and a blow

54 Ibid., p. 344.
55 Ibid., p. 344.
on the head makes the ears ring and the eye flash, but no sound or light are present. The effect depends on the part of the brain excited."\(^{56}\)

Given these conceptions, Bell sought to answer the following questions: Do the nerves of the trunk and limbs derive the ability to perform their functions from a combination of peculiar forces received from the different parts of the cord indicated by their double roots? Is this the reason why their course is simple or isolated as compared with the cerebral nerves? Which nerves of the head and face correspond in structure with those of the trunk? Bell was acquainted with the sensory and motor effect of irritating the anterior and posterior columns respectively. On this point he says: "I found that injury done to the anterior portion of the spinal marrow convulsed the animal more certainly than injury done to the posterior portion."\(^{57}\) Therefore, he was led to observe a corresponding difference of function for the roots. Further, he says: "On laying bare the roots of the spinal nerves, I found that I could cut across the posterior fasciculus of nerves, which takes its origin from

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\(^{56}\) Ibid., p. 344.

\(^{57}\) Ibid., p. 344.
the posterior portion of the spinal marrow, without
convulsing the muscles of the back; but that on touching
the anterior fasciculus with the point of the knife, the
muscles of the back were immediately convulsed.58

In a later paper,59 Bell lays down the principle
that complexity of nervous supply to an organ indicates a
corresponding complexity of function. An organ with but
a single nerve has but one function to perform; while the
tongue, for which he observed five distinct sources of
nervous supply, was employed in many ways. For a volun-
tary muscle he asserted the existence of a double nervous
supply, a nervous circle, one arc of which transmitted the
excitement of the brain to the muscle, the other carried
the sensation of the muscle to the brain. The proof of
this he sought in the fifth nerve, where besides direct
fibers to the muscle, there are also fibers which enter
the muscle after passing the ganglion of Gasseri. The
latter must be sensory nerves according to a fundamental
principle that Bell asserted, namely, that no motor nerve
was ever interrupted between its origin and its peripheral

58 Ibid., p. 345.
59 Ibid., p. 345.
end by ganglia. All nerves, he admits, may be divided into two classes, sensory and motor, but in view of the division of function and for convenience sake, he prefers to make a separate class for the respiratory nerves, that is, the nerves which coordinate the muscles for respiration, expression of emotion, etc.

It was the investigation of this class which led Bell to his great work upon the nerves of the face and chest, and this in turn brought to light many facts in support of his law. He performed experiments upon living animals to demonstrate his law to his own satisfaction, but his aversion to vivisection no doubt delayed a full comprehension of the scope of his discovery; nevertheless, an extended collection of observations confirmed it beyond all doubt, and he asserted its validity for each of the thirty-one pairs of nerves in man, as well as for all forms of lower vertebrates.60

From studying the effects of cutting the facial and then the maxillary nerve in asses and monkeys, Magendie (1783-1855) was led to sever anterior and posterior spinal roots, and he declared that he had at last established by direct experiments the difference between sensory or posterior, and

60Ibid., p. 345.
anterior, or motor fibers. In examining the body of a patient who had lost all power in his arms, while sensation in them remained intact, he found the anterior roots considerably decayed. This law he found to be valid along the entire length of the cord, from which Legallois had already proved the motor and sensory powers of all organs without exception to be derived, one part of its surface being extremely sensitive, the other motor. It might therefore be suggested that as one passes from the surface to the center of the cord, one would reach a secret sanctuary where sensation perhaps passes into motion. Magendie states that this is not the case, for touching the center of the cord produces neither sensation or motion. This paper was published as an entirely independent and original discovery. There is little doubt, however, that Bell deserves to be called the discoverer. From earlier papers of Bell it appears that he was filled with the idea that the difference of neural functions was grounded in anatomical differences; and there is not doubt that Bell's results, which his assistant demonstrated in Paris in 1821, had been seen by Magendie.

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61 Ibid., p. 346.

62 Ibid., p. 347.
Bell's discovery at once caused excitement on the continent. Many doubted the validity or universality of the Law. Of those who believed the Law to be true, some inquired further as to how the sensory and motor roots were distributed peripherally. The greater number of investigators, however, were led to study the functions of the various columns of the spinal cord to ascertain how far the distinction of sensory and motor roots could be traced.

Belingeri distinguished three pairs of columns in the spinal cord. The anterior pair were connected with the cerebrum, the posterior pair with the cerebellum. The lateral, restiform, and especially the ganglionated columns mediated organic and instinctive functions. The anterior roots were composed of fibers from each of these columns. So too were the posterior roots. Those fibers of the anterior roots which sprung from the anterior columns mediated voluntary motions, and the fibers of the posterior columns which sprung from the posterior horns of the grey substance were exclusively sensory. All fibers of whatever root, that took their rise from the posterior cerebellum columns innervated extension muscles, and those from the anterior columns innervated flexors. 

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Ibid., p. 347.
Schoeps, in 1827, concluded that mobility required more nerve force than sensibility, and that the former was more impaired by the section of the anterior root than by the section of the posterior, because the latter was feeble, smaller, and not able generally to move a limb. He grants that there is more mobility in the anterior columns and roots, and more sensibility in the posterior, but concludes from his experiments adversely to Bell's assertion of a complete division of function.\(^6\)

Much of this confusion is cleared up with the publication of Muller's *Physiologie* in 1834. It is Muller who is credited with establishing Bell's Law in Germany. One reason why previous investigators had found such difficulty and reached such conflicting results was that most of them had used warm blooded animals, the nerves of which, especially of the posterior roots, speedily lose their power and die in the course of the necessary operations. Another reason was that many of them had not clearly distinguished between reflex and direct stimulation, nor between the results of stimulating the peripheral or the central end of the sensory root. Muller used frogs for his experiments, and the large, accessible, and

\(^6\)Ibid., pp. 347-348.
persistently vital nerves made them especially suited for such studies. In his experiments, he compared the effects of stimulating the severed peripheral ends of each root. He discounted any clear distinction between anterior and posterior columns, either anatomically or functionally. He also discounted the idea that the outer or white substance mediated motion, and the grey central substance, sensation. He was inclined to regard the spinal cord as the common collective bundle of all the trunk nerves, rather than as a part of the central organ. Bell's theory, though ingenious, he thought had not been satisfactorily proved. His own method established it with simplicity and certainty. The results were confirmed by applying galvanic irritations to both roots. Panizza and Van Deen confirmed Bell's Law by new and manifold experiments.65

The work especially of Bell, Magendie, and Johannes Muller had made known, in a practical way, the anatomical components of the reflex action, namely, a centripetal and a centrifugal nerve with their portion of the spinal cord. When these components are known, the questions that occur are physiological and metaphysical ones. Namely, do the

65Ibid., pp. 349-349.
anatomical components operate on mechanical principles or not? and what part does consciousness or the soul play in this process? It is at this point where anatomy, physiology, and the study of consciousness overlap that the study of modern psychology begins. This is the topic of the next chapter.
CHAPTER III

THE REFLEX AND CONSCIOUSNESS

When the anatomical components of the reflex are finally identified, a new problem for investigation develops. This problem is: is the reflex a purely mechanical operation or is consciousness involved? As the investigation continues, a new question arises, namely, can consciousness be studied, using the methods of the physiologist? When this question is seriously attempted to be answered by Pavlov, we find a powerful inspiration for modern behaviorists.

Marshall Hall is the first to elaborate a mechanical theory of the reflex action. He argues for an excito-motor system that never sleeps, but constantly watches, day and night, with great, though not absolute independence from the brain, over all the openings of the body, and all the sexual and excretory passages. There is nothing whatever that can

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be called psychic connected with its activities. Hall gives some explanation of how the sensory irritation passes through the cord in being reflected outward into motor nerves, but he does not attach much weight to this point.²

Grainger thought he found in each spinal root a portion which turned upward toward the brain, and another portion which buried itself immediately in the cord. Spies, carrying the error further, assumed a direct connection of excitomotor fibers with each other.³

Volkmann objected to this on the ground that it was too complex, and he argued at length for a transmission of irritation from one nerve fiber to another.⁴ This may occur for all nerves, in the cord, in plexi, in ganglia, and in the brain, while the law of isolated conductivity holds for the peripheral nerves. Not only is reflex action thus explained, but all sympathetic movements and sensations, and even delirium, where a painful wound causes delirium without a fever, are accounted for. Even indistinct vision, and a

²Ibid., pp. 351-352.
³Ibid., p. 357.
⁴Ibid., pp. 355-357.
defective ear, may be due to the transmission of the irritation from the nerve previously affected to the others which lie near it.

Johannes Muller is credited with formulating the excito-motor hypothesis, but he repudiates this and shows that his view is distinct from that of Marshall Hall.

Muller maintains that it is by no means necessary that sensation should always accompany reflex action. According to him, the stimulation of a sensory spinal nerve causes a centripetal action of the nerve principle, which reaches the cord. If this can pass on to the sensorium commune, it becomes a conscious sensation. But if, on account of the spinal cord, it cannot reach the sensorium, it expends its entire force as a centripetal action upon the cord. In both cases reflex movements may result, in the first instance attended by conscious sensation, in the second, not. As many German physiologists were to do, Muller rejects Hall's hypothesis of specific excito-motor fibers.5

In 1847, Helmholtz, a teacher of Wundt's, publishes On the Conservation of Force. In this work he wanted to refute the theory of a vital force. In particular, he hoped

5Ibid., pp. 357-358.
to show that all physiological activities could be accounted for in terms of ordinary natural forces. He concluded, in this work, that all forces could ultimately be reduced to matter and motion.

Pfluger publishes *Die sensorischen Functionen des Ruchenmarks* in Berlin, in 1853. It is an able, though in many respects, difficult and obtuse work. In the preface, Pfluger states that consciousness is motion, and has no being. As such, it is part of the great life of the world. For Pfluger, consciousness exists only where central nerve substance is found. It is extended in space, and by whatever name it is called, whether sensorium or soul, it is divisible in all animals with its material substratum. After a short discussion of other views, recognizing especially Whytt, Prochaska, and Legallois as his predecessors, he proceeds to develop his theory of a spinal cord soul.

He then defines reflex action as the operation of that neuro-physic mechanism by means of which the peripheral sensory fiber, by whatever means excited, alters through the mediation of the spinal cord, the orginary state of excitation of definite motor nerves.\(^6\)

\(^6\)ibid., pp. 358-359.
The change that is therefore caused in the motor nerves may be of such a nature as to effect the shortening of the muscles, giving us a reflex contraction; or it may cause the muscle to relax, resulting in the phenomenon of reflex inhibition, or paralysis. These processes must be widely distinguished from those of sympathetic or irradiated sensations. These latter, Pfluger states, have been explained by some as occurring in the spinal ganglia, which act as imperfect conductors and arrest weak excitations, while stronger impulses spill over and stimulate neighboring fibers and are reflected outward according to the law of isolated conduction. This, however, is not sufficient, for sympathetic sensations arise in the nerves which pass no ganglia, for example, nasal tingling from looking at the sun, and in those which enter the cord remote from each other.

Pfluger believed that reflex action could best be studied in men, and after searching through a great number of cases of "reflex neuroses" from Germany, France, and England, he was led to formulate the following laws of reflex action:

\[7\text{Ibid., p. 359.}\]
I. Law of Unilateral Reflexes - If peripheral stimulation causes contraction in only one-half of the body, the contraction always occurs on the same side of the stimulus, and in general those muscles contract whose nerves arise from that segment of the cord, to which the irritated sensory nerve belongs.

II. Law of Reflex Symmetry - If the effects of stimulating a sensory nerve upon one side extend to the other side, only such motor fibers are called into activity as correspond with those which are already excited on the side of the stimulation.

III. Law of Unequal Contraction on the Two Sides - If the contraction is unequal on the two sides, the stronger reflex is always on the side of the stimulation.

IV. Law of Reflex Irradiation - (1) When stimulation of a cerebral nerve causes reflex contractions, the motor nerve concerned is invariably either in the same level as the sensory nerve, or it is further downward toward the medulla oblongata. (2) When stimulation of a spinal nerve causes reflex contractions beyond its own segment, irradiation always takes place toward the medulla oblongata.
V. The Law of the Three Locations of Reflex Contractions - Upon stimulation of a sensory nerve, reflexes can occur in only three parts of the body. These are: (1) At the level of the stimulated nerve; (2) In parts innervated from the medulla oblongata; (3) In the entire body.  

Finally, Pfluger argues that if the brain were the only organ of sensation, all sensory fibers must go to it and that after section of the cord an irritation of the upper surface of the section would cause sensation, which by the law of eccentric projection would seem to be located in all parts of the body below the section, while an irritation of its lower surface would cause contraction of all the voluntary muscles below the section. The fact is, however, that if the upper part of the cord be injured, the sensation of pain is located not in the legs, but in a band around the body. While if the cord could be gradually destroyed from above downward, instead of motions of all the parts at once, the muscles of the arms, breast, belly, thigh, etc., are successively stimulated. These facts go to prove that both 

8 Ibid., pp. 359-360.
9 Ibid., pp. 360-361.
motor and sensory nerves end in their respective levels of the spinal cord and not in the brain, which so many would make the sole organ of sensation and volition. Pfluger regards the brain as a reservoir of motor forces. The brain, by its instrumentality, can compare and otherwise express sensations (verbally, for example) while the cord can respond only by moving. Every motion, however, is probably not a certain index of the presence of the dull, undifferentiated sensations, which are assumed in the cord and which must rise above a certain threshold before motion can follow. Pfluger believes that none of the functions of the sensorium, extended through the cerebro-spinal system, are suspended during sleep, but that sensorial activity is reduced uniformly throughout.  

Lotze replies to Pfluger's theories, and he argues that the reflexes, and perhaps the lower forms of instinct are purely mechanical. He had argued for such a thesis earlier.  

Nature, he says, must lead the soul by the hand a little way into the strange land of space and matter. For each stimulus that breaks upon it from the outer world, a

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10 Ibid., p. 361.

11 Ibid., p. 361.
mechanism must be furnished ready-made to its use, which will respond with an appropriate movement, or the impulse to it. By this means, nature shows the immaterial, unspatial soul, by purely physical connections, what purposive movements to make. After the soul learns these elementary motions, it weaves them into ever richer and more complicated patterns; but, these elements themselves, it can neither invent or construct. They are like the letters of the alphabet or elementary sounds, which must first be learned, and which reason may then combine in countless ways into words and sentences, but do not alter in form or number.

Lotze repeats Pfluger's experiments and argues that the results are not due to intelligence or sensation present in the cord, but to the after effects of these. Acts of conscious will leave behind not only unconscious recollections, but also physical impressions in the organs of the central nervous system, and these latter, as well as the soul itself, are sufficient to account for Pfluger's findings. States which can be first caused by consciousness may actively persist as conditions of a substance after consciousness has vanished. By practice and training,

Ibid., p. 361.
a secondary character, which survives decapitation, is imparted to subordinate centers, giving the already complex apparatus possession of new associations between sensations, and motion. Lotze finally concludes that the experiments of Pfluger are too inconclusive to support the inferences drawn from them.13

It is in this milieu that modern psychology takes form. The trend in the history that I have presented thus far is obvious. Components have been identified. Immaterial or vital forces are being expelled. Laws are being discovered, and their validity is being checked, experimentally, by a number of independent investigators. A method of investigation which has led to spectacular results has evolved, and increasingly, the method becomes more important.

Wundt was born on August 16, 1832. He earned the degrees of Ph.D. and M.D. at Heidelberg, where for seventeen years, he was a lecturer in physiology.

In 1857, he was appointed Dozent at Heidelberg, and he began lecturing in physiology. Between 1858 and 1864, Wundt served as an assistant to Helmholz who had just arrived from Bonn.

13Ibid., pp. 362-363.
During these years, Wundt was very active in physiology. In 1858, he published a study of muscular movement and elasticity during action, in which he investigated the effect of constant galvanic current and mechanical and chemical stimuli upon the muscles. Not only was Wundt working in the field of physiology at this time, but a conception of psychology as a distinct science was beginning to emerge. Between 1858 and 1862, various sections of his *Beiträge zur Theorie der Sinneswahrnehmung* appeared. This volume so much anticipated further developments in Wundt's thinking, that Titchner, one of his greatest students, has argued that it contained the program of his life.¹⁴

In the introduction of this work, Wundt stresses the value of method as a means of scientific advance. He also cites apparatus advances, such as the laryngoscope and the ophthalmoscope, as a means of ushering in a whole new series of discoveries. Psychology, he continued, had not yet felt the impulse of the new empirical method being used all around it. It had asked metaphysical questions first, such as the essence of the soul, its origin, and its destination.

These are questions appropriate to where psychology may end, but not to where it should start. It must take the simplest experiences for its point of departure. Wundt presents evidence from work done with vision to support this premise, and one can see an attempt to utilize physiological methodology in dealing with psychological problems.

From 1867 on, Wundt gave a course at Heidelberg entitled Physiological Psychology. This date establishes the formal offering of an academic course of this nature. As he collected and refined his lecture notes over the next few years, a book took form. This was his Principles of Psychology. It is by general agreement, his most important book. The first half was published in 1873, and the second in 1874. Wundt's influence upon the development of psychology is well documented. G. S. Hall, James Cattell, and Titchner were all among his students at one time or another.

Ivan Pavlov was born September 14, 1849, in Ryazan, Russia. In 1870, he went to St. Petersburg and enrolled in the Faculty of Natural Science in the University of St. Petersburg. While there, he came under the influence

15 The reader is referred to this volume and the one mentioned earlier for a systematic account of Wundt's thought.
of Ilya Cyan. Cyan was a fine scientist with a European reputation. He was, by all accounts, a brilliant lecturer as professor of physiology. He was master of an exceptional experimental technique. Among his other accomplishments, Cyan (1876) wrote and published the first textbook on experimental physiological technique that was of first-rate quality.

Like Cyan, Pavlov was an exceptionally skilled operator. Speed, accuracy, and delicacy all characterized his surgical methods. In 1878, Pavlov was invited by Professor S. P. Botkin to take charge of the newly opened experimental laboratory connected with the clinic of the Medico-Chirurgical Academy.

Before going abroad to complete his studies, Pavlov completed his own experiments on the augmentor nerves of the heart. The investigation established an entirely new fact, namely that the various branches of the nerves of the heart, during stimulation by an induction current, are capable not only of accelerating the heartbeats, which was already known, but also of augmenting or diminishing their force. For the first time in a warm-blooded animal (the dog) it was determined that the heart exerts a dynamic as well as a rhythmic effect.
Pavlov was made a lecturer in physiology at the Military Medical Academy in 1884. In 1890, he received the chair of pharmacology in the Military Medical Academy, and in 1891, the directorship of the Department of Physiology in the Institute of Experimental Medicine. In 1895, Pavlov was appointed to the chair of physiology vacated by I. R. Tarkanov.

Pavlov's scientific work can be divided into roughly three periods. His earlier work dealt primarily with the regulation of blood circulation. The middle period of his work dealt with the investigation of the digestive glands. The last period of his work dealt with the investigation of conditioned reflexes. It is this latter period that is most important in the history of behavioral techniques.

Two other physiologists helped inspire Pavlov in his work with conditioned reflexes. The first is I. M. Sechenov. The second is J. Hughlings Jackson.

Sechenov was a remarkable Russian physiologist. By Pavlov's own admission, it was Sechenov's Reflexes of the Brain, which led him to study the psychic, higher nervous activity in animals by a purely physiological method.16

Sechenov's attempt to consider mental phenomena as physiological process was somewhat unusual. He published *Reflexes* as a journal article in 1863, and as a book in 1866. This was before Fritsch and Hitzin discovered the cortical motor centers, and before the experimental psychology of Wundt was widely known. Further, Sechenov could not look to the psychology of the fifties and sixties for help in his attempt to advance a reflex theory of the brain, for almost without exception, psychology of this period was still philosophical.

The basic idea of Sechenov's thinking is that the origin of all acts of conscious and unconscious life is the reflex. For Sechenov, all voluntary activity was composed of reflexes which begin with sensory excitation, continue by means of a definite psychical act, and end in definite muscular movements and again, a given stimulus inevitably leads to the two components of the whole phenomenon, and always in the same sense, granted that the external and internal conditions are the same, and that the physiological state of the person who is performing the action is unchanged. The final member of every voluntary act, i.e., the muscular movement, is identical with the action of muscles in pure reflexes, i.e., in elementary involuntary movements.
Sechenov argues as follows: "All the endless diversity of the external manifestations of the activity of the brain can finally be regarded as one phenomenon—that of muscular movement. . . .everywhere the final manifestation is muscular movement." 17

The origin of every involuntary movement simple or complicated, inborn or learned, is the excitation of the sensory nerve. A sensory stimulation, external or internal, may or may not call forth a conscious sensation.

The possibility of frequent repetition of involuntary muscular movement presupposes the existence of definite mechanisms in the body, inborn or acquired by learning. This mechanism consists of sensory and motor nerves with their center in the central nervous system. Along these paths, a reflex is transmitted from the endings of a sensory nerve to the muscle. 18

What is true of involuntary movement is true of voluntary: here, too, in spite of the seeming independence of a voluntary movement from a sensory stimulation, voluntary movement may also be looked upon as machine-like. To prove


18 Ibid., p. 290.
this assertion, Sechenov discusses the formation in a child of various associations of gradually increasing complexity which become the basis for corresponding images. The mechanism for the formation of these associations is purely reflex. For example, if a child touches a bell, the muscular and tactile sensations produced by this act, together with the visual impressions, are accompanied by stimulation of the acoustic nerve and the sensation of sound. If the process of ringing a bell is repeated often, the child begins to recognize the bell not only by its sound, but also by its appearance. The consecutive series of reflexes, Sechenov contends, gives a complete idea of the object.\textsuperscript{19}

When a child has received a concrete impression of some object, he is able to produce an analysis of it. This is a process of disintegrating a concrete impression into its elements. Owing to the properties of the retina and the eye muscles, the child is able to discriminate among different elements of an object, and later, when vision becomes more acute, among finer elements.\textsuperscript{20}

A child's differentiation between various sensations, which he receives from his body and those derived from

\textsuperscript{19}Ibid., p. 297.

\textsuperscript{20}Ibid., p. 299.
external objects, forms the basis of self-consciousness. This process is based on some complex reflex processes.\textsuperscript{21}

The capacity to reproduce sensations is based on memory and has much to do with the aftereffects of stimulation of the sensory nerves.

The most complex association is nothing more than an interrupted series of contacts of the end of every preceding reflex with the beginning of the following one. The merest hint of any part of an association results in the reproduction of the entire association. That is, its nature is that of the reflex.

In most cases, a reflex ends in the contraction of a group of muscles or in a movement of the whole body. However, there are reflexes in which inhibition is the end of the arc and movement is absent. The capacity to inhibit movement is the property of the central nervous system. The arrest of a movement is not due to the contraction of the antagonistic muscles, but to a mechanism acting in the central nervous system. This is Sechenov’s notion of central inhibition of reflexes.\textsuperscript{22}

\textsuperscript{21}Ibid., p. 304.

\textsuperscript{22}Ibid., p. 312.
Sechenov attached great importance to the notion of central inhibition of the motor reflexes. He believed that to such reflexes, in which the last member of the reflex action, for example, movement, was inhibited, man owed his capacities to think, deliberate, and judge.\(^2^3\)

Sechenov asserts that emotions and passions are psychic reflexes, the end of which is augmented. The origin of an emotion lies in the instinctive craving to satisfy the senses, and an emotion arises owing to the frequent repetition of the psychic reflex. That is, an emotion is induced by an external stimulation. However, the emotional state, which grows at first with repetition of the stimulation, diminishes or even vanishes after many repetitions.

The stimulation of all forms of human mental activity depends on the impressions which our organs of sense receive from outside or from the inner parts of the body. If the impulses from the organs of sense do not reach the central nervous system, psychic life is destroyed.

Sechenov regarded his conception of mental life as a hypothesis. He wrote: "My teaching is a pure hypothesis as

\(^{2^3}\)Ibid., p. 326.
far as the presence in man of three separate mechanisms
directing the phenomena of conscious and unconscious life
is concerned. (That is, the mechanism of pure reflex, and
those of reflex inhibition and augmentation.)"24

Sechenov states his hypothesis as follows: "Under
similar external and internal conditions, man must act in
the same way. The choice of one of many possible ends of
the same psychical reflex is definitely impossible, and its
apparent possibility is only an illusion of our conscious­
ness. . . . The real cause of every human activity lies outside
man."25

What is important for Pavlov, in the theory of Sechenov,
is that mental activity is expressed in the form of movement.
That is, at the foundation of mental processes is the well­
known phenomenon of reflex action. Therefore, it may be
possible to study mental phenomena using physiological
methods. Sechenov never attempted this, but this is exactly
what Pavlov attempted to do.

Sechenov was not the only scientist who was thinking in
this manner. J. Hughlings Jackson (1843-1911) was one of the
outstanding neurologists of the time, and his interpretation

24Ibid., p. 333.

25Ibid., pp. 333-334.
of the brain activity had much in common with Sechenov's. Both believed that the activity of the nervous system was based on reflex action, but neither had materialistic conceptions of mental phenomena. The conceptions of Sechenov and Jackson are indicative of a trend among physiologists toward the end of the nineteenth century. More physiologists were thinking in terms of a purely physiological interpretation of the functions of the brain, and in terms of a unification of physiology and psychology. Although these men admitted that mental phenomena were a different order than physiological phenomena, they believed that the former were controlled by and based on the latter. It is in this milieu that Pavlov works. His investigations are a continuation of the work of Sechenov, and conditioned reflexes are a logical sequel to the teaching of Sechenov.

In the preface to Twenty Years, Pavlov says the following:

More than twenty years ago I independently began these experiments, passing to them from my former physiological work. I entered this field under the influence of a powerful laboratory impression. For many years previous, I had been working on the digestive glands. I had studied carefully and in detail all the conditions of their activity. Naturally I could not leave them without considering the so-called psychical stimulation of the salivary glands, i.e., the flow of saliva in the hungry animal or person at the sight of food or during talk about it or even at the thought of it. Furthermore,
I had demonstrated myself a psychical excitation of the gastric glands. I began to investigate a psychic secretion with my collaborators, Dr. Wolfson and Dr. Snarsky. Wolfson collected new and important facts on the subject; Snarsky, on the other hand, undertook to analyze the internal mechanism of the stimulation from a subjective point of view, i.e., he assumed that the internal world of the dog is analogous to ours. We were now brought face to face with a situation which had no precedent in our laboratory. In our explanation of this internal world, we diverged along two opposite paths. New experiments did not bring us into agreement nor produce conclusive results, in spite of the usual laboratory procedure, according to which new experiments undertaken by mutual consent are generally decisive. Snarsky clung to his subjective explanation of the phenomena, but I, putting aside fantasy and seeing the scientific barrenness of such a solution, began to seek for another exit from this difficult position. After persistent deliberation, after a considerable mental conflict, I decided finally in regard of the so-called psychical stimulation and to maintain the role of a pure physiologist, i.e., an objective external observer and experimenter, having to do exclusively with external phenomena and their relations.26

In studying this psychic secretion as a physiologist, Pavlov found that the cerebral cortex played an important role. The object does not act by its essential properties on the appropriate receptive surface of the body (for example, in the case of food, on the mucous membrane of the mouth cavity) but acts on the other receptive surfaces:

26Pavlov-Gnatt, Twenty Years of the Higher Nervous Activity (Behavior) of Animals (Leningrad, 1928), p. 37.
(eye, nose, ear) by its unessential properties such as sight, color, smell, or sound. The participation of the central nervous system is essential for the display of the psychic secretion. The removal of the cerebral cortex in animals almost always abolishes these reactions.

The next problem about the psychic secretion was its origin. Was it inborn or acquired? The reaction of the salivary glands to food substances from the mouth cavity is inborn. However, the psychic secretion to food or an unpleasant substance is always acquired. This has been proved by many of Pavlov's students.

Pavlov, in his most famous experiments, offers proof that the ability of an animal to react to signaling stimuli is acquired during its life. In these experiments, any unrelated event in the outside world, or inside the animal could become a signaling stimulus. To achieve this, Pavlov let an indifferent stimulus such as light or sound coincide with the act of eating or the introduction into the mouth of an unpleasant substance. After several repetitions, the signaling stimulus alone elicited a positive or negative motor reaction. This was called an artificial conditioned reflex.⁷

Undoubtedly, this type of a reaction is of a reflex nature. Since special conditions were always necessary for the formation of a response, and since this reaction had the fundamental features of a reflex, Pavlov called it a conditioned reflex. For the formation of a conditioned reflex, it was necessary that the essential properties of a substance, like its taste, consistency, etc., act on the receptors in the mouth coincidentally with the stimulation of one of the other organs of sense.

Given the background presented thus far, and the results of his experiments, the only conclusion that Pavlov could come to was that the reaction of the salivary glands to food substances was in the nature of a reflex action. But to adopt such a physiological point of view, it was necessary to abandon the psychological approach, which was not compatible with the fundamental conceptions of physiology. All considerations about the feelings, wishes, and thoughts of an animal needed to be excluded from the experiments. Only physiological interpretation of observed facts could be permitted.

Pavlov is a physiologist, and he was interested in studying the activity of the brain, especially the functions of the cerebral cortex. But it is easy to see, that if the
wishes, feelings, and thoughts of animals are disregarded, and this method leads to fruitful investigation, should not the same or a similar procedure be used in studying men? This is exactly the course that B. F. Skinner follows.

Behavioral techniques, however, are developing independently of Pavlov in America. While Pavlov is still a student, the laboratory of Wundt is flourishing in Germany. Americans are traveling to Heidelberg to study under Wundt, while at home the years after the Civil War until the turn of the century are years of astonishing transformation. It is immediately following this transformation that behavioral techniques begin to develop in America, and it is necessary to understand this transformation, since it is in this milieu that behavioral techniques begin to develop in America.
CHAPTER IV

EFFICIENCY AND THE PUBLIC SCHOOLS

The Civil War marks a turning point in the history of America. Livestock states:

...while industrialization was well under way by 1860, its full implications were not apparent until after the Civil War. Statistics document the rapid transformation of the American economy in the post-war years: the augmented railroad systems criss-crossing the country, the increased output of iron and steel, the accelerated exploitation of natural resources, the multiplication of capital investments in industry, and the steady movement of foreign immigrants, Southern Negroes, and farmers (or their sons and daughters) into the cities and manufacturing centers. But indices of industrial growth cannot measure the full impact of industrialization, the ways in which it revolutionized American society, politics, religion, and industry, or the significant effect it had on the postwar generations. And statistics of production can only suggest the impact of industrial change on the producers: the laboring class.¹

Bottomore says of this period:

The decades following the Civil War were not an age of criticism, but one of exuberant optimism and of

prodigious industrial and geographic expansion. In this period American society was transformed and the conditions were established for a new surge of criticism which, in its essential features, has persisted to the present day. The yeoman farmer finally disappeared before the advance of commercial agriculture. The towns grew rapidly with the development of industry; in 1860, the rural population was twenty-five million, the urban population only six and one quarter of a million; by 1910, the rural population had doubled, but the urban population had multiplied almost seven times to nearly two million. . . The great trusts had come into existence, in railways, steel, banking, and the meat packing industry. . . In the 1880's, mass immigration began to supply the additional workers needed by industry and brought new and staggering problems in its wake; of education, poverty, and mis-government.

The character of this period of American history is indicated well by the intellectual pre-eminence which Herbert Spencer's social theory acquired. 2

In Social Darwinism and American Thought, Hoffstadter says the following about Spencer: "He maintained that among societies as among organisms, there is a struggle for existence. This struggle was once indispensable to social evolution, since it made possible successive consolidations of small groups into large ones and stimulated the earliest forms of social cooperation." 3


3 Hoffstadter, Social Darwinism In American Thought (Boston: Beacon Press, 1944), p. 42.
Further, in the same place, Hoffstadter states: "With its rapid expansion, its exploitative methods, its desperate competition, and its preemptory rejection of failure, post-bellum America was like a vast human caricature of the Darwinian struggle for existence and the survival of the fittest."\(^4\)

It is in this milieu that the first big push for efficiency in the public schools is born. Michael Callahan, by focusing on the plight of school administrators, documents this push.

Callahan contends that American Education from 1900 to 1925 is:

A story of opportunity lost and of the acceptance of educational administrators of an inappropriate philosophy. . . . For while schools everywhere reflect to some extent the culture of which they are a part and respond to forces of that culture, the American public schools, because of the nature of their pattern of organization, support, and control, were especially vulnerable and responded quickly to the strongest social forces. In this period as in the decades immediately preceding it, the most powerful force was industrialism—the application of mechanical power to the production of goods—and along with that the economic philosophy of the free enterprise, capitalistic system under which industrialism developed in America.\(^5\)

\(^4\)Ibid., p. 44.

The push for efficiency in the schools must be seen as part of the reform movement of this period. This movement was an attempt by moderate men, not radicals, to cope with the problems which were produced by rapid industrialization. These problems are well-known. They are: centralization and concentration of industry and wealth; ruthless exploitation of workers, including women and children; a massive influx of immigrants into urban areas; and fear of the lower classes by the middle classes.

The year 1910 was a benchmark for the push for efficiency in the schools. It is in that year that Scientific Management comes to prominence.

The railroads of the Northeast had applied to the Commission for an increase in freight rates to compensate for higher wages granted to railroad workers in the spring of 1910. The merchants of the area opposed this action because it would increase shipping costs. The trade association, led by lawyer Louis Brandeis introduced as witnesses a number of engineers and industrial managers who testified that through the introduction of scientific management the railroads should be able to increase wages and lower costs. The impact of this testimony apparently was tremendous.  

Frederick W. Taylor is credited with being the originator of the scientific management system, and in his book

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6 Ibid., pp. 19-20.
The Principles of Scientific Management, he explains his system.

Production in most plants was below what it should be. The reasons for this low production were faulty management and malingering workers. There was always one best method for doing any particular job and this best method could be determined only through scientific study. (Here, Taylor is concerned with technique, not science. His system should more accurately be called technical management.)

According to Taylor, if the wasteful situation described above was to be eliminated, management needed to assert itself and assume new duties. They are: first, the development of a science for each element of a man's work, which would replace the old rule-of-thumb method. Second, management must scientifically select, teach, and develop the workman, whereas in the past, he chose his own work and trained himself as best he could. Third, management needed to heartily cooperate with the men so as to insure all of the work being done in accordance with the principles of science which have been developed. Fourth, management needed to realize that there is an almost equal division of work and responsibility between them and the workmen. Management needed to take over all the work for
which they are better fitted. In the past, almost all the work, and the greater part of the responsibility, was thrown on the workman.

According to Callahan, "The fourth duty was really the heart of the approach. It was a new role for management—an active role of analyzing, planning, and controlling the whole manufacturing process in detail... The workers equal division of the work was to do what he was told to do by management and his share of the responsibility was that responsibility to do what he was told."  

During the years 1911-1912, criticism against many institutions, especially those large, publically, supported ones, mounted, and in 1913, American educators wholeheartedly respond to that criticism. At a meeting of superintendents in Philadelphia in February, 1913, the superintendent at Newton, Massachusetts, Frank Spaulding, spoke.

Spaulding, in effect, advocated the dollar as educational criterion. Spaulding stated that there were important "products or results which could be measured and, the efficiency of schools in these respects can definitely be compared."  

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7 Ibid., p. 27.
8 Ibid., p. 69.
Spaulding really wanted an analysis of the school's budget.

By a study of local considerations he meant a study of per-pupil costs and pupil-recitation costs. His scientific determination of educational value turned out to be a determination of dollar value. His decisions on what should be taught were made not on educational, but on financial grounds... But this occasion was particularly unfortunate because it was presented to leading administrators from all over the nation by one of their leaders and because it clothed this business philosophy and practice with the mantle of science.9

Another effort to apply scientific management to education was made by Franklin Bobbitt. Bobbitt was an instructor in educational administration at the University of Chicago. His work on this subject appears in the Twelfth Yearbook of the National Society for the Study of Education. The gist of Bobbitt's argument is clear. In any cooperative effort, the tasks of management are always about the same. Bobbitt states:

In any organization, the directive and supervisory members must clearly define the ends toward which the organization strives... They must find the best methods of work, and they must enforce the use of these methods on the part of the workers. They must determine the qualifications necessary for the workers and see that each rises to the standard qualifications if possible; and when

9Ibid., p. 73.
impossible, see that he is separated from the organization. This requires direct or indirect responsibility for the preliminary training of the workers before service, and for keeping them up to standard qualifications during service. Directors and supervisors must keep the workers supplied with detailed instructions as to the work to be done, the standards to be reached, the methods to be employed, and the materials and appliances to be used. They must supply the workers with the necessary materials and appliances. They must place incentives before the worker in order to stimulate desirable effort. Whatever the nature or purpose of the organization, if it is an effective one, these are always the directive and supervisory tasks.¹⁰

Because of mounting criticism, and because of the trends towards specialization, and consolidation, American educators were forced to assume the role of the expert. This is true particularly among school administrators. In doing this, administrators either turned their attention to cost accounting, or to simple mechanical problems. The stage had now been set, and a mania for efficiency in the schools was the result. Before the mania had run its course, various efficiency procedures were applied to all aspects of learning. Efficiency bureaus manned by efficiency experts or engineers

were established in many large cities after 1911. Prominent professors of education made their services available as consultants. Efficiency measures were devised for the schools. School surveys, in which efficiency experts studied the schools and made recommendations to increase the efficiency were made. The notion of the school as a physical plant came into being between 1911-1925, and administrators worked to attain greater efficiency and economy through a more intensive use of the school plant. The Gary plan introduced an organizational scheme which could offer children special studies and still be economical. This was done by a departmentalized system in which children moved from room to room.

Callahan says:

. . . Perhaps the most important and, in consequence, the most far-reaching aspect of all this, was the change that occurred in the nature of the superintendency. Because of their position in the schools

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12 Ibid., p. 95.

13 Ibid., p. 99.

14 Ibid., p. 112.

15 Ibid., p. 126.

16 Ibid., p. 129.
and their vulnerability to public opinion and pressure, it was the superintendents who interpreted and applied scientific management, as well as other business methods, to education.

This was not, however, the only influence that steered administrators in the direction of increased efficiency. Administrators were subjected to strong influence pushing them in this direction from inside their own profession, through their training programs. The nature of the courses and programs that were established and of the work done by students (e.g., on doctoral dissertations) was determined to a considerable extent by men who were in the relatively secure shelter of the universities.

An important result was the transition of the position of superintendent of the schools, from educator to business manager.17

Here Callahan points out that even men who were relatively safe in the universities were caught up in the efficiency mania. Studies during this period reveal a profile of the type of man who endorsed this push for efficiency.

In 1899, Tyack and Cummings wanted to find out the social characteristics of school administrators. From the surveys of superintendents made by the American Association of School Administrators, and Frederick Bair's study of approximately eight hundred and fifty superintendents in 1934, a consistent, though sketchy and incomplete, portrait of the typical head administrator in school districts is

17 Ibid., pp. 141-181.
revealed. This administrator was a white male in his mid­forties, from a rural background. He rose from the ranks, as a teacher. His career was a lifelong one, devoted to service to the schools. In Bair's sample, almost all (98.5%) were native born. Ninety percent were of Anglo-Saxon background (half had ancestors who had immigrated before 1800). Ninety percent were church members. Almost all of them were Protestant. (Of the 823 who answered this question, only six had Roman Catholic fathers, and none were Jewish.) They were disproportionately Republican, and they were men of moderate to conservative philosophy.  

There is nothing new, of course, about this type of individual in America. This is the type of person Franklin addressed his proverbs to. What is significant is that a person such as this would need very little persuading in adopting a technological mind-set or ideology, which was what was occurring in America.

From the facts that have been presented thus far, I must disagree slightly with Callahan's assessment of the

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efficiency mania, which has occurred in the American public schools. What was occurring in America was the need felt by many Americans to somehow adapt to the dizzying transformation that had taken place, and was still occurring. That is, though Callahan was right in stressing the business philosophy in America, and its influence should not be underestimated, the problem now was how to efficiently organize and control this new, and in many instances, unrecognizable society. More will be said about the problem of adaptation in the following chapter. This is, however, a technological and bureaucratic problem, and Ellul and Weber are useful in understanding the notions of technology and bureaucracy.

Bateson found that the mind-set or world view of any culture may differ greatly from that of any other culture. Trobriand Islanders and Americans are not different because the latter are industrialized and the former are not. The difference lies in whether these cultures have a different view of the world. The difference does not develop on the basis of what the individual learns. The difference lies in the way the individual learns those activities which are basic to all cultures.
Benjamin Whorf in *Language, Thought, and Reality* makes precisely this point. Where a Navajo Indian, in his own language would say, "The tree greens me," and English speaking American would say, "The tree is green." The English speaking American would tend to see the world as an instrument to be manipulated. The Indian would be less likely to see the world instrumentally. Therefore, the notion of technology is a mind-set, if we follow Whorf and Bateson, and it is also an ideology, in the general sense, if we follow Mannheim, in *Ideology and Utopia*.

In *The Technological Society*, Jacques Ellul has identified this approach to the world. For Ellul, what is common to every technique, and what is most obvious, is that it is a method. That is, it is an orderly and systematic mode of operation. Because the mode of operation is orderly and systematic, planning is required in all technical operations. Chance, spontaneity, and, in fact, all other value criteria must be eliminated. Since the goal of those who opt for technology is the most efficient solution to any problem, human or physical, and the reasons for employing these will be quantifiable, and therefore unassailable, this must be the case.
Another important aspect of technology is that any solution to any problem must be rational, and increasingly, all areas of life must become rational. Mumford has noted this tendency with alarm, and Weber has pointed it out many times.

Ellul states further, that we should never be misled into believing that technology is concerned exclusively with machines or means of production. By merely considering psychic, intellectual, and economic techniques, we can see that this is the case.

Technique, for Ellul, knows no limits, in either time or space. It seeks, without any regard for morality, to extend itself wherever it can, and it seeks to transform all it comes into contact with, into technique.

Ellul identifies two particular characteristics of modern technique. These he calls automatism of technical choice, and technical self-augmentation. By automation he means:

. . . when everything has been measured and calculated mathematically so that the method which has been decided upon is satisfactory from the rational point of view, and when, from the practical point of view, the method is manifestly the most efficient of all those hitherto employed or those in competition with it, then the technical movement becomes self-directing.
The human being is no longer, in any sense, the agent of choice. He is a device for recording effects and results obtained by various techniques. He does not make a choice of complex, and in some way, human motives. He can decide only in favor of the technique that gives the maximum efficiency. But this is not a choice. A machine could effect the same operation.  

Ellul says that at the present time self-augmentation has two aspects.

Technique is being transformed and is progressing almost without decisive intervention by man. Modern men are so enthusiastic about technique, so assured of its superiority, so immersed in the technical milieu, that without exception they are oriented toward technical progress. Technical progress and human effort come to the same thing.

There is an automatic growth (that is, a growth which is not calculated, desired, or chosen) of everything which concerns technique. This applies even to men. Statistically, the number of scientists and technicians has doubled every decade for a century and a half. Apparently, this is a self-generating process. When a new technical form appears, it makes it possible and conditions a number of others.

This is precisely what has happened with psychology in America. It has generated a number of educational, technical forms. There is no conspiracy here. There is a self-augmentation of the areas of application.

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20 Ibid., pp. 55-86.
Finally, Ellul shows that in any technical operation, the skill and creativity of the worker must be diminished. This is unavoidable. If the method that has been decided upon is really the most efficient one, and if efficiency is the only value, the worker can do his job in one, and only one way. Nothing else is possible.

(This is an especially serious consequence for teachers. Teaching must rest on creativity and competence. If teaching must be defined in terms of technical considerations, then it will no longer be teaching. This is not to imply that if one rejects behavioral techniques, he will then be a good teacher. It is to suggest that behavioral technology can never make up for an original lack of talent, and that further, it offers an excuse and defense to the mediocre and talentless. In fact, this type of person will become an even worse teacher. Nothing else is possible.)

As the problem of efficiency in the schools illustrates, the organization of the schools in this new era, along technical lines, was occurring. One social manifestation of modern technology is the formation of a bureaucracy. This is, again exactly what was occurring in the public schools. The writings of Max Weber form the starting point in all discussions about the nature of modern bureaucracy, and if
one examines his notion concerning bureaucracy, the push for efficiency in the schools becomes more understandable.

For Weber, a bureaucracy cannot be irrational, because it functions in the following manner: In any bureaucracy there is the principle of jurisdictional areas that are governed by laws or administrative regulations. This means that the regular activities of the bureaucratic structure are assigned as official duties. The authority to give commands is distributed in a stable way and it is strictly limited by the rules placed at the disposal of officials. The fourth duty in Taylor's system of scientific management comes to mind here.

In a bureaucracy, methodical provision is made for the regular and continuous fulfillment of these duties and of the corresponding rights. Only persons who qualify under general rules are employed. Here, the work of Bobbitt comes to mind. This creates the bureaucratic specialist.

Of all the elements mentioned, calculable rules is the most important one for modern bureaucracy. According to Weber, the peculiarity of modern culture, and specifically of its technical and economic basis, demand this very calculability of results. When fully developed, bureaucracy also stands, in a specific sense, under the principle
of sine ira ac studio. Bureaucracy develops the more perfectly, the more it is dehumanized, the more completely it succeeds in eliminating from official business love, hatred and all purely personal, irrational, and emotional elements which escape calculation. This is appraised as its special virtue by capitalism.

Because a bureaucracy must become dehumanized to achieve its function, it can only deal with abstractions, never with people. People are individuals, and when they have problems, they have specific, unique problems. Bureaucracies can never deal with specific problems of any sort. In fact, some bureaucracies function so as to impede the solving of a problem.

What is significant in this discussion, is that while the terms of behavioral technology have a long and illustrious scientific history, some of the important problems that America faces at the turn of the century are being solved along technological and bureaucratic lines, and psychology, as it develops, will be another part of this ensemble of techniques. That is, though the terms come from science, specifically anatomy, science has really very little to do in the solving of these problems.
By eliminating all mental activity, thoughts, emotions, etc., behavioral technology eliminates that which is most essentially human, but again, this is not a conspiratorial act. Psychology, if it will be useful, must follow this course. The child-study movement, started by G. S. Hall, died because it did not follow this course. Strong historical developments in science, and the specific historical conditions in America at the turn of the century practically insure this. In fact, only a revolution of the most radical sort, which could have effected a total transformation of American society, could have permitted non-technical solutions. But it is an age of moderate men, with moderate reforms, and adaptation, not revolution, describes the era.
CHAPTER V

ADAPTATION AND THE EVOLUTION OF PSYCHOLOGY IN
AMERICAN EDUCATION

The individual is not by himself rational enough to accept what is necessary to the machines. He rebels too easily. He requires an agency to constrain him, and the state had to play this role—but the state now could not be the incoherent, powerless and arbitrary state of tradition. It had to be an effective state, equal to the functioning of the economic regime and in control of everything, to the end that machines that developed at random should become coherent.

It soon became evident that such external action was insufficient. A great effort was required of the individual, and this effort he could not make unless he was genuinely convinced, not merely constrained. He must be made to yield his heart and will, as he had yielded his body and brain. And so, the techniques of propaganda, education, and psychic manipulation came to reinforce the others. Without them, technique could not have been completely certain of its operation. To the degree that material technique became more precise, intellectual and psychic techniques became more necessary. By these means man acquired the conviction and strength needed to make the maximum utilization of the others. So the edifice was complete.¹

Given the historical background in the preceding chapter, and the quote above from Ellul, it is apparent that one of the most serious problems facing America at the turn of the century was the problem of adaptation. Because of reasons already stated, native Americans were living in a country which they no longer recognized. The myths which had sustained the country would continue to do so, but they were becoming farther and farther removed from reality.

One instance of this is Fredrick Jackson Turner's essay "The Significance of the Frontier in American History." In this piece, Turner asserted that the development of America differed from that of contemporary Europe, because of the vast amount of land that remained unoccupied. Americans not only believed in equality, but they had a vast area of unoccupied land with which they could maintain this equality. This land was always available in the region between the wilderness and the more settled districts. This transition area was the frontier, and its influence was potent. For the first hundred years of the Republic, no area remained frontier for long. As soon as the conquest was completed in one area, a new frontier appeared. So the man who failed in business, the numerous sons of a poor farmer, the laborer,
the tenant, etc., could always get a new start on the frontier. Land monopoly was impossible, and formation of a distinct industrial class was discouraged, because of the many opportunities. When depression threatened, it was the frontier that acted as a safety valve, by drawing off the rebellious elements.

By 1890, however, the Director of the Census claimed that the frontier had disappeared. This meant that the era of free land was over. Turner asks the question: if the existence of free land had helped to preserve democracy and equality, and if it had helped to prevent stratification, what do the years ahead hold, and by what new measures can the loss be compensated for? Turner had no answers, but the quote by Ellul which began this chapter is at least a partial answer.

The problem for immigrants, again, was one of adaptation. Hansen makes this point in The Immigrant in American History. Immigrants, for the most part, were very conservative. They hoped to become a part of America, and have a better life for themselves, and their families. It was usually in the second generation that liberalism appeared. This is clear if one looks at the reaction of the immigrant press concerning the Haymarket Square disorders in Chicago. Hansen says the following:
The immigrant press took prompt occasion to make clear that it desired no change through violence, or otherwise, in the existing system. The writers declared that the constitutional regime of liberty under law was just to all, rich and poor, native and foreigner, and that the absence of any government would only prepare the way for despotism. As further evidence of their attitude, mass meetings of Germans and Scandinavians condemned the traitors, who had cast an ill-deserved repute on all foreign-born, and affirmed their faith in things as they were. Immigrant church conventions also adopted solemn resolutions pledging loyalty to American ideals and approving the process which brought the offenders to justice.

The history of the next twenty-five years proves that such sentiments represented the general view.²

Israel Friedlaender points out this problem when he writes: "The general culture of the land stands before us like an iron wall, and we shall be cracked like a nutshell if we attempt to run our heads against it. The only solution left to us is that of adaptation, but an adaptation which shall sacrifice nothing that is essential to Judaism. . ."³

Lawrence Cremin says in The Transformation of the School:

Much of this undoubtedly would have continued had not Americanization become such a burning national issue. With the publication of the United States Immigration Commission's multivolume study in 1911, schoolmen, social workers, and government officials intensified their search for fresh


³Israel Friedlaender, Past and Present (Cincinnati, 1919), p. 12. Friedlaender had formulated his position as early as 1907 in an address "The Problem of Judaism in America."
solution to the problem. A 1913 conference sponsored by the North American Civic League for Immigrants heard a variety of speakers urge special approaches to English, Civics, etc., . . . . Schools were encouraged to transcend their traditional limitations, and become all-day neighborhood centers coordinating the larger work of Americanization.4

Gradually as Americanization became first a preparedness and then a war measure, a point of view crystallized that bore a strong resemblance to the settlement notion of socialized education. "The schools," argued one widely distributed pamphlet, "should be the wheel upon which all other activities may turn. This means that they will have to realize that education does not consist merely of 'book learning.'"5

Psychology in America was to play a part in the solution of this problem of adaptation; however, given the temper of the times, it needed to evolve into a more technical form before it could be useful. This is precisely what happened, and the evolution is reflected in the N.E.A. Proceedings, as seen in the changing attitudes of schoolmen towards psychology.

In 1900, in the N.E.A. Addresses and Proceedings, one writer says the following: "...the one thing needful in

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character study is the habit of continued and continuous observation. There can be few scientific investigators of human nature, or artistic painters of character, but there may be and must be many close and careful observers of things human and childlike. . . Life is not life if not continuous, and child study must be a process."

And, further in the same place: "Above all, let us not lose faith in this quiet and reverent study of character." In the first quote, with emphasis on process, we can notice the influence of Darwin. The psychology is of the functional variety. But further, it is obvious from these quotes, that the method of investigation being advocated here is a non-technical one. Anyone can make these observations, an expert is not needed. Observation is called for, but what kind of observation is never explicitly stated. Several important technical questions are never even addressed. Under what conditions should the observations be made? Which variables are to be controlled? What does the writer mean by character? Clearly, this is non-technical, functional psychology.

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6 N.E.A. Addresses and Proceedings, 1900, p. 583.

7 Ibid., p. 584.
In 1902, as reported in the N.E.A. Addresses and Proceedings, "What Aspects of Psychology and Child Study are Suitable Subjects for Instruction in Normal Schools," is the topic for a round-table discussion. On the panel are Putnam, Seerley, Salisbury, Lord, Green, and Keith. The following is from the published report of that discussion:

Physiological psychology and its near relative, experimental psychology, have properly large room in the laboratories of universities and other higher institutions, but only a limited place in the normal school. It is to be assumed that the students of a normal school have a tolerable acquaintance with the structure of the brain and the nervous system, and with their functions in general. Some additional instruction may appropriately be given on their special functions in connection with sensation and perception, with experiments requiring little, and in most cases, no apparatus at all.\(^8\)

And further, in the same place:

That aspect of psychology which treats the powers and processes of thinking should receive a large share of time and attention. . . . The processes embraced under this term are among the most important of the mental activities, and are, at the same time, very easily and readily understood provided they are not obscured or mystified by learned explanations and awe-inspiring terms.\(^9\)

The reaction of these educators is just short of hostility. The gist of their discussion is clear. Psychology has only a very limited role in the preparation of teachers.

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\(^8\) Ibid., 1902, p. 241.

\(^9\) Ibid., p. 241.
It must be of practical use to the every-day teacher. Experts and their problems are fine for the universities, but they usually only impede and confuse the every-day teacher.

In the same article, three reasons are given for including psychological studies in the normal school:

1. Studies which its students are expecting to teach.

2. Some studies which the student may not expect to teach, but a knowledge of which will be of great service in the presentation, explanation, and illustration of the branches which they do teach.

3. Studies, a knowledge of which gives the intending teacher a thorough insight into his own nature, into the nature of his pupils, into the nature of the processes of learning, and the correlative processes of teaching, and most of all into the springs of human conduct, and into the forces, motives, and influences which are most potent in molding and fashioning human character, and in giving right direction to human activities. . .10

Here again, the implication is clear. Teachers need psychology only if it can be of immediate use to them, and the present psychology of the universities is not very useful.

10Ibid., p. 240.
In 1903, Spaulding has an article published in the N.E.A. Addresses and Proceedings, under the Child Study section. Spaulding, as mentioned earlier, is one of the leaders in the mania for efficiency that hits American education. The title of his article is "The Teacher's Practical Application of the Results of the Child Study," and the article is a sign of things to come for Spaulding.

In it he says:

There are, then, two kinds of child study, with two kinds of results, each supremely important, but each the special function of a different class of workers. The one aims at generalizations which may be formulated on paper; truths which are generally valid anywhere. This may be called scientific child study, and belongs to the scientist. . . The other kind of child study begins and ends in the concrete. Facts concerning an individual child, here and today are the data. . .

Invaluable to the teacher as are the guidance and suggestion to be derived from the scientific generalizations of child study already well established, the limits of their applicability are soon reached. Most of the great, crude, fundamental facts in the life and environment of every child have never been seized and reduced to scientific formulae. But these facts the teacher must perceive, comprehend, and act upon. Teachers have no need of psychology. The successful teacher must be a practicing psychologist par excellence. I am inclined to agree that the teacher can profit little from the intricate and too often jejune machine studies of the psychological laboratory,
even less indeed than from some of the webs spun out of the introspective experience of the now scorned and ridiculed armchair metaphysician.

The message here could not be clearer. Teachers have no need for psychology, especially of the structural variety. It is the domain of university professors in ivory towers.

In 1904, an article appears in the N.E.A. entitled, "Typical Child Study Methods at the St. Louis Exhibit." The article is written by Monroe. With the luxury of hindsight it is easy to see why the child study movement failed in America. Monroe says:

The child study movement in the U. S. is less than twenty-five years old. It has passed thru various phases. From the first, the movement appealed to normal schools, colleges, and other institutions engaged in the training of teachers. These child study advocates have aimed to place prospective teachers in rapport with child life, and at the same time to give their student-teachers some scientific knowledge of the natural history of the child, and the factors conditioning its physical and psychical development.

Methods of child study have accordingly been developed to meet the needs of these various workers. President G. Stanley Hall, who initiated the child study movement in America, had made extensive use of the questionnaire method; and many of the normal schools and some of the colleges and universities have followed to a considerable extent the same general plan. . .

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11 Ibid., 1903, p. 764.

12 Ibid., 1904, p. 759.
A type of child study, which has to some extent employed the method of the laboratory, has been applied to certain specific problems touching the physical nature of children. The tests have been in the nature of measurements, and the investigations for the most part, have been under the direction of trained psychologists. The laws of conditioning growth; motor ability of children; eye, ear, and other sense defects; factors inducing fatigue—these are some of the problems more definitely studied by means of physical tests and measurements. Professor Edward Thorndike has lately urged that the same method must be applied to the measurement of mental traits of children. He says:

If we could make such adequate measures exhaustively, we could describe a man's mind as so many units of that emotional tendency, so many of this sense of power, and so on through a well-nigh interminable list of possible mental traits. We should then be able to state exactly the difference between any two human beings, between the conditions of any one before and after any course of study, or other educational influence; we could compare the results of different systems of education, describe the changes to maturity, or calculate the personal efficiency of different teachers.

Such laboratories for the experimental study of children are already in force at Chicago and Antwerp, Belgium.¹³

Here, in the N.E.A. literature, as early as 1904, we can see a shift beginning to take place, and it is not surprising that Thorndike, as America's first educational psychologist is in the vanguard. Here, it is clear that there is a branch of educational psychology, which is

developing, that is much more technical than anything that has hitherto been mentioned. Since the method of the laboratory will be employed, trained psychologists, that is, experts, will be needed to conduct the studies. Measurements need to be made, laws need to be stated, and results need to be interpreted. The result of all this, of course, will be to increase the efficiency of the teacher.

In the same year, in the same publication, an article by Kline, entitled, "Contributions of Zoological Psychology to Child Study" appears. Kline says:

Attention is briefly called however, to the fact that at about the beginning of the nineteenth century science forsook the unprofitable task of classifying and describing permanent entities, and instead undertook the stupendous problem of accounting for the endless variety of objects and occurrences in nature by the process of growth and differentiation controlled by the law of natural selection. Science sought to explain phenomena in terms of their genesis and causal relations. One of the first gigantic results of these methods as applied to life was the discovery of the facts of organic evolution and the forming of a theory adequate to their interpretation. The theory and the ever-growing storehouse of facts assert the kinship and continuity of all forms of life; that the manifold living forms of the present are descendants of a common, primitive, life-substance. . . . The reciprocal relations existing between these two forms of evolution impress upon us that the mental life of man and animals has a common root or origin, that there is kinship running thru (sic) all mental life, and that man is but the final link in a long chain binding the whole animal creation together.
Thus it comes about that zoological psychology and child study form two separate chapters in the great book of mental evolution. Their relations toward each other are reciprocal with perhaps the balance of trade to the credit of zoological psychology. The appearance of Darwin's name among those who have deemed the child worthy of study, suggests that the two subjects are closely related.\textsuperscript{14}

Zoological psychology has "brought instincts from the realms of mysticism to the ground plan of empirical observation."\textsuperscript{15} "It broadens the generalizations concerning the origin and composition of the emotions."\textsuperscript{16}

It "has increased the means for a more accurate determination of the relative values of heredity and environment on the human infant."\textsuperscript{17} "It exalts the individuality of childhood and indicates that progress is possible only by nurturing this individuality."\textsuperscript{18}

This is functional psychology that obviously comes from the findings of Darwin. Further, though never explicitly stated, this is a vigorous argument for species

\textsuperscript{14}Ibid., p. 776.
\textsuperscript{15}Ibid., pp. 776-777.
\textsuperscript{16}Ibid., p. 782.
\textsuperscript{17}Ibid., p. 782.
\textsuperscript{18}Ibid., p. 782.
equality. More importantly, the search for mind in animals is well under way, and it is a short step from here, to no mind at all. In fact, most of the elements for a behavioral technology are present in the preceding two articles. The only element that is missing is the rejection of the mind as suitable matter for investigation.

In another article in the same volume, by G. S. Hall, there are hints of the rejection of the mind as suitable matter for investigation. The article is entitled "Unsolved Problems of Child Study and The Method of Attack." Hall names as enemies of Child Study Froebel, Herbart, and finally, the epistemologist. He says:

The third and last enemy of child study is the epistemologist, who introspects thru (sic) his study window, and who will not even study his own college students, illustrates the apotheosis of a formalism almost utterly contentless. He has given us a psychology without a soul, a philosophy without an external world; a system that ostentatiously expels the muse of common sense and fears contact with life; that represents a pallid, refined, and in its way interesting type of mental individualism for want of blood and iron.19

This is most certainly an attack on the introspective, German type of psychology, which originates with Wundt. It is also an affirmation of the new functional psychology that is inspired by the findings of Darwin. But is is more than

19Ibid., p. 787.
that. If introspection is under attack, why not all mental activity? Why shouldn't something concrete, like behavior, be studied? That is, if the method is under attack, perhaps the content too should come under attack.

It is easy to see that at least since 1904 psychology has been a part of American education, and it is equally easy to see the direction in which it is heading.

In the N.E.A. Proceedings of 1905, Hall again presents an article entitled, "Child Study in the University and College." Here, he presents the requisites for a person who expects to do research in child study. He must be an expert. This is the chief requisite.\textsuperscript{20} This person must have a knowledge of French and German. He must understand the theory and construction of averages and graphic curves. He must understand simple apparatus for testing the eye, ear, and voice, and for making anthropometric curves and other hygienic and physiological tests usually found in a physiological laboratory.\textsuperscript{21}

Again, in the same article, Hall states that the "university study of children needs an expert in its literature."\textsuperscript{22}

\textsuperscript{20} N.E.A. Proceedings, 1905, pp. 710-711.
\textsuperscript{21} Ibid., p. 711.
\textsuperscript{22} Ibid., p. 712.
This is because the field has grown so large and complex that only an expert can adequately be familiar with all of its aspects.

In a startling article in the same volume, a Miss Tanner presents "The Relation of the Child's Development to Control Him." Miss Tanner states: "We take, then, an efficient social individual for our end, and when any problem of school discipline arises, the first question, and the only one of any importance is: What course of treatment will make this child more self-controlled and social in his ends?"  

Obviously control of students in American education is not a new idea. Neither is the aid which psychology can offer in this area. Miss Tanner deserves admiration. The problem that she talks about is one of adaptation, and the question that needs to be asked is, what treatment is the most efficient? One would like to know if there is a pathology implied in Miss Tanner's use of the word 'treatment.'

In 1908, Hall again presents an article entitled, "Recent Advances in Child Study." Here he contends that most scholarly and helpful papers that have attracted general attention or have exerted wide influence within the last few years, have been based upon genetic data, that is, upon empirical studies.

\[^{23}\text{Ibid.}, \text{p. 713}.\]
The study of juvenile crime had become a specialty. Even the study of the human soul is being revolutionized. Here, again, Hall calls for empirical studies, and a knowledge of genetics. This can only mean more specialization.


Here Hall states that:

Nothing in the history of education has contributed so much to make teaching professional and scientific as child study. Specialization in child study is already well-advanced and an aggressive and active campaign is being organized to extend the application of results and influence of child study.24

Here, as the technique becomes more developed, it seeks to extend itself, and turn everything else into technique, as Ellul points out.

In the same volume, Spaulding again presents an article entitled, "Child Study and School Organization and Administration."

Here Spaulding states: "The pedagogic lessons of most of the many invaluable studies of children are apparently for the teacher... rather than for the school administrator."25

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25 Ibid., p. 906.
And further:

Both the professional student of children and the teacher animated with the spirit and practicing the lessons of child study are inclined to regard the organization and administration of schools as necessary evils. Necessary they certainly are and always will be; evil they are and will continue to be, until we learn to make the influences or organization and administration minister positively to the welfare of the individual child. To learn how to do this, we must study the child from the standpoint and in light of the problems of the school administrator as we have thus far studied the child mainly from standpoint and in light of the teacher.²⁶

Spaulding makes explicit what he has in mind as he continues. "Taken as a practical guide, the fundamental purpose of making the most of every child. . .has a most profound effect, on every phase of the organization and administration of the schools.

This purpose established a rational and progressive standard by which to determine the amount of financial support to be given to education."²⁷

That is, some of the results of child study have been used to gain money. By 1910, the bureaucrats are co-opting the child study movement, and the evolution towards a more

²⁶Ibid., pp. 906-907.

²⁷Ibid., pp. 907-908.
technical form of psychology is well under way. Further, we can see the change in Spaulding's thinking. He has moved from teachers have no need of psychology to child study (psychology) may be a valuable tool for administrators, provided the emphasis is shifted. Actually, as can be seen from the data presented thus far, it is not so much Spaulding's thought as it is the evolution of psychology, that is responsible for this apparent shift. The findings of psychology can now be used as a standard for dollars. This is only possible if it can present something concrete. Spaulding's address signals the end of the child study movement. By 1913, the child study section of the N.E.A. has evolved into the section of Child Hygiene.

In the 1914 N.E.A. Proceedings, Edward Thorndike presents "The Foundations of Educational Achievement." It is approximately one year after Watson is credited with founding the behavioral school of psychology. The year 1910 marks the beginning of the mania for efficiency in the schools, and by 1914 it has gathered considerable momentum. Americanization is a national issue.

Thorndike says the following in his article:
What you wish, I judge, is that, as a representative of educational psychology, I should report any contribution that recent psychology has to offer to your work of making schools more efficient--of increasing educational achievement.

There is such a contribution, and, as I hope to convince you, an important one in the general view of human nature which recent studies of human thought and action support.

About fifteen years ago the point of view of students of human nature showed the first clear signs of what had been a rather abrupt change toward thinking of a man's mind as the sum total of connections between the situations which life offers and the responses which the man makes. Up till then the mind had been thought of primarily as a set of magical faculties or powers--attention, inference, memory, reasoning, choice, and the like--or as a collection of certain contents--sensations, images, thoughts, volitions, and the like. Today the progressives in psychology think of a man's mind as the organized system of collections or bonds or associations, whereby he responds or reacts by this or that thought or feelings or act to each of the millions of situations or circumstances or events that befall him. Their customary name for the mind is the connection system; their ideal of psychology is a science which can predict what any given situation or stimulus will connect with or evoke in the way of thought, feeling, word, or deed, in any given man; their offering to education is an offering of knowledge of the laws whereby connections in thought and behavior are made and broken, are preserved and weakened, and are of help and hindrance one to another.

From this point of view educational achievement consists, not in strengthening mystical general powers of the mind, but in establishing connections, binding appropriate responses to life's situations, "training the pupil to behavior" (behavior being the term we use for every possible reaction on the
circumstances into which he may find himself brought), building up a hierarchy of habits, strengthening and weakening whereby one thing leads to another in a man's life. 28

This is behavioral technology. The terms are somewhat different than those currently in vogue. Because Thorndike thinks that this technology can adequately deal with some mental processes, the scope is broader, the optimism is more ambitious, but this is behavioral technology. Thorndike is addressing the Superintendents at the 1914 convention, and the evolution I have been speaking about concerning psychology is almost complete. Thorndike continues:

The first suggestion resulting is the obvious and simple but profitable one that nothing is achieved by schools unless some connection is influenced, that we cannot assume change in any pupil unless bonds have been made or broken so as to cause him to respond as he did not before. . . But if anything is achieved, some actual connection or bond has been made, strengthened, weakened, or broken. . . learning is connecting. It never becomes so spiritual, so general, so involved as to evade expression in terms of concrete couplings between real happenings to a man and real responses by him. Of any educational achievement that does evade such expression, we should be suspicious. Probably its only existence is in our hopes and fears. 29

Thus, learning can be measured, and any learning that cannot be measured in concrete terms probably is not learning.


29 Ibid., p. 200.
This is arrogance fueled by certainty, which seeks to rob life of its existential richness. Thorndike continues:

What bonds are formed, what is being put with what in the pupils experience, then becomes a fundamental question concerning school achievement. It is of course the old, old question of what knowledge, what habits, what interests, what skill, what ideals are being taught, but put so as to encourage real rather than vague, answers. We need to ask it. For this point of view protects us against careless omissions and mistakes.  

But Thorndike never really asks this question in this article. The examples that he gives are so trivial as to be meaningless, in terms of the question that he poses. He never asks this question, because there is really no need to. The answer is contained in what he has said thus far. Since there are "laws whereby connections in thought and behavior are made or broken, etc." an expert is needed to discover these laws. He, the expert, since he is privy to this information, will decide what is to be taught. What else can one infer from what Thorndike has said thus far. He continues:

I turn now to a second fundamental principle for school achievement, the order of formation of the connections. The bonds to be formed, having been chosen, the next step is to arrange for their most

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economical order of formation—to arrange to have each help the others as much as possible, or, as we psychologists say, to get the maximum of facilitation and minimum of inhibition.

You have heard so many discussions and read so many treatises concerning the sequence of topics, the correlation of studies, and the like, that you perhaps shrink from re-examining a minute inventory of all school work and reconsidering its best possible arrangement as a system or hierarchy of connections to be formed, each with the interests of all the others in view. It must, indeed, be admitted that the work is long and also tedious, unless one has a scientific interest in minute matters of educational efficiency and in principles whereby to adjudicate them. It is, however, important, for economy in educational achievement means that we form the most desirable connections in the most useful order. And it is needed; for in spite of the very great advance of the past hundred years, textbooks and courses of study still follow more traditional customs or the order which happens to appeal to some individual expositor.31

Here, again, the message is clear. If efficiency and economy are desired in education, then the expert must be used to determine the educational program. Tradition, custom, or talent of an individual expositor will not do. Again, this is typical of a technician.

Curiously, Thorndike seems to negate most of what he says at the end of the article in his discussion of human nature. He cannot go all the way and say finally, that the technique, regardless of the needs or feelings of the pupils,  

or knowledge, in disregard of crude forms of courage, zeal, kindness, or intelligence, is enough. Still, as early as 1914, the evolution of a behavioral technology is clearly a part of American education, and Thorndike is asking that this technology be accepted in the public schools.

In 1916, Harrison presents "Modern Psychology in Its Relation to Discipline." There he says:

All changes produced happen in accordance with certain fundamental laws of change, and reason finds the aim of human life the improvement and satisfaction of wants. These laws are: First, the law of exercise. Other things being equal, exercise strengthens the bond between stimulus and response.

This stimulus-response concept is the pivot and core of all modern educational psychology, and Thorndike feels that original satisfiers and annoyers are the greatest levers education has at its command for redirecting, modifying, and eliminating original nature.  

Here, even the jargon is beginning to sound familiar.

If what Harrison says is true, then what need to be discovered utilized, and measured, are these original satisfiers and annoyers. The emphasis shifts further from the psychic activity of the student. Further, this is very close to the modern notion of positive and negative reinforcement.

Again, in 1917, the problem of adaptation is mentioned, but now it is the curricula that needs to be adaptable. Hunter says:

The slogan of the new spirit of education is adaptation to individual needs. The curricula of the schools must be adaptable, thought out in terms of service to various groups; the units of organization must be flexible, adapting themselves to the needs of different communities, different types of children, and various ends to be sought in education. The efficient system is the one which embodies this principle in its working program.33

We have seen such a program developed recently. The S.R.A. reading series is a perfect example of this. With Hunter's emphasis on efficiency, we can only conclude that this is what he has in mind. That is, the system which can help the greatest number of people adapt is the most efficient one.

In 1918, A. H. Sutherland, a school psychologist from Los Angeles, presents, "The Practical Value of Psychological Tests--Do They Find the Bright and Dull Pupils." The fact that a new class of workers has developed, namely school psychologists, illustrates how far the position of schoolmen has shifted. From Spaulding's "teachers have no need of psychology" in 1903 to the presentation of an article by a school psychologist in 1918, we can see a remarkable change in attitudes.

In 1921, Judd presents, "An Analysis of Learning Processes and Specific Teaching." Here he says: "This will be the era of analysis and of specific teaching. No longer content to merely measure results, we shall try to understand results and consciously produce better results by dealing with causes." Further in the same place, Judd explains what he means. "The cycle of evolution will then be as follows: first, the test to show the present condition; second, intensive analysis to explain; third, experimentation to improve the situation; fourth, more tests; fifth, more analysis, and so on." 

Compare this with the program in Designing for Effective Instruction, a manual for implementing a behavioral technology in the classroom, which was published in 1970. The titles of chapters there are as follows: "Unit 6, Determining Entery Levels; Unit 7, Entery Level tests; Unit 8, Stimulus and Response; Unit 9, One-Way and Two-Way Stimulus-Response Pairs Single and Multiple Discrimination. Unit 10, Content Analysis; Unit 11, Stimulus-Response Pairs in Chain Activities. Unit 12, Influence of Objectives on Content; Unit 13, Developing Objectives and Deriving Content; Unit 14, Programmed Lesson Plans and Instructional Media; Unit 15, Validation.

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34N.E.A. Proceedings, 1921, p. 783.
35Ibid., p. 784.
This sounds like essentially the same program that Judd advocates forty-nine years earlier. The jargon is more prolific, and the use of terms that have scientific history (for example, stimulus-response) is more pronounced, but the program sounds essentially the same. More fragmentation, another characteristic of technique is more apparent in the later version.

After the war, and during the twenties, interest in behavioral technology, according to the literature that I have been studying, seems to slacken. This is to be expected, since the rise in interest seems to coincide with the efficiency movement. When enthusiasm diminishes for the efficiency movement one would expect a similar lack of enthusiasm for behavioral technology, and this is what happens. But there is another reason why interest is not reflected in the N.E.A. Proceedings. By 1925, educational psychology of a behavioral nature is a fact of American education. It had produced its first great proponent, Thorndike. Its first department had been established some twenty years earlier at prestigious Teachers College, by Thorndike. Its own journals had developed, and publications continue in these. Specialization is well-advanced, and many aspects of educational psychology are of interest only to experts. That is, by 1925, educational psychology has become a small, closed, domain of experts.
There is probably a third reason for this lack of enthusiasm. By 1925, the problem of adaptation was not as serious as it had been. Except for the farmers and some minorities, many people were prosperous and the mood of the country was optimistic. In 1921, Congress began to pass a series of laws to restrict the number of immigrants, especially those from central and eastern Europe. The new laws permitted each nation to send three percent of the number of persons of that nationality who were living in this country in 1910. The Johnson bill, which was passed by Congress in 1924, reduced the quota to two percent and took the year 1890, instead of 1910 as the basis for determining the quota. The two percent quota was only a temporary one. The Johnson bill provided that a study be made to show the nationalities of the people who lived in American in 1920. This number would be the basis for future immigration. Only about 150,000 immigrants would be admitted in any one year, hereafter.

The problem of adaptation in an advanced technological society such as the United States is never really absent. It is, however, more or less acute, and when it is more acute, it is to be expected that all techniques which facilitate adaptation, including behavioral techniques, will
be more popular. This is only common sense. Since one
segment of our society is made up of technicians, and since
practically everyone else is convinced of the necessity and
superiority of technology. When a serious problem is
encountered a technical solution will be advanced by the
technicians.

This is again reflected in the Yearbook of 1932, for
the Department of Superintendence. In 1932, the country
is in the middle of the worst depression of its history.

In the introduction of this journal, "the greatest
moral problem of the age--the task of achieving a modicum
of control over a changing society..." is stated. The
mood of the country is revolutionary, or at least it is
perceived in this way by some American leaders. Tugwell is
trying to explain to Roosevelt the necessity of a planned
economy. Hoover gives McArthur his head, in dealing with
the veterans demonstration in Washington, and the violence
that ensues enrages the nation. Everything in the country,
capital, labor, production is frozen. Again the problem of
adaptation is more acute.

The 1932 Yearbook has for its topic, Character Education,
and on page fifty-nine one of the objectives of character
education is stated. Character education is ". . .the dis-
covery or creation of a way of living which concerns and
produces as many values as possible over as long a time as possible. Character education is the facilitation of this way of life." Again, the myths that sustain the country are even further removed from reality than they were thirty-two years earlier. Values are eroding. Families are being fragmented. New myths, or fresh evidence for old ones, must be found.

Later in the journal, the pros and cons of character development as the behaviorist views it are presented. "The objection is that the form of the description to which it confines itself is not adequate to cover the entire range of human behavior and what lies back of it." Then the validity of a behavioral approach and its application to character development is presented.

But while it is not the whole of character or personality development, emotional conditioning does determine a great deal of one's attitudes toward persons, things, and ideas, and is responsible for a large part of one's outlook on life. Conditioning is therefore a process which may be employed by the teacher or parent to build attitudes in the child and predispose him to the actions by which these attitudes are expressed. Fear, anger, and love, or more complex forms of these emotions, may be attached to particular objects by associating these objects with those which already arouse the emotions. It is perhaps still more important to avoid the mistake of defeating our own ends by unwittingly attaching unfavorable attitudes toward actions which we wish the child to learn.  

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37 N.E.A. Tenth Yearbook of the Department of Superintendence, 1932, p. 65.
38 Ibid., p. 65.
In Chapter Five of this yearbook, research related to character education is presented, and almost all of the studies are of a technical nature. A large part of it relies on behavioral technology. That is, even before Skinner writes, behavioral technology is a significant part of American education.

Study No. 1 deals with "Behavior Frequency Tests." Study No. 2 is "An Appraisal of Behavior Changes in Boys at Camp Alimek." Study No. 3 is a "Report on the Use of Parent Information Blanks and Judging Camp Results Blank in Camps During the 1929 Season." The purpose of this study was to ascertain changes in behavior brought about by a boy's camp as judged by parents. Study No. 5 deals with "Camping and Character." The purpose of this study is to eliminate undesirable behavior. Study No. 9 is "Positive vs. Negative Instruction." This is an experimental study of the effects of various types of instruction on behavior. Correlational studies are then presented. Study No. 11 is "Causes for Discharge." (They mean firing an employee.) Here we find, surprisingly, that in the middle of the largest economic disaster of the country's history, which may have ultimately been caused by such a massively unequal distribution of wealth, that nearly twice as many workers are discharged for moral
shortcomings or defects of character, as for lack of ability to do the work. Study No. 13 is "A Statistical Study of Character." Study No. 14 is "Personality as Revealed by Mental Test Scores and by School Grades." Study No. 16 is "The Consistency of Certain Extrovert-Introvert Behavior Patterns in Fifty-One Problem Boys." Study No. 17 "Studies in the Nature of Character," undertaken by Teachers College at the request of the Institute of Social and Religious Research. Its chief contribution is the development of certain techniques for measuring deception, service, persistence, inhibition, moral knowledge, and reputation. Study No. 18 is "Untruthfulness in Children. Its Conditioning Factors and Its Setting in Child Nature." Study No. 20 is "Geschwisterschaft, Schultuchligkeit, and Charakter." Here the number of children of each sex in the family and chronological position of the given individual among siblings were compared on the basis of simple averages with four behavior manifestations. Study No. 23 is "Bible information in Relation to Character and Conduct." Here five Bible information tests were used, in conjunction with eight tests by Hartshorne and May, for measuring conduct in cheating, lying, class loyalty, and altruism.
Part II of Chapter Five is entitled "Studies in Delinquency" and the nature of the research presented is similar to that which was presented in the first part. The title, however, clearly implies a problem in adaptations. Study No. 25 is "Changing the Delinquent Attitude." Study No. 28 is "A Problem in Social Adjustment." Study No. 34 is "Motivation of Conduct Disorders in Boys." This study was made in order to get an idea of the causes motivating behavior problems in children. The most frequent cause of difficulty was found to be the desire to avoid anything unpleasant.

Part III of Chapter Five is entitled "Studies in Personality Adjustment," and the nature of the research is still the same. Study No. 44 is "The Conditioned Reflexes and Children's Neuroses." Krasnogorski is the investigator. On Page 124 it is stated: "Krasnogorski's laboratory touches the problem of personality adjustment in quite another fashion. He shows that nervous children, given too difficult a task go to pieces..." This breakdown of a wide range of character because of failure is one limited area is familiar to parents and teachers, but has not been sufficiently stressed. Pavlov is one of the experimenters who has demonstrated this same reaction in dogs. (Of course, Pavlov would never speak
of a breakdown in character in dogs. However, given the historical circumstances, we can see why these words are chosen. If people cannot adapt effectively, then it must be due to some character flaw; they may be too nervous; or it must be due to some variable in the environment which can be controlled.) Study No. 46 is "Nervous System, Aschuer's Symptom, and Behavior of Children." It is a reflexological study of bisocial groups of children.

Part IV of Chapter Five is entitled "Studies of Attitudes, Opinions, and Prejudices." The nature of the research is the same as that presented in the other three sections. Again, when compared with the attitudes of schoolmen around the turn of the century, it is easy to see the transformation which has occurred. Of course, by 1932, Pavlov's work is known by psychologists throughout the world, and they are optimistic about his results. Perhaps the study of psychic phenomena can be based on physiological models, and psychology will become truly scientific. Pavlov's influence is apparent throughout this volume.

What is significant, is that since at least 1914, behavioral technology has been a part of American education, and by 1932, its influence is apparent. All of this occurs before Skinner publishes, and it is no surprise when in the late
sixties and early seventies Skinner and his brand of behavioral psychology become very popular. The problem of adaptation is serious, and there is a history of the use of behavioral technology in such times.
CHAPTER VI
CONCLUSION

"The basic task of research in the sociology of knowledge," Mannheim says, "is to determine the various view points which gradually arise in the history of thought and are constantly in the process of change."¹ These various view points, this fragmentation of thought, are necessary for a work of this sort. If everyone in our society relied on the same verifactory model, or used a common conceptual framework or mind-set, a work such as this would be impossible. When different ways of perceiving the same reality are prevalent, however, some attempt must ultimately be made to discover the reasons for these differences. That these differences exist is no longer open to question.

For example, if two sets of test scores were obtained, one set from a suburban, affluent high school, and another

set from an urban non-affluent high school, and sharp
differences were observed in the results of these scores,
explanations of these differences would vary, depending
on who was providing the explanation. Skinner could offer
one explanation, Marcuse another, and Ellul yet another.

It would be wrong to conclude from this, however, that
since there are so many diverse ways of perceiving reality,
all truth is relative and no possibility exists for under­
standing reality in its entirety. It is precisely this
diversity of mind-sets which offers a way of escaping the
relativism which stems from a diversity of mind-sets. Only
as one gradually becomes aware of the limited scope of every
point of view it is possible to consider the comprehension
of the whole. If we were to be masters of our fate,
if we are to avoid being swept along blindly by forces we
cannot even name, then comprehension and understanding must
be our ultimate aim.

The question I have asked at every stage of this study
is, "How is behavioral technology possible?" When the ques­
tion is asked in this matter, the focus must be on extra­
logical factors. To find this or that logical consistency
or inconsistency is behavioral technology as a system, offers
no explanation regarding the social conditions of its emergence,
which in turn may be crucial in determining the nature and development of its assertions. Mannheim calls this the position behind a point of view, and he asserts that if we fail to take this position into account, then we falsely characterize the existential situation of a thinker. "A position in the social structure carries with it, as we have seen, the probability that he who occupies it will think in a certain way."\(^2\)

Mannheim states:

The existential determination of thought may be regarded as a demonstrated fact in those realms of thought in which we can show (a) that the process of knowing does not actually develop historically in accordance with immanent laws, that it does not follow from the nature of things, or from purely logical possibilities and that it is not driven by an inner dialectic.

This existential determination of thought will also have to be regarded as a fact (b) if the influence of these existential factors on the concrete content of knowledge is of more than peripheral importance, if they are relevant not only to the genesis of ideas, but penetrate into their forms and content and if, furthermore, they decisively determine the scope and the intensity of our experience and observation., i.e., that which we formerly referred to as perspective of the subject.\(^3\)

\(^2\)Ibid., p. 293.

\(^3\)Ibid., pp. 267-268.
In this work I have tried to show that it is the existential or extra-logical factors which have penetrated the form of knowledge being considered, and because the form had been influenced by these factors, the content, of necessity had also been influenced. This must be the case, for only under the most artificial and abstract conditions can one argue for a separation of form and content. That is, one may argue that the statement, "We shall lynch the nigger tomorrow," is good grammatical form, but he may do so only if psychological and sematic components of language are not considered. The feelings of disgust and repugnance which arise in one because of the intent of the speaker, however, cannot be ignored. Only if language is turned into something else, can one argue in this manner. So it is in all matters of form and content.

This preoccupation with form is characteristic of behavioral technology, and there can no longer be any doubt "that no real penetration into social reality is possible through this approach."\(^4\) By attempting "...to construct a world of facts in which there will exist only measurable data, only correlations between series of factors in which

\(^4\)Ibid., p. 44.
the degree of probability of modes of behavior in certain situations will be predictable,\(^5\) no penetration into social reality is guaranteed.

That this system ignores social reality, however, does not necessarily mean that a particular ideology, in Mannheim's sense, is at work. Behavioral psychology and the technology which evolve from it are serious attempts to answer epistemological questions which arise when certainty can no longer be guaranteed by the church. This attempt does not arise in a vacuum, but evolves from existing inquiries which also attempt to answer epistemological questions. In the first Chapter, I have tried to identify these existing inquiries and their relationship to behavioral technology. Of course, these inquiries did not arise in a vacuum either, and though it is not within the scope of this study, significant, yet unanswered questions remain. For example, we know that the political theory of Locke, and the findings of Darwin as they are applied in the United States, represent conservative political trends. We know that Locke in his *Two Treatises of Government* articulates a political theory that seeks to legitimize the political ambitions of

\(^5\)Ibid., p. 43.
the landed and monied English middle classes. By using concepts such as "state of nature," "God," "Freedom," "Security," "Tacit Consent," etc., in a very special way, Locke presents a framework in which all the inequalities which exist prior to the formation of Civil Society are legitimate. Once this framework is established all that remains is to show men where their obligations in Civil Society lie.

In Social Darwinism in American Thought, Hofstadter points out how the findings of Darwin were used in an attempt to legitimize ruthless competition and exploitation. The questions that occur, then, are: Is political theory in any way connected with the development of behavioral technology, and if it is, what is the nature of this connection, and how might it be articulated? We know that behavioral technology represents a conservative trend in American thought. Does this trend exist throughout the evolution of this technology?

In the second and third chapters, I have focused in more specifically on one area of interest in the first chapter, namely the development of the physical sciences. In addition to the reasons already given for the presentation of this material, there is another. Too often in the course
of this research I have read that behaviorism, or operationalism, or empiricism, etc., has drawn its verifactory model from the physical sciences, but it was difficult to find anything more specific. In the material gathered by Hall, however, I was able to see in a most specific way, the evolution of the form which behavioral technology was to employ, and here I could see why the attraction was so strong. Questions, which for fourteen hundred years had puzzled the most brilliant minds in western civilization, were now being answered satisfactorily, and these answers could not have been gathered independently of this model.

I have not talked about social conditions in relationship to the physical sciences, specifically the evolution of the physiological model, for two reasons. First, it is beyond the scope of this study, and second, a discussion of this nature is not really necessary. Natural sciences can be detached from social and historical processes more easily than almost any other topic. This is reflected in the second and third chapters.

In the fourth chapter, there are four areas of interest which I have tried to identify. These are: the transformation of America after the Civil War; the reorganization of the public schools; the identification of a technical
mind-set; the identification of the characteristics of a bureaucracy. In the years following the Civil War, the United States experienced a remarkable transformation. Perhaps the material I have presented in this area is too brief, but much has been written about this topic, and the fact that a transformation had occurred is beyond dispute. Because of this transformation, new and staggering problems concerning the organization of society arose. One instance of this was the reorganization of the public schools. By examining this reorganization in terms of efficiency, I have asserted that this reorganization was occurring along technical and bureaucratic lines. By identifying the characteristics of a bureaucracy and a technological mind-set, I have tried to expand the conclusion that Callahan draws in Education and the Cult of Efficiency, namely that a capitalistic, business mentality was responsible for the structure that was used in this reorganization of the schools. This is true, but by identifying the characteristics of technique and bureaucracy, I have tried to show that there were other components involved, which when taken into account, greatly increase our understanding. My assertion is that this reorganization of the public schools by a capitalistic, business mentality along technical and bureaucratic lines must be understood
if the emergence of a behavioral technology from 1900-1932 is to be understood. The similarities among Ellul's notion of technique, Weber's notion of bureaucracy, and the notion of behavioral technology are apparent. Mechanistic dehumanization, calculability, orderly and systematic modes of operation, elimination of chance and spontaneity, automatism, and self-augmentation of areas of applicability, can be noticed in all three of these notions. Since a technical and bureaucratic structure was evolving as the public schools were being reorganized, and this reorganization reflected the fact that many Americans were living in a country they could not understand, it seemed that a technical evolution in psychology would be necessary, if psychology was to be a part of this reorganization.

This was the purpose of Chapter Five. I wanted to find out if there was an early relationship between American education and psychology, and if there was, I wanted to find out if, as the schools were being reorganized, psychology would reflect this reorganization. I found, by examining selected literature of the N.E.A. Proceedings that there was an early relationship between psychology and education, that initially schoolmen were hostile towards psychology, but as psychology evolved into a more technical form, the
attitude of schoolmen changed to acceptance. This evolu-
tion of psychology and its relationship to American edu-
cation cannot be understood independently of the reorgani-
zation of the public schools. And the reorganization of the
schools cannot be understood independently of the problems
that America faced at the turn of the century. That is,
while the model which behavioral technology employed evolved
from the physical sciences, extralogical factors played a
crucial part in this evolution. There is a sharp break
between the third and fourth chapters of this study, and
what I have said thus far explains this break. To know
which particular model behavioral technology adopts as its
own, and to know the significant developments which occur
in the evolution of that model are helpful, but they are not
enough. These facts cannot adequately explain the emergence
of a behavioral technology in American education. One must
take into account the social conditions in America at the
turn of the century, without which the emergence of a
behavioral technology would be impossible.

It is also significant that in times of crises, beh-
avioral technology seems to be more popular in American
education. The problem of adaptation in a political pro-
blem, and the techniques which facilitate adaptation are
political techniques. The issue that needs to be raised is this: in a democracy, what are the limits concerning techniques which facilitate adaptation? If these limits are exceeded, will a democracy be turned into something else? Is a democracy possible when teachers are no longer teachers, but technicians? One consequence of the teacher as technician would be the emergence of a false consciousness. Since by its very nature, behavioral technology would exclude a multiplicity of mind-sets, it would present a distorted picture of reality in its entirety and therefore a "form of knowledge which is no longer adequate for comprehending the world." A democracy which is based on a form of knowledge which is no longer adequate for comprehending the world is no longer a democracy. Democracy cannot exist on a foundation of lies, half-truths, and psychic manipulation. It must aspire to what is best and noblest in man.

The consequences for teachers concerning behavioral technology are equally serious. If behavioral techniques were to be employed systematically and seriously, individual creativity would automatically diminish. All the emotional aspects of teaching would necessarily be removed. Curriculum

Ibid., p. 96.
would undergo a radical transformation. Trivial bits of information would be the building blocks.

I have studied the emergence of a behavioral technology from 1900-1932, because these years were important in the reorganization of the public schools. There is another reason, however, for this choice. In doing preliminary research for this study, I examined E.R.I.C. for articles relating to behavioral technology from 1970-1975. The number of articles that I encountered were so numerous, they were unmanageable. I suspect that behavioral technology has become an industry that is part of American education. Recently the entire state of Georgia has switched to a competency-based form of education. There has been talk of such a switch in the public schools of Columbus, Ohio. If there is a trend in this direction, it is an alarming one. It is one thing to say that the schools are organized along technical and bureaucratic lines. It is quite another to insist that teachers become technicians and bureaucrats.
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