JEROME BRUNER AND HIS PREDECESSORS
IN THE CONTEMPORARY INTELLECTUAL TRADITION

DISSERTATION

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# TABLE OF CONTENTS

## PART I. INTRODUCTORY

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Chapter 1.</td>
<td>THE IMPACT OF BRUNER</td>
<td>12</td>
</tr>
</tbody>
</table>

## PART II. BRUNER'S THEORIES

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 2.</td>
<td>THE NATURE OF KNOWLEDGE: BRUNER'S EPISTEMOLOGY</td>
<td>26</td>
</tr>
<tr>
<td>Chapter 3.</td>
<td>THE NATURE OF THE KNOWER: BRUNER'S PSYCHOLOGY</td>
<td>43</td>
</tr>
<tr>
<td>Chapter 4.</td>
<td>DEVELOPMENT and the INFLUENCE OF ENVIRONMENT</td>
<td>63</td>
</tr>
<tr>
<td>Chapter 5.</td>
<td>ON KNOWING: BRUNER'S THEORY OF EDUCATION</td>
<td>86</td>
</tr>
<tr>
<td>Chapter 6.</td>
<td>ART AS A MODE OF KNOWING: BRUNER'S AESTHETIC THEORY</td>
<td>109</td>
</tr>
</tbody>
</table>

## PART III. BRUNER'S INTELLECTUAL PREDECESSORS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 7.</td>
<td>THE STRUCTURE OF KNOWLEDGE and the NATURE OF REALITY</td>
<td>122</td>
</tr>
<tr>
<td>Chapter 8.</td>
<td>THE NATURE OF THE KNOWER</td>
<td>150</td>
</tr>
<tr>
<td>Chapter 9.</td>
<td>ON KNOWING</td>
<td>178</td>
</tr>
<tr>
<td>Chapter 10.</td>
<td>ART AS INTUITION</td>
<td>198</td>
</tr>
</tbody>
</table>

## PART IV. CONCLUSION

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 11.</td>
<td>SOME CONCLUSIONS</td>
<td>215</td>
</tr>
</tbody>
</table>

## BIBLIOGRAPHY | | 232 |
PART I

INTRODUCTORY
Introduction

Bruner's Influence as Educational Theorist

In 1960, Jerome Seymour Bruner, Professor of Psychology at Harvard University, published his little book, The Process of Education. The book was the summary report of the Conference held at Woods Hole, Massachusetts, some months before in which a group of scientists and disciplinarians had met to discuss how education in science in primary and secondary schools in the United States might be improved. Professor Bruner had served as Chairman of the Conference, and to him had fallen the task of summarizing the major themes and the conclusions which had emerged from the days of discussion. Conference summary-reports are rarely noted for lucidity or literary style; they rarely provide for their readers (especially those who had not been participants) anything more than a glimpse of the excitement which might be generated in the sharing of ideas, old and new, that conferences are intended to encourage. But Bruner's report was not the same as other such reports, and in this fact lies the genesis of the following study.

The Process of Education was written with lucidity, and, even more, with style, and grace and verve. It was filled
with many thoughtful and sound ideas, made to seem exciting and novel, with regard to education of the nation's young people in scientific subjects, and, by implication, in all others as well. Such a report, based on the thinking of so many distinguished scholars, was not fated, as are so many reports, to be little-read and much ignored. Instead, it was hailed, immediately, by the popular press as a new classic in educational theory, and the most important book on education since the early writings of John Dewey. The name of Jerome Bruner became known as an important and innovative educational theorist by the literate general public which was concerned with matters of education.

It might be asked just what are the qualifications of Jerome Bruner that should have led to his acclaim as an educational theorist of such note? Bruner is a psychologist who began his career, prior to World War II, doing experimental studies on perception in rats. During the war, he served in psychological warfare, and became concerned with problems of social psychology. Immediately after the war, he worked for a time on studies in opinion research. And, beginning in about 1950, he turned his attention as a member of the Harvard faculty, to studies on human perception. The perceptual studies, which brought him recognition as one of the most important of the scholars in modern perception theory, were
broadened to include the area of concept-formation, problem-solving, thinking, and of cognition in general.

In the mid-1950's, Bruner started to study problems of learning-block children with the expectation that this would shed light on the problem of intellectual growth as such. But he did not remain with pathological manifestation for long — he soon shifted his interest to learning in general, with attention to the process of intellectual development in children in which growth achieved its full range. As Bruner put it,

So I turned to work on the other end of the continuum -- how people reach their high-water mark. This is how it came about that in a few years I found myself so deeply involved in educational matters.¹

This involvement found its first expression in print in a paper published in the summer of 1959 in the Harvard Educational Review entitled, "Learning and Thinking." Shortly afterwards, the Woods Hole Conference was convened.

As a noted psychologist, expert in studies of cognition and of the processes of intellectual growth, Bruner was surely highly qualified to serve as its Chairman. And, from the point of view of the Conference, it was a most fortunate circumstance that his ability as a literary stylist was such as to produce, in his summary, what the Saturday Review called "An alchemist's effort in reducing what was said at the Woods

The Process of Education was followed, in a few years, by On Knowing and Toward a Theory of Instruction. Both were small books of essays, dealing with a considerable range of topics some related quite directly to education and others of a more general nature. During the same years (1960 through 1966) Bruner also contributed numerous articles to journals, dealing with matters of teaching and learning, made a great many speeches to professional educational societies, and joined with other scholars to participate in a curriculum development center in Cambridge which is heavily subsidized by government as well as foundation funds. In 1965, he served as President of the American Psychological Association (an honor which would bear evidence to the esteem in which he is held by his colleagues in his own discipline) and his presidential address dealt with matters directly related to education. In a few short years, he has become widely recognized as an expert, indeed, a distinguished expert in matters of educational theory and practice. This recognition came, at first, from the general community, but it was soon followed, even though with not the same initial enthusiasm, by recognition from the special community of educational scholars and practitioners.

3 See Chapter 1.
It might be asked why it is that the "educational establishment" was willing to invite Bruner to speak to its societies, to write in its journals, and allow him to guide and influence certain among its important members to the extent to which it did. It would be difficult to imagine them welcoming quite so readily a figure such as Admiral Rickover or Arthur Bestor after the publication of their books on the state of American schools. It might be conjectured that the nature of Bruner's approach to educational theory and practice provides the explanation for this phenomenon of acceptance by the profession. For Bruner, in his books and articles on education, is not obviously critical of the profession. He does not harp at its members, nor damn them, nor condemn them for past failures and severe inadequacies as do many other critics from outside their ranks. He is respectful of Dewey and the experimentalists in spite of his differences from them; he is respectful of the potential of the teacher to perform at a respectable, even a high level; he does not see the need for a radical revision of the structure of schools, of school administration, of school organization, or even of schools of education.

Bruner wishes to see, in effect, that the more intense intellectual content of the curriculum, developed under the guidance of scholars, directed at improved intellectuality as defined by the psychologist, be introduced in the schools, as they presently exist, with teachers, principals,
administrators and academic educationists involved and cooperat­ing and directing the improvements every step of the way. He views the need for instituting a partnership with mutual res­pect between educationists and scholars devoted to the end of making schools better. The fact that there is a very, very strong implied criticism of the past directions and accomplish­ments of the American School is not painfully apparent because the criticism is never blatant, and, indeed, not even terribly obvious unless one chooses to find it. And the implied critic­ism extends as much to psychologists for their "mistaken" views about intellectual development, and to scholars for their avoidance of structuring disciplines for instruction, as to educationists. This very quality of apparent gentleness and respect in his approach to the educational profession, and the apparent gentleness of his implied criticism, has made him much more subject to acceptance by that profession than many other scholars from outside the profession might be. Even though that acceptance may hardly be viewed as com­plete, nevertheless Bruner, his books and papers and his ideas may be thought of as exerting great influence on the educational scene and the educational profession within the decade of the 1960's. And, it is to be expected that this influence will not diminish in the future.
The Purposes of this Study

In reading Bruner's books and papers, in hearing his speeches, in discussing his ideas with students of them, one impression becomes very strong. Bruner develops doctrines which seem exciting; he states these doctrines with remarkable eloquence, but somehow, he does not seem to say anything that is new or different from what has been said before by others, both within and outside of the educational tradition. Everything, or almost everything he writes about sounds familiar. A perceptive reader has the feeling that many of his exciting new doctrines are, in fact, simply restatements of old ones, which have been presented earlier by other thinkers. Bruner, especially in his writings on education which have a close relationship to psychology, cites sources constantly, documenting with great care. In his writings in psychology which have a close bearing on education, the same kind of extensive and careful documentation is evident. In his writings on other topics which are related to education, or on education itself, the documentation is less in evidence, and, indeed, often absent.

There is, here, no suggestion that Bruner has deliberately restated, as his own, ideas and theories of his predecessors in the intellectual tradition. Thoughtful men
such as Bruner, men who are obviously very erudite and broadly so, and who have absorbed a great deal from the culture which has nurtured them are, invariably, influenced and affected by their heritage. The influence of such a heritage is always present in the writings of such individuals. In addition, it does happen that men, writing at different times, may develop the same ideas quite independently of each other, and, indeed, be unaware that their contribution has been made or is being made by another or others. Bruner, himself, has spoken to these points, in the preface to The Process of Education. He says,

Many of the ideas that emerged at the Conference and after have long and honorable lineages in the history of educational thought. I, as Chairman of the Conference and author of this Report, apologize for the virtual absence of bibliographical citation in the pages that follow. Our thinking has been shaped and aided, obviously, by the literature related to this subject, and it is a vast literature. In writing this book, I have not sought to do justice to the parentage of ideas, a task more properly undertaken by a more scholarly volume.

The study which follows is devoted to demonstrating the contention, made above, that Bruner's theories are not new, but have all (or almost all) been presented before by other scholars in the intellectual tradition. It is not devoted to tracing them back to their "long and honorable lineage."

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(There is undoubtedly a sense in which, according to Whitehead, the entire intellectual tradition of the western world is but a footnote to Plato). It is, instead, concerned primarily with the "lineage" as reflected in the relatively contemporary intellectual tradition of the twentieth century. It does not deal with every aspect of Jerome Bruner's scholarship over the past twenty eight years, but, rather with those revealed in or significantly affecting his books and papers on education. It treats of those areas of his theorizing whose source he, himself, clearly recognizes, as well as others whose source he does not indicate, or of which, indeed, he may be quite unaware. In short, the problem to which the following chapters are addressed is the tracing back to a source (or sources) in the twentieth century intellectual tradition of each of the major areas of discussion with which Bruner deals in his books and papers on the educational process.

The Plan of the Study

The study which follows is divided into four sections. The first part, which is introductory, includes this Introduction together with a section discussing the impact and influences of Bruner as an educational theorist. The second part presents a summary of Bruner's major theories which are quite
directly related to education. The third part demonstrates that each of these theories was anticipated by one or more twentieth century scholars (both in and outside of the tradition of educational thought) prior to 1960 when *The Process of Education* was first published. The final section will provide some conclusions for the study, together with an evaluation of Bruner's contribution and significance as an educational theorist.
CHAPTER 1
THE IMPACT OF BRUNER

In the autumn of 1959, a group of about thirty five scholars and educators gathered at Woods Hole, Massachusetts to discuss ways in which science education in primary and secondary schools in the United States might be improved. This Conference was not the first occasion for such discussion -- indeed, in the last few years of the decade of the 1950's, groups of scholars and educators in various parts of the country had been meeting to devise new curricula in mathematics, in physics, in chemistry, and in biology, a few of which were already being tested in some of the nation's schools. The National Academy of Sciences, the American Association for the Advancement of Science and the Carnegie Corporation were concerned with the problems of these new curricula, and with the even broader problems of stimulating discussion and cooperation between the scientists and scholars, primarily university based, who were working on these new programs, and educators and psychologists who were expected to be expert in the problems of teaching and of learning. These organizations encouraged the creation of the Woods Hole Conference,
and the National Science Foundation, the U.S. Office of Educa-
tion and the Rand Corporation provided financial support for it. The purpose of the Conference was to examine the progress of new curricular studies and their prospects for the future, relating them to the possibilities for instruction revealed by psychological and educational research.

The Conference, in its first few days, devoted its at-
tention to hearing reports about the new curriculum projects, and concerning new psychological and educational research relevant to the educational effort. Then, it divided into five working groups concerned with the following topics: The Sequence of a Curriculum; The Apparatus of Teaching; The Motiva-
tion of Learning; The Role of Intuition in Learning and Think-
ing; Cognitive Processes in Learning. Each group prepared a lengthy report of its discussions, which were then presented before the entire Conference for discussion and debate.

Jerome Bruner, the noted psychologist from Harvard, who was a member of the Conference, served as its Chairman. It was he who undertook to prepare a final account of the pro-
ceedings of the conference, "perforce a selective account of what in his view were the major themes, the principal conjectures and the most striking tentative conclusions reached."\(^1\) Copies of this account were submitted to the Conference mem-
bers, who made comments and suggestions for revisions. It

\(^1\) Ibid., p. xii.
was then revised by the Chairman into final draft form, and published by Harvard Press in the autumn of 1960 under the title *The Process of Education*.

This slim, 92 page report, immediately upon publication, had a remarkable impact upon the lay community. This was a community which had responded with such fierce enthusiasm to Rudolf Flesh's book on the incapacity of Johnny to Read, to Bestor's and Rickover's critiques of progressivism in education, and to Conant's somewhat more restrained study of the limitations of the American secondary school. It was in a state of upheaval following the launching of the first Soviet sattelite in 1957, and fearful that Soviet scientific and technological education had surpassed that of the United States. It held the "educational establishment" from the professors of education down through the supervisory hierarchies of the school systems to the teachers, responsible for the alleged sad state of American education. The Woods Hole Conference, staffed as it was primarily by non-establishment scholars from the scientific disciplines, including psychology (having among its participants only two academic educationists), was the sort of body which could win the approval of a somewhat aroused community.

Some of the organs of the book-reviewing popular press which lay claim to an intelligent national reading public
first publicized *The Process of Education*. *Time*, in its Education Section of September 26, 1960, summarized the main ideas of the Report appreciatively. *The Saturday Review* of October 15, 1960 was much more laudatory. Frank Jennings, in his review, refers to Bruner's role in writing the report as "an alchemist's effort in reducing what was said at the Woods Hole Conference to readable form." He states,

That he writes on occasion with the touch of a poet, is the reader's good fortune; that he reasons with the scientist's secure modesty makes his vision understandable; that he never succumbs to the luxury of cheap anger is a mark of his respect for our human potential. He has written a useful, satisfying, and, for me, a very exciting book.²

Paul Goodman, the iconoclastic sociologist, reviewed *The Process of Education* in the *New York Herald Tribune* of December 25. Speaking of it as "a lovely book," he states, "It will be a classic, comparable for its philosophical centrality and humane concreteness to some of the essays of Dewey."³

In 1962, Bruner published the second of the three books dealing with the subject of education which bear his name as their author and which have carried his fame and reputation as an authority on education to the general community. This book, entitled *On Knowing* consists of a series of essays, all

of which had been published or presented as papers, previously, and which had been revised or modified for inclusion in this new volume. They dealt with art and the aesthetic process in the first section, with the process of knowing in the second part, and with knowledge and society in the concluding section. The popular press again responded to this book, reviewing it widely.

In the Saturday Review of June 16, 1962, Frank Jennings said of On Knowing,

We in this country have been especially fortunate in having the best of our psychologists devote their sharpest talents to the problems of education. Inevitably they address themselves to the largest issues, and Bruner is firmly in the great tradition.\(^4\)

The New York Times, which had failed to review the Woods Hole Report, presented a review of On Knowing by the eminent aesthetcian, Eliseo Vivas. While raising some questions about the correctness of Bruner's aesthetic theories, Vivas is, nevertheless, highly commendatory in his review, speaking of the book as a "thoroughly intelligent" collection of essays on diverse topics which pays heed to the aesthetic as well as the scientific dimension in knowing. And Rudolf Flesh, quoted on the dust jacket, spoke of the essays as constituting "possibly the most exciting book published this year."

In 1966, Bruner's third book on education, entitled Toward A Theory of Instruction, was published. This book, like

\(^4\) Frank Jennings, Saturday Review of Literature, June 16, 1962, p. 66.
his second, consisted of a collection of essays, many of which had been previously published in slightly different form, or presented as lectures before learned societies or university groups and then revised for publication. They dealt with many of the same topics which had appeared in his previous works, albeit in altered form, and with somewhat different emphasis. Banesh Hoffman in the New York Times reviewed the book, stating

Though good sense on the subject of education is not quite in the man-bites-dog category, it is sufficiently rare to be newsworthy. When it appears in conjunction with cogency, insight, wisdom and style the result is a heady mixture.5

By 1966, the name of Bruner as an educational thinker was of sufficient importance that the two non-learned journals which are often thought of as being the most prestigious intellectual organs in the United States, Commentary and the New York Review of Books, reviewed Toward a Theory of Instruction. Earlier, in 1964, Commentary had published an article by Bruner dealing with motivation in learning; in its July 1966 issue, Edgar Z. Freidenberg, a sociologist and educational critic of note, reviewed Bruner's latest book. Freidenberg was quite completely critical in his review, referring to the book as a "trifle," and taking Bruner to task for not paying sufficient heed to the moral and political forces which shape our schools, and which concern with instruction and learning cannot correct until the political and social milieu within

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which the school operates is changed.

The New York Review of Books presents a very long review article by the psychologist John Holt, in which he states,

How easy it would be to join the chorus of worshipful critics, who are or soon will be calling this book great, challenging, revolutionary, destined to change the course of American education, and so on. But it is not a very good book.6

Holt goes on to criticize the book on the ground that it is based on bad psychology, repudiating Bruner as well as Piaget, and arguing for a psychology based on Deweyian notions of experience and doing. However, in spite of the negative aspects of the review by these two magazines, it might be stated that the mere fact that Bruner's book was considered by them would constitute evidence of his importance as a thinker who had captured the popular imagination.

In addition to the very extensive reporting of Bruner's three books on education by the popular press, of which the above examples provide only a sample and are by no means exhaustive, Bruner himself was the subject of a clever and critically appreciative profile in Harper's of December of 1964 by Andrew Weil, a student in the Harvard Medical School. Weil states that Bruner's theories on teaching "have stirred up more excitement than any educator since John Dewey."7 He refers, somewhat irreverently, to The Process of Education,

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which has become a "sort of Bible to educational theorists (The Gospel According to St. Jerome, some call it.)" The general assumption of the profile is that Bruner has become the leading figure on the horizon of educational theory since Dewey, and it examines him and his work in the light of this assumption.

Another profile of Bruner, in the Education Section of Time, discusses him and the Center for Cognitive Studies at Harvard, which he organized and set up in 1960. Time states that the type of research studies which Bruner is undertaking can lead to a revolution in United States education, and seems to imply that it will.

Thus, it may be seen that in a manner quite unprecedented (insofar as the works of scholars are concerned) in the United States, the three books of Bruner on Education, and Bruner himself as an authority on educational theory have been considered, lauded and publicized in the popular press. It is surely the case that the popular press has great power to create and certainly to enhance the public reputation of any writer. In the case of Bruner and his books on education it has succeeded in doing just that.

An examination of the impact of Bruner's educational writings on the community of academic and professional educators reveals a different situation from that of the general

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8 Ibid., p. 83.
community. The *Process of Education* was reviewed by several education journals, although, as in the case with all scholarly publications, there existed a time lag between the publication of the book and the first reviews. *School and Society*, in December of 1961, contained a brief note about the book, written by William Brickman. Brickman indicates that the book is a summary of the Woods Hole Conference, and he states, "The content is not frequently new, but it highlights some significant points."\(^{10}\)

The *Harvard Educational Review* in the spring of 1962 contained a review by Richard Anderson which appraised the book very cautiously. Anderson states that Bruner's summary "sometimes approaches the fanciful." He speaks of it as an eloquent expression of a hope for education in the future, but is skeptical that it will be of use in improvement of instruction in math and science until such time as a great deal more is known about the learning of complex concepts.\(^{11}\)

Sidney Salt, in a review in 1962 in *Teachers' College Review*, recognizes that *The Process of Education* is an important professional book. Nevertheless, he states,

Not everyone, however, will agree with the statement found on the jacket that the author outlines a challenging new philosophy of education. It is true that the book presents a challenging philosophy, but its ideas are not so much novel as novelty synthesized.\(^{12}\)


The British Journal of Educational Studies reviewed the book in 1962. W. Arnold Lloyd provided a short summary of the main ideas. Then he states,

Within the limits of a hundred pages Professor Bruner offers a useful summary of a valuable discussion of some urgent problems facing American educators. Perhaps it may be suggested that the title is inept, as the book is concerned mainly with successful learning and teaching rather than with education.¹³

Like its American counterparts, the British journal is only mildly appreciative of The Process of Education.

On Knowing was reviewed by even fewer journals than The Process of Education. Educational Theory, Harvard Educational Review, Teachers College Record did not review it at all. A very negative review in Studies in Philosophy and Education appeared in 1963. Rubin Gotesky denounces the essays as confused, vague and their position as essentially inapplicable by educators.¹⁴ The British Journal of Educational Studies devoted a short notice to it, referring to the essays as "worthwhile."¹⁵

Toward a Theory of Instruction has been ignored by the major journals dealing with educational theory, with one exception. In the summer of 1966, David Ausubel, a psychologist,

published a scathing criticism of the third of Bruner's books. Ausubel states, "This is not a very important book, either for the serious general reader or for the serious student of literature." He goes on to refer to the essays as somewhat respectable only for meeting the standard for banquet addresses or speeches at state teachers' conventions. Bruner, in them, "publishes his well-known themes and rides his hobby horses." Ausubel states,

No publisher, let alone the Harvard University Press would have the temerity to publish this collection of essays in book form if their author were someone other than Jerome Bruner....Whenever any author captures the public imagination anything he writes -- no matter how superficial, trivial, and repetitious -- gets put between hard covers.17

It may be seen on the basis of the above examples that the critical appraisal of Bruner's books on education was varied, depending on its source. The general, non-professional appraisal was mostly glowing; the reception on the part of the educational profession much less enthusiastic, if it may properly be said to be enthusiastic at all. If the books had been received only by the profession on the basis of the profession's evaluation of them, it is likely that they would have made rather a small impact, as is the fate of most books of their sort. However, a very interesting phenomenon occurred with regard to Bruner's reputation and acceptance by the educational profession, in

17 Ibid., p. 337.
spite of their initial indifference to him. It seems very likely that the non-professional exaltation of his books caused the profession to take him seriously.

After *The Process of Education* was published, the Philosophy of Education Society invited Bruner to speak to them, and he delivered an address which appears, in some revision, as the essay, "The Act of Discovery," in *On Knowing*. During the four years between *On Knowing* and *Toward a Theory of Instruction*, Bruner addressed the National Council of the Teachers of English, in 1963, the Educational Testing Service in 1964, and he was invited to contribute to the N.S.S.E. 63rd Yearbook in 1964. He participated in the New England Kindergarten Conference in 1963, addressed the N.E.A. on liberal education in 1964, published in *Educational Leadership* in 1963, the N.E.A. Journal in 1963, etc. This is hardly an exhaustive list, but merely a representative one. He became involved in Educational Services Incorporated, a highly-subsidized curriculum research center in Cambridge which, under the guidance of Jerrold Zacharias had done much to develop the new physics curriculum, and which, under the guidance of Bruner, became engaged in developing social science curricula which were widely adopted. It may be seen that Bruner as an authority in educational matters, soon became accepted as an authority by the educational profession which had reacted to him as such with an initial indifference.
It is not the purpose of this chapter to evaluate the worth of Bruner's educational writings, nor to judge whether the educational community was shortsighted in not realizing his contribution when he first made it, as did the popular press. It might be interesting, however, to hypothesize concerning the somewhat delayed response to him as an educational thinker, and the reason for his ultimate acceptance on the part of educationists. It has been the implied contention of the above discussion that Bruner was catapulted into prominence by the popular press and the general community. It was because this was so that the education profession felt compelled to reexamine his doctrines and recognize his contributions, and not because they had initially realized their worthwhileness (nor, indeed, that they ultimately have). It will be, therefore, in some sense, the burden of the chapters which follow to show why the education profession, and, especially the academic educational community, had responded to Bruner with its initial indifference.
PART II

BRUNER'S THEORIES
Knowledge as Structure

For Bruner,

Knowledge is a model we construct to give meaning and structure to regularities in experience. The organizing ideas of any body of knowledge are inventions for rendering experience economical and connected. We invent concepts such as force in physics, the bond in chemistry, motive in psychology, style in literature as means to the end of comprehension.¹

An understanding of this rather obscure definition provides the key to an understanding of Bruner's theory of the nature of knowledge. Certain key terms are presented in this definition -- "model," "experience," "body of knowledge," and "we," among them, whose meaning must be clarified if the definition is to be understood properly.

As a knowing organism, the human intelligence is subject to a vast array of experiences -- of sensations, observations, ideas, facts, data, which confront him on every side. These experiences are of two general varieties, perceptual and

¹ Bruner, On Knowing, p. 120.
conceptual, and Bruner deals with each type in depth in his psychology of perception and cognition. Experience, for Bruner in his definition of knowledge, may be taken to mean "the congeries of disconnected observations" which the knower encounters all around him in his interaction with his environment and through the refinements which his cognitive processes provide for the raw data of this interaction.

The congeries of disconnected experiences, in themselves, are but raw material for knowledge. They serve, in their disconnections, only to confuse and disorient the knowing organism, until such time as they are organized into a structure or model which connects them and renders them economical. Bruner states,

The binding fact of mental life in child and adult alike is that there is a limited capacity for processing information — our span, as it is called, can comprise six or seven unrelated items simultaneously...the principle of economy is to fill our seven mental-input slots with gold rather than dross.\(^2\)

To make knowledge-getting possible, the data must be grouped into a pattern or a model or a structure so that they may be classified and connected in such way that one idea or item of experience will follow from another. In this use of models or structures, each new item of experience can be fitted into its proper place in the structure, and assume a meaningfulness which only the capacity to deal with patterned experience makes possible.

\(^2\) Ibid., p. 123.
In the history of culture, multitudes of experiences have been patterned or structured into certain broad, conceptual frameworks which have been characteristic of bodies of knowledge or disciplines. Certain "key concepts," which compose the framework may be thought of as representative of each domain. Thus, for example it ought to be possible for a physicist, or a group of them, to identify which these key concepts are, and for a historian of science to identify which concepts have been characteristic of the discipline called physics during the centuries. As Foshay has stated, a discipline or body of knowledge is recognizable in that it has a domain, a method, and a history, which is its own, and which makes it identifiable and differentiates it from others.

When Bruner says that knowledge is a model we construct to give meaning and structure to regularities in experience, by we he is speaking of the scholars, the scientists, the disciplinarians, the men who experience the "ever deepening insights that are developed on the frontiers of knowledge." The determination of what constitutes the basic structure of a discipline or a field of knowledge requires the most fundamental understanding of that field. It is a task that cannot be carried out without the active participation of the ablest scholars and scientists.

This is a matter of particular importance, especially when dealing with structures for purposes of instruction of the

\[3\] Ibid., p. 125.
young. A sophisticated scholar may have an almost-intuitive grasp of the structure of his discipline, and an implicit awareness may be enough for him. For purposes of instruction the implicit must be made explicit by creation of an explicit model. It is only the scholar whose awareness of his field is deep and sophisticated enough who can do this.

Thus, for Bruner, knowledge is equated with the conceptual models or structures of the scholarly disciplines which the best minds of the discipline agree is the best way to organize the data of the discipline. This view of the realm which constitutes knowledge is not without certain problems, although they are problems of which he is aware. It may be asked whether a model, once constructed by the best minds of a discipline, is to be taken for all time as constituting knowledge. Bruner's reply is, of course, that no one structure is to be taken as a final, authoritative view of what constitutes knowledge in any particular field of inquiry. Models must be subject always to review, revision and change, and even, to scrapping and complete replacement, by the best scholars in a particular area. Thus, the Newtonian model, which bore such rich fruit in the development of the scientific and technological revolution, has been replaced or supplemented by the Einsteinian, as the consensus of scholars has seen the need to replace it. The model of non-Euclidian geometry may
be seen as more fruitful in thinking about geometrical problems than Euclid's, in some if not in all cases of mathematical investigation; then it must be used in its place. For Bruner, the structure which is knowledge must be subject always to review by the consensus of scholars who serve on the frontiers of knowledge.

A second problem, which Bruner's view of knowledge as structure raises, is that of the possibility of more than one model to deal with the data of a discipline. Scholars are by no means unanimous in their model-building activities, and, indeed, may often be at complete odds concerning what constitutes the proper structure. For Bruner this is not a problem either. It is the capacity to get at knowledge in an organized way which is of interest to him as the means for maximizing learning. Insofar as a structure promotes the capacity to get at knowledge in an organized way, it serves its function. Students approaching structured knowledge will become familiar with the methodology of dealing with structures, and will be able to move quite easily from one structure to another as scholars see the need to change one for another, or even from one to another as alternative ways of dealing with the same data and experiences.5

Still another problem of dealing with knowledge as structure lies in the identification of what precisely constitutes

5 Bruner refers to Nils Bohr's principle of complementarity whereby particle properties and wave properties constitute two different aspects of the photon -- two ways of viewing the same phenomenon, both fruitful. See Daedalus, Vol. 87, 1958, p. 157.
a discipline. Bruner's view of knowledge involves determination of the membership and organization of disciplines which means the identification of significantly differing disciplines, and the attempt to find the relationship of one discipline to another. Identifying separate disciplines is necessary, at least for purposes of instruction, because this identifies what is to constitute the subject matter of education. Determining the relatedness of one discipline to another determines what may be joined together and pursued as one object of instruction, and what must be separated, or, if the latter, in what sequence they can most desirably be presented. Does mathematics consist of the separate disciplines of geometry, algebra, trigonometry, or are they all one discipline? Are biology and chemistry to be identified as two separate disciplines, or are they to be viewed as one? Here, Bruner would reiterate that the problem is one to be solved by the best minds of the intellectual community, the men who are on the frontiers of knowledge and who would best be able to identify and relate disciplines.

One additional problem remains to be considered and that is the problem of scholarly consensus upon which Bruner depends. The examples which Bruner utilizes in his discussions of the structures of the disciplines, are mathematics and the sciences, primarily. But Bruner, who is a man of very broad
learning, and who may be thought of as passionately interested in the arts and the humanities, is by no means in favor of learning which is limited to science and mathematics. In the Introduction to The Process of Education, he states that although his examples are weighted in the direction of science and mathematics, this is due to the accident that in these fields most of the development of new curricula had occurred — here had been most of the model-building for the purposes of instruction. He states,

Redoubled efforts are essential in the social studies, in the humanities, and in language instruction. A sense of tragedy and triumph achieved through the study of history and literature is surely as important to modern man as a sense of the structure of matter achieved through the study of physics. It should be utterly clear that the humanities, the social studies and the sciences are all equally in need of imaginative effort if they are to make their proper contribution to the education of coming generations.6

It seems, however, that Bruner's appeal to the development of structuring knowledge in science and mathematics as an historical accident which can soon be paralleled by similar structuring in non-scientific disciplines, is not completely candid. Why is it the case that scholars of note joined to develop models for instruction of the young in mathematics and science, rather than in the non-scientific disciplines?

The answer must surely be that science and mathematics are much more readily structurable and that consensus about what constitutes a proper structure is much more readily reached by scholars in these disciplines. Given certain variations, the structures exhibited in the various mathematics curricula show a relative similarity. Is it likely that the same sort of consensus among social scientists could be reached with regard to the sort of structure Bruner himself devised for a fifth grade study of the nature of man? Or, even, of historians in their view of Turner's concept of the frontier in structuring American history?

In a little book, *The Structure of Knowledge and the Curriculum*, Graham C. Wilson discusses the problems of structuring presented in the study of English. He states,

Certainly, something special is called for to see a concept of over-all structure in English as a discipline in schools and colleges today. To begin with: the structure of what? There is language, which may include grammar, philosophy, anthropology, semantics and general semantics, psychology and English as a foreign language; literature, which may be English, American, European, world and when the time comes, interplanetary; composition, which may include grammar (again), rhetoric, semantics (again), and logic. Language artists speak of reading, writing, speaking and listening. This is quite a mixture. In this age of increasing specialization, it is pleasant to feel that in at least one academic area, the totally

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7 See Bruner, *Toward a Theory of Instruction*, p. 73ff. This is the sort of structure which many teachers, in the years of the blossoming of progressivism would have greeted with joy as an ideal example of a core social studies unit based on a problem approach.
qualified teacher will be a true Renaissance man or woman -- communicative, comprehensive, contemplative -- and non-existent.\footnote{8}

Wilson goes on, in his article to suggest that, while any over-all structure of the discipline can hardly be demonstrated, nevertheless, for purposes of instruction, it might be useful to divide English into its language and literature components, and to study language in the light of twentieth century linguistics and literature in the light of twentieth century literary criticism. However, it is certain that this approach may very likely not achieve scholarly consensus in the same way as in the case of mathematics. There are apt to be as many structures as scholars engaged in structuring, in the case of non-scientific and non-mathematical disciplines.

Here, too, Bruner would undoubtedly reply that this problem of structuring in the humanities and social sciences is not insurmountable. It is better for students to learn to use any structure which has scholarly responsibility involved in its creation than no structure at all. A structure which leads to an increase in comprehension of literature performs a useful function in teaching and learning, so long as the student is made to realize that it is not the ultimate structure, and that many others might serve adequately. And, it may perhaps be desirable in teaching in the humanities if learning is to be

\footnote{G. W. Ford and Lawrence Pugno, \textit{The Structure of Knowledge and the Curriculum} (Chicago: Rand McNally, 1964), p. 72.}
maximized, for alternative structures to be provided so students may come to realize that the nature of these disciplines themselves are such as to present certain problems which science and mathematics learning do not provide in nearly the same degree. In short, art and science involve different problems in knowing because the latter deals with more readily structurable experience (experience about which scholarly consensus about structuring can be reached) than does the former.

In summary, Bruner views knowledge as consisting of models of experience which are to be constructed by the best minds of the scholarly disciplines by which the history of culture has been advanced. These models are not fixed or final, and alternative models in the various disciplines are possible or even necessary. But it is only in dealing with structures of knowledge so conceived that the learner's limited capacity for processing information can be maximized — i.e., that knowledge can be made available to be learned.

**Knowledge and the Nature of Reality**

It is most likely that a serious consideration of epistemological problems such as those which have engaged the attention of Bruner will lead a thinker to a confrontation with ontological problems which lie at their base. When the question, "What is the nature of knowledge?", is asked, it is often preceded or followed by the prior question, "What is the nature
of reality which knowledge seeks to represent?" And, indeed, it is a question which Bruner often asks, and which he has made efforts to answer.

The Newtonian view of the nature of knowledge and its relationship to reality stated that there existed a vast sea of ignorance which might be equated with reality, in which the scientist conducts his explorations, now and again encountering an island of truth which could be then marked on his map as known. The task of the scientist or of the seeker after knowledge in this Newtonian view, becomes one of searching out more and more islands in the sea, so the realm of the known becomes larger and larger, and the unknown portions of the sea fewer and fewer.

Man in his search for knowledge deals with nature or reality quite directly in this view of the scholars' search. There is a picture of man, on the one hand, and a potentially knowable nature on the other which exists independently of man and is governed by certain immutable laws. It is the task of man to discover and formulate these laws mathematically, and the laws are conceived as applicable without any qualification to the entire cosmos. Man uses his senses to conduct experiments which seek out truths about nature. As science progresses, he utilizes more complex apparatus which may be conceived as extensions of his senses. The seeker after truth, thus, extends the realm of the known which he seeks to dis-
cover from that available to him by direct perception to in-
clude all the areas of experience, however remote from his
immediate perception, which he can confront with the aid of
science and technology. This is the Newtonian view of the
nature of reality and the search for knowledge which prevailed
during the nineteenth and early twentieth centuries.\(^9\)

During the past few decades, there has been a profound
change in this conception. Instead of a view in which man,
on the one hand, views nature on the other, each as a cate-
gory distinct from the other, there has come into being an
awareness of the role which the process of observation itself
and which the observer himself plays in what it is that is
seen. Thus, Heisenberg tells us that, with the growth of
atomic physics in the twentieth century, when the scientist
is observing building blocks of matter smaller even than
electrons, protons, and neutrons, the process of observation
itself must be taken into account. When such small blocks of
matter are considered, "every process of observation causes
a major disturbance."

The conception of the objective reality of the
elementary particles has thus evaporated in a curious
way, not into the fog of some new, obscure or not
yet understood reality concept, but into the trans-
parent clarity of a mathematics that represents no
longer the behavior of the elementary particles but
rather our knowledge of this behavior. The atomic
physicist has had to come to terms with the fact

\(^9\) Werner Heisenberg, "The Representation of Nature in
that his science is only a link in the endless chain of discussions of man with nature, but that it cannot simply talk of nature 'as such.' Natural science always presupposes man, and we must become aware of the fact that, as Bohr has expressed it, we are not only spectators but also always participants on the stage of life.10

Bruner stresses that the physicist's knowledge of reality is expressed in the form of mathematical models which he creates or constructs, thus injecting himself and the product of his intellect between the realm of reality per se and himself. Reality cannot be "gotten at," so to speak, without the intermediary of the model, which is the construct of the scholar.

The process of model-construction is not peculiar to physics. Bruner employs as another example the realm of poetry, which, while exhibiting certain significant differences, also evidences certain interesting similarities. He states,

The theory and practice of poetry -- and it is a convenient point of contrast to physics -- also concerns itself with models, with images, with the invention of knowledge. Like physics, it has as a mission the exploration of the interstices and the limits of experience. Its method is metaphoric, and the firm of its imagery is not restricted, as in physics, to a particular ensemble of constructs. Yet it has a discipline and a set of constraints that must be adhered to if the result is not to be absurd -- much as the physicist cannot ignore the principle of conservation without an absurd result.11

The limits of experience -- i.e., reality constitutes the bounds within which the poetic model must be created.

10 Ibid., p. 100.
11 Ibid., p. 157.
The conception of the role of the physicist and of the poet not only as spectator but as an active participant in the apprehension of reality, and, as such, affecting what it is he sees, extends to the entire process of intellectualization. This has been one of the major concerns of Bruner's researches into perception and cognition. The human mind plays a large role in determining which of the experiences it encounters it will honor and how it will monitor them in constructing "representations of the world." Bruner states,

We know now, for example, that the nervous system is not the one-way street we thought it was — carrying messages from the environment to the brain, there to be organized into representations of the world. Rather, the brain has a program that is its own, and monitoring orders are sent out from the brain to the sense organs and relay stations specifying priorities for different kinds of environmental messages.12

The phenomenon of categorization of the data of experience in any number of alternative models has been the problem to which Bruner has addressed himself.

Bruner states that judgment, memory, problem-solving, inventive thinking and aesthetics, as well as the more conventional areas of perception and concept formation all involve operations which group and regroup data into classes or structures, and it is through the mediation of these models or representations that man views the world or reality.13 Thus, just

12 Bruner, On Knowing, p. 6.
as the physicist represents the world of reality by the abstract mathematical models which his science has constructed, so does every individual engaged in thinking represent the data of reality with a model which he constructs. To be a thinking being, for Bruner, means to engage in model construction.

What then, is the meaning of Bruner's conception of reality, and its relationship to his conception of knowledge? Reality, the real world, represents the outer limits of experience, the world of nature to which he refers in one essay as the realm of fate.\(^{14}\) Man in his search to know, in his quest for knowledge, does not deal directly with nature or reality -- indeed, he cannot. Instead, he must represent aspects of this reality which he experiences through the construction of powerful abstractions, which serve as models of what he experiences. Bruner quotes Ernst Cassirer to the effect that "man lives in a symbolic world of his own collective creation, a symbolic world that has as one of its principal functions the ordering and explication of experience."\(^{15}\) It is through the mediating mechanism of these symbolic constructs of man (mathematical representations in the case of the physicist and mathematician, poetic constructs in the case of the poet, simple structuring into categories which group

\(^{14}\) Bruner, *On Knowing*, p. 159.

concepts and percepts in the case of any act of thinking of any ordinary man) that it becomes possible for man to approach, to understand and to make incursions into the realm of reality or fate.

Against the background of this view of reality, it may be seen once again and this time more clearly just what is Bruner's view of the nature of knowledge. Knowledge, for Bruner, as we have seen, is the model which the scholar constructs to give meaning and structure to regularities in experience. The meaning and structure is to be found in the models which are the creative products of the workings of the minds of men, because it is only through the intermediary of the model that man has an approach to reality. For a model to be the richest and most fruitful in terms of its capacity to provide workable descriptions of the universe (or some aspect of it), it must be created by the best minds engaged in model-building; by the scholars on the frontiers of knowledge. Since the most workable descriptions of the universe have been, in the history of our culture, those advanced by the separate disciplines, it is to the disciplinarians that we must turn for such descriptions. Each discipline concerns itself with a different aspect of reality; the nature of the discipline and of the models it creates insures that we see even the same data of experience differently as they are
structured into differing conceptual systems. But with the use of knowledge in the sense of disciplined models, we are able to push further and further into the realm of reality, or, as Bruner puts it in a poetic mode, the realm of fate, and to increase the area of the operation of human potency.

Each discovery of a way of proceeding, of a way of discovering, forestalling or effecting (i.e., of a new structure or model which is knowledge)\(^{16}\) is, then, an incursion into fate that in effect rolls back what we take fate to be.\(^{17}\)

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16 Parenthetic remark mine.
CHAPTER 3

THE NATURE OF THE KNOWER: BRUNER'S PSYCHOLOGY

Bruner's educational theory is dependent upon an understanding of his conception of the nature of the knower -- the human being as an organism which is subject to intellectual growth and development. Many of his controversial educational doctrines, such as his views on readiness, or the need for a spiral curriculum, or his emphasis on the necessity for the teaching and learning of rich symbolic systems (his emphasis on language) can only be understood in the light of his developmental psychology.

In Bruner's view, over the period of thousands of years in time, man evolved as the species we know. He states,

Man's use of mind is dependent upon his ability to develop and use tools, or instruments or technologies that make it possible for him to express or amplify his powers. His very evolution as a species speaks to this point. It was consequent upon the development of bipedalism and the use of spontaneous pebble tools that man's brain and particularly his cortex developed. It was not a large-brained homonid that developed the technical-social life of the human; rather it was the tool-using, cooperative pattern that gradually changed man's morphology by favoring the survival of those who could link themselves with tool systems and disfavoring those who tried to go it on big jaws, heavy dentition or superior weight. What evolved as a human nervous system was something, then, that required outside devices for expressing its potential.

1 Bruner, Toward a Theory of Instruction, p. 25.
This theory of species development Bruner calls "evolutionary instrumentalism."²

What was the nature of these "tools" which man was dependent upon in his evolution from the primitive state to that of his present morphology? For Bruner, they denote not merely "hardware" or the kinds of tools which serve as extensions of his hands and arms, but "software" even more importantly. These are the skills which serve as tools to heighten the perceptions of the senses, and to amplify the power of thought or cognition itself.

Language is perhaps the ideal example of one such powerful technology, with its power not only for communication but for encoding 'reality,' for representing matters remote as well as immediate, and for doing all these things according to rules that permit us both to represent 'reality' and to transform it by conventional yet appropriate rules.³

Thus, man in the evolution of his species from primitivism to his present state has developed three skill-systems, whereby he uses tools to process information and represent the world as he counters it. Mature man, as an evolved organism, can use tools for his hands, tools for his "distance receptors," and tools for cognition or ratiocination. The tools which serve to amplify his hands (or his motor capacities) are those such as the cutting tools, levers and wheels, plus an entire array of sophisticated modern implements. Tools for his "distance receptors" or sensory capacities include devices

such as smoke signalling and modern radar, and, in addition, whole series of "conventionalized perceptual short cuts that can be applied to the redundant sensory environment;" such things as diagrams, pictures, maps may serve as examples. The amplifiers of the powers of thought include language, myth, theory and explanation.4 Bruner states,

In the deepest sense, then, man can be described as a species that has become specialized by the use of technological implements. His selection and survival have depended on a morphology and a set of capacities that could be linked with the alloplastic devices that have made his later evolution possible.5

The view of evolitional instrumentalism, which describes the evolution of the species man, is paralleled by the development of each individual man, in Bruner's view. The developing human organism lives in its environment by representing to himself the world as he encounters it. Bruner tells us that representation of the environment depends on techniques which amplify our motor capacities, our sensory responses and our thinking.

We know and respond to recurrent regularities in our environment by skilled and patterned acts, by conventionalized spatio qualitative imagery and selective perceptual organization and through linguistic encoding which, as so many writers have remarked, places a selective lattice between us and the physical environment. In short, the capacities that have been shaped by our evolution as tool users are those we rely on in the primary task of representation.6

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5 Ibid., p. 56.
6 Ibid., p. 57 (underlining mine).
Man, in his individual development, recapitulates the development of the species.

It is human ontogenic development which is of primary concern to Bruner. He tells us, with regard to this development, that

several important conclusions stand out....The first is that mental growth is not a gradual accretion, either of associations or of stimulus-response connections, or of means-end readinesses, or of anything else. It appears to be much more like a staircase with rather sharp risers, more a matter of spurts and rests. The spurts ahead in growth seem to be touched off when certain capacities begin to develop. And some capacities must be matured and nurtured before others can be called into being. The sequence of their appearance is highly constrained.7

What is the nature of these steps or stages in the development of the child? Bruner states that they have been described in different ways by different researchers, all over the world, but they all bear a striking similarity to the developmental theory of Jean Piaget. The first stage is the manipulative, when attention is short and single-tracked. Knowing is knowing how to do -- a hole is to dig, a line is to pace off, an object is the same as what one can do to or with it. Reflection is at a minimum. This stage Bruner refers to as the stage of enactive representation,8 and it is characteristic of the pre-school age child.

The second stage of development is characterized by Bruner as the "iconic," and reaches its height usually between

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7 Bruner, Toward a Theory of Instruction, p. 27.
the ages of five and seven. This is a period in which the developing human mind becomes capable of reflection which is divorced from the concrete actions in which it is involved. The child becomes capable of internalizing the environment, of creating certain representations in the form of images which stand for the data of and activity with the environment. Bruner tells us,

Iconic representation is principally governed by principles of perceptual organization and by the economical transformations in perceptual organization...techniques for filling in, completing, extrapolating.  

This capacity for internal representation of the experience which constitutes the child's environment employs images of more than one part. The image-making involved in iconic representation serves to symbolize concepts, without fully defining them. However, the images serve as a means for structuring only immediately present experience. The child creates a model of the experience he encounters directly, but he is not able to move beyond this present experience to that which he is not directly encountering or has not already directly encountered. Bruner says,

This is not to say that children operating concretely (in the iconic mode) are not able to anticipate things that are not present. Rather it is that they do not command the operations for conjuring up systematically the full range of alternative possibilities that could exist at any given time.  

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9 Ibid., p. 11.
It is in the third stage of growth which Bruner calls the symbolic,\textsuperscript{11} that the child develops the capacity to deal with symbol systems as an instrument of thinking. This occurs at the onset of adolescence -- somewhere between ten and fourteen years of age. In this stage, Bruner tells us, the child's intellectual activity seems to be based upon an ability to operate on hypothetical propositions rather than being constrained to what he has experienced or what is before him. The child can now think of possible variables and even deduce potential relationships that can later be verified by experiment or observation. Intellectual operations now appear to be predicated upon the same kinds of logical operations that are the stock in trade of the logician, the scientist or the abstract thinker. It is at this point that the child is able to give formal or axiomatic expression to the concrete ideas that before guided his problem-solving but could not be described or formally understood.\textsuperscript{12}

During this third period, the significance of language (and of symbol-systems such as mathematics) as an instrument of thought emerges. Words stand for objects which are not immediately present; words are manipulated in ways which permit of the solution of intellectual problems. Words become a means of dealing with "categories of the possible, the conditional, the counterfactual conditional" which permit models of reality not only experienced but possible, and which may be used for inquiry of the most sophisticated sort.

Bruner illustrates these phases of development in a child using the principle of a balance-beam. A small child can act on the principles of a balance beam by showing his ability to

\textsuperscript{11} Bruner, Toward a Theory of Instruction, p. 11.
go up and down properly on a see-saw. He knows that his side will go down further as he slides out further from the center. A child in the iconic stage can represent the balance beam to himself by constructing a model and hanging weights on it, or by making a drawing of it. A child in the symbolic stage can describe a balance beam with language and without graphic representation, and, equally significantly, with the use of mathematical symbolism.

Thus, just as man, in his evolution as a species has developed three implement systems, so does man as an individual develop the appropriate skill systems which match themselves to these implement systems. These appropriate skill systems, as represented in Bruner's writings on education, manifest themselves in the enactive, the iconic and the symbolic phases of development of the human organism. The human mind develops according to a "program" which is its own and which is characterized by an "intrinsic and self-contained logic" which manifests itself at each stage of development. At maturity, the human mind is equipped with three systems to use separately or in combination.

Readiness

The "dictum" which, in the popular mind is most closely associated with the name of Jerome Bruner, and which has

\[13\] Bruner, On Knowing, p. 8.
captured the imagination of that public which has read him or read about him, is Bruner's hypothesis about readiness. In the chapter dealing with readiness in *The Process of Education*, he states, "We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development." At each stage of development, the child has a certain way in which he sees the world and explains to himself what he sees. If one is to teach any subject to the child, this subject must be structured so that it appears to the child as compatible with his own way of viewing the world. In a word, the subject must be translated into the child's terms so he may grasp it. In Bruner's view, any subject or any idea can be presented in an honest and useful form which fits the thought-form of the school aged child. A first presentation, thus, can then be returned to and represented again, this time more powerfully and in more sophisticated form as the child moves from one stage of intellectual development to the next. The later, and more sophisticated presentation is made easier for the child to assimilate precisely because he has already learned the idea, even if in a different and simpler form.

Bruner uses mathematics learning as a means of demonstrating how his hypothesis might be applied in a school setting.

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When the child is in the enactive stage, he is capable of grasping "intuitively and concretely," in Bruner's language, many of the basic mathematical concepts. But he can do so only within the limits which the enactive stage sets for him. Bruner states,

It can be demonstrated that fifth-grade children can play mathematical games with rules modeled on highly advanced mathematics, indeed, they can arrive at these rules inductively and learn how to work with them. They will flounder, however, if one attempts to force upon them a formal mathematical description of what they have been doing, though they are perfectly capable of guiding their behavior by these rules.

What is most important for teaching basic concepts is that the child be helped to pass progressively from concrete thinking to the utilization of more conceptually adequate modes of thought. But it is futile to attempt this by presenting formal explanations based on a logic that is distinct from the child's manner of thinking, and sterile in its implications for him. Much teaching in mathematics is of this sort. The child learns not to understand mathematical order but rather to apply certain devices or recipes without understanding their significance and connectedness. They are not translated into his way of thinking. Given this inappropriate start, he is easily led to believe that the important thing is for him to be 'accurate' -- though accuracy has less to do with mathematics than with computation. Perhaps the most striking example of this type of thing is to be found in the manner in which the high school student meets Euclidean geometry for the first time, as a set of axioms and theorems, without having had some experience with simple geometric configurations and the intuitive means whereby one deals with them. If the child were earlier given the concepts and strategies in the form of intuitive geometry at a level that he could easily follow, he might be far better able to grasp deeply the meaning of the theorems and axioms to which he is exposed later.

Thus, for Bruner, the concept of readiness, as related to his theory of intellectual development involves the presentation of subject matter to the child in terms of the stage of cognitive growth in which the child finds himself, and the return to that material as the child moves from one stage of growth to a higher one. Set theory, in mathematics, expressed in iconic level terms, can be comprehended by fourth graders who are in the iconic stage of development; when they reach the symbolic level they can learn it again, this time expressed in the proper formal symbolism. This principle, illustrated in mathematics above, and in physics with the use of the conservation theorem, taught in increasingly sophisticated form as the child grows, will also apply to teaching in the humanities. Bruner suggests that the same situation is applicable to teaching in the humanities. The concept of tragedy, he states, may be introduced to the very young child and when he has met and assimilated it on a simple level, he will be better able to encounter and assimilate it when he meets it again in a more sophisticated and powerful form.

Bruner repeats this theme in each of his three books on education -- in The Process of Education, in On Knowing, and again in Toward a Theory of Instruction, as well as in many articles on education written during the period 1960 to 1966. The theme has two parts -- first, that concepts can be taught

16 Bruner, On Knowing, p. 110.
18 Bruner, Toward a Theory of Instruction, p. 29.
to the child at any stage of development if they are translated into a form which corresponds to his level of development; second, that teaching a significant concept in a simple way at a simple stage of development will make possible better learning of the same concept in its more sophisticated form when the child is reintroduced to it in his more sophisticated state of development. In short, they can be taught and they should be taught in such way, if learning is to be maximized.

Bruner recognizes in 1966, as he did in 1960, that his hypothesis, in both its aspects, must be subject to widespread testing and evaluation and he cannot, in 1966 any more than in 1960 claim that evidence has proven its validity. With regard to the question of translation, appeals to the experience of apparently extraordinary teachers of mathematics such as David Page of the University of Illinois can hardly be thought to constitute proof. Dr. Page, quoted in *The Process of Education* states that when the child has reached the "proper point of view," the skillful teacher and text book can find the "medium questions" which the child is capable of answering, thus avoiding the trivial or the impossibly difficult which will lead him nowhere.19 This, however, requires a level of skill in teaching which perhaps only the David Pages can attain.

In 1966, Bruner states again that most subjects can be translated and retranslated into forms which parallel the

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developmental pattern of the child. His case for mathematics is fairly explicit; his example of tragedy in the study of literature far less so. He suggests that a retelling of the great myths, or use of children's classics may translate into the child's terms an awareness of the meaning of human tragedy. May it not perhaps be suggested that a retelling of Macbeth, certainly a tragedy, to young children may find them enjoying it, not as tragedy, but rather as a tale of adventure of the "good guys" and the "bad guys" with the bad being conquered in the end? Is a young child who has not matured sufficiently to comprehend the meaning of human tragedy (which, perhaps, only living and encountering suffering can do for an individual) capable of understanding tragedy as tragedy even when it is presented in simple terms, in quite the same way as he can comprehend intuitive geometry? Is the Lambs' Tales From Shakespeare a "classic" attempt to translate Shakespeare into the terms a young child can comprehend, in any sense at all to be considered Shakespeare? These and many other such questions related to the contention about translation remain still to be answered. In On Knowing Bruner states, "The evidence shows that the problem of translating concepts to this or that age level can be solved once we decide what it is we want to translate." But it may be argued that saying so, even

20 Bruner, Toward a Theory of Instruction, p. 30.
21 Bruner, On Knowing, p. 111.
when it is Bruner who does the saying, hardly makes it so.

The second part of Bruner's dictum refers to the improve­ment in learning which occurs for a child on a more sophistica­ted level of development when he has encountered a concept earlier and translated into a form he could assimilate. Bruner, himself, in The Process of Education, raises some of the issues which such a hypothesis presents. He states,

Here one is immediately faced with the question of the economy of teaching. One can argue that it might be better to wait until the child is 13 or 14 before begin­ning geometry so that the projective and intuitive first steps can immediately be followed up by a full formal presentation of the subject. Is it worthwhile to train the young inductively so that they may dis­cover the basic order of knowledge before they can appreciate its formalism?....There is evidence to indicate that such rigorous and early training has the effect of making later learning easier....But the danger of such early training may be that it has the effect of training out original but deviant ideas. There is no evidence available on the sub­ject, and much is needed.22

Perhaps the only experiment in curriculum in the schools of the United States which has been in force for long enough to test Bruner's hypothesis that early learning in the enactive and then in the iconic stage improves later learning in the symbolic stage, is the new mathematics with its widespread 1-12 adoption. Examination of evaluations of these curricula in terms of the success of mathematics learning of more advanced students who had had new math in earlier grades as well by no means provides proof for Bruner's hypothesis.23

This lack of clear-cut proof of its validity, of course, may be attributed to inadequate teaching, inadequate "translation" in the devised curricula, or inadequate standards for evaluation, and may not be due to shortcomings in the hypothesis. Much more evidence must be collected over the space of many more years to determine the value of this second aspect of Bruner's hypothesis.

In a recent popular journal, an article appeared concerning the work of Jean Piaget (whose developmental psychology Bruner has popularized in the United States, and whose postulation of the stages of growth is paralleled by Bruner's.) In the article, Piaget is quoted as having stated with regard to Bruner's dictum,

a few years ago, Bruner made a claim which has always astounded me; namely that you can teach anything in an intellectually honest way to any child of any age if you go about it the right way. Well, I don't know if he still believes that.24

Piaget's astonishment which was shared by many educators when Bruner's hypothesis was first stated in 1960, has not been confronted with evidence which could effectively dissipate the astonishment, by 1967.

Motivation

Bruner states that the single most characteristic aspect

24 Saturday Review of Literature, May 20, 1967, p. 82.
of human beings is that they learn. Learning is so much a part
of human behavior, it is so "deeply ingrained in man" that it
occurs almost involuntarily. Bruner suggests that "thoughtful
students of human behavior have even speculated that our speciali-
ization as a species is a specialization for learning."25

But mere learning is not enough for man -- he not only
learns, but he is educated. Education is a human invention,
which conserves the learning of the past and transmits it to
the young human of our culture so he need not relearn it all
again from the beginning. This process of education as we
know it occurs in a special setting, which is the school, usually
located physically apart from the home. In this special setting,
the child is required to regulate his learning according to
standards established externally, and remote from his interests
and desires of the moment. He must encounter abstractions
which are removed from his immediate experience. He must be
orderly and organized, perhaps in a way he has not ever known
before encountering school; he must be restrained and quiet in
a way never expected of him before. What are the motivations
which can be appealed to to cause a child to submit to educa-
tion; indeed, not merely to submit, but to participate in, en-
joy and benefit from the process?

25 Bruner, Toward a Theory of Instruction, p. 113.
There are two general categories of motivations; extrinsic and intrinsic. Extrinsic motivation is that in which the child is willing to submit to education because such education provides a series of rewards, or, in not tending to the process, of punishments. With regard to extrinsic motivation, Bruner states,

You will have noted by now a considerable de-emphasis of extrinsic rewards and punishments as factors in school learning. There has been in these pages a rather intentional neglect of the so-called Law of Effect, which holds that a reaction is more likely to be repeated if it has previously been followed by a 'satisfying state of affairs.' I am not unmindful of the notion of reinforcement. It is doubtful, only, that 'satisfying states of affairs' are reliably to be found outside learning itself -- in kind or harsh words from the teacher, in grades and gold stars, in the absurdly abstract assurance to the high school student that his lifetime earnings will be better by 80 percent if he graduates. External reinforcement may indeed get a particular act going and may even lead to its repetition, but it does not nourish, reliably, the long course of learning by which man slowly builds in his own way a serviceable model of what the world is and what it can be.

For Bruner, then, the "satisfying states of affairs," which are to be encountered in learning are found within learning itself. The child who is motivated to learn does so because of the intrinsic pleasure which education provides for him. One aspect of this intrinsic pleasure is related to the satisfaction of curiosity. Curiosity is the state in which our attention is attracted to something which is unfinished,

26 Bruner, Toward a Theory of Instruction, p. 128.
or unclear or uncertain. And attention maintains itself until the unclear or uncertain become clear or certain, and the unfinished finished. The search for the achievement of certainty in itself is satisfying. In the young child, curiosity manifests itself in an interest in everything, without a capacity to sustain such interest in any one thing for a very long period. The child is, so to speak, "drinking in the world"27 -- he has an unsatiable interest in new impressions. As the child grows and develops, his curiosity becomes channeled into a more sustained and active form. It is part of the function of education to help channel curiosity from the unrestrained and episodic form it assumes at first to the more significant and productive form it may later assume.

Insofar as one may count on this important human motive -- and it seems among the most reliable of motives -- then it seems obvious that our artificial education can in fact be made less artificial from a motivational standpoint by relating it initially to the more surfacy forms of curiosity and attention, and then cultivating curiosity to more subtle and active expression.28

A second form of intrinsic motivation is one which Bruner refers to as the drive to achieve competence. The child, in the process of learning how to grasp, explore, crawl or walk, for example, engages in behavior which is persistent and directed. This directed behavior occurs because the child has an intrinsic need to master his environment. The young child

27 Ibid., p. 115.
28 Ibid., p. 117.
learning to speak will go on using his new words long after no one appears to be listening to him. He seems to obtain sheer pleasure merely in practicing his new skill. Bruner suggests that although competence may not naturally be directed toward school learning, it is certainly possible that the great access of energy that children experience when they get into a subject they like is made of the same stuff.

We get interested in what we get good at.29

Bruner suggests that skilled teachers working with the new curricula in mathematics and science note the delight and eagerness with which students want to move forward in mastering the material. This confidence, based on awareness of competence, propels them forward. Arousal of this competence motive is based on the mastery of tasks which have a structure about them -- "a beginning, a plan and an end," according to which progress can be checked. The task at which competence is to be achieved must be appropriate for the child's age, or his sex, or his social class. A great deal more remains to be learned about this fundamental motivational drive, perhaps, most important, the role which education can and must play in nourishing and encouraging the drive to competence. But the existence of an intrinsic desire on the part of human beings to achieve competence, to master a task or a subject for the sheer joy of its mastery, is a motivational process which can

29 Ibid., p. 118.
be of immeasurable aid to the teacher and the school in promoting learning.

In summary, Bruner's educational writings conceive of the human species man as having evolved by the development of three skill systems whereby he is able to use tools for his hands, tools for his distance receptors, and tools for thinking. The evolution of the species man is paralleled by the growth and development of each individual man. Each man goes through a period of development in which he encounters the environment by manipulation, then by perception which is capable of internalization, and finally by symbolization, which is divorced from the objects of experience as such, and makes possible modes of thought of great power and richness. At maturity, he has attained the use of three systems of dealing with the world.

The conception of readiness which Bruner develops is based on the notion that the more powerful and advanced phases of development are enhanced and enriched when the prior stages have been enriched. Thus, it is the function of the school to provide material which is translated into the form which can be assimilated by the child in each stage of development. If a child will encounter a significant idea translated into a simple form, he will be better able to master it when he encounters it again in a more complex form when he has reached a more advanced stage.
Finally, Bruner views motivation as an intrinsic force, and not dependent upon the extrinsic factors of reward and punishment. The child, given curiosity and a certain innate drive to achieve competence will push himself to learn for the sheer pleasure of succeeding at his task, provided the learning environment and the learning tasks are such as will encourage these intrinsic motives. The child, as a developmental unit, confronted with properly structured knowledge, will then engage in the process of education. Bruner's epistemology and his psychology become linked through his theory of education.
CHAPTER 4

DEVELOPMENT AND THE INFLUENCE OF ENVIRONMENT

In *The Process of Education* Bruner refers to the "intrinsic and self-contained logic" which determines the development of cognitive growth. This means that the human mind moves from level to level according to the unfolding of a certain intrinsic pattern. In 1966, he repeats the same description, referring to mental development as a series of "spurts and rests," which are touched off when certain capacities begin to develop.¹ This has been the burden of his argument in his writings on education, and he has chosen to insist that curricula must be devised which honor these steps, each level of the spiralling curriculum being suited to the developmental state of the child.

However, from the very beginning of his writing on education, Bruner has presented the possibility that the developmental states are not completely intrinsic, but that they are subject to the influence of environment to slow them or to speed them, depending upon the type or the richness or poverty of such environments. Thus, in *The Process of Education*, he states, ¹

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¹ Bruner, *Toward a Theory of Instruction*, p. 27.
But the intellectual development of the child is no clockwork sequence of events; it also responds to influences from the environment, notably the school environment. Thus, instruction in scientific ideas even at the elementary level, need not follow slavishly the natural course of cognitive development in the child. It can also lead intellectual development by providing challenging but usable opportunities for the child to forge ahead in his development. Experience has shown that it is worth the effort to provide the growing child with problems that tempt him into next stages of development.²

In Toward a Theory of Instruction, he states,

these steps, or stages, or spurts or whatever you may choose to call them are not very clearly linked to age; some environments can slow the sequence down or bring it to a halt, others move it along faster.³

There seems to be a fundamental contradiction in these two approaches to the dynamics of cognitive growth. When the human organism is conceived as having a program for development which is its own,⁴ which proceeds according to an "intrinsic and self-contained logic" of its own, the environment serves as a kind of preservative force which can encourage or inhibit development, but which cannot determine its course. When the course of cognitive development is determined by the richness or poverty of the environment in its interaction with the growing child it is the social or environmental dimension which assumes the primary role in the course of intellectual growth.

In the educational writings of Bruner, the emphasis has been

³ Bruner, Toward a Theory of Instruction, p. 27.
⁴ Bruner, On Knowing, p. 6.
on the intrinsic, unfolding aspect of mind, with only hints
concerning the possibility of the power of environment. How­
ever, in Toward a Theory of Instruction the hint becomes a
signal for a change in direction.

The first essay in this book (which was written, appar­
ently, at the same time as the publication of Studies in
Cognitive Growth) summarizes some of the research which is
reported in this latter book which embodies the change in
Bruner's thought about the signal power of environment. In
this essay, Bruner states that intellectual development is
dependent upon the

Systematic and contingent interaction between a
tutor and a learner, the tutor already being equip­
ped with a wide range of previously invented techni­
ques that he teaches the child.5

The child is born into a culture and shaped by it, and this
culture performs this shaping function by the medium of a
series of relationships which constitute the tutor-learner
association. These include the child and his family, the child
and his teachers, the child and his peers, the child and indi­
viduals with whom he identifies, the child and the culture's
heroes, etc. The medium of language, especially in its more
complex and symbolic form is the instrument which the tutor
employs to enable the child to move beyond his immediate world

5 Bruner, Toward a Theory of Instruction, p. 6.
of action or impression to deal with a world which is remote in reference, and they (the symbols) are almost always highly productive or generative in the sense that a language or any symbol system has rules for the formation and transformation of sentences that can turn reality over on its beam ends beyond what is possible through actions or images.  

When the tutor-learner interaction is inhibited (and "tutor" is to be considered in the broadest sense as any or all agents of the culture which transmit the technology of the culture to the developing child); the development of the child is inhibited -- there is a failure of growth. Bruner, thus, is emphasizing in this essay something which his educational writings prior to this time have not stressed --

that mental growth is in very considerable measure dependent upon growth from the outside in -- a mastering of techniques that are embodied in the culture and that are passed on in a contingent dialogue by agents of the culture.  

Attention, then, must needs be paid to the outside, or the culture, and to its effect on development, rather than primarily or exclusively to the inside, which is the child who develops according to a working out of an irrevocable inner logic which culture can affect adversely only when it is seriously deprived or positively, if at all, only when it is greatly enriched.

The new direction in Bruner's thought, this new emphasis on the extrinsic factors affecting growth is presented in

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6 Ibid., p. 12.
7 Ibid., p. 21.
Bruner's book, *Studies in Cognitive Growth*, and, in part, in an important article which appeared in *The American Psychologist* in 1964. There are two types of studies with which he deals -- studies concerned with the effect of tutoring on the three stages of cognitive growth within a given culture, and cross-cultural studies which show the differences in the course of growth as such in different cultures.

**Intra-Cultural**

*Studies in Cognitive Growth* presents the results of many research studies organized to demonstrate the stages of growth discussed by Bruner. However, in several of the studies, Bruner and his associates find that factors other than those purely maturational affect the performance of the children studied at tasks posed by the experimenters. These factors are those in which the tutor, as a result of teaching techniques, modifies the expected developmental sequence.

Piaget and his associate, Barbel Inhelder, have demonstrated that if children below the age of seven are shown two beakers of identical size which they consider to be equally filled with water, the concept of equality is lost if the contents of one of the beakers is then transferred to another beaker which is either thinner or wider than the original. When the water is poured into a thinner beaker, with a re-
sultant higher water level, the children will say there is more water; when it is poured into the wider beaker with a resultant lower water level, the children will say there is less water. This points to the fact that children in this phase of development are unable to conserve a quantity of matter over transformations in appearance. The capacity to conserve does not arise, in the Piagetian view, until the child is able to internalize the operation which enables him to recognize that it can be inverted (by realizing that in pouring it back it remains the same) or compensated (realizing that greater height multiplied by lesser width yields the same quantity). Bruner states, with regard to this idea of conservation,

"The rather lengthy series of experiments reported in the following pages grew out of our efforts to explore more deeply the psychological factors leading to the growth of the idea of conservation or invariance, for Piaget has principally described the invariance pattern as if it were a series of quasi-inevitable maturational steps involving the unfolding of logical operations. Like others who have followed his lead, we, too, are in his debt, though in the end we have been led onto other paths and, on some crucial points, have been forced to bring his theoretical account into serious question."

These experiments Bruner refers to constitute an attempt to "create instructional conditions favorable to the development of conservation." It seems obvious to Bruner, on the basis of the classic Piagetian experiments discussed above

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8 Bruner, Studies in Cognitive Growth, p. 185.
9 Ibid., p. 191.
that children who have not yet achieved conservation need help which would protect them from "the bias of perceptual immediacy" present in the height of the water level in the beakers.

If they could be shielded from a quick, misleading iconic rendering of the situation -- shielded in a fashion that would permit them to represent the situation in language before they could see it -- perhaps the language would serve as a guide for organizing their perceptions in a new way.10

An experiment by Francoise Frank provides just such conditions. She dealt with 40 children divided equally between ages 4, 5, 6, and 7 from the suburbs of Boston. They were first given the standard Piagetian conservation pretest described above -- pouring water from a beaker to another either wider or higher, so as to determine which children exhibited conservation, and which did not. In one of the experiments, two standard beakers are equally partly filled, and the children judge them as containing equal amounts of water. A third beaker of the same height but wider is presented. The three beakers are then hidden by a screen, with only their tops visible. The experimenter pours the liquid from the standard into the wider beaker. The child, without seeing the water level in the wider beaker is asked whether there is still the same amount of water or more or less, and to justify their answer. In comparison with the standard pretest results, correct responses shift from 0-50 percent among the 6's and

10 Ibid., p. 193.
7's. And they explain their judgment by such remarks as "it looks different but it's really the same because it was poured from one glass to the other."

Following this experience, Frank tries another unscreened test on the children in which the additional beaker is thinner and taller than the original. The four year old children have been unaffected by their learning experience. They are unable to exhibit conservation, and they all say that there is more water in the taller beaker. However, with 5 year old children, 70 percent show conservation instead of the 20 percent in the pretest; 90 percent of the 6's and 7's show conservation as contrasted with 50 percent in the pretest. The learning experience has had a marked effect on the hurrying of learning of conservation in children who, in Piagetian terms, are not capable of conservation. Bruner states,

> It is plain that if a child is to succeed in the conservation task he must have some internalized verbal formula that shields him from the overpowering appearance of the visual displays much as in the Frank experiment.\(^{11}\)

In the case of 4 year olds, however, no verbal formulae can overcome the power of the iconic phase. But 5, 6 and 7's, who are thought to be in the iconic phase, can be led out of it by the power of the tutor-learner transaction and its use of language.

Another group of experiments reported in Bruner's book

deals with conservation of solids. Eighty-one public school children from a Boston suburban community with a median age of 7 constituted the subjects. None of them showed conservation on a pretest. The pretest consisted in showing two balls of clay which the child agreed were the same, and then changing one of them into a "hot dog" as the child watched. The child was then asked whether the ball and the hot dog had the same amount of clay or whether one had more. Those children who asserted they were different were retained in the study. A post-test consisted of the same procedure, except that a "snake," which was longer than a "hot dog," was made of the second ball.

A detailed description of the stages of the experiment is perhaps unnecessary for purposes of this explication. It need only be said that one of the clay balls was changed in shape and then moulded back again several times, with the child asked to judge which had more clay and why he thinks so. Some children were allowed to manipulate the clay themselves, while others only watched while the experimenter did the manipulation. Some children were subjected to a training procedure which involved the use of labeling terms in the transformation of the balls of clay. Thus, after the child manipulated one of the balls into a pencil-shaped mass, the experimenter would ask which of the two balls is the longest and
which the fattest. Only after these labels were attached to the clay objects was the question concerning the relative amounts of clay asked.

The results of the experiment are interesting. Thirty one of the 81 subjects learned conservation as indicated on post-test results, compared with those of the pretest. The result of manipulation training is more significant. Twenty two of 41 children learned conservation when they were allowed to manipulate the clay themselves, as contrasted with 13 out of 40 who only watched as the experimenter did it. However, allowing the child to manipulate the clay results in conservation only when the labels are provided. Similarly, labeling helped the child to learn conservation but only when the child was permitted to manipulate the clay himself. In the words of the experimenter,

manipulation and labeling...were highly successful in inducing conservation; but -- and this is the most interesting fact of all -- each of these worked only when the other was present. Thus, manipulation without labeling was virtually ineffective, and the same was true of labeling without manipulation; but together they produced a remarkably high degree of learning among children.12

What, then, are the conclusions which are drawn about the effect of the tutor-learner relationship in leading the child from one stage of development to the next -- by teaching the solution of a problem which, in purely maturational terms...
he might not be considered ready to learn. Bruner's associate, Anne Sonstroem, states with regard to teaching the conservation of solids,

The young child, relying on his usual iconic mode of representing events, makes the judgments he does in the conservation situation because it is a situation in which perceptual cues are dominant. The teaching problem, then, is to lead the child to represent events before him in other ways, ways that will conflict with his perceptual rendering to the extent that he will reject it in favor of the more compelling alternatives. 13 Such a rejection, the argument might run, constitutes at least a tacit acceptance on the child's part of the imperfect correlation between appearance and reality, and he is, therefore, less likely in the future to take appearance, without questioning it, as an adequate representation of reality.

What our experiment did precisely, by the use of manipulation and labeling, was to offer the child ways of representing the conservation problem that conflicted with the iconic. By offering him manipulation, we were encouraging enactive representation; and by offering him verbal labels for compensating attributes, we were encouraging symbolic representation. In short, he was made to cognize the clay 'physically' and verbally, instead of only perceptually.

The interesting fact is, however, that neither of these new modes of representation alone was able to induce enough conflict to produce appreciable learning. This is not really surprising when we consider how compelling were the perceptual cues in the situation, and how strongly the child of six or seven has learned to rely on his perceptual processes for representing his world. Would it not perhaps be asking too much of enactive representation -- developmentally prior to iconic representation and not so salient to the child as it once was before he came into the world of imagery -- to undo entirely what iconic representation is doing? An enactive message, 'It feels the same' (as one child told us), pitted against a most compelling 'But it looks dif-

13 Underlining mine.
ferent.' may have a poor chance of survival in the iconic child. The same thing is perhaps true with respect to a verbal message by itself. But when both enactive and verbal messages are saying 'same' and perception alone is signaling the difference, the two win out over the one. Thus, it is only when we marshal both enactive and symbolic forces against the iconic that the iconic finally gives way. It is when the child is both saying and doing that he learns not to believe fully what he is seeing. Except for the interaction among different modes of representation, learning could not occur.\textsuperscript{14}

Thus, Bruner and his associates have attempted to demonstrate that the tutor-learner relationship in teaching the technology of the culture is such that the stages of growth (in a middle class society as represented by the children they have studied) can be accelerated. Emphasis in education must be placed on the environment and content of teaching rather than on the natural unfolding of capacity. Bruner states that

what is significant about the growth of mind in the child is to what degree it depends not upon capacity but upon the unlocking of capacity by techniques that come from exposure to the specialized environment of a culture.\textsuperscript{15}

It is not within the competence of this dissertation to judge the relative validity of Bruner's earlier, as contrasted with his later theory of development. However, certain questions and problems do arise which it might be useful to raise.

\textsuperscript{14} Bruner, Studies in Cognitive Growth, pp. 223-224.
\textsuperscript{15} Ibid., p. 14.
Some preliminary questions concerning the nature of the size of the samples, the extent of the experimentation, etc., are, of course, probably the first to be considered. Second, and more important, are those related to the implication for transfer of training which are so clearly stated in the conclusion to the experiment on conservation of solids. Sonstroem states that when the child learns conservation before he is quite ready to do so (from a purely maturational viewpoint) by being led to manipulate and verbalize in a way which will over-rule his perceptual biases, he will accept the fact that appearance and reality are not adequately correlated. And, she states that consequently, "he is therefore less likely in the future to take appearance without questioning it, as an adequate representation of reality."\(^\text{16}\) Her experiment, and all the others in the study which demonstrate that growth can be led or pushed show no such thing. They demonstrate merely that in a certain specific kind of situation, conservation can be taught early -- not that in a second different type of situation the teaching of the first experiment will affect the child's mastery of the second without another pain-staking effort to teach him again. There is no proof at all in Bruner's book that the child, in future, will be less likely to take appearance as representing reality. It will require many, many more experiments, conducted on the same group of

\(^{16}\)Ibid., p. 222 (Underlining mine).
children, on different groups, with larger samples better distributed with regard to geography and social class to demonstrate that transfer occurs from one learning situation to another when cognitive growth in a specific instance is speeded by the efforts of the tutor. Had the conservation of solids experiment been conducted on the same group of children as those involved in the liquids experiment with dramatic results (from the conservation-learning point of view), the argument of transfer would be much more convincing.

Finally, the most significant question about the contention that the stages of growth can be pushed, is raised by Piaget himself. Piaget has said,

If we accept the fact that there are stages of development, another question arises which I call 'the American question' and I'm asked it every time I come here; if there are stages that children reach at given norms of age, can we accelerate these stages? Do we have to go through each one of these stages or can't we speed it up a bit? Well, surely, the answer is yes... but how far can we speed them up?

But I have a hypothesis that I am so far incapable of proving: probably the organization of operations has an optimal time.... For example, we know that it takes 9-12 months before babies develop the notion that an object is still there even when a screen is placed in front of it. Now kittens go through the same stages as children, all the same sub-stages, but they do it in three months — so they're six months ahead of babies. Is this an advantage or isn't it? We can certainly see our answer in one sense. The kitten is not going to go much further. The child has taken longer, but he is capable of going further, so it seems to me that the nine months probably were not for nothing.
It's probably possible to accelerate, but maximal acceleration is not desirable. There seems to be an optimal time. What this optimal time is will surely depend upon each individual and on the subject matter. We still need a great deal of research to know what the optimal time would be.

Each of the stages is essential for the development of the following stages. This isn't simply a linear order in which you could jump over one stage and still get to the next one. Each stage integrates the preceding stage and prepares the way for the following.\(^17\)

In conclusion, the question which Bruner must be asked to consider is not whether growth can be led and pushed (even granting that he has demonstrated that it can), but whether it should be.

**Intercultural**

Theories of the developmental stages of the child such as Bruner's (and Piaget's) have been constructed and experiments related to them performed, essentially, as descriptions of the cognitive growth of western middle-class schooled children. In *Studies in Cognitive Growth*, Bruner and his associates have addressed themselves as well to the effect of differing cultures on cognitive growth. The purpose of these studies is

\[\text{to study development in societies in which the culturally given technologies are radically different from our own, with the hope of finding and analyzing differences in cognitive functioning.}\] \(^18\)

\(^{17}\) *Saturday Review of Literature*, op. cit., p. 82-83.

Bruner's colleague, Patricia Greenfield, studied groups of Wolof children in Senegal, employing the familiar conservation of quantity of liquids experiment of Piaget discussed above. The children included a group in the French-styled schools in Dakar (urban-schooled), a group of school children in the village (rural-schooled), and a group of village children who were unschooled (rural-unschooled). All experiments were conducted in the Wolof language. Children in each category were grouped by ages -- 6-7, 8-9, and 11-13.

It was found as a result of one aspect of the experiment that no more than half of the rural unschooled children achieved conservation by the age of 11-13, and this was almost the same as those who had attained it by 8-9. (Further studies of unschooled rural adults indicated that they had not achieved it beyond the level of the 8-9 group, demonstrating that there was not operative a delayed maturational effect.) These experiments "suggest that without school, intellectual development defined as any qualitative change ceases shortly after age 9." In contrast to the unschooled rural children, the schooled children of the village, as well as the schooled children in Dakar, all achieved conservation by the age of 9.

Another inter-cultural experiment report deals with the study of equivalence groupings made by 50 North American suburban children ranging in age from 6-17, as contrasted with 57

\[19\] Ibid., p. 234.
Mexican village children with a similar age span. The children in each culture were presented an array of items in succession, the name of each printed on a small white card, and read to the child. When a card had been once presented, it was placed in front of the child so that it and all the previous items in the array would be seen at once. The array for the American children was banana, peach, potato, meat, milk, water, air, germs, stones. For the Mexican children, naranja was used instead of peach, frijol instead of potato and lumbre instead of germs. The American child was asked, "How are banana and peach alike?" Then, potato was presented with the question, "How is potato different from banana and peach?" And, "How are they all alike?" Of "stones," all that was asked was how they were different. A similar procedure was followed for the Mexican array.

The results of the experiment indicated that, in general, children 6-8 of both groups were able to differentiate objects, but not synthesize them. Differentiation was done primarily on the basis of perceptible qualities such as color and shape. At ages 9 and 10, half of the North American children could synthesize well, as compared with only one of 19 Mexicans. This synthesis involved the utilization of abstract concepts, such as the idea that a group of the objects are necessary for sustaining life, or that a group of objects can all be bought
at the supermarket. In the case of the Mexican child, as he becomes older he employs more and more subtle perceptual distinctions such as "a banana and a bean are both crescent-shaped like the moon." This direction continues with the older children, 16 or 17 year old Americans using more and more abstract functions and formal equivalencies, while the Mexican adolescent rarely abstracts.

American and Mexican 6 year olds are not strikingly different in their emphasis on perceptible properties, but with growth, the Mexican child moves toward greater perceptual subtlety and the North American toward more abstraction.20

The same test for equivalence was next performed on two groups of Mexican children -- 52 village children and 102 children living in Mexico City, this time divided into two age groups, one of 8-10, and another of 12-13. The results of the test indicated that by age 9, twice as many urban as rural children (in percentages) succeeded at the task of synthesizing. By age 12, four times as many city children had achieved synthesis as village children (82-26). The percentage of synthesis of the urban Mexican children is almost identical with that of the urban North American children described above. In short,

The perceptual, concrete, difference-sensitive, organically oriented village child is by age 12 in sharp contrast to the more abstract, functional, similarity-sensitive, cosmopolitan city child of the same age.21

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20 Ibid., p. 262.
21 Ibid., p. 267.
The conclusion which is drawn on the basis of these equivalence experiments is,

A city child coming from an industrial society starts by dealing with objects in terms of their perceptible, concrete characteristics. He soon comes to consider them in the light of what he can do with them. In time, he is led to more abstract formulations as to how things are, how they are alike, and how different.

Peasant children do not change that much. They are much more similar to their older brothers: they both look. The older one looks at things more closely and considers ways to use them. While the older peasant child can say how things are alike, he feels more at home with their differences for that is where reality lies for them. He does not think in generalities. At his best he shows a rich interest in and relation to individual people, individual objects or particular events. At his poorest, he sees only the concrete and the particular, and walls himself off from anything beyond immediate experience.22

Bruner's associates performed several other equivalence experiments of the types discussed above, dealing among others with Wolof children in Senegal again, and including in the samples rural and urban-schooled children and rural-unschooled. A difference between the capacity for abstraction (synthesis) in rural and urban children again was manifest, as in the Mexican case. However, a still larger difference between the children who had been to school and those who hadn't was revealed. Rural life, as was found to be the case in Mexico, is less conducive to the development of abstraction than urban life. But, as was seen in the development of the capacity for

22 Ibid., p. 268.
conservation (which, like synthesis, is a function of the "symbolic" stage of growth), the effect of schooling was such as to result in an even greater difference in synthesis than the rural-urban difference. Greenfield states, "Schooling appears to be the single most powerful factor we have found in the stimulation of abstraction."\(^{23}\) And schooled urban children have greater power for abstraction than schooled rural children, making urbanization a second factor.

**Summary**

In these intercultural studies, Bruner and his associates have attempted to demonstrate the validity of his thesis, namely, that mental growth is not merely a matter of matura­tion, but that its very form is dependent upon influences of the environment. The cognitive style of any group of people is reflective of the demands of the culture. When, as is the case in modern, industrial society, abstractions are demanded of a populace, the institutions of society such as the school or the city mould its children to use abstractions. When such abstractions are not required by the culture, the capacity to use them may never develop. Furthermore, in defense of his thesis that it is the influence of the environment which strongly affects mental growth (and not primarily matura­tion as indicated in his educational works), he has attempted to demonstrate that within a culture an "enriched" environment

\(^{23}\) Ibid., p. 315.
can push growth, demonstrating again the influence of the culture affecting the course of cognitive growth from the outside. Whether or not the thesis has been satisfactorily proved by Studies in Cognitive Growth is a matter for psychologists to determine, and beyond the province of this dissertation.

Some Implications for Bruner's Educational Theory

The concern of this dissertation is with Bruner's educational writings, and their antecedents in the intellectual tradition.

Studies in Cognitive Growth outlines a conception of the nature of the knower which departs rather considerably in emphasis from the psychology of these educational studies. It is the impact of these educational writings on the community of educators which is being considered, and so it may be asked whether this newer emphasis is relevant to the central concerns of the dissertation. In one sense, however, it is very relevant, and this constitutes the reason for the rather detailed presentation of this chapter.

The Process of Education and the other educational books are essentially addressed to the situation of the school children of the middle class, technologically advanced societies of the western world. The view of intellectual growth is essentially maturational, and it is the function of the school and the teacher and, surely, the educational establishment,
to provide for each state of this growth the optimum intellectual environment which maximizes learning and enables subsequent development to be built upon as firm and as rich a foundation as is possible. The end of education is to develop the power and sensibility of mind, and it is to this end that educators must devote their efforts.

*Studies in Cognitive Growth* is devoted to the thesis that it is the institutions of a society which play a dominant role in shaping the course of cognitive development of the members of that society. Within a society such as the middle-class society of the United States, an enriched tutor-learner relationship is one which can lead, speed, push the growth process of children (and, conversely, a deprived tutor-learner relationship can retard or stunt it). Between societies such factors as schooling, urbanization (which, of course, implies technological advance), westernization affect the course of cognitive growth. The logic of this position of Bruner's must, therefore, lie no longer with the function of education as developing the power and sensibility of mind. For the power and sensibility of mind to be developed, it is the social institutions themselves which must be acted upon. The tutor-learner relationship which Bruner conceives broadly as concerning all the institutions of the culture such as the family, the school, the community, can only flourish optimally
with healthy families, both physically and psychologically, communities which are clean and free of poverty, disease and social malaise, and schools which flourish in such an environment. The body politic must be uncorrupted, jobs must be plentiful, discrimination eliminated. In intercultural terms, the non-technological societies must be brought into the twentieth century, literacy and schooling must be universalized, the process of urbanization which accompanies industrialization must be sped, and, of course, poverty, disease and fear must be eliminated. No longer can the process of education be separated from the vast task of social reform since it is only the fruits of social reform which will make possible the institutions which will maximize cognitive growth.

Bruner, of course, never once moves along the path which his new emphasis in development points toward — a path strikingly, and surprisingly, like that followed so boldly by John Dewey many decades before him. The educational question, according to this view, must be allied to the social question, and ultimately to the moral question. The next step is for Bruner to write a new Process of Education, this time to be entitled, *The Process of Education: A Need for the Reformation and Reconstruction of Society and Its Institutions.*
CHAPTER 5

ON KNOWING -- BRUNER'S THEORY OF EDUCATION

For Bruner, the nature of knowledge, and the nature of the knower (each of which can be understood as separate entities for purposes of analysis), must be linked with an understanding of knowing or be "doomed to triviality."¹ The question which he asks, in his writings on education, is how one goes about bringing knowledge, in the form of conceptual models of experience, to the developing organism who is capable of cognizing. The transaction occurs through a process, the process of education, and it is through explication of the dynamics of this process that Bruner develops his educational theory.

The Act of Discovery

In Bruner's eyes, the process of knowing implies activity rather than passivity on the part of the knower. He must engage in knowing if he is to make that which constitutes knowledge his own. He must participate in an "act of discovery" for himself, a model-building procedure of his own if the

¹ Bruner, Toward a Theory of Instruction, p. 21.
knowledge which he confronts is to become his knowledge. This procedure is referred to by Bruner as the "act of discovery." He converts his emphasis on the act of discovery in learning into the following hypothesis:

Emphasis on discovery in learning has precisely the effect on the learner of leading him to be a constructionist, to organize what he is encountering in a manner not only designed to discover regularity and relatedness but also to avoid the kind of information drift that fails to keep account of the uses to which information might have to be put. Emphasis on discovery, indeed, helps the child to learn the varieties of problem-solving, helps him to learn to go about the very task of learning.²

Bruner distinguishes between two types of teaching — that of the expository and that of the hypothetical mode. In the expository mode, the teacher himself determines what is to be the type and the pace and the style of the presentation, and the student is the listener — his role is essentially passive. In the hypothetical mode, the student is, to considerable extent, cooperating with the teacher in setting the type, pace and style of the presentation. He participates in its formulation, and, indeed, may even dominate in the relationship at times. He will recognize that there are alternative ways of dealing with the content of the material since he participates in choosing them. It is teaching which is done in the hypothetical mode, according to Bruner, that is the teaching which encourages discovery. Bruner says,

² Bruner, On Knowing, p. 87.
A body of knowledge, enshrined in a university faculty and embodied in a series of authoritative volumes is the result of much prior intellectual activity. To instruct someone in these disciplines is not a matter of getting him to commit results to mind. Rather it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as an historian does, to take part in the process of knowledge-getting. Knowing is a process, not a product.  

What are some of the advantages for the learner in the act of discovery? Bruner suggests that discovery leads to an increase in intellectual potency, for one thing. Thus, he reports an experiment in which groups of students were presented with certain types of information, some of the groups being told they were to transmit the information to others at a later time, and others that they were merely to keep the information "in mind." There was "more differentiation" of the information to be transmitted than that which was merely to be passively received. The necessity for actively transmitting information led to its organization in a form related to this task in a way in which the information which was not task-related was not organized.

Discovery plays an important role in bringing about conservation of memory, which is related to the problem of intellectual potency. The primary problem of memory is not the storing of information, but the capacity to find it when it needs to be recalled. This capacity is related to the

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3 Bruner, Toward a Theory of Instruction, p. 72.
4 Bruner, On Knowing, p. 87.
ability to organize what it is that has been learned and committed to memory. An experiment cited by Bruner serves to illustrate this point. Pairs of words are presented to two groups of children. One group is told only to remember the pairs, to be repeated back to the experimenter at a later date. The other group is told to use a word or an idea which will tie the pairs together in a way which makes sense to each child, to help him repeat them to the experimenter later. As might have been predicted, the group of children which provided mediators was able to recover 95 percent of the second words when given the first words of the pairs, as compared with only 50 percent recovery in the group which had not provided mediators.\(^5\)

Bruner concludes,

One can cite a myriad of findings to indicate that any organization of information that reduces the aggregate complexity of material by imbedding it into a cognitive process a person has constructed for himself will make that material more accessible for retrieval. We may say that the process of memory, looked at from the retrieval side, is also a process of problem solving...

Thus, the very attitudes and activities that characterize figuring out or discovering things for oneself also seems to have the effect of conserving memory.\(^6\)

The techniques, or "heuristics" of discovery involve learning or knowing how to deal with many kinds of difficulties or problems by imposing on them a "workable kind of

\(^5\) Ibid., p. 95.
\(^6\) Ibid., p. 96.
problem-solving form." Bruner suggests that it is only by gaining exercise in problem-solving that one can learn how to solve problems. With practice, a certain style in problem-solving or discovery is developed by the learner, and this style may be generalized and adapted to apply to almost any kind of learning task. The child through such practice, learns to "cut his losses but at the same time be persistent in trying out an idea." He learns at what point in the discovery process it is proper to form a hypothesis — neither too early nor too late in the process. He learns how to propose "testable guesses" which are reasonable.

Practice in inquiry, in trying to figure out things for oneself is indeed what is needed....Of only one thing am I convinced: I have never seen anybody improve in the art and technique of inquiry by any means other than engaging in inquiry. 7

Only by engaging in discovery can one develop the proficiency he needs to engage successfully in further discovery.

Intuition in Discovery

A significant aspect of learning as discovery involves the promotion of intuitive understanding. In The Process of Education 8 Bruner makes clear that it is not easy to make clear just what is intuitive understanding. Indeed, it is a great deal easier to discuss and identify thinking in the analytic

7 Ibid., p. 94.
mode than the intuitive. Analytic thinking moves forward step by step. Each step is explicit, and the thinker can describe to another just how he is proceeding. He knows quite well what data or information he is using, and what method or operations he is following to achieve an answer to his inquiry. He may use deduction, perhaps employing mathematical or logical methods in his problem-solving. Or, he may use standard inductive techniques, using hypotheses and careful induction such as scientific experiment or statistical analysis. Proceeding in an explicitly charted fashion, he moves from statement of the problem to its solution.

Intuitive thinking, by contrast, does not advance in this careful, step-by-step manner. Instead, the problem-solver seems to have a certain innate perception of the problem in its totality. He may "see" or "arrive at" the answer without quite knowing what process he has followed to reach it. When he is asked to retrace his steps, he often cannot account for them since it is likely that he is unaware of what these steps may be. However, Bruner quotes one member of the Woods Hole Conference as saying, "it is wrong to look at intuition as all a la mode and no pie."9 The intuitor may need a special capacity to be a good intuitor, but this capacity demands a sound knowledge of his field of inquiry so that he has a base upon which to work. With such a base he can hop about from step to step, skipping where he prefers to, and using

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9 Ibid., p. 56.
"unorthodox" short cuts to arrive at his conclusion. Then, these conclusions may be subjected to check by analytic means.

How does one go about defining intuitive thinking more precisely? Bruner states,

For a working definition of intuition we do well to begin with Webster: immediate apprehension or cognition. 'Immediate' in this context is contrasted with 'mediated' -- apprehension or cognition that depends on the intervention of formal methods of analysis or proof. Intuition implies the act of grasping the meaning, significance or structure of a problem or situation without explicit reliance on the analytic apparatus of one's craft. The rightness or wrongness of an intuition is finally decided not by intuition itself but by the usual methods of proof. It is the intuitive mode, however, that yields hypotheses quickly, that hits on combinations of ideas before their worth is known. In the end, intuition itself yields a tentative ordering of a body of knowledge that, while it may generate a feeling that the ordering of facts is self-evident, aids principally by giving us a basis for moving ahead in our testing of reality.\textsuperscript{10}

The problem in encouraging discovery by intuitive means is in separating out good from bad intuitors, good from bad intuitions. Can good intuitive thinking be encouraged in the students when the teachers are themselves intuitive thinkers? Should the student be encouraged to make an intuitive guess instead of going painstakingly through the analytic steps involved in finding his solutions? Does fostering self-confidence in the student by encouraging him to trust his judgment and take an intuitive leap lead to better intuitors or "self-confident fools.?" Intuiting is a form

\textsuperscript{10} Ibid., p. 50.
of activity which, Bruner tells us "is not dependent upon right answers at all times." But how does the willingness to credit the student for the wrong answer at certain times fit together with the typical evaluative methods of the typical school? What of the place in school of the intuitor whose approach to problems is beyond the grasp of his teacher who follows methods of discovery which the teacher himself cannot follow? These, and many other such questions and problems are raised by Bruner\textsuperscript{11} with regard to intuitive thinking in learning by discovery. He suggests that it is most important to try to find the answers to these problems, and that much research is necessary for identifying the need for intuition in learning, establishing a proper balance between intuitive and analytic thinking in the act of discovery, and promoting ways in which intuition can be encouraged within the context of the institutional structure which is the school. But his over-all tone is one of hopefulness that these problems can be solved (without evidence that such hopefulness is warranted), and that intuition can take its proper place as a significant technique in learning by discovery.

**Delight and Travel**

There are two elements, by-products so to speak, which enhance the fruitfulness of learning by discovery. Bruner refers to them as delight and travel. By "delight," he means

\textsuperscript{11} Ibid., pp. 64ff.
the intellectual pleasure which is obtained from an act of "reduction of surprise and complexity to predictability and simplicity." In learning knowledge which has been modeled or structured by the process of discovery, there is constant delight to the learner — the process of learning becomes one of continuous happening on the surprising and complex which become reduced to the ever-newly simplified, the process whereby suddenly the incomprehensible becomes comprehensible, the difficult easy, the confusing clear. By travel, Bruner means the capacity whereby learning by discovery leads to generalization far beyond the specific information dealt with — the capacity for abstracting which will carry the child far in dealing with many kinds of data and seeing beyond their specificity. Thus, the road which is constructed for children to follow in learning by discovery is a long road, leading farther than the eye can see, and intellectual delight in the trip greets the traveller at many places all along the way.

Learning by Discovery in Mathematics

Bruner illustrates the process of learning by discovery, using as his prototypical case the learning of mathematics. For Bruner, "discovery in mathematics is a by-product of making things simpler." At first, the child is led to do something manipulative (corresponding to the enactive phase of develop-

12 Bruner, On Knowing, p. 110 (This constitutes an aesthetic response).
13 Ibid., p. 100.
ment). "A hole is to dig, a yard is to pace off or measure with a ruler, subtraction is to take away."\textsuperscript{14} But, once having acted, the child must be encouraged to "turn around" on his actions and represent them (corresponding to the iconic phase of development) by the means of simple symbolism which simplifies all this activity in some way. Thus, after the pacing off, or measuring with fingers or hands or a ruler, the child is introduced to the concept "unit of measure." Bruner states, "Learning to simplify is to climb on your own shoulders to be able to look down at what you have just done -- and then to represent it to yourself."\textsuperscript{15} In the sequence described above, this is precisely what the child has done -- he has been led to discover what a unit of measure is and he has been led to develop a concept which brings order and sense to the operations he has performed.

The promotion of intuitive thinking in mathematics involves leading the student to an awareness of a mathematical concept before he has a formal name or label to apply to it. Bruner describes the behavior of a ten year old youngster playing with snail shells, trying to put them into rectangular arrays. The child found that however he arranged them, there was always one shell which couldn't fit into the rectangle, and which had to be left out. But he found that two rectangular

\textsuperscript{14} Ibid., p. 100.
\textsuperscript{15} Ibid., p. 101.
arrays, put together, produced one larger rectangle, and the two left-out shells could be put together to make a corner for a new rectangle. This child, obviously, had constructed a mathematical model which depended on some very subtle principles. He couldn't identify these principles, but he could do all sorts of things based on them. He had employed the associative law. He was able to put two sets together and take them apart: he was learning something about prime-number arrays and about the construction of identical sets. All these notions constitute some rather complex mathematical concepts. However, if in school these intuitive ways of dealing with numbers are submerged under a plethora of rules which must be rigidly adhered to, and of labels which identify each step of his path, the child loses the recognition that what he has been doing is really mathematics.

Bruner states that he is objecting to the premature use of the language of mathematics, its end-product formalism, which makes it seem that mathematics is something new rather than something the child already knows.\(^\text{16}\)

In observing children learn in mathematics and in other disciplines as well, it is readily noted that they tend to employ natural or intuitive ways of thinking, as in the case of the boy and his shells. This tendency must not be inhibited by unnecessary formalism -- indeed, it must be encouraged, and

\(^{16}\) Ibid., p. 104.
ways must be found to help the child improve at it so as to enhance the process of learning by discovery.

In summary, Bruner states with regard to the act of learning by discovery.

I shall operate on the assumption that discovery, whether by a schoolboy doing it on his own, or by a scientist cultivating the growing edge of his field is in its essence a matter of rearranging or transforming evidence in such a way that one is enabled to go beyond the evidence so reassembled to new insights. 17

The process of knowing, which is the process of discovery, is no different for the young student than it is for the scholars on the frontiers of knowledge. Both are engaged in creating structures which constitute knowledge, and this is what discovery is all about. The young student must learn -- indeed he must be taught to build for himself the mathematical structures if he is to think mathematically, to create for himself the historical models as the historian does, in short, to discover knowledge for himself by participating in knowledge-getting.

It is this process of discovery which is knowing for Bruner. It is not a rigorous, scientifically-ordered procedure following certain fixed rules and steps. It is often dependent upon guessing, intuiting, upon non-analytic methods of problem-solving and of inquiry. Standard analytic techniques

constitute only part of its arsenal of approaches to problem-solving. And these standard analytic techniques may not apply at all in certain realms of knowing, since Bruner distinguishes between the mode of knowing which is science and the mode of knowing which is art. (This distinction serves as the basis of the discussion on Bruner's aesthetic theory which appears in Chapter 6). Discovery, which is an inherently flexible way of knowing, includes elements which can deal with art and others which are equipped to deal with science, and the same elements are not necessarily at work in the different types of knowing. For knowing is not a single, monolithic process for Bruner, and the method of knowing must be adapted to the kind of knowledge with which it deals. But all discovery in all realms of knowledge involves process, participation in structuring by the learner, no matter what the level of his learning, it involves analysis, and the use of intuition. Together, these lead to increased intellectual potency, conservation of memory, delight in the surprises which learning reveals, and capacity to travel, by generalization and abstraction far beyond the specific data to be learned or situation in which it is learned.

Excellence and the End of Education

At the beginning of his essay "The Act of Discovery," Bruner quotes (in admiration) the philosopher Maimonides, con-
concerning the four forms of perfection which men might seek. He tells us that the first and lowest form is perfection in the acquisition of worldly goods. But such goods do not bear a meaningful relationship to their possessor, in that he can lose them suddenly and find then that there is no difference between him and the lowliest of men. The second and next lowest perfection is that of physical strength and skill. However, the physical is not what is uniquely human about man, and in this regard he is far inferior to many animals — even the mule. Moral perfection, the third form is the next to highest. However, moral principles are only called into use when a man comes in contact with his fellows — they would be completely at rest when a man is alone and is isolated from society. But the fourth kind of perfection is the true human perfection — the possession and perfection of the highest intellectual faculties. This is justified on the ground that the other three forms, if a man possesses them, are not the property of man, but of others. But the perfection of intellect is purely a man's own — no other man owns any part of it.¹⁸ "Man's intellectual excellence is the most his own among his perfections,"¹⁹ Bruner states, and it is this highest excellence which it is the end of education to pursue.

¹⁸ Ibid., p. 81.
¹⁹ Ibid., p. 82.
For Bruner, as may be seen in his psychological theory (especially that of the educational writings) man is conceived as an individual, developing cognitive organism, and it is this capacity for cognition, for thinking, which is his unique characteristic. The purposes of education are "to develop the power and sensibility of mind." Bruner's primary emphasis is on education as developing the processes of intelligence so that the individual can go beyond the ways of his own culture to innovate intellectually so that he is able to "create his own version of the world." He decries the emphases in education which have attempted to subordinate the individual to the aims of society. He speaks condemingly of a conception of man's role in society as a purely instrumental one. And he urges that "The need is now to employ our deeper understanding not only for the enrichment of society, but also for the enrichment of the individual." And this enrichment is obtained through education by the pursuit of the excellence of intellectuality.

The school, for Bruner, is conceived as an entry-way into the life of mind. It is devoted to helping the child engage in discovery (which is learning), by the use of his intelligence, his cognitive capacity, causing him to leap into new and un-

20 Even in Studies in Cognitive Growth, where the power of social institutions in effecting intellectual development is stressed, it is their importance for increasing the capacity for thought which concerns Bruner, and not the institutions as such.

21 Bruner, On Knowing, p. 115.
22 Ibid., p. 116.
imagined realms of experience," quite discontinuous with everything that he had encountered before. Education will serve, under these circumstances, to awaken a host of new perspectives which will bring about "the realistic confidence in the use of thought that characterizes the effective man." This awakening and developing of intellect is the function, the end of the school, in Bruner's eyes, and the end which serves man's greatest perfection.

This end can be served best not merely by the cultivation of the perfection of intellect in the abstract, but by the emulation of images of excellence which are brought before the developing child. The school must provide images of excellence by providing teachers as models who, in their own way, pursue and embody these intellectual qualities. The school must bring before the child "working versions" of excellence in the labors of the leading scholars, artists, etc., whose work personifies this highest perfection.

The Nobel poet or the ambassador to the United Nations, the brilliant cellist or the perceptive playwright, the historian making use of the past or the sociologist seeking a pattern in the present -- these men, like the student are seeking understanding and mastery over new problems. They represent excellence at the frontiers of endeavor. If a sense of progress and change toward greater excellence is to illuminate our schools, there must be a constant return of their wisdom and effort to enliven and inform teacher and student alike.23

23 Ibid., p. 126.
Not every child can achieve the excellence of these great men on the frontiers of knowledge, nor even the much lesser level of the excellence among his teachers. But any man, any student, any budding young mind can aspire toward an image which he creates, each in his own way and in the style which is his own. Each individual must develop his own, personal image of excellence, and it is a principal task of the school to help him to do so.

The Curriculum

The school curriculum which would be devised by Bruner is based on the great conceptual inventions of the scholars, contemporary and past, on the "frontiers of knowledge." In the history of culture, masses of data, facts, observations and experiences have been patterned into broad, conceptual frameworks or models which have been characteristic of bodies of knowledge or disciplines. It is study of these disciplines which are to constitute the curriculum.

Bruner's answer to the question about what shall be taught is, "that which is worthwhile knowing." This includes, Knowledge of the natural world, knowledge of the human condition, knowledge of the nature and dynamics of society, knowledge of the past so that it may be used in experiencing the present and aspiring to the future -- all of these, it would seem reasonable to suppose, are essential to an educated man. To these must be added another -- knowledge of the products of our artistic heritage that mark the history of our aesthetic wonder and delight.24

24 Ibid., p. 122.
And, of central significance, the tools of symbolism which enable structures to be comprehended and talked about. These are language in its natural and in its mathematical sense, and no educated man of the future can be imagined by Bruner, who is not adept in both.

Translated into conventional terms, then, the curriculum of the school is to be based on the tools of mathematics and language (presumably reading and writing and speaking). It is to include physical and biological sciences, social studies such as sociology, anthropology, social psychology, economics, politics and geography (which will give a key to knowledge of the nature and dynamics of society), history, literature, music and art. It is to include also knowledge of the "human condition," which, presumably, must refer to psychology, philosophy (especially ethics and metaphysics), religion and theology. Bruner states that the structures which are devised by the scholars of these disciplines are to be the ones which the students, in their learning by discovery, will be led by their teachers to recreate so that they will make them their own.

In addition, these structures are to constitute the curriculum from the earliest point in the child's school experience. A key idea or group of ideas laid bare as essential to the structure of a discipline will be presented in a form and a language "honest though imprecise" which can be grasped by a
child in an early stage of his development, and it will be revisited again and again each time with "greater precision and power," as the child's development proceeds. The learner thus moves from a weak and simple grasp of a subject, which is, nevertheless an honest one, to succeeding stages in which his grasp becomes increasingly powerful.

Bruner states,

It seems to me that the implications of this conclusion are that we opt for depth and continuity in our teaching, rather than coverage....I think that at the very least an educated man should have a sense of what knowledge is like in some field of inquiry, to know it in its connectedness and with a feeling for how the knowledge is gained. An educated man must not be dazzled by the myth that advanced knowledge is the result of wizardry. The way to battle this myth is in the direct experience of the learner -- to give him the experience of going from a primitive and weak grasp of some subject to a stage in which he has a more refined and powerful grasp of it.25

Summary

Thus, Bruner's educational theory postulates that the intellect's is the highest excellence toward which man can aspire. The purpose of the school (and this is a normative and not a descriptive statement), is to develop the power and sensibility of mind. Every mind is capable of excellence, each in its own way and according to its own style, and it must be the task of the school to provide models of excellence, in the form of excellent teachers who themselves

aspire to excellence, as well as in the form of the labors of the scholars and creators on the frontiers of knowledge adapted and presented to the students in the way in which they can be assimilated at each stage of their development.

The realm of knowledge, structured by the finest minds of each discipline will be brought to the developing cognitive organism which is the mind of the child through a process which Bruner characterizes as discovery. This is an active, problem-solving technique, whereby the child himself undergoes the structure-creating process, using both analytic and intuitive means in doing so.

The curriculum, devoted to the optimal development of intellectual excellence, is to consist of the structures of all the major disciplines of the arts and sciences, with special emphasis on the cultivation of skills in symbolics -- mathematics and language. But depth, not coverage, is to be opted for, and the major conceptual themes of each discipline are to be introduced from the earliest point in the school and returned to again and again, each time on a higher level commensurate with the child's increased intellectual power.

Upon studying Bruner's educational theory, the reader is left with a feeling that it is a magnificent statement of a magnificent purpose for the educational enterprise, but that it has only one serious limitation -- namely, that it simply won't work except when it deals with youngsters capable of the
intellectual excellence of Jerome Bruner himself. Bruner quotes Maimonides to the effect that the highest perfection which man can attain is that of intellectual excellence, but he does not indicate that Maimonides, himself, made very clear that while it was the highest perfection, it could be attained by only a very few men.26 Bruner’s concession to this fact lies in his formulation that each young mind must aspire to an image of excellence in the style and way which is his own. But the image of intellectual excellence of the average, or even more, the less than average child (granting that he can be encouraged to develop one), as compared with the most superior is much more than different in degree — it might very well be thought of as completely different in kind. This is the problem of a school system with intellectual excellence as its goal, a problem encountered often by educational theorists writing long before The Process of Education, as well as many of those writing since. A problem often encountered and, alas, never satisfactorily solved. For while it seems evident that more children can be led to develop more intellectual excellence than they have in the past, and, indeed, that intellectual excellence itself can be more highly regarded in our society than it has in the past, it is much to be questioned that the achievement of what Bruner considers to be the perfection of intellectualuality (even with his modification) is a realistic goal for a universal educational system.

Bruner suggests that the schools provide working models of intellectual excellence in the persons of its teachers. What he does not recognize is that most of the school establishment would be thoroughly satisfied with models of competence. The teaching profession, especially under the college level, is not given to attracting the intellectually excellent to its ranks -- matters of economics and social prestige alone preclude this possibility. Probably the hope that each child may be, in a twelve year school career, exposed to one or two teachers who provide a personal model of intellectual excellence, is the most which could be expressed by a realistic educator, and even this may seem a bit too much to wish for.

The curriculum which Bruner has proposed, even in an intellectually oriented school with children working with models of excellence, is completely unrealistic. A curriculum which includes mathematics and language, physical and biological sciences, social studies which must include sociology, anthropology, social psychology, economics, politics, geography, history, literature, music and art, and studies in the "human condition" which must include psychology, philosophy, religion and theology, cannot be adopted in any school unless dismal failure is to be assured. Even opting for depth and not coverage does not sufficiently restrict the knowledge which must be in the possession of the teacher to present such a curriculum.
(And Bruner makes clear that the teacher must himself be a master of the structure of the discipline which he is to help the child discover.) In addition, the problem of translation of these structures into the spiral presentation Bruner regards as most desirable has been raised before, and he has never satisfactorily shown that it can be solved.

As for Bruner's method of discovery in learning, he has said again, and said in a lovely way, what educators who know about children and their learning have been saying not only since the time of Dewey, but long before. Children learn best what they discover for themselves. It is hard to imagine many contemporary educational theorists disputing the virtues of learning by discovery.
CHAPTER 6

ART AS A MODE OF KNOWING: BRUNER'S AESTHETIC THEORY

The Grammar of Art

The subtitle of Bruner's book *On Knowing* is "essays for the left hand." Bruner tells us in the introductory section to his book that since his childhood he has been fascinated by the symbolism of the right hand and the left: as he puts it, "the one the doer, the other the dreamer." The beauty of the right hand is that of order, lawfulness, "taut implication," -- science, as the common view would have it. In contrast, the left hand is the hand of sentiment, intuition, feeling -- art, as the common view has it. But, the way of the common view is not satisfying to Bruner because to say that science is the right hand overlooks the fact that "the great hypotheses of science are gifts carried in the left hand," are the products of that very intuition which is carried by the left hand. And to speak of art as of the left hand is to ignore the difference between undisciplined fantasy, as Bruner puts it, and true art, which demands a right hand which is adept at order and technique.¹

¹ Bruner, *On Knowing*, p. 2.
One of the prime functions of Bruner's writings is to deal with the phenomenon of knowing. But he is firmly aware that knowing, as it has been studied by psychologists like himself, has been viewed as an activity of the right hand. In his studies and researches over many years he tells us:

One thing has become increasingly clear in pursuing the nature of knowing. It is that the conventional apparatus of the psychologist -- both his instruments of investigation and the conceptual tools he uses in the interpretation of his data leaves one approach unexplored. It is an approach whose medium of exchange seems to be the metaphor paid out by the left hand. It is a way that grows happy hunches and lucky guesses, that is stirred into connective activity by the poet and the necromancer looking sidewise rather than directly. Their hunches and intuitions generate a grammar of their own -- searching out connections, suggesting similarities, weaving ideas loosely in a trial web.²

It is Bruner's hypothesis that the grammar (to which he refers above) of the left hand, the grammar of art, is much different from the grammar of the right hand, or the grammar of science. He tells us that "the elegant rationality of science and the metaphoric non-rationality of art operate with deeply different grammars."³ In the art experience, the grammar of metaphor rules, as contrasted with the grammar of rationality in science. Knowledge of how we know, of knowing, must be expanded to include awareness of knowing the grammar of metaphor. Knowing the grammar of metaphor rests on an understanding of what the art object is which can only be so

² Ibid., p. 4.
³ Ibid., p. 74.
known, and it is to this end that Bruner develops his aesthetic theory.

What is Art?

Art is concerned with the products of the creative enterprise. Bruner states that an act that produces effective surprise he regards as the hallmark of the creative enterprise. Surprise is defined as "the unexpected that strikes one with wonder or astonishment." When one encounters the surprising, there occurs a certain "shock of recognition" as if it is something quite obvious. There is a certain self-evident quality about it all implicit in the encounter with the creative enterprise.

Bruner mentions three kinds of effectiveness operative in surprise. One he calls "predictive effectiveness" -- the kind which has high predictive value as in the case of a formula for falling bodies, or of a theoretical scientific reformulation. This type he considers as operating largely in science. The second form he calls formal, and it is to be seen usually in mathematics, logic or music (possibly, as he qualifies his classification). Formal effectiveness "consists of an ordering of elements in such a way that one sees relationships that were before not present, ways of putting

\[4\] Ibid., p. 18.
things together not before within reach." This leads to a consistency or harmony in the combination that brings to light relationship between elements which have been known in their disparity, but never before believed to have been capable of combination.

The third form of effectiveness in surprise Bruner calls metaphoric. This is the form which operates in art -- visual and literary. In this form, diverse experiences are connected by the "mediation of symbol, metaphor and image." Among his examples, he points to the combination of the Grand Inquisitor and the Christ figure in Dostoevsky's *Brothers Karamazov*, the combination into a unified work of the elements of sickness and beauty, sexuality and restraint in Mann's *Death in Venice*, the strange combination of objects in a Picasso painting which, somehow, then, all seem to belong together.

What is common to all forms of effective surprise is this combinatorial activity in which elements are placed in new perspective which arouse wonder, astonishment and then a feeling that it is as it should be. Such activity which can be described as the aesthetic dimension, is at work in all forms of endeavor -- the scientific, the mathematical (the purely formal), as well as the artistic (which is the only area in which it is expected to be found). Bruner does not make very clear just what are the distinguishing features of

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5 Ibid., p. 19.
surprise-creating as contrasted with non-surprise-creating efforts, beyond saying that it would be necessary to refer to each specific field in question to obtain some view of what constitutes creativity and the method of creativity. But such terms as "emotional sensibility," used by Poincaré to describe the creative mathematician, "physical intuition", used by physicists to distinguish the good theorist from those with purely technical mastery, "emotiveness" as describing the work of the painter, give evidence that while each area of empirical endeavor differs in terms of what constitutes a creative effort in that field, nevertheless there is an underlying core of generality which applies to them all.

In his discussion of art as a mode of knowing, it is art itself which serves as the vehicle for Bruner's exposition. However, it is necessary to bear in mind that the artistic element is present in seemingly non-artistic enterprises as well. The grammar of metaphor which is characteristic of the artistic mode

joins dissimilar experiences by finding the image or symbol that unites them at some deeper emotional level of meaning. Its effect depends upon its capacity for getting past the literal mode of connecting and the unsuccessful metaphor is one that either fails in finding the image or gets caught in the meshes of literalness.°

As a simple example of an unsuccessful metaphor, Bruner offers a description of a woman as a "peach" -- a pedestrian effect

° Ibid., p. 63.
at best. He contrasts this with the metaphor of a woman as a "garden," and here a web of emotional connections is brought into play, as it is seen that "the metaphoric process is renewed."

Another element in the metaphor of art is the operation of aesthetic economy. The web of metaphor must speak quietly, compactly, in such a way that a simple symbol or image can "travel great distances to connect ostensible disparities."\(^7\) Bruner contrasts, as an example of symbolic economy, an elaborate ceremonial painting which pictures the power and the piety of the Church of the sixteenth century and an El Greco canvas with its stark depiction of a cardinal, which combines cruelty and piety in one unified personification.

There is work, effort, involved in the experiencing of art as well as in its creation. Bruner suggests that the distinction between art that is "merely decorative," between literary creations which are "merely entertainment," and art which is worthy of the name is to be found in the amount and the nature of the work which is involved in experiencing it. Effort is called forth if a "new connection between different perspectives"\(^8\) is to be made, as is the case in the example of the El Greco cardinal. And effort is involved in what Bruner refers to as "the control and conversion of the

\(^7\) Ibid., p. 65.
\(^8\) Ibid., p. 67.
impulses that are aroused in the experience of art." To ex­
perience a work of art involves an act of containing these
impulses which is somewhat analogous to the work involved in
containing and converting impulses in creating it. In short,
the beholder must undergo something like an act of creation
in his experiencing of the art object.

Bruner illustrates this process of the control and con­
version of impulses in the experiencing of an aesthetic object
by referring to a lovely statue of the Virgin and Child in the
Toledo Cathedral known as the Santa Maria Blanca. He states,

This White Virgin is all the faces of a woman, mother,
wife, flirt, daughter, sister, mistress, saint and
harlot. As one looks at it there are impulses-in­
restraint to father her, be mothered by her, make love
to her, gossip with her, and just to watch how the
face will change when the Child finally pokes her
under the chin. It provides a fine example, for
probably the conversion of impulse into a sense of
beauty requires the arousing of several impulses at
once. And here, if anywhere, one may speak of the
experience of art as a mode of knowing. For when
one looks at the White Virgin the energy of all one's
discordant impulses creates a single image connecting
the varieties of experience in her extraordinary
face.\footnote{Ibid., p. 70.}

What Bruner is saying is that work is involved in creat­
ing the unified experience of an art-object by the unifying
of the impulses into one single impulse -- a combinatorial
act on the part of the beholder. In experiencing a word of
art, in knowing a work of art, there is a simultaneous presence
of many "streams of metaphoric activity" as he describes them.
The work of art itself makes it possible to fuse, to unify these streams through the "genius of its economical imagery." But the beholder must work to know the object, and such knowing, as is indeed the case with all knowing, is not a passive act.

Bruner recognizes that each man who beholds a picture or reads a poem will bring to it a range of life-experience which is his alone. Thus, the aesthetic visions of the White Virgin of the sexton who lights the evening candles in the Toledo Cathedral, the Renaissance contemporary of the sculptor and a middle-class American tourist have certain profound differences between them. However, he denies that the communicability of an art-object is completely related to the time, place and condition of the viewer. He states, for if it were, one would not find such a shock of refreshment in the cave paintings of Altamina and Lescaux or in the artifacts of the second Pueblo period. One need not invoke a racial unconscious or archetypal images to account for this communicability across cultures and times; there are features of the human condition that change only within narrow limits whether one be a cave-dweller, a don in medieval Oxford, or a left-bank expatriate of the 1920's; love, birth, hate, death, passion and decorum persist as problems without unique solution.10

In summary, Bruner's aesthetic theory (and it is surely not complete but rather fragmentary; some theorizing about art as a mode of knowing rather than a complete theory as such), rests on an object which has the capacity to produce

10 Ibid., p. 73.
effective surprise in the beholder. Surprise is the unexpected which arouses astonishment or wonder in the beholder. It can be found in the creations of science, in the formal structures of mathematics, as well as in art, where its expression is through symbol and metaphor. Surprise is followed by what he refers to as a "shock of recognition" -- a certain sudden realization of the fittingness of the art object to "fill the gaps in our own experience," as he puts it. The art object provides a model for the interpretation of reality.

The aesthetic object serves the function of combining a series of dissimilar elements, brought together in a unity at a deeper, emotional level of experience. This unifying, to be successful, must be simple, economical -- must operate with "aesthetic economy." And the beholding of a work of art, the aesthetic experience, involves work on the part of the beholder. It involves, as in all knowing, the active participation of the beholder in the unifying of the diverse impulses aroused by the divergent streams of metaphoric activity which are involved in the work of art itself.

**Art as a Mode of Knowing**

Thus it may be seen that art, in Bruner's eyes, involves a mode of knowing which is different from the way of knowing

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11 Ibid., p. 72.
which is science. He tells us,

The intent of the scientist is to create rational structures and general laws that, in the mathematical sense predict the observations one would be forced to make if one were without the general laws. To the degree that the rational structures of science are governed by principles of strict logical implication to that degree prediction becomes more and more complete, leading eventually to the derivation of possible observations that one might not have made but for the existence of the general theory. Surely, then, science increases the unity of our experience of nature. This is the hallmark of the way of knowing called science.

In contrast, 'Art as a form of knowing does not and cannot strive for such a form of unification....The elegant rationality of science and the metaphoric non-rationality of art operate with deeply different grammars; perhaps they even represent a profound complementarity. For in the experience of art, we connect by a grammar of metaphor, one that defies the rational methods of the linguist and the psychologist.'

The hallmark of the way of knowing called art is an increase in the unity of the experience of nature, but a unity achieved in a vastly different way than the way of science.

However, Bruner strives to emphasize in his aesthetic theorizing that the grammar of science and the grammar of art are not separated by an unbridgeable gap because there exist elements of the artistic in the way of knowing called science, just as there are elements of the scientific involved in expression of the grammar of metaphor. As an example, Bruner refers to the way in which the scientist gets his hypothesis. This is based, in the case of truly creative scientific en-
deavor, on a pre-scientific effort where, it is suspected, "the art of science" operates according to the grammar of metaphor. Here is the place for the inspiration, the intuition, the unifying, surprising, economic effort at formulation where "art in science" is to be found and where it must be found if the scientist is to produce the earth-shaking hypotheses which have been characteristic of the truly great scientific figures.

In contrast, the grammar of science operates in art as well. Bruner tells us that the combinatorial acts (the artistic unities which constitute the art object) "almost always succeed through the exercise of technique."¹³ Thus, he says of Henry Moore that he adopted the use of holes in his sculptures because he was faced with a technical problem of making solid forms appear three-dimensional. Moore found this effect was achieved because the hole connected one side to the other enhancing the tri-dimensional quality. Examples of the technical mastery of the artist can be multiplied. Inspiration, then, combined with technique yields an object of art.

What of discovery as a way of knowing, in the light of more than one mode of knowing? As has been seen in Chapter 5, discovery is an inherently flexible way of knowing, containing elements which are equipped to deal with art and others which are equipped to deal with science, and the same elements

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¹³ Ibid., p. 22.
are not necessarily at work in the different types of knowing. Bruner's emphasis on intuition in discovery, on the encouragement of cultivation of the intuitive sense of each child provides the elements necessary to know the artistic. His emphasis on analysis in discovery provides the elements necessary to deal with the purely scientific. Knowing for Bruner is not a single, monolithic process. The tools which it employs must be of a kind which are adaptable to the mode of knowledge with which it deals, and in any mode of knowledge there may be elements of other modes which it is the task of the knower to discover. In learning by discovery, he is able to do just that.
PART III

BRUNER'S INTELLECTUAL PREDECESSORS
CHAPTER 7

THE STRUCTURE OF KNOWLEDGE AND THE NATURE OF REALITY

The Structure of Knowledge

Philip Phenix, the educational philosopher at Columbia University, published his important book, Realms of Meaning, in 1964. In the preface to his book, he refers to Bruner's The Process of Education as the most widely read and influential work in the field of education in which human learning is related to the structure of knowledge and the processes of disciplined inquiry.¹ He goes on to state that his own book is an attempt to elaborate a theory of the curriculum based on ideas similar to those outlined by Bruner and his Woods Hole colleagues several years earlier.

What Phenix does not state in his introduction is that in 1956 he had published a brief and largely-ignored article in the Teachers College Record which outlined the argument which is developed in detail in his book. The article was entitled "Key Concepts and the Crisis in Learning."² It antedates The Process of Education by at least three years, and it anticipates in almost every detail the emphasis on structure

in learning which helped to bring Bruner's name into such prominence.

In his article, Phenix states that the state of learning (in the United States as well as elsewhere) faces a grave crisis. He attempts, in his paper, to point to a way in which to solve this crisis. Modern man is in possession of a vast and constantly expanding store of knowledge which modern scholarship and the possibilities for transmitting this scholarship have made available to the entire world. Opposed to this increase in knowledge is the fact that there has not been a corresponding increase in capacity to learn. Phenix even goes so far as to suggest that "the swift pace of contemporary living and its attendant psychic strains may have actually diminished the ability to learn, by comparison with calmer and more stable eras." The crisis in learning consists, then, in the imbalance between what is available to know, and, indeed, what must be known to meet the demands of an increasingly technological society, and the capacity of the individual learner to learn it.

Phenix suggests that Ortega y Gasset has pointed to the basic principle of education which might be of use in solving the crisis. This is called the "principle of economy in learning." According to the principle, the primary aim of education is in the minimizing of the disparity between what is to

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3 Ibid., p. 138.
be known and the capacity to know. Phenix states that this problem can be approached through an analysis of the nature of all the kinds of knowledge. He says,

The thesis of this discussion is that by a philosophical analysis of the fields of human knowledge and by appropriate application of the results of the analysis, a spectacular economy in learning can be effected. Only this approach attacks the problem at its point of real difficulty, namely, the overwhelmingness of the knowledge-store. By administrative and psychological means the conditions and capacities for learning can at best be improved only moderately. It appears that only through the philosophical analysis of knowledge can a really drastic economy be realized.  

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According to Phenix, knowledge does not consist in merely an accumulation of isolated items of information. These items are interconnected within the frame of reference of an idea system. Each datum may then be placed within one or more frameworks of knowledge. Certain family resemblances, or similarities of type may be discerned so that information known may be classified into fields of knowledge, or disciplines such as physics, psychology, mathematics, literary criticism, etc.

One of the basic powers of human intelligence lies in the ability to form class concepts -- to categorize, as Bruner and the psychologists call it. Thus, to know what a dog is, one does not have to become acquainted with all the dogs in the universe. The concept "dog" itself stands for a

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4 Ibid., p. 139.
class of creatures with specific, common properties. The economy afforded by concept-formation permits a vast array of individual data of experience to be caught up in a generalizing idea.

This capacity for concept-formation may be extended beyond the purely perceptual range to include the organization of facts and theories which make up the realm of knowledge — i.e., to the realm of ideas. Concepts may be utilized in the same way as is the idea "dog" which will serve to summarize the class of ideas which distinguish a domain of knowledge or a discipline such as psychology or physics.

A careful analysis will reveal that in a field of knowledge there are certain key concepts which have the power to epitomize the significant common features of a large number of particular concepts. These key concepts are the "basic central ideas an understanding of which opens the door to an effective grasp of an entire field of knowledge." Thus, when certain key concepts of mathematics are understood, individual propositions in mathematics can be properly comprehended in the light of them. The key ideas provide something akin to a map which gives a view of the entire field and into which characteristic features of topography in the form of individual items of knowledge can be fit into their proper place.

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5 Ibid., p. 140.
There are, of course, certain problems and questions connected with Phenix's view of key concepts which he recognizes in this paper. First, he suggests that it is not necessary that the key concepts always be taught explicitly and directly, at least to beginners. However, it is necessary that the teacher select and use particular items of knowledge, with the recognition that they exemplify these key concepts so that when the child does come to learn the basic structure directly, those items of knowledge can be placed within a meaningful framework. In addition, it cannot be suggested that each field of knowledge has a single key concept. There may be any number which must be taught which will provide better insight into a discipline than that which can be attained by piling up disconnected bits of information. Furthermore, the disciplines or fields are not permanently organized under the framework of a certain, specific group of key concepts. With the development of knowledge better organizing principles appear, a discipline may decline and new ones may appear. But it is the discovery of these key concepts which is the very best way to define a field of knowledge, and an awareness of them helps to identify a discipline, whether it is stable or changing.

Finally, Phenix recognizes that there would not necessarily be a consensus, even among the most expert of scholars, in the fields in question, about any one choice of representative
generalizations. This is not a problem which, in this paper, he attempts to solve, but by stating it he indicates his awareness of its existence, and suggests that it is one to be solved by recourse to the "philosophy of the several fields of knowledge."\(^6\)

Phenix illustrates his doctrine of key concepts by referring to several disciplines. He suggests that some of the key concepts of science are abstraction, public verification, and fruitfulness. Key concepts of physical science lie in the abstracting of mass, length and time characteristics of things through a process of physical measurement. Certain key concepts of mathematics are the axiomatic and the concept of necessary inference. And, key concepts in the understanding of art include the concrete, individual wholeness of the art object, and that of significant form. These suggestions are considerably expanded and it must be added, much improved upon in Phenix's discussion in *Realms of Meaning*. However, it is not their specific formulation in a short article of a few pages which is here at issue, nor even their valid character, but the notion that key concepts lay bare the basic structure of a discipline that is his important contribution.

In conclusion, Phenix states,

Thus, the theory of knowledge in its several areas provides a means for developing key concepts which by indicating the essential character of whole

\(^6\) Ibid., p. 141.
fields of knowledge can insure the necessary general understanding with relatively limited knowledge of specific details. The use of such key ideas in the organization and teaching of subject matter may effect important economies in learning effort, greatly increase the depth of comprehension and facilitate further independent exploration in any discipline. These are the conditions for the making of well-educated persons and they are one answer, from the philosophy of education, to the crisis in learning.7

Thus it may be seen that Phenix's brief article contains, in embryonic form, almost all of the arguments presented and popularized by Bruner in all his educational writings in favor of structuring knowledge by presenting key ideas of the disciplines for purposes of instruction. Bruner speaks of the limited capacity for processing information and Phenix of the fact that knowledge increases vastly while the capacity to learn remains the same. Bruner speaks of "filling our mental-input slots with gold instead of dross," and Phenix to the principle of economy in learning. Bruner speaks of models or structures of the disciplines, and Phenix of idea-systems of the various fields of knowledge. Bruner stresses the most significant concepts of the discipline as the framework for the model; Phenix refers to the key concepts. Bruner speaks of the need for the scholars to lay bare the structures of their disciplines, and Phenix uses the term "experts."8

Phenix and Bruner both recognize the problems such an approach involves. Both men are aware that no one model is

7 Ibid., p. 143.
8 The use of experts in Phenix's theory is only referred to in one brief passage on page 140. He expands this idea in more detail in Realms of Meaning (See p. 53, pp. 312ff.).
necessarily final, and, indeed, that consensus among scholars or experts cannot necessarily be achieved in selecting any one model. Although models are subject to change, and with advances in scholarship there is need for what Bruner would call alternative or complementary models; although disciplines themselves shift and change over the years, nevertheless it is the increase in capacity to deal with organized knowledge which such structuring promotes that is the significant factor for both men. As Phenix puts it, the emphasis on educational economy is the principle concern rather than the specific group of key concepts involved.

A similar emphasis on the structure of the disciplines is to be found in Whitehead's *Aims of Education*. In his discussion of the shortcomings of the traditional mathematical curriculum in the English schools, Whitehead raises his voice against the "reconditeness" of the subject of mathematics as it was taught. While such reconditeness appealed to some of the keenest intellects among students over the ages, the appeal is only to a highly select class of students -- for the rest, it is fatal. To eliminate this aspect of mathematics from the general (as opposed to the specialists') preparation in mathematics, Whitehead suggests that the course of instruction be planned to illustrate a succession of mathematical ideas of obvious importance. He states,

For the purposes of education, mathematics consists of the relations of number, the relations of quantity
and the relations of space....These three groups of relations concerning number, quantity and space are interconnected.\textsuperscript{9}

The students should be taught the use of these general ideas by being given practice among simple examples. They should not be expected to work endless theorems, but only those which serve to illustrate the general principles.

As many examples as you like; let the children work at them for terms or for years. But these examples should be direct illustrations of the main ideas. In this way and this only, can the fatal reconditeness be avoided.\textsuperscript{10}

Whitehead goes on to "lay bare" the essential ideas of a course in the History of Mathematics, of geometry, of trigonometry. In each case he stresses the need for the teaching of the central ideas and leading the student to do only such problems as illustrate the main ideas. He provides in his essay a significant case of a scholar on the frontier of knowledge structuring his discipline by laying bare the key concepts which the student is to learn if the learning is to be fruitful. His ideas concerning mathematics could be projected to the other parts of the curriculum as well.

Thus, the concept of education by teaching the structure of a discipline appears in Whitehead, in Phenix and finally in Bruner.


\textsuperscript{10} Ibid., p. 87.
The Nature of Reality

Mechanistic Physics

It was Galileo who, in some sense, may be considered the forerunner of nineteenth century classical physics. He began his researches by considering the simple cases of motions of objects along a straight line with constant velocity, and of motions of objects along a straight line with constant acceleration. From study of these simple forms, he attempted to extend his understanding to more complex types of motion, most particularly that of falling bodies. He found that the motion was made up of two components, inertial and gravitational.

Galileo's scheme was expanded and extended by Newton to apply to the motion of the celestial bodies, and then to all motion in general. Newton developed the celebrated "laws of motion," and the Universal Law of Gravitation, which formed the basis for all physics, astronomy, mechanical engineering, and optics. The laws of mechanics were extended as well to other branches of science -- electromagnetism, heat and chemical reactions. Explanations for phenomena in all these areas were made on the basis of a mechanical model or structure which obeyed Newton's laws of motion. The success of these explanations was attested to by the phenomenal practical achievements of science during the centuries after their for-
mulation. And because of these practical achievements, it was assumed that only an exposition which was based on the Newtonian model could be regarded as "giving a satisfactory physical understanding." 11

The implications for a world view of the Newtonian mechanistic model were soon apparent. Heisenberg describes this role of classical physics in human thinking in the following way:

In physics this picture (of the world) was to be described by means of those concepts which we nowadays call the concepts of classical physics. The world consisted of things in space and time, the things consist of matter, and matter can produce and can be acted upon by forces. The events follow from the interplay between matter and forces; every event is the result and the cause of other events. At the same time the human attitude toward nature changed from a contemplative one to a pragmatic one. One was not so much interested in nature as it is; one rather asked what one could do with it. Therefore, natural science turned into technical science; every advancement of knowledge was connected with the question as to what practical use could be derived from it.

In this way, finally, the nineteenth century developed an extremely rigid frame for natural science which formed not only science but also the general outlook of great masses of people. This frame was supported by the fundamental concepts of classical physics, space, time, matter and causality; the concept of reality applied to the things or events that we could perceive by our senses or that could be observed by means of the refined tools that technical science had provided. Matter was the primary reality. The progress of science was pictured as a crusade of conquest into the material world. Utility was the watchword of the time. 12

Thus, the Newtonian view of reality was mechanistic, materialistic, deterministic, and illuminated by the certainty that all the secrets of nature could be revealed as expressing a pattern of laws of nature by man, through the methods and techniques of natural science.

**Twentieth Century Physics**

Heisenberg states that it has been the contribution of modern physics of the twentieth century which has brought about the dissolution or at least the questioning of the conceptual framework of the Newtonian view of nature and reality. Through experimental research carried on with increasingly refined technical equipment, with refined mathematical formulations of this research, the need for a critical analysis of the classical view became evident.

**Einstein**

The first break in the structure occurred in the Einsteinian theory of relativity, the formulation of which occurred in 1905 in his special theory. The "revolution" of the Einstein theory applied particularly to the Newtonian concepts of space and time, to the Newtonian conception of the ether through which light was thought to pass, and to the conception of the inertia of energy, or the equivalence of mass and energy \( e = mc^2 \).

However, there is not consensus concerning the revolution-
ary effects of Einstein's theories on the Newtonian conceptual scheme. As distinguished a physicist as Philipp Frank holds to the view that Einstein's system constitutes a radical break with its Newtonian past -- that, in his terms, Einstein concluded "not only that the mechanistic theory of light was erroneous, but that even the Newtonian mechanics of material objects could not be generally valid."13 Frank states, with regard to Einstein's general theory of relativity,

The great difficulty involved in explaining Einstein's new theory lies in the fact that it does not arise from any slight modification of Newtonian mechanics. It bursts asunder the entire framework within which Newton attempted to comprehend all phenomena of motion.14

This view, however, is not shared by the Quantum theorists, particularly Bohr and Heisenberg. Their conception of the "Einsteinian revolution" was one in which Einstein's theories refined and completed the Newtonian mechanistic model. Thus, Bohr states that Einstein's theory of relativity "harmoniously completed the framework of classical physics."15 He states again that Einstein's work brought the whole conceptual structure of classical physics to "so wonderful a unification and completion."16

Whether Einstein is thought of, in his physics, as having provided a break with the classical mechanistic model or as having completed and perfected it, nevertheless in his ontology he is still part of the materialistic tradition. It is quite generally recognized, even by Frank (although he insists that in these matters Einstein is ambivalent)\textsuperscript{17} that Einstein in his ontology does not differ strongly from the Newtonian realism. Indeed, part of Einstein’s discomfiture with the physicists who followed him, his friends and colleagues who constituted the Copenhagen group, lay in what he thought to be their radical positivism. Frank states,

He was not ready to admit that one must abandon the goal of describing physical reality and remain content only with the combination of observations. He was aware that it was not possible as Newton had thought, to predict all future motions of all particles from the initial conditions and the laws of motion. But perhaps, thought Einstein, physical events could be described in terms of a new theory as yet unknown. It would consist in a system of field equations so general that they would contain the laws of motion of particles and of photons as special cases.\textsuperscript{18}

Einstein was, therefore, in the realistic tradition of classical physics — he believed in the ontology of materialism. Heisenberg states that Einstein believed in the existence of an objective real world, the smallest parts of which exist objectively in the same way as trees or rocks, and that its existence is independent of its being observed.

\textsuperscript{17} Frank, \textit{Einstein}, p. 218.
\textsuperscript{18} \textit{Ibid.}, p. 215.
The Copenhagen Interpretation of Quantum Theory

The final break with Newtonian mechanism in both physics and philosophy was brought about by the development of quantum physics, especially as interpreted by the so-called Copenhagen group. Perhaps the two most important members of this circle were Niels Bohr and Werner Heisenberg, both of whom have written considerably in philosophy in addition to their work as scientists.

Quantum physics is concerned with research into the realm of sub-atomic particles. Bohr states,

> Our penetration into the world of atoms, hitherto closed to the eyes of man, is indeed an adventure which may be compared with the great journeys of discovery of the circumnavigators and the bold explorations of astronomers into the depths of celestial space. As is well known, the marvelous development of the art of physical experimentation not only has removed the last traces of the old belief that the coarseness of our senses would forever prevent us from obtaining direct information about individual atoms, but has even shown us that the atoms themselves consist of still smaller corpuscles which can be investigated separately.19

There are three aspects of the theory of quantum physics which have special relevance for ontology. One has to do with the role of the means and the process of observation itself in the experimentations of the scientist. One has to do with the fact that the phenomena under study are considered as exhibiting features of probability or chance which enter, not merely into the possibility of error in the scientific

procedure, but in the very statement of the theory of the physical system itself. Finally, Bohr's expression of his complementarity principle deals with the fact that "reality" can be viewed from more than one perspective. It is possible to consider the same "reality" from more than one aspect, and that the picture provided by one may be very different from that of another, yet both may be fruitful in enhancing understanding. These conceptions are not simple to understand, most particularly in ordinary language. However, certain significant features relating to the nature of reality which they imply can be, and have been, drawn from them.

The Newtonian view of scientific investigation was that of an object which was to be studied on the one hand, and the rest of the world on the other. But in the study of sub-atomic particles, of building blocks of matter smaller even than electrons, protons, and neutrons, an additional group of factors must be taken into account. These are the process of observation itself, the observer himself and the measuring devices which he uses, all of which, of necessity, considering the minute size of the objects being studied, have a disturbing effect on the results of observation. Thus, the former view that it is nature or reality itself which is being studied must now be modified to recognize, in Heisenberg's terms that
What we observe is not nature itself but nature exposed to our method of questioning. Our scientific work in physics consists in asking questions about nature in the language that we possess and trying to get an answer from experiment by the means that are at our disposal. In this way, quantum theory reminds us, as Bohr has put it, of the old wisdom that when searching for harmony in life one must never forget that in the drama of existence we are ourselves both players and spectators. It is understandable that in our scientific relation to nature our own activity becomes very important when we have to deal with parts of nature into which we can penetrate only by using the most elaborate tools.20

Thus, in this view, science cannot describe what actually happens in the real world (indeed, carried to its extreme the concept of reality itself must be drawn into question or denied validity), but can only describe and combine the results of various observations.21

In dealing with the world of sub-atomic particles, the question, "What really happens in an atomic event?" cannot be answered in the conventional terms of mechanistic physics. All that can be deduced from an observation, Heisenberg tells us, is a probability function, a statistical expression which

combines statements about possibilities or tendencies with statements about our knowledge of facts. So we cannot completely objectify the result of an observation, we cannot describe what happens between this observation and the next.22

It is impossible to predict the result of an observation with certainty; all that can be predicted is the probability that

20 Heisenberg, Physics and Philosophy, p. 58 (underlining mine).
21 Frank, Einstein, p. 214.
22 Heisenberg, Physics and Philosophy, p. 50.
a certain result will take place, and the probability function can be checked by repeating the experiment many times. "The probability function does...not describe a certain event but at least during the process of observation a whole ensemble of possible events." Thus, knowledge of what really happens in the real world of sub-atomic particles is impossible; all that can be known is the statistical statement of probability. Science can only describe and combine the results of different observations -- it cannot discover what actually happens in the world.

A consequence of the quantum theorists' contention that the objective reality of the elementary particles cannot be known is Bohr's famous principle of complementarity. It cannot be known what is the true nature of a sub-atomic particle. Therefore, the scientist creates a model or a mental-picture which will permit interpretation of the behavior of the particle. Bohr found that the creation of alternative models to apply to the same "reality" results in more fruitful understanding than the use of only one. Thus, it is not even possible to determine whether the sub-atomic material particles are particles at all. Often they are seen to exhibit the characteristics of waves. The concepts of particle and wave are basic in physics, because they represent the only two possible modes of transport of energy. When dealing with large-scale objects in classical

23 Ibid., p. 54.
physics, energy is always transported by either a wave or a particle. Thus, a thrown baseball is always viewed as a particle transporting energy; a disturbance on the water a wave phenomenon. In the case of somewhat less obvious situations, such as the propagation of sound, the wave description is applied because it is altogether similar to the water phenomenon. In the movement of gases, a particle model is applied because it is always successful in describing the behavior of the gas. Furthermore, the wave and particle descriptions are "mutually incompatible and contradictory" --- one must be used, or the other to describe what happens.24

In the case of sub-atomic phenomena, it is not possible to know whether a wave or a particle property is the "true" description. Heisenberg elucidates Bohr's solution to this problem as follows:

Actually we need not speak of particles at all. For many experiments it is more convenient to speak of matter waves;...the use of matter waves is convenient, for example, when dealing with the radiation emitted by the atom. By means of its frequencies and intensities the radiation gives information about the oscillating charge distribution in the atom, and there the wave picture comes much nearer to the truth than the particle picture. Bohr advocated the use of both pictures which he called 'complementary' to each other. The two pictures are of course mutually exclusive because a certain thing cannot at the same time be a particle (i.e., substance confined to a very small volume), and a wave (i.e., a field spread out over a large space), but the two complement each other. By playing with both pictures, by going from

one picture to the other and back again, we finally get the right impression of the strange kind of reality behind our atomic experiments. Bohr uses the concept of 'complementarity' at several places in the interpretation of quantum theory. The knowledge of the position of a particle is complementary to the knowledge of its velocity or momentum. If we know the one with high accuracy, we cannot know the other with high accuracy; still we must know both for determining the behavior of the system.\textsuperscript{25}

Furthermore, these complementary "pictures" or models are expressed in mathematical schema which, in their inherent flexibility, make possible transformations from one to the other.

In summary, then, the quantum physicists of the Copenhagen school, in their investigations, have discovered that the mechanistic, deterministic, materialistic realism of the classical Newtonian ontology is not applicable in dealing with the realm of sub-atomic structure. The classical conceptions of a knowable, objective reality no longer hold true. In their research, their models of "reality" must include the considerable interference and distortion which the process of investigation and the measuring instruments themselves provide when dealing with such minute phenomena. The scientist cannot deal with the phenomena themselves, but only with his knowledge of these phenomena. The scientist cannot know for certain what is happening to the "reality" he is studying between observations -- he can only summarize the results of his observations in such a way that they express a statistical

\textsuperscript{25}Heisenberg, \textit{Physics and Philosophy}, pp. 48-49.
statement of probability. And, finally, he has recourse to more than one mathematical model, each of which deals with a different aspect of the "reality" being studied, each one of which excludes the other in a simultaneous view of what is happening, but both (or all) of which taken as complementary give a better picture of what is "really" happening, even though this can never be known in the classical sense. The scientist cannot know reality -- he can know only his knowledge of it. Reality, per se, is unknowable.

Conceptual Systems -- The Model Building Process

Heisenberg suggests that from the standpoint of the physicist there are four coherent sets of concepts or conceptual systems (models) which have been defined. These include the Newtonian mechanical model which is suited for description of all mechanical systems, the motion of fluids and the elastic vibration of bodies, and includes acoustics, statics and aerodynamics. The second closed systems refers to the theory of heat which, realistically, must be considered apart from mechanics.(This theory can, however, be combined with any of the other three systems.) The third system has its origin in the phenomena of electro-magnetism, and it comprises electrodynamics, special relativity, optics and magnetism. The fourth system is the quantum theory whose central concept is
that of the probability function, and it relates to quantum
and wave mechanics, atomic spectra, electric conductivity,
ferro-magnetism and chemistry.

Just as there are four conceptual systems in physics
which, taken separately or related in any number of ways, give
knowledge about aspects of physical reality, there are the
possibilities (or the actualities of) the development of such
systems in the other disciplines. Heisenberg suggests that
chemistry, through quantum theory, has come to a complete
union with physics -- that the quantum model describes the
"laws of chemistry" in a way in which the Newtonian could not.
(When the Newtonian model prevailed a different, less-
scientific model applied to chemistry.) The biological model
at least at present, must provide not only for the psychico-
chemical aspects of the organism together with its evolution-
ary aspects, but for the aspect of its being alive (perception,
affection, etc.) as well. Bohr suggests that this aliveness
aspect be regarded as "representing laws of nature complementary
to those appropriate to the account of the properties of inani-
mate bodies."26 In the field of psychology, the concepts of
physics, chemistry and evolution taken together cannot adequat-
ely describe the facts. The physical events in the brain can-
not be regarded as sufficient to explain them. For an under-
standing of psychology, it is necessary to start from the fact

26 Bohr, Atomic Physics and Human Knowledge, p. 21.
that the human mind enters as both subject and object into the process of psychology — in Bohr's terms, as both actor and spectator. The model of psychology which can be considered adequate must take this into account much as the quantum physics models takes into account the effect of the observer and his measuring instruments in its picture of "reality."

Heisenberg concludes his discussion on conceptual systems with the suggestion that they bear a certain similarity to "style" in art. Style in art is defined, as is a conceptual system, by a set of formal rules which is applied to the material of the art. These formal rules represent "reality" although the art object is an idealization of that reality. He states,

The style arises out of the interplay between the world and ourselves, or more specifically, between the spirit of the time and the artist. The spirit of a time is probably a fact as objective as any fact in natural science, and this spirit brings out certain features of the world which are even independent of time, are in this sense eternal. The artist tries by his work to make these features understandable and in this attempt he is led to the forms of the style in which he works.27

Thus, the scientist and the artist both try to represent reality.

Both science and art form in the course of the centuries a human language by which we can speak about the more remote parts of reality and the coherent sets of concepts as well as the different styles of art are different words or groups of words in this language.28

28 Ibid., p. 109.
It is not always known how accurately the model describes reality -- not all models allow for a completely objective description of nature. But only through the process of model-building can man respond to the challenge which nature provides for him -- the challenge of attempting to understand.

**Bruner and the Quantum Physicists**

It is obvious that Bruner's conception of the nature of reality and that of the Quantum Physicists is very similar, and, indeed, in many respects, completely identical. Bruner himself frequently refers to them as having brought about a revolution, not only in physics, but in philosophy as well, and he would surely be the first to acknowledge his debt to them for the statement of the major outlines of their ontology (or their denial of the possibility of ontology) which his so closely parallels.

In Heisenberg and Bohr, just as in Bruner, there is emphasis on the role of the observer and the observational devices in the observational process which make it impossible to speak of "nature" as such. Man can view nature only through the mediation of his representation of it. Because reality is unknowable in the conventional meaning of the term, man constructs models which provide workable descriptions of the universe, or of some aspect of it. The same data of experience

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may be represented by more than one model, seen, so to say, from more than one viewpoint in the same way as a sub-atomic mass may be considered as both a wave and a particle according to Bohr's complementarity principle. Heisenberg's description of the models of physics, and of the conceptual systems of the other disciplines and their fruitfulness in the understanding of aspects of "reality" is completely similar to Bruner's emphasis on the model-building activities in the many disciplines. And his parallel between style in art and models in science both serving to explore the limits of experience is almost the same as Bruner's discussion of poetry as a model-building activity similar to the conceptualizing of the scientist. (Bohr, too, states that just as the scientist builds models using the means of expression of his own field of experience, so, too, does the artist.)

Bruner refers to the revolution in physics which has led to this new ontological viewpoint, as the "new nominalism." He states,

Our intellectual history is marked by a heritage of naive realism. For Newton, science was a voyage to discover islands of truth. The truths existed in nature. Contemporary science has been hard put to shake the yoke of this dogma. Science and common-sense inquiry alike do not discover the ways

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30 Bruner refers often to complementarity in his discussion of model-building activities of the disciplines. Thus, he says that art and science as modes of knowing exhibit a profound complementarity. See On Knowing, page 74, and "Colloquy on the Unity of Learning," Daedalus, Volume 87, 1958, p. 157ff.
31 Bohr, Atomic Physics and Human Knowledge, p. 79.
in which events are grouped in the world; they invent ways of grouping. The test of the invention is the predictive benefits that result from the use of invented categories. The revolution of modern physics is as much as anything a revolution against naturalistic realism in the name of a new nominalism. Do such categories as tomatoes, lions, snobs, atoms and mammalia exist? In so far as they have been invented and found applicable to instances of nature, they do. They exist as inventions, not as discoveries.32

It is the contention of this study that while Bruner's ontology (or anti-ontology) is quite completely similar in many regards to that of the quantum physicists, in a most fundamental aspect it rests on a complete misunderstanding of what it is the quantum physicists are saying. Bruner has drawn the implication from their philosophy that the world of reality of Newton is a naive construct, and that it must be replaced by a new nominalism which is in truth the extreme form of logical positivism. This view looks upon the "laws of nature" as impossible of determination, and the role of science as one not of attempting to discover what actually happens in the world, but as one of describing and combining the results of different experiments and observations. Heisenberg, himself, in clear and unequivocal language, denies that the Copenhagen interpretation is in any way positivistic. He states,

> It should be noticed at this point that the Copenhagen interpretation of quantum theory is in no way positivistic. For whereas positivism is based on the sensual perceptions of the observer as the elements of reality, the Copenhagen

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interpretation regards things and processes which are discoverable in terms of classical concepts, i.e., the actual, as the foundation of any physical interpretation.\footnote{Heisenberg, \textit{Physics and Philosophy}, p. 145.}

Heisenberg states that the conclusion which people (presumably such as Bruner) have arrived at, namely, that the structure of Newtonian realism has been disproved and must be replaced by a "new nominalism" is a rash and improper one.\footnote{\textit{Ibid.}, pp. 96-97.} Because it must be clearly borne in mind that the Newtonian reality model, brought to its perfection by Einstein, still applies to the laws of nature in every area of physical investigation except the sub-atomic. The real world which is known to the common-sense observer and the scientist as well is knowable and can be objectively described by the model of what Bruner calls "naive realism" which would indicate it is, perhaps, not so naive after all. Heisenberg states that most experiments by which fields are measured are based on Newtonian mechanics. Whenever the concepts of Newton can be used to describe events in nature, Newton's laws are correct and present an objective description of reality. It is only in the realm of sub-atomic investigation that they cannot be extended, and so the "reality" of these phenomena cannot be known. (Einstein, in his opposition to the Copenhagen theories, insisted that the fact that quantum theory is unable to describe "reality" in the sub-atomic realm means not that reality
is unknowable, but that the physicist must keep searching until he has extended his theories so they do reveal it.)

Bruner, thus, draws his denial of ontology from the "new nominalism" of the atomic physicists. But they have only related this denial to the limited world of the atomic range, whereas he, in what may be thought of as a mistaken or a rash reading of their theory, has extrapolated this unknowable to include all the realm of reality which he insists can never be known objectively but only through the subjectivity of the mediating force of men's conceptualizing.
CHAPTER 8

THE NATURE OF THE KNOWER

Cognitive Development

It is the noted and important Swiss psychologist, Jean Piaget, whose psychological theory is most closely paralleled by Bruner's. Bruner regards himself and his students and colleagues at Harvard as the American group which is engaging in research and theory-building based on Piaget's system, and it is well known that he has done more to popularize and spread the ideas of Piaget in the United States than any other contemporary scholar.

In 1963, Professor John Flavell of the University of Rochester published his book, *The Developmental Psychology of Jean Piaget*, which is a scholarly study of the system of Piaget. This "system" has been developed over the course of 40 years by Piaget and his associates in Geneva; it has been presented in an enormous bibliography, bit by bit, and relatively little has been available in English. Flavell undertook the task of summarizing and evaluating the major aspects of this work in a book which would make it available to the

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1 Referring to Piaget as a psychologist is perhaps too limited a delineation of his role. However, this designation will be used in this chapter for purposes of convenience if not complete accuracy.

English-speaking professional world. That there has been great interest in Piaget in this world, and that Flavell's labors served an important function is attested to by the fact that his book has gone through six printings in a few short years. That the book is a true and definitive presentation of the system is attested to by the fact that Piaget, himself, wrote the introduction to Flavell's volume and glowingly endorsed it as an excellent, sympathetic and true presentation of his major work up until 1960. For the purposes of this chapter, therefore, it is Flavell's study which has been utilized in obtaining the elements of Piaget's theories.

**Aims and Methodology of Piaget's Developmental Psychology**

The principal scientific concerns of Piaget, in Flavell's formulation have been as follows:

"He is primarily interested in the theoretical and experimental investigation of the qualitative development of intellectual structures."\(^3\) The major focus of his researches over the years has been on the area of intelligence, but intelligence seen in its developmental aspect. Piaget studies successive ontogenic states in a given culture, with emphasis on the change from less to more advanced functioning. This study of change necessitates careful comparison among these successive states.

It is the structure of the developing intelligence which draws Piaget's primary attention. The developing organism functions by engaging in intelligent activity throughout its life. This functioning is made manifest by certain external behavior which tells the observer that functioning has occurred and which Piaget terms the content of intelligence. (Thus, when it is observed that a child has the capacity to make detours, or to estimate distances visually, the content of his functioning intellectually is manifest.) Interposed between function and content is structure and this is Piaget's primary focus. Flavell states that structures, in Piaget's system, are the organizational properties of intelligence, organizations created through functioning and inferable from the behavioral contents whose nature they determine.4

An intelligence functions resulting in the external behavior which is the content, but this functioning occurs according to organizing patterns which are characteristic of the various developmental levels. These different organizing patterns, in other words, these structures, constitute a large part of the subject matter of Piaget's system.

Finally, Piaget emphasizes the qualitative aspects of development. Flavell states that structural changes are, in their very essence, qualitative in nature. Thus, he says,

4 Ibid., p. 17.
In Piaget's system, the panorama of changing structures in the course of development is conceptually partitioned into stages whose qualitative similarities and differences serve as conceptual landmarks in trying to grasp the process.\footnote{Ibid., p. 19.}

Intellectual development occurs in stages; these stages exhibit qualitative heterogeneity of a sufficient sort that they warrant stage-by-stage analysis. The stages emerge in a constant order in every child, A before B, and B followed by C (although the exact age at which a given stage appears in one particular child, as contrasted with another, may vary considerably.)\footnote{Piaget recognizes that not all individuals necessarily achieve the final stages of development nor do they all function at the same structural level for all tasks. Arrested development due to mental deficiency, lack of socialization, etc., are factors to be considered. Flavell, p. 20.} The structures which are characteristic of earlier stages are integrated with those of the succeeding stages, exhibiting a relationship of structural hierarchy. Furthermore, the structural properties of any given stage are integrated into a totality in which the parts are highly interdependent -- they form what Piaget calls a "structure d'ensemble." This "structure d'ensemble," this structural whole by which Piaget seeks to identify organized intelligence in its essential character at each level is abstract and generalized, and it is this generalization which has been the goal of his lifelong search.

Piaget's theory does not state that there are not underlying similarities between the developing organism in each
stage of his development. But it is the differences in these stages, in addition to the similarities which are of interest to him, and it is with these differences that his theory deals.

In his researches, Piaget has quite consistently employed a methodology which is clinical in its essence rather than quantitative-statistical. His studies tend to involve some form of experimenter intervention, in the sense that the experimenter provides a stimulus. The child being observed is presented with some sort of task. Not all children, even in the same age group, will necessarily be given exactly the same task, nor will this task necessarily be administered to all children in the same way. The child's response will serve to elicit a new stimulus situation which is at least in part a response to the child's response. The process continues in this way, each response of the child partially determining the experimenter's next move. Flavel states,

Piaget refers to his experimental technique as the clinical method, and rightly calls attention to its similarity to psychiatric procedures. The approach does have much in common with diagnostic and therapeutic interviews, with projective testing, and with the kind of informal exploration often used in pilot research throughout the behavioral sciences. The crux of it is to explore a diversity of child behaviors in a stimulus-response-stimulus-response sequence; in the course of this rapid sequence the experimenter uses all the insight and ability at his command to understand what the child says or does and to adopt his own behavior in terms of this understanding.  

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7 Ibid., p. 28.
The Piagetian methodology in the intelligence studies involves the establishment of experimental tasks which are designed in terms of intuitions or hunches on the basis of observation of children's spontaneous behavior and then used in a systematic study. It involves a highly skilled examiner, trained in the methodology, who operates always within the framework of a theory, who knows not to be overly suggestive, not to lead, but at the same time to be looking for something definitive. The data are presented not in statistical form, but rather in a quasi-anecdotal manner, since Piaget does not believe in giving an "illusory aura of objectivity and precision" to material which is capable of understanding without being amenable to precise quantification. His results are oriented toward description and explanation rather than specific prediction, presented with a high ratio of discussion, analysis and interpretation to data, and concerned with philosophical issues to a degree rarely seen in contemporary psychology. All of these features tend to make Piaget's method rather distinctively different from the methodology pursued by most psychological investigations, and an awareness of the distinctive character of his research approach is necessary for a proper understanding of the system.

**Stages of Cognitive Growth**

According to the system of Piaget, intellectual develop-
ment from birth to maturity proceeds by periods or epochs, each characterized by certain general fundamental characteristics. Flavell presents a summary of these general characteristics, as follows:

The period of sensory-motor intelligence (0-2 years). During this important first period, the infant moves from a neonatal, reflex level of complete self-world undifferentiation to a relatively coherent organization of sensory-motor actions vis-a-vis his immediate environment. The organization is an entirely 'practical' one, however, in the sense that it involves simple perceptual and motor adjustments to things rather than symbolic manipulations of them. There are six major stages in this period, with substages here and there within these.

The period of preparation for and organization of concrete operations (2-11). This period commences with the first crude symbolizations late in the sensory-motor period and concludes with the beginnings of formal thought in early adolescence. There are two important subperiods. The first, that of preoperational representations (2-7) is the referent of the term 'preparation for' in the title above. It is that period in early childhood in which the individual makes his first relatively unorganized and fumbling attempts to come to grips with the new and strange world of symbols....The labor of this preparatory era comes to fruition in the next subperiod, that of concrete operations. (7-11) Here the child's conceptual organization of the surrounding environment slowly takes on stability and coherence by virtue of the formation of a series of cognitive structures called groupings. In this subperiod particularly the child first begins to 'look' rational and well-organized in his adaptations; he appears to have a fairly stable and orderly conceptual framework which he systematically brings to bear on the world of objects around him.

The period of formal operations (11-15). During this period a new and final reorganization takes place, with new structures isomorphic to the groups and

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8 The term "period" refers to the major developmental epochs; "stage" is a smaller subdivision within it, and "sub-period," or "substage" are used when necessary.
lattices of logical algebra. In brief, the adolescent can deal effectively not only with the reality before him (as does the child in the preceding subperiod), but also the world of pure possibility, the world of abstract, propositional statements, the world of 'as if.' This kind of cognition, for which Piaget finds considerable evidence in his adolescent subjects, is adult thought in the sense that these are structures within which adults operate when they are at their cognitive best, i.e., when they are thinking logically and abstractly.9

Sensory Motor Period

The six major stages in the sensory-motor period, as defined by Piaget are: (1) characterized by the use of reflexes such as sucking, swallowing, crying, etc.; (2) characterized by the use of the first simple habits involving sucking, vision, hearing, vocalization, etc.; (3) procedures for making sights which have unexpectedly interested the child, last, such as swinging, striking, rubbing, and shaking objects to create and sustain sights and sounds; (4) intentionally setting into play events which will obtain a specific goal such as setting aside an obstacle in order to reach a certain wanted object; (5) discovery of new means of pursuing novel experiences through active experimentation such as the child pulling an object with a string attached to it toward himself by pulling at the string alone; (6) invention of new means through mental combinations, as for example, when a child, finding no habitual

9 Ibid., p. 86.
schema which will serve as a means will "think up" one.
(Thus, when a child pushes his wagon against a wall and wants
to take it away from the wall again he walks around the wagon
to the side against the wall and commences, then, to push it
again.) In this culminatory stage, the child has learned to
invent a schema of activity by internally combining the repre­
sentation of various schemas of activities into a new total­
ity.

With the advent of the capacity to represent actions
rather than simply to perform them, the sensory-motor
period draws to a close and the child is ready for an
analogous but even more extended and tortuous ap­
prenticeship in the use of symbols. The end of the
sensory-motor period is thus synchronous with the
beginning of the preoperational period. This does
not, of course, mean that the child no longer con­
tinues to develop in the sensory-motor sphere. But
it does mean that henceforth the most advanced in­
tellectual adaptations of which a given child is
capable will take place in a conceptual-symbolic
rather than purely sensory-motor arena. And intellec­
tual adaptations, after all, are what Piaget is con­
cerned with.10

Period of Preparation for and Organization of Concrete
Operations

The subperiod of "preparation for" concrete operations
covers the age period of 2-7 years, and is characterized by
development of the capacity for representational thought.
Representational intelligence, through its possession of
the function of symbolizing, is greatly different from sensory­
motor intelligence. Sensory-motor intelligence is capable of

10 Ibid., p. 121.
linking the successive actions or perceptual states with which it deals in a linear relationship, one static frame following after another. Representational thought, through its capacity for symbolizing is capable of grasping a whole group of separate events in one single representation.

It is a much faster and more mobile device which can recall the past, represent the present and anticipate the future in one temporally brief organized act.¹¹

It has the capacity to reflect on its acts, it is action-contemplative rather that merely active. Finally, it is able to get outside the immediacy of the present, and to extend its scope beyond the concrete acts of the child and the concrete objects in his environment -- to picture events and acts in their absence, to internalize them in representations of the intelligence.

In this period of "preparation", the so-called pre-operational subperiod from two through six, the child's representations are still strongly saturated with the impress of his sensory-motor responses. It is concrete, its images tied to concrete actions, it is slow, static, "relatively unsocialized, unconcerned with proof or logical justification, and, in general, unaware of the effect of its communications on others."¹²

In short, it still resembles sensory motor action to which a new dimension has been added, the representational, but the

¹¹ Ibid., p. 152.
¹² Ibid., p. 162.
action and representation are linked in a way in which the action dominates the relationship.

The subperiod of concrete operations is attained through the years of middle childhood when the child is seven to eleven years old. During this period, Flavell says,

The older child seems to have at his command a coherent and integrated cognitive system with which he organizes and manipulates the world around him. Much more than his younger counterpart he gives the decided impression of possessing a solid cognitive bedrock, something flexible and plastic and yet consistent and enduring, with which he can structure the present in terms of the past without undue strain and dislocation, that is, without the ever-present tendency into the perplexity and contradiction which mark the preschooler.¹³

Piaget, in his writings, describes a wide variety of representational acts which he calls operations. These include "logical" operations such as adding, subtracting, multiplying, dividing, setting terms into correspondences within systems of classes and relations, and "infralogical" operations involving quantity, measurement, time, space, etc. However, and this is crucial to an understanding of Piaget, he believes that the organization and process of cognition in middle and late-childhood can better be understood by studying structures of logical and mathematical systems which, he asserts, parallel the structures which the child creates. Thus, the eight year old child's thought organization has formal properties very

¹³ Ibid., p. 165.
like the formal properties which define a certain logico-algebraic structure. The mathematical structure is found to have certain specific and definable properties; it is inferred from the behavior of the child that his cognitive structure has the same or similar properties -- that an isomorphism exists between the cognitive and the logical-mathematical structures. It is this emphasis on the structures of knowledge which the child exhibits at his various periods of development which establishes validity for the claim that Piaget's mission is epistemological rather than psychological in emphasis. What Piaget has done is to write the implicit logical theory according to which the child proceeds when dealing with intellectual tasks, and this logical theory and the structure of mathematical-logical systems are parallel.

The concrete-operational child is beginning to extend his thought from the actual (the phenomenal, in-front-of-the-senses reality) toward the potential. However, they still are oriented toward concrete things and events immediately present. The starting point for concrete operations is the real, rather than the potential, although the seven to eleven year old is beginning to be able to extrapolate from the here to the non-there, which he will do when it becomes necessary. These beginnings preview the general characteristics of the
period which follows that of concrete operations.

Formal Operations

The most important characteristic of formal-operational thought in Piaget's system lies in the relationship of the real versus the possible. The adolescent child approaches the solution of a problem by considering all the possible relations which could apply to the data, and then attempting in a combination of logical analysis and experiment to find out which of the possible relations is indeed true. Thus, it becomes the cognizer's task to find out what, in the large realm of the possible is indeed real, or actual. This orientation toward reals versus possibles is thus a "fundamental reorientation toward cognitive problems."14 Because the adolescent can imagine, potentially "all that might be there," he has a much better chance of insuring that he will find "all that is there."

There are several important characteristics of formal thought. Such thought is fundamentally hypothetico-deductive in character. It is propositional thinking, in that the adolescent takes the results of concrete operations, puts them in the form of propositions and then makes various kinds of logical connections between them, such as implications, conjunctions, identities, etc. Finally, in approaching the realm of the possible, he deals with a whole series of variables which in addition to considering individually, he then combines making

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14 Ibid., p. 205.
a much larger group of variables. In short, he engages in combinatorial analysis, a method which, in Flavell's words, "guarantees that the possible will be exhaustively inventoried."\textsuperscript{15}

Flavell presents a paradigm of formal-operational thinking. He states, of the adolescent,

He begins by organizing the various elements of the raw data with the concrete-operational techniques of middle childhood. These organized elements are then cast in the form of statements or propositions which can be combined in various ways. Through the method of combinatorial analysis he then isolates for consideration the totality of distinct combinations of these propositions. These combinations are regarded as hypotheses, some of which will be confirmed by subsequent investigation. Is it true that A elicits X? If so, does B also? Is it true that A produces X only when B is absent? Such are the hypothetical questions which make up the domain of the possible in such problems; and the adolescent views his task as that of determining the actual shape of things by successively putting them to empirical test.\textsuperscript{16}

These formal operations, Piaget has characterized as he did the concrete operations which preceded them, in terms of logico-mathematical structures which he thinks of as serving as abstract models for them -- i.e., he has made of them epistemological rather than psychological models. It is not important for purposes of this chapter to consider these models in any detail, but it might be stated that the basic logico-mathematical properties are much more integrated and complex than the mathematical-logical structure which parallels the concrete-operational child's thought.

\textsuperscript{15} Ibid., p. 206.
\textsuperscript{16} Ibid., p. 206.
Thus, from birth to maturity, the developing child undergoes three distinctive phases of cognitive growth. The child in the preoperational period is "the child of wonder," as Flavell describes him — his thinking is naive, not well-organized, and bound to impressions, and yet his approach to new situations is characterized by zest and flights of fancy. The concrete-operational child is a "sober book-keeperish organizer of the real and distruster of the subtle, the elusive and the hypothetical. The adolescent combines the concrete-operational child's passion for order and pattern together with a sophisticated version of the young child's conceptual lack of inhibition and daring.

Unlike the concrete-operational child, he can soar; but also unlike the preoperational child it is a controlled and planned soaring, solidly grounded in a bedrock of careful analysis and painstaking accommodation to detail.17

The Dynamism of Piaget's System

The child, in Piaget's system, moves from one stage of development to another. This movement occurs according to certain rules of transition which are the mechanisms or processes by which the child is propelled through the developmental sequence. Piaget's major emphasis in his research has been on characterizing the separate states themselves; however, he has also made an effort to deal with the transition mechanism as well.

\[17\] Ibid., p. 211.
This mechanism is characterized as a process of equilibration -- a process which is "the propellant for change and transition." The process gives rise to a series of discontinuous states of equilibrium which follow, one after another, in succession. It operates in the exchanges between the growing child and his environment. Maturation and learning are subsumed under the general mechanism of the equilibration process. The equilibration model even serves to point to a certain teleology in ontogenic development, in the sense that it recognizes that higher states of equilibrium incorporate and integrate the cognitive actions of the lower states into a broader and more complex totality without annulling them (even though the specific form which the higher equilibrium state assumes is predictable only within very broad limits).

Piaget illustrates "la marche à équilibre," as he frequently calls it by examining the process as it leads from preoperational lack of conservation across transformation (of quantity, length, etc.) to the capacity for conservation of concrete-operationalism. One of the most important elements of the transition from preoperational to concrete-operational thought is the acquisition of conservation, in which properties such as quantity, number, length, etc. remain invariant, or are conserved in the face of transformations, such as displacing objects or parts of objects in space, dividing an object into pieces, changing its shape, etc. As an example,
Flavell deals with conservation of mass. The subject is shown a succession of transformations in shape of a ball of clay, into longer and thinner sausage-shapes, and with each change he is questioned as to conservation or non-conservation. The "evolution" of conservation Piaget sees as a process of equilibration containing four major steps, each step comprising in itself a state of equilibrium.

In conservation of mass, the steps are as follows:

1. The subject pays heed only to the width, or only to the length of the shape, and not both. Thus, he will say the sausage, relative to the standard, is thinner and thinner, and has less quantity.

2. The subject pays heed, still, to only one property, but the one other than that considered in step one. Thus, he will say the sausage is longer and longer, and has more quantity.

3. In step 3, the subject pays heed to both width and length, but the outcome is not a clear case -- he tends to hesitate and find conflict. This is because he is becoming aware, jointly, of both properties within a single cognitive act, although he is not yet prepared to deal with both of them conjointly.

4. In step 4, the subject has achieved conservation, without equivocation.
While these four steps may provide an accurate description of the equilibration sequence in the case of conservation, the question of why the child follows just these steps in precisely this order must be asked of Piaget. Piaget proposed a probabilistic explanation. He tries to show that the nature of the subject-stimulus in the conservation task is such that step 1 is the most probable beginning strategy of behavior. With performance at step 1, continuing the transition to step 2 is increasingly more probable; continuing performance at step 2 makes the transition to step 3 more probable, etc. At step 4, the "level to level upward movement ceases," when "a permanent and parsimonious solution to the problem renders null the probability of further changes in strategy."18

Piaget has attempted to fit this general four-step equilibration-equilibrium model and his probabilistic explanation to coming-into-equilibrium processes other than those having to do with conservation. It applies to perceptual development, sensory-motor phenomena, the formation of concrete-operational structures, etc. It may be suggested that the basic question is how children come to acquire the many, diverse concepts they do come to acquire "in the stream of every day experiencing," as Flavell calls it. The equilibration process model is Piaget's attempt to explain this phenomenon. Whether it does so adequately must be a matter for sophisticated psychologists.

18 Ibid., p. 247.
to determine. For the less sophisticated, the model and its probabilistic explanatory model seem to be only two more descriptions (neither of which is truly explanatory) of a most complex and difficult-to-explain phenomenon.

Bruner and Piaget

Bruner's intellectual relationship to Piaget is a very close one, as he himself has stated countless times in his many books and papers written in the years since 1960, when The Process of Education appeared. In the preface to his book, Studies in Cognitive Growth, a book which is dedicated to Piaget, Bruner states,

Many points of disagreement are nevertheless minor in comparison with the points of fundamental agreement we share with Professor Jean Piaget. This volume would have been impossible without his monumental work. His genius has founded modern developmental psychology. It gives us all deep pleasure to dedicate this book to him on his seventieth birthday and to present it to him on that occasion at the XVIIIth International Congress of Psychology in Moscow on August 9, 1966.19

The points of fundamental agreement between the two men are to be found in their view of the child as a developing, cognizing organism. Both see the child moving through three stages of intellectual growth from birth to maturity (although there is some difference between their age placement of each stage). Piaget's period of sensory-motor development together with the stage of preparation for concrete operations

is equivalent to Bruner's enactive stage; Piaget's concrete-operational period coincides with Bruner's iconic stage, and formal operationalism and Bruner's symbolic stage are essentially the same.

Another point of fundamental agreement between the two men lies in their research methodology. In the Harvard experiments reported in Studies in Cognitive Growth, Bruner employs a clinical approach which follows the stimulus-response, stimulus-response sequence of Piaget's experiments. Experimental tasks devised by Bruner and his colleagues are designed in terms of "intuitions or hunches" as are Piaget's, and, indeed, in Bruner's conservation studies it is Piaget's classic experiments which are adopted for use. The results of both men are oriented toward description and explanation rather than specific prediction and they are presented with a high ratio of discussion, analysis and interpretation to data. Both may be looked upon as philosophical-theoretical oriented and not purely empiricists, as so many of their colleagues are.

The similarities between the men are overwhelming, especially in comparing the thrust of Bruner's exposition in the educational writings with that of Piaget. The differences become apparent in the beginning essay in Toward a Theory of Instruction, in the paper "The Course of Cognitive Growth," and in Studies in Cognitive Growth, and they relate to the problem of the dynamism of the Piagetian system.
Bruner maintains that the equilibrium-equilibration model is inadequate to explain this dynamism and here he offers his own views of the effect on the developing organism of the mastering of techniques which are embodied in the culture and passed on in a dialogue by the agents of the culture. Bruner states that this view has been shaped by the work of cultural anthropologists such as Hallowell, Medawar, Kluckholn, and with regard to the influence of language as a symbol-system, such scholars as Vygotsky, Chomsky and Brown. Whereas the educational writings of Bruner as well as Piaget stress growth from the "inside out," the later studies of Bruner are much concerned with growth from the outside-in. They center on the effect of the institutions of the culture, of language, of the tutor-learner relationship in shaping, speeding or modifying this growth. Piaget, of course, is always cognizant of these cultural factors, but he does not emphasize them, whereas Bruner attempts, in Studies in Cognitive Growth, to create a second theory dealing with the influence of the "outside-in" which he then conjoins to the first. However, at least in terms of his present influence in educational circles, Bruner may be considered to be firmly in the Piagetian tradition, and it will not be until the implications of the "outside-in" emphasis have caused a change in his educational theory that he will have to be viewed differently.
Motivation

In an article in the Psychological Review in 1959, Robert White of Harvard University presented a new theory of motivation to which Bruner refers frequently throughout his books on education. White states, in his paper, that in the past few decades there has been, among psychologists, great dissatisfaction with the long-accepted theories of motivation based on notions of primary drives. This dissatisfaction appeared in animal psychology, psychoanalytic ego psychology, and general psychology as well—realms far apart, yet all aware of the same basic deficiency. In his paper, White summarizes some of the dissenting literature of each of these three psychological "schools," and then, building on this literature forms a new conceptualization which represents his contribution to motivation theory.

White states that it has been found that certain kinds of behavior cannot be successfully conceptualized in terms of drive theory. This includes

visual exploration, grasping, crawling and walking, attention and perception, language and thinking, exploring novel objects and places, manipulating the surroundings, and producing effective changes in the environment.

He suggests that the behavior which leads to effectiveness in these areas is not random— it is directed and persistent,


\(^{21}\) Ibid., p. 329.
and it continues not because it serves primary drives, such as hunger or sex, "but because it satisfies an intrinsic need to deal with the environment."22 White defines the organism's capacity to interact with its environment as competence.23 And he argues that it is necessary to make competence a motivational concept -- "there is a competence motivation as well as competence in its more familiar sense of achieved capacity."24 This motivation White designates by the term "effectance," and the experience it produces is characterized as a feeling of efficacy.

White states that the concept of competence motivation does not refer to any and every form of neural activity.

It does not include reflexes and other kinds of automatic response. It does not include well-learned, automatized patterns, even those that are complex and highly-organized. It does not include behavior in the service of effectively aroused drives. It does not even include activity which is highly random and discontinuous, though such behavior may be its most direct forerunner. The urge toward competence is inferred specifically from behavior that shows a lasting focalization and that has the characteristics of exploration and experimentation, a kind of variation within the focus. When this particular sort of activity is aroused in the nervous system effectance motivation is being aroused, for it is characteristic of this particular sort of activity that it is selective, directed, and persistent, and that instrumental acts will be learned for the sole reward of engaging in it.25

22 Ibid., p. 318.
23 Ibid., p. 297.
24 Ibid., p. 318.
25 Ibid., p. 323.
Thus, it may be seen that the association of interest with the work of achieving an effective level of interaction with the environment (competence) can be made to bear a large share of the explanation of why children learn for the sake of learning -- that there is an intrinsic motive in learning which makes it fun and play, and which leads to a large network of competences far beyond those explained by the pressing need which satisfaction of primary drives arouses.

Bruner, drawing on White's competence motivation, applies it to a school situation. He states that the "satisfying state of affairs" which induces learning is to be found within learning itself, and this state nourishes the long course of learning which man must undergo. Education provides its own intrinsic pleasures. In Bruner's image-arousing prose,"we get interested in what we get good at." The competence motive conceptualized by White constitutes the source of Bruner's theory of motivation, as he himself clearly states, a motive which it is the place of education to nourish and encourage.

Readiness

The conception that material to be learned by the child must be put into a form which will correspond to his developmental capacity to comprehend it is one which would represent almost a truism to any teacher worthy of the name. Thus, in The Aims of Education, Whitehead states,
The alternative principle of order among subjects is that of necessary antecedence. It is impossible to read Hamlet until you can read; and the study of integers must precede the study of fractions.\(^\text{26}\)

A teacher is aware that his students, newly-having-learned-to read, will read children's literature at seven or eight, Tales from Shakespeare at eleven or twelve, and Julius Caesar at fifteen. He will add two and two at seven, he will do long division at eleven, and algebra at fourteen (at least if he is doing "old" math). He will learn about honest Abe Lincoln from Daugherty's book on Lincoln at eight, and read Carl Sandberg on Lincoln when he is sixteen or seventeen. The obviousness of this principle of necessary antecedence need hardly be labored.

As has been discussed in Chapter 3\(^\text{27}\) above, Bruner's concept of readiness, as related to his theory of intellectual development, involves the presentation of subject matter to the child in terms of the stage of cognitive growth in which the child finds himself. This aspect of his theory of readiness is quite the same as the concept of necessary antecedence, and quite the same as the traditional views of readiness and teaching based on maturation which dominate much educational thinking. Indeed, Piaget's own views on the teaching of a general principle or rule are similar. Flavell states that, in Piaget's view,


\(^{27}\)Chapter 3, pp. 49ff.
In trying to teach a child some general principle or rule, one should so far as is feasible parallel the developmental process of internalization of actions. That is, the child should first work with the principle in the most concrete and action-oriented context possible; he should be allowed to manipulate objects himself, and "see" the principle operate in his own actions. Then, it should become progressively more internalized and schematic by reducing perceptual and motor supports, e.g., moving from objects to symbols of objects, from motor action to speech, etc.28

Bruner's "readiness" dictum, however, while it includes an element of necessary antecedence, includes other elements as well. He has stated, "We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development."29 This dictum, as stated before,30 rests on the view that to teach a concept to a child at any stage of his development requires translation of the concept into the thought-form he can assimilate. The impetus toward translation which has affected so many of the national curriculum projects may be thought to have been initiated with the popularization of Bruner's dictum. In addition, the dictum is related to Bruner's hypothesis that teaching a significant concept which has been translated into a simple form will make possible much better learning of the same concept when he reencounters it in a more sophisticated state of development. This, too, has influenced some of the content of the new curriculum projects in which a concept is taught on an intuitive level and then,

28 Flavell, Piaget, p. 84.
30 See Chapter 3, pp. 50ff.
later, on a symbolic with the thought that the later learning will be much better as a result. Finally, in Studies in Cognitive Growth, Bruner and his associates have concluded that through the tutor-learner relationship readiness can be speeded by accelerating the developmental steps.

It may be stated that, although the necessary antecedent aspect of Bruner's readiness theory is not original with Bruner, perhaps the other aspects are. The stress on the possibility of translation of concepts into each level of development, for the need to do so if later learning is to be improved, and for the apparent desirability of trying to accelerate the developmental steps is quite original with Bruner. But, as has been stated before,\textsuperscript{31} there has been no convincing experimental evidence that his original hypothesis is valid, and, indeed, it has evoked a counter-hypothesis in response from Piaget that the acceleration aspects may be undesirable. It can only be suggested that this hypothesis in which Bruner has made what appears to be an original contribution to readiness theory has, in fact, not been verified, and indeed, some of the evidence may point to the fact that it is not verifiable.

In summary, it may be stated that Bruner's developmental psychology is in the Piagetian mold. His theory of motivation is based on the concept of competence of White. It is only

\textsuperscript{31} Chapter 3, p. 55.
in his readiness theory that an original contribution seems to have been made, and the original elements of this theory are, as yet, not verified by the experimental evidence.
CHAPTER 9
ON KNOWING

Learning by Discovery

Piaget and the Method of Active Learning

Piaget has shown an active interest in educational matters for a large part of his long professional life, according to Flavell, and he has written a great deal about the subject of educational method. However, it is in a monograph by one of his associates in Geneva, Hans Aebli, that Flavell finds the best statement of Piaget's favored methodology.

According to Piaget, "Penser, c'est operer."

Stable and enduring cognitions about the world around us can come about only through a very active commerce with this world on the part of the knower.¹

In terms of the educative process, this means that the student himself must be guided to perform actions on the materials which he is learning. It will be the task of the teacher to view the material to be learned in the light of the operations implicit in it. This material must be learned in such way that the student himself carries out these operations. Flavell states of the teacher:

¹ Flavell, Piaget, p. 367.
Suppose he wishes to teach the elementary notion of fractions. He would do well to eschew pictures of objects divided into equal parts in favor of actually dividing a concrete object before the class, or, better still, getting the student to make the partition himself. Similarly, to convey the idea of contour lines on a map, one might actually have the student cut a model mountain horizontally into layers.  

However, Piaget is not interested in limiting the child to performing only concrete actions of the type described above. He is interested in the development of formal operations, in which originally overt actions are transformed into mental actions. The teacher must assist in encouraging this internalization by leading the student to perform actions which are more and more divorced from perceptual support. The child may be led to operate, at first, directly on physical objects; then he may be guided to work on pictures or representations of these objects, and finally, he must be led to symbolic handling of them so the action occurs internally and completely separated from the external, perceptual manifestation of the object. Thus, the intellectual developmental process which the child follows must be translated into the operations of the classroom. But it is the child, himself, who must actively engage in the operations involved in learning if learning is to occur.

Piaget, himself, has very recently stated what is the essence of his educational methodology. He says,

\[^2\text{Ibid.}, \text{p. 368.}\]
Even in order to understand we have to invent, or, that is, to reinvent, because we can't start from the beginning again. But I would say that any thing is only understood to the extent that it is reinvented.

Intelligence is born of action. Any act of intelligence whether it be on the part of a man involved in scientific research or of any normal adult in his everyday problem-solving, or the child of seven and eight -- any act of intelligence consists of operations, carrying out operations and coordinating them among themselves.

It may be seen that in "le systeme Piaget," the process of education occurs through and only through an activity on the part of the learner in which he operates, structures, in other words, discovers knowledge for himself. There is a very strong similarity between the method of learning advocated by Bruner and by Piaget.

Who Discovered Discovery?

The pupil is not to be told, but led to see...whatever the pupil gains, whatever thought-connections he works out must be gained with the consciousness that he, the pupil, is the active agent -- that he is, in a sense at least, the discoverer.

With this quotation, which appears to embody all the major elements of Bruner's way of knowing which is discovery, Mauritz Johnson, dean of Cornell University's School of Education, begins his article entitled, "Who Discovered Discovery." Johnson goes on to demonstrate that "discovery" was discovered by many thinkers, educationists and non-

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3 Saturday Review of Literature, p. 83.
4 Mauritz Johnson, "Who Discovered Discovery," Phi Delta Kappan, November, 1966, p. 120.
educationists as well, decades (and even centuries) before Bruner's writings of the last seven years have brought it into prominence as a most important way of knowing. The quotation above appeared in the writings of William Bagley and was published in 1905 in his book entitled, The Educative Process.

Johnson states that Frank and Charles McMurry, the distinguished Herbartians of the University of Illinois, writing in the last decade of the nineteenth century, advocated a method of learning very akin to that of discovery. They suggested that learning can occur both inductively (from the particular to the general) and deductively (from the general to the particular) and they insisted also that the student is to be expected to conceive answers to questions put to them by themselves — —

he is systematically required to make discoveries, to judge from a given situation, to put two and two together and declare the result.\(^5\)

The famous Herbert Spencer, writing in 1860, had recommended much the same method. He stated that

children should be led to make their own investigations and draw their own inferences. They should be told as little as possible and induced to discover as much as possible.\(^6\)

Finally, Johnson cites a more contemporary figure, Henry Morrison of the University of Chicago, who, writing in 1940, provided unit plans of study in which each student went about

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\(^5\) Ibid., p. 121.

\(^6\) Ibid., p. 121.
the process of learning by discovery the ideational sequence of each subject (the structure) independently and at his own rate of progress. Johnson suggests that Spencer, the McMurry's, Bagley, Morrison, as well as Bruner, were all aware that earlier Plato, himself, in creating the Socratic Method, had developed a technique for teaching and learning by discovery which, properly practiced, has probably not ever been surpassed.

Thus, Johnson links Bruner's learning by discovery with a long tradition, a tradition adhered to by thinkers as far apart in time as Plato and Bruner, including Herbartians such as the McMurry's and the modern Herbartian, Morrison, an essentialist such as Bagley, and the famed social-evolutionist, Herbert Spencer. Although Bruner has never claimed to have discovered discovery, nevertheless his name has become synonymous with this "new" and original-sounding method. Johnson suggests that educators should realize that "most of the ideas (such as discovery) now being put forward by scholarly reformers were at one time or another advanced by educationists."

Demonstrating this has been his purpose in providing a brief (and by no means exhaustive) history of the method of discovery.

Dewey and Problem Solving

It is somewhat surprising that Dean Johnson in "Who Discovered Discovery?" has not noted the most obvious source of

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Ibid., p. 122.
similarity to Bruner's method of discovery, namely, Dewey's problem-solving or inquiry. A careful examination of the Dewey-ian methodology reveals that, in spite of all their differences in so many concerns relevant to education, on this crucial problem of how knowing is best to proceed, Bruner and Dewey speak with almost one voice.

For Dewey, knowledge-getting emerges out of a transaction which is initiated when the human organism engages in contact with its environment. In this contact he experiences sensations, perceptions, images, and this experience is immediate. However, this immediate experience serves to provide but the background out of which knowledge may ultimately emerge. It is only when the immediate datum begins to serve as a symbol for initiating the process which is knowledge-getting that it becomes pertinent. The immediate experience is translated into a symbol which points beyond itself, and represents, for Dewey, an idea or a thought.

The knowledge-getting process, or inquiry, or reflective thinking (these terms are synonymous in Dewey's theory) begins when the thought-as-symbol initiates an inquiry concerning the reliability of that to which it points. This process into the reliability or worth or any particular symbol begins, in Dewey's words,

when we try to test its value and see what guarantee there is that the existing data really point to the idea that is suggested in such a way as to justify acceptance of the latter.8

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8 John Dewey, How We Think (Boston, New York: D. C. Heath, 1933), p. 11.
The process of "testing its value," or of inquiry, proceeds along a prescribed path. It begins with a state of uncertainty, of doubt, of mental difficulty, in which the experience-as-symbol creates a problem for the experiencer. The problem initiates an "act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity." The famous case of the "forked road" contains a simple, classic example of the process. The problem is posed by the sudden appearance of the fork in the road causing a general uncertainty or doubt concerning which fork to follow. The next step is to intellectualize the problem in such a way that a solution can, at least, be indicated. The third step is that of stating the hypothesis, if in scientific terms, or the guiding idea in more common-sense or practical situations. The next step consists of making deductions, the if-then phase of reflection, in which the mind elaborates a suggestion until an idea or a series of ideas is obtained which is quite different from the original idea with which the reasoning process began. Finally, the hypothesis is tested in action so that experimental corroboration or verification can be made of the conjectures of step four.

It is to be understood, clearly, that these five operations or sequences need not necessarily follow each other in a set order. In the process of inquiry, two of them may be

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9 Ibid., p. 12.
joined, one or another may be paid scant attention or skipped over, one of them may be developed out of all proportion to the other. But the sequence of such operations, implicit or explicit, does occur, and can be reviewed in the event that verification does not follow, so that a new process may be instituted. This routine of reflective thinking applies to any situation in which there is a problem, from that of simple or complex common sense through that of technical scientific concern, as well as to the realms concerned with value.

For Dewey, the optimum form of reflective thinking is that found in science. It leads to the most, the best, and the most productive knowledge-getting. He contrasts it with empirical thought, which, useful as it may be in many areas of common sense inquiry, nevertheless may lead to false beliefs, difficulties in confronting the novel, or mental inertia.\textsuperscript{10} Scientific method in contrast, breaks up "the coarse or gross facts of observation into a number of minute processes not directly accessible to perception."\textsuperscript{11} By engaging in analysis and synthesis, in which one discriminates his observed phenomenon into a number of separate variables, and then, fixing on the variable which finally explains the phenomenon, assimilates it to a whole group of data from which it had been isolated, scientific thinking causes less liability to error.

\textsuperscript{10} Ibid., p. 192.
\textsuperscript{11} Ibid., p. 195.
Dewey states,

Physical inquiry has been taken as typical of the nature of knowing. The selection is justified because the operations of physical knowledge are so perfected and its scheme of symbols so well-devised. But it would be misinterpreted if it were taken to mean that science is the only valid kind of knowledge; it is just an intensified form of knowing in which are written large the essential characters of any knowing.  

Thus, Dewey suggests that, wherever possible, the optimum form of knowing which is scientific method must be applied to knowing in all areas of concern to man — social and humane subjects, as well as science per se. Such knowing will serve to expand the frontiers of knowledge and expand, as well, the areas in which men have control over their environment.

In examining Bruner's method of discovery and comparing it with Dewey's inquiry or problem solving, it becomes apparent that there is no significant difference between the two. Discovery may rely more on intuition and somewhat less carefully follow the prescribed five steps of inquiry, but Dewey clearly recognizes the propriety of eliminating or combining or de-emphasizing any or even most of these steps in many acts of knowledge-getting. And, although discovery encourages intuiting so that the learner hops about from step to step, skipping here or there and using unorthodox short cuts to arrive at conclusions, nevertheless, these conclusions must be subject to check by analytic means which are the

means of inquiry. Bruner states,

The rightness or wrongness of an intuition is finally decided not by intuition itself but by the usual methods of proof.13

The divergence between Dewey and Bruner lies in their contention concerning the unity or multiplicity of ways or modes of knowing. For Dewey, there is but one mode, which is the scientific and which applies equally to all areas of knowledge-getting, science, art and the realm of values. (Although it may be contended that in all his writings he has never satisfactorily demonstrated that reliance on scientific method could deal with the problems raised in art or realms of value.) For Bruner, discovery subsumes two modes of knowing, the mode of knowing which is art and that of knowing which is science, and the proper mode is to be adopted according to the type of knowledge which is to be achieved. (See Chapter 7) But, in spite of this divergence, discovery and problem solving, whether it represents one mode or two, involve the student, or the learner, in an active process in which he must engage if he is to achieve knowledge. Thus, discovery and Dewey's method of inquiry or reflective thinking share the same emphasis, the emphasis on active engagement on the part of the learner.

In summary it may be stated that discovery (or a method akin to discovery) as the optimum method of learning is

advocated by Bruner and Piaget, Dewey, Bagley, Morrison, the McMurry's, Spencer, and, undoubtedly, many others in the tradition of educational thought, as well.

The Ends of Education

Bruner and Hutchins

In his various books on education, Robert Maynard Hutchins pays homage to the intellectual virtues which are those virtues which are good in themselves. By the intellectual virtues, he means good intellectual habits. He states that St. Thomas distinguished five intellectual virtues, intuitive knowledge (which is the habit of induction), scientific knowledge (which is the habit of demonstration), philosophical wisdom, which combines scientific and intuitive knowledge, art which is the "capacity to make according to a true course of reasoning," and prudence, which is right reason in respect to action.¹⁴

The intellectual virtues are, for Hutchins, "habits resulting from the training of the intellectual powers." An intellect which has been taught these proper habits is able to operate in all fields of knowledge, and the student whose education has consisted in the cultivation of the intellectual virtues is equipped to live the life of contemplation as well as the life of action. Hutchins states,

If education is rightly understood, it will be understood as the cultivation of the intellect. The cultivation of the intellect is the same good for all men in all societies. It is, moreover, the good for which all other goods are only means. Material prosperity, peace and civil order, justice and the moral virtues are means to the cultivation of the intellect. So Aristotle says in the Politics: 'Now, in men reason and mind are the end toward which nature strives so that the generation and moral discipline of the citizens ought to be ordered with a view to them.' An education which served the means rather than their end would be misguided.15

Ultimately, the student must be sent forth into the world to practice practical wisdom — which is "a true and reasoned capacity to act with regard to the things that are good or bad for man."16 But cultivation of practical wisdom is the province not of formal education, but of the home, the church, the state, the newspaper, the radio, the movies, the club and the boy next door, as Hutchins puts it.

Today as yesterday, we may leave experience (practical wisdom) to other institutions and influences, and emphasize in education the contribution that it is supremely fitted to make, the intellectual training of the young.17

The similarity between the view of the proper ends of the school of Bruner and of Hutchins is very strong. It is, perhaps, interesting to note that Bruner quotes Maimonides' statement of the highest excellence as being intellectual excellence, and good in itself, while Hutchins relies on the authority of St. Thomas. Both Thomas and Maimonides were

15 Ibid., p. 67.
16 Ibid., p. 68.
17 Ibid., p. 69.
medieval Aristotelians, and the ultimate source for the end of education as being intellectuality for both these great thinkers was the same. Hutchins, the neo-Thomist, or neo-Aristotelian (call him what you will) draws, ultimately, on Aristotle for the end of education. Bruner, by his own terminology, a "new nominalist," draws from the same source. And so, contemporary educational theory is confronted with the image of two theorists, Bruner and Hutchins, so far apart in so many fundamental ways, united in their view that the proper end of education in the school is the development of the power and sensibility of mind.

Education for Excellence

Bruner states in On Knowing that the fundamental need in our culture is "to employ our deeper understanding not only for the enrichment of society, but also for the enrichment of the individual." The function of education lies in developing the processes of intelligence so that the learner is able to create an interior culture of his own. This view is very much the same as that proposed by Harry Broudy in an essay published in 1960. Broudy states that the problem of our time is in finding a formula for life which will provide the maximum of subjective happiness combined with the maximum of social usefulness. This in his view, can be achieved only through self-cultivation. The first stage of self-cultivation is the

mastery of the arts of learning. Beyond the perfection of these arts,

the road of self-cultivation penetrates the knowledge and art selected by the best minds of every epoch. Here are the Sciences and the Humanities; what men of training, experience, knowledge and life-long devotion to study have judged to be true, good and beautiful.19

Furthermore, self-cultivation on its highest plane is necessary in order to maintain and guide a highly advanced society. Intellectual freedom is only possible if the individuals who desire it have knowledge. Political freedom is only possible if the citizens of a state have knowledge and understanding of political and social processes. Moral freedom is only possible when individuals have the knowledge which enables them to choose wisely in the area of moral decision.

Broudy states, —

the cultivation of our powers through the best knowledge available alone frees us from the web of interdependence of the Machine Age. It frees us not by escape or flight, nor by indiscriminate immersion into group enterprises. It frees us by giving us a chance to envision a type of behavior and life that expresses us as individuals and not merely as members of a class. And all this with the possibility that our own individuality may enrich the character of the social self that registers the progress of the social order.20

Broudy refers to the cult of self-cultivation as the cult of excellence. He says that the pursuit of excellence does


20 Ibid., p. 338.
not demand equality of intelligence and talent, since differences in "brains and talent" are a fact which cannot be denied. He maintains that excellence does not require in advance any one combination of talents. "All they ask for is the full exploitation of the capacities the person happens to have."21

It may be seen that both Broudy and Bruner stress the need of education for excellence. This excellence has its base in intellectuality, in development of the powers of intellect and mastery of knowledge, for, with such development comes the capacity to enrich not only the interior life of the individual but the social life as well. Excellence is a goal which can be aspired to by all men, each in the style and with the capacities which are his own. Broudy the "classical realist," and Bruner, the "new nominalist" are united in their insistence that education pursue the goal of excellence for all students, and that this excellence can only be achieved through the development of intellectuality. And to aid in this development of the intellect is the role of the school.

The Curriculum

In Education for Modern Man, Sidney Hook providing an answer to the quest, "What should we teach?" suggests what he considers to be an adequate curriculum. This is to include

21 Ibid., p. 339.
selected materials from the fields of mathematics and the natural sciences; social studies including history, language and literature, philosophy and logic, art and music. The knowledge imparted by such study should be acquired in such a way as to strengthen the skills of reading and writing, of thinking and imaginative interpretation, of criticism and evaluation.22

In his book, Education at the Crossroads, Jacques Maritain sets forth a curriculum which, he suggests, is to be pursued by students between the ages of thirteen through nineteen. The first three years of this period are to constitute secondary education, and the next four, college education, and they are to be devoted to the study of pre-liberal and liberal learning. Secondary education is to be devoted to language, natural and foreign, grammar and rhetoric, history, geography, astronomy and geology, botany and zoology. College education (which includes what are the junior and senior years of the contemporary American secondary school as well as the freshman and sophomore year in college) would include mathematics, literature, logic, physics and natural sciences, fine arts and history of science, as well as continued study of foreign languages and history. In the first two college years, philosophy, including metaphysics, ethics and politics and psychology would be added to studies of mathematics, literature, art and history.23

In General Education in a Free Society, the 1945 report

of the Harvard Committee, the members of the Committee suggest that there are certain basic elements of a general education in the secondary schools which will lead to full growth of the human mind and which should be required of all students in the secondary schools. These elements include the humanities, with emphasis on language and literature, reading and writing both in the natural and a foreign language; the arts including music, painting, drawing and modeling; the social studies including history, American, European and general (which provides cultural literacy and a sense of the nature of the heritage), historiography, geography and "contemporary society," which would encompass government, economics and sociology, science and mathematics, including physics and chemistry and biology, and geometry and algebra. They suggest the need for more advanced work in these three areas for those students who expect to go on to college or who wish to specialize in one or another of them, or who give evidence of special aptitudes in one or another of them. But for all students of the American secondary school, this basic background in general education must provide a minimum curriculum to prepare students to assume their place in a free society.

The three sample secondary school curricula presented above are offered by a noted experimentalist, in the Dewey tradition, Sidney Hook, a famous Catholic philosopher, Jacques

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Maritain, and by a cross-section of the Harvard University faculty with, presumably, all shades of philosophical orientation, and chaired by a noted scientist, James Conant. The three differ very little from one another, and they resemble strongly the curriculum proposed by Bruner. All four curricula place emphasis on the learning of what is commonly thought to be the main elements of a liberal education -- the intellectual heritage which the leading minds of the past and the present have bequeathed to students of this generation together with mastery of the tools of language, method and symbol-systems which make knowledge of this heritage possible. Bruner's curriculum then, it may be seen, has been proposed many times before, by educational theorists of many persuasions. All of them who value the tradition of liberal learning and its transmission from generation to generation, look upon this common heritage as necessary to be known by a man if he is to be considered educated.

It is only in his insistence that the structures which constitute the disciplines which are to comprise the curriculum are to be presented to the student from the earliest point in his school career that Bruner differs from these other theorists who propose curricula similar to his. They tend to suggest that the early years of school be spent at mastery of skills, and that the material of the scholars be presented to students when they have reached secondary

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school level, at least. While they all urge that the materials which students confront in school, the literature, the poetry, the art, the science, be of the best quality, and not watered-down or distorted or ill-presented versions of what constitutes scholarship, nevertheless they do not suggest that the disciplines can be and must be structured and then translated for presentation at each and every level of the students' intellectual development. This suggestion that the liberal tradition can and should be presented, and re-presented, and re-presented to the student as he passes from the beginning of school to the end of secondary school is Bruner's alone, and it is, as has been stated before, closely linked to his readiness concept. In the matter of the vertical view of the curriculum, Bruner differs from these other theorists. However, in the suggestion of what it is that is worth while to know, Bruner has many colleagues who have antedated him in terms of planning the curriculum.

In summary, it may be stated that Bruner shares with many of his predecessors in the educational tradition, predecessors as diverse as the McMurry's and John Dewey, an insistence that the child learns best that which he discovers for himself -- that the child himself must engage in inquiry, or active learning if he is to make that which he is learning his own. He shares with Hutchins and Broudy a view (which undoubtedly may be traced to a common source in Aristotle),
that the highest excellence which can be pursued by man is the excellence of intellectuality, and that it is the function of the school to lead the student in the pursuit of this excellence. And, finally, he proposes a curriculum consisting of the heritage of liberal studies together with the tools which make possible these studies, a curriculum often proposed by many men of diverse philosophical views, but all of whom are united concerning the need for the transmission to the present generation of the scholarship and products of inspiration of the great minds, past and present, which have molded western civilization.
CHAPTER 10

ART AS INTUITION

In his significant work, Aesthetic, first published in 1909, the great Italian philosopher, Benedetto Croce, presented his intuitionist theory of art. It is Croce's thesis that knowledge has two forms -- either intuitive, which is obtained through the imagination, or logical, which comes to man through his intellect. Intuitive knowledge is of the individual, of particularities; intellectual knowledge is of the universal or the general. Intuitive knowledge is concerned with individual things, whereas intellectual knowledge refers to the relations between individual things. Finally, intuitive knowledge produces images, while concepts are the result of conceptualizing.

In the history of thought, it has been intellectual knowledge which has been most highly regarded by philosophers and theoreticians. Croce says, of this regard for intellectual knowledge,

Logical knowledge has appropriated the lion's share, and if she does not slay and devour her companion outright, yet yields to her but grudgingly the humble place of maid servant or doorkeeper. -- What can intuitive knowledge be without the light of intellectual knowledge? It is a servant without a master; and though a master find a servant useful, the master is a necessity to the servant, since he enables him to gain his
livelihod. Intuition is blind; intellect lends her eyes.\footnote{1}

It is the argument of Croces Aesthetic that "intuitive knowledge has no need of a master." It is a mode of knowing which lays as significant a claim to truth as the mode of knowing which is the intellectual. Intuition is knowledge which is completely free of concepts, for those elements of the conceptual which appear to be mingled with the intuitional are no longer conceptual, because by their fusion in the work of art they lose their status as concepts. Thus, Croce states that

the philosophical maxims placed in the mouth of a personage of tragedy or of comedy perform there the function, not of concepts but of characteristics of such personage;...A work of art may be full of philosophical concepts; it may contain them in greater abundance and they may there be even more profound than in a philosophical dissertation....\footnote{2}

But the total effect of a work of art is intuitional, and it is the whole, the total work of art which determines what is the quality of its parts.

Intuition and Expression

To understand Croce's intuitionism it is necessary to understand what is the real nature of intuition in his aesthetic theory. Perception is, in his view, an intuition, in the sense that the paper before him, the desk on which he writes, the chair in which he sits, exist for him as he

\footnote{1} Benedetto Croce, Aesthetic (London: Macmillan & Co., Ltd., 1929), p. 2. (Translated by Douglas Ainslie)
\footnote{2} Ibid., pp. 2-3.
apprehends them as actual reality. But the image he forms in his mind of himself sitting before another desk, writing on a different pad of paper in another room is also an intuition. Thus, intuition is not dependent on perceptions of reality, alone, or of the immediately present, but includes the non-real as well. "Intuition is the undifferentiated unity of the perception of the real and of the simple image of the possible."\(^3\)

The stuff of which intuition is made is sensation, in Croce's view. Without sensation, no human activity or knowledge is possible, he agrees, but sensation alone cannot achieve knowledge. Sensation is subject to the activity of mind in which it is "clothed and conquered by form." It is this very activity of the mind which forms, constructs, distinguishes between the flux of sensations; it leads to a productive association of sensations which is a synthesizing activity. The experience of sensation is a purely passive state; intuition involves activity of the mind in molding the sensation into concrete form.

For Croce, the fundamental aspect of true intuition, that which distinguishes it from pure sensation is expression. He states that "intuitive activity possesses intuitions to the extent that it expresses them."\(^4\) This refers not only to verbal expression, but pictorial, musical, and any other form which expression might assume. Thus, it is not possible to possess

\(^3\) Ibid., p. 4.
\(^4\) Ibid., p. 8.
an intuition of, for example, a geometrical figure unless it is possible to trace its form on a blackboard. Impressions and feelings must be formulated to be meaningful; indeed, the formulation or expression in a cognitive process is an inseparable part of intuition. Croce refers to people who say that they have great thoughts in their minds, but they are unable to express them. But he recognizes that if they really had them, they could express them, and if they cannot express them it is because they do not really have them. He states,

They believe that any one could have imagined a Madonna of Raphael; but that Raphael was Raphael owing to his technical ability in putting the Madonna upon canvas. Nothing can be more false than this view.... Michael Angelo said, 'One paints not with the hands, but with the brain.'

The painter sees, gives form and expression to what others only feel or get a glimpse of. Others have impressions, sensations, feelings, impulses, emotions; the true intuitor expresses them.

Thus for Croce,

intuitive knowledge is expressive knowledge...intuition or representation is distinguished as form from what is felt and suffered, from the flux or wave of sensation, or from psychic matter; and this form, this taking possession, is expression. To intuite is to express; and nothing else (nothing more but nothing less) than to express.

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5 Ibid., pp. 9-10.
6 Ibid., p. 11.
Intuition and Art

Croce identifies intuitive knowledge with the aesthetic or artistic fact. Art is intuitive knowledge. However, intuition is not limited to artists -- it is had by the most ordinary of men. The difference between the intuition of a love poem by Keats and that of the simplest love-lyric to a popular song is not one of basic material (they are always of sensations and impressions) nor of intensiveness but rather of complexity, of extensiveness. Some men have a greater aptitude for expression of complex states of the soul. These men are known as artists. When a complex, difficult expression is achieved, a work of art has been produced. The line between the expressions which are art and those which are non-art is impossible of definition. Similarly the artistic genius differs from the non-genius only in a purely quantitative manner. The ordinary man can appreciate the work of the genius because there is an identity of nature in the artistic and the ordinary imagination -- the difference is but of quantity. "Some men are born great poets, some small." Thus, the artistic differs from the non-artistic, the genius from the non-genius in a purely quantitative manner -- the difference in their expressions is one of degree and not of kind, of more and greater complexity as distinguished from the simple and less complex.
Art as Synthesis

The aesthetic expression, in the Crocian view, is to be seen as a synthesis, in which it becomes impossible to distinguish one impression from another, one as more important or as having priority over another. When one views a picture or a poem, he does not have of it a series of impressions insofar as his response is an aesthetic one. This is not to say that distinctions about impressions cannot be made of a work of art— that it cannot be analyzed into components, this line and this line, this color and this color, this shape compared with the other shape. But these distinctions, these analyses made as the result of reflection have nothing to do with art as such or the aesthetic experience.

The work of art, thus, is indivisible. Every art expression is a single one. The impressions-through-expression are fused into an organic whole. The work of art has unity, or, more explicitly, unity in variety. Expression provides a synthesis of the various in the one. The work of the artist involves absorption of the rich material of diverse impressions into his "psychic organism." This material is then subdued and dominated by the artist's activity and synthesized in the form which he provides for it.
Intuition in Conceptual Knowledge

Croce has made clear his contention that aesthetic knowledge is, in its very nature, free of intellectual or conceptual elements. However, it cannot be said that the intellectual is similarly free of the aesthetic. "To describe the independence as reciprocal would not be true."

Croce asks precisely what is knowledge by concepts. Conceptual knowledge deals with the relations of things, and as such is concerned with generalities. But the generalities are formed on the basis of experience with particulars, with particular things, and such things are intuitions. An intuition is our experience of this river, this lake, this rain, this glass of water; the concept is water, divorced from any particular appearance or example of it. But water is, in Croce's words, "the material of infinite intuitions." Somehow, the concept has its base in the intuition, though it then becomes separated from it.

In addition, Croce maintains that every scientific work is also a work of art. He states that art and science meet on one side, which is the aesthetic side.... The aesthetic side may remain little noticed when our mind is altogether taken up with the effort to understand the thought of the man of science and to examine its truth. But it is no longer unnoticed when we pass from the activity of understanding to that of contemplation and see that thought...: develop itself before us, limpid, exact, well-shaped, without superfluous or insufficient words, with appropriate rhythm and intonation.7

7 Ibid., p. 25.
Even when men of science express their thoughts with literary mediocrity, the "well-arranged composition" may be recovered from the fragmentary or ill-arranged statement, the flame may be easily "liberated from the spark," because even these fragmentary writings have the scientific value of harmoniousness, coherence and perfection. Perhaps the experiencing of a set of equations by a mathematician which provide an elegant solution to a problem (after their purely ratiocinational reception, or even before) can serve to illustrate this point. Such experiencing has an aesthetic quality, a feeling of intense emotionalism at the beauty of the whole which has often been attested to by mathematicians.

Thus, whereas the artistic is free of the conceptual, the conceptual is not equally free of elements of the aesthetic. The conceptual is, in some sense, based on the knowledge of the phenomenon which is known intuitively. And the product of conceptualization of the great scientist or mathematician has an aesthetic quality, apart from its conceptual significance which further indicates the impossibility of separating the conceptual from the aesthetic.

The Aesthetic Product

Croce states that the process of aesthetic production can be symbolized in four stages. These are: (a) Impressions; (b) Expression or spiritual aesthetic synthesis; (c) Hedonistic
accompaniment or aesthetic pleasure; (d) Translation of the aesthetic fact into physical phenomena such as sounds, movements, combinations of line and color, etc.\(^8\) It is only the expression, or (b) which is truly the aesthetic, whereas the other elements are the merely naturalistic manifestations or constructions which accompany it.

The physical phenomena, in which words are combined to form poetry, sounds are combined to produce operas, lines and colors and shapes are combined to produce pictures or sculptures provide the art object, the aesthetic product which is the thing of beauty. However, the beautiful is not the thing itself, but the activity of man, the spiritual energy involved in creating or experiencing the expression which is the aesthetic object. Upon perceiving the aesthetic object, the viewer can then reproduce in himself the already produced expression or intuition. The process of reproduction involves confronting the physical object, perceiving the physical phenomena, which are (d) above formed into the aesthetic synthesis (b) and accompanied then, by aesthetic pleasure, or (c). When the art-object can be preserved, it is always possible (other conditions remaining equal)\(^9\) to reproduce in its experiencing the already-produced expression.

However, it is necessary to heed Croce's qualifying clause "all other conditions remaining equal." Physical

\(^8\) Ibid., p. 96.
\(^9\) Ibid., p. 97.
objects grow old, faded, broken, ruined; the poem's text becomes corrupted by printing errors; a work of architecture falls into decay. In addition, the psychological conditions of the viewer change. Croce says,

Fortunately no arduous researches are necessary to convince oneself that pictures, poetry and all works of art only produce effects upon souls prepared to receive them.10

There is a fundamental and inevitable change in society and in the internal conditions of life. Croce states,

The phonetic manifestations of words and verses of Dante's Comedia must produce a very different impression on an Italian citizen engaged in the politics of the third Rome, from that experienced by a well-informed and intimate contemporary of the poet. The Madonna of Cimabue is still in the Church of Santa Maria Novella; but does she speak to the visitor of to-day as to the Florentines of the thirteenth century? Even though she were not also darkened by time, must we not suppose that the impression which she now produces is altogether different from that of former times?11

In spite of this indisputable fact, he contends that it is possible for man to replace himself in the conditions in which the physical object of beauty was produced, and that the varieties of obstacles produced by physical and psychical change are not insurmountable. Restorers of manuscripts and pictures labor to restore to the physical object its original state. Historians and scholars labor to reawaken and rearouse in men knowledge of the psychological conditions which have

10 Ibid., p. 125.  
11 Ibid., p. 124.
altered in the flow of history. They "revive the dead, complete
the fragmentary and enable us to see a work of art (a physical
object) as its authors saw it in the moment of production."
By these means of linking themselves to the past, men live in
communication with other men of the past, just as through
social intercourse they put themselves in communication with
other men of their own time. They engage in a dialogue, which
enables them to reproduce the aesthetic experience which has
been produced by one other than themselves.

The production of an art object requires, in Croce's
terms, "a vigilant will," which strives to prevent the intui-
tion from being lost. This will may act quickly and instinctive-
ly, in a flash, so to speak, or with long and industrious
deliberation. The aesthetic vision is not subject to will;
its externalization, however, is.

To engage in externalization requires technical knowledge,
which is to say "knowledge at the service of the practical
activity directed to producing stimuli to aesthetic reproduc-
tion."\textsuperscript{12} The technical knowledge relating to architecture
comprises mechanical laws, data concerning the physical pro-
properties of materials, etc. The technical knowledge relating
to sculpture has to do with the instruments for sculpting,
means of casting or of mixing materials. The "theory of oraa-
tory" gives the best methods of producing and projecting the

\textsuperscript{12} \textit{Ibid.}, p. 111.
voice, and so on. These techniques, however, are not to be confused with the aesthetic -- they constitute practical activity which, combined with inspiration, result in the creation of the art object.

Such, then, are some of the elements of Croce's intuitionism. This chapter has made no attempt to outline in detail all of the elements of this theory, nor, indeed, to analyze or attempt to evaluate them. Such a presentation and critique is not within the limits or purposes of this dissertation. However, by a brief sketch of some of the main considerations of Croce, it becomes possible to see the relationship between Croce's Aesthetics and the aesthetic theorizing of Jerome Bruner.

**Croce's Aesthetics and Bruner's**

The similarity between Croce's aesthetic theory and Bruner's is a most striking one. The main burden of Croce's discussion is to convince his reader that knowledge has two forms -- the intuitive or artistic and the logical or scientific, and that each form lays as significant claim to truth as the other. Bruner's main contention is the same -- namely, that art and science are two modes of knowing, and that the knowledge disclosed by one mode is as necessary and significant in man's dealing with reality as is that of the other. That which Bruner calls the grammar of metaphor, or of art is akin to Croce's intuition as expression; his grammar of
science or logic is similar to the language of concepts which is characteristic of Croce's scientific-philosophical realm.

For Croce, pure intuition as flux of sensations is not enough -- for it to become productive it must be subject to an activity of mind whereby it assumes form -- where it attains expression. This is very analogous to the structuring or model-building activity of the human mind which Bruner asserts so constantly is characteristic of men -- a structuring by metaphor in the case of the artistic mode of knowing.

For both men, the artistic creation is to be seen as a synthesis, a unity, in which all of its elements have been merged into one, indivisible whole -- Bruner's combinatorial activity of aesthetic knowing, which results in an economical, simple symbol. For Croce, the work of art is indivisible, it possesses unity in variety, in which the variety has been merged by the synthesizing activity of the creator, which is surely very much the same conception as Bruner's.

Croce suggests that expressed intuition is not limited to artists -- it is had by the most ordinary of men. The difference between a love poem of Keats and the lyric of a popular love song or even the halting expression of love uttered by any simple man to his beloved is a purely quantitative difference. All are based on intuition, and the intensity of the expression of the humble man does not of necessity vary one whit from the intensity of Keats. But one is the unification of extensive, complex impressions which, presumably,
requires a much more extensive activity of the spirit to achieve expression than the others. This formulation of the complexity of expression which results in the artistic object is very similar to Bruner's contention that the difference between the artistic and the purely decorative, the great literary work and the entertainment lies in the amount of work involved in its production. Effort is required to produce a work of art, and this is much the same as Croce's extensive and complex activity which differentiates the true artistic creation from the one which fails.

Croce and Bruner both refer to the aesthetic or intuition-al element in scientific knowledge. Bruner states that the two realms of knowing are not separated by an unbridgeable gap, but that there is an "art of science," the pre-scientific activity in which the inspirational, the intuitional, the expressive effort is present. Croce maintains that science rests on an intuitional base, which is the experience of particularities by the scientist and that the scientific work, in its total formulation may serve as an object of contemplation in an aesthetic sense. Bruner further maintains that the scientific operates in art as well, through the combination of inspiration and technique. Croce would disagree, because he regards the inspiration alone as the aesthetic, and the technique merely as a means of bringing forth in a physical embodiment the inspiration. All of the most consummate technique, important as it is, cannot create a work of beauty;
it is only the technique in the service of the inspiration which results in a physical object of beauty. Technique serves as the handmaiden of the aesthetic. It seems most likely that Bruner could not take exception to this more careful distinction drawn by Croce, since he, too, looks upon the inspiration as paramount.

Both Bruner and Croce recognize that experiencing an art-object involves the viewer in many of the same activities as its creator. Croce states that experiencing the beautiful object involves the viewer in a process in which he reproduces the four stages of production involved in its original creation. Bruner states that in beholding the art object, the viewer must engage in work, whereby he fuses and unifies the streams of metaphorical activity of which it is composed, and this work is analogous to the work involved in its production. The viewer, in the theory of both men, must engage in an active response-pattern to obtain an aesthetic experience.

Both Croce and Bruner recognize that each man in each time and condition brings to an art-object a range of life-experience which is uniquely his. Both recognize that these differing psychological conditions are bound to affect the communicability of an aesthetic object. Bruner circumvents the particularity argument by suggesting there are certain human conditions which are universal, which transcend time and place and change little, and since art speaks to many of these
conditions it, too, transcends time and place. Croce suggests that knowledge of the past, and, indeed, of the present, enables men to understand the psychology of the artist, and so to be able to experience the work of art as did its author. While the explanation of the timeless quality of the aesthetic object offered by each man may raise questions and not completely satisfy, nevertheless in both there is agreement that a work of art can, and does, invoke an aesthetic response among different viewers in different places at different times.

Thus, it may be seen that Bruner's aesthetic theorizing stands firmly in the intuitionist tradition of Benedetto Croce.
PART IV

CONCLUSION
CHAPTER 11
SOME CONCLUSIONS

Bruner's Theories

Summary

For Bruner, knowledge is conceived as consisting of models or structures whereby the vast array of experiences which the intelligent, human organism encounters is grouped in such way as to connect them and render them economical. In the history of culture, experiences have been patterned into broad, conceptual frameworks which have been characteristic of bodies of knowledge or disciplines. These frameworks are identified by the organizing or "key" concepts which may be thought of as representative of each discipline. For such a model to be a valid one, it must be constructed by the best minds of each discipline, by the men who experience the "ever deepening insights that are developed on the frontiers of knowledge." Such models or structures are not fixed or final, and in some disciplines alternative models are possible or even necessary. But it is only in confronting a student with knowledge so structured that it becomes possible to maximize the limited capacity of a learner for processing information; i.e., to present him with knowledge which has been made available to be learned.
Discussion about the nature of knowledge, in the history of philosophical thought, has often been related to discussion about the nature of reality which knowledge seeks to represent. For Bruner, this reality cannot be apprehended by man directly. Reality represents only the outer limits of experience, the world of nature with which man deals but not directly because he cannot. All man can do is to represent aspects of this reality which he experiences through the construction of powerful abstractions which serve as models of what he experiences. Man lives, in the words of Ernst Cassirer,

in a symbolic world of his own collective creation, a symbolic world that has as one of its principal functions the ordering and explication of experience.

It is only through the mediating mechanism of these models or symbolic constructs (mathematical models, in the case of the physicist, or poetic models in the case of the poet) that it becomes possible for man to approach the world of reality or nature. The scholar cannot simply speak of knowing nature as such -- nature as such is unknowable. Reality cannot be "gotten at," so to speak, without the intermediary of the model, and this model is the invention or construct of the scholar.

Bruner's conception of the nature of the knower which is relevant to his educational theory, is based on the view of man as a developing, cognizing organism. Man, in his evolution as a species over thousands of years, has developed three skill-systems whereby he can use tools for his hands, tools
for his "distance receptors," or sensory capacities, and tools for cognition or ratiocination. The evolution of the species man is paralleled by the development of each individual man. The developing human organism lives in his environment by representing to himself the world as he encounters it, first, by manipulating that world, second, by representing it internally by simple images governed by principles of perceptual organization, and finally, by being able to represent it symbolically, with the use of complex symbol-systems divorced from reality which enable him to deal not only with models of reality which are directly experienced, but also with the much wider realm of the possible. These three phases of development, Bruner calls the enactive, the iconic and the symbolic. The human mind develops according to a program which is its own, and this program is characterized by an "intrinsic and self-contained logic" which becomes manifest at each stage of development.

Bruner states that there has been some important speculation to the effect that the specialization of human beings as a species is a specialization for learning. Indeed, in the case of man, he not only learns, but he submits to education, which is a process which conserves the learning of the past and transmits it to the young human beings so that they need not relearn it all over again from the beginning. Much of this education occurs in the setting of a school. To persuade or appeal to a child to submit to the unnatural setting for
learning which is the school, the child must be motivated. At least a good part of this motivation occurs because the long course of learning by which man builds mastery over his environment provides, within itself, a "satisfactory state of affairs." The child who is motivated to learn and willing to be educated, finds that education itself provides, for him, an intrinsic pleasure. He appears to obtain this pleasure in perfecting a capacity to master his environment, and later on, when he is in school, in mastering the material which is presented to him. Bruner suggests that this drive toward mastery, toward the achievement of competence, is a motivational drive which, if utilized properly can be of great aid to the teacher and the school.

Bruner's theory of education provides the link between his view of the learner as a developing, cognizing organism and knowledge as the structures created by the scholars in the disciplines. It is through the process of education that knowledge becomes known by the knower. This process of knowing implies activity rather than passivity on the part of the knower. He must participate in an act of discovery of his own through which he recreates and restructures and participates in the reformulation of the material which he is learning. The student must think mathematically for himself, consider matters as the historian does if he is to learn mathematics or history. Discovery leads the student to increased intellectual potency,
improved memory-conservation, improved problem-solving skill which can be generalized and adapted to any kind of learning task. The teacher must guide the student in ways of discovery in an analytic mode, and must guide and encourage him as well to engage in discovery in the intuitive mode. Discovery then, is not a monolithic process— it is inherently flexible, involving analysis as well as the use of intuition, and the method of knowing must be adapted to the kind of knowledge with which it deals. But all discovery is a process, an activity of structuring on the part of the knower whereby the knowledge which he encounters he makes his own.

For Bruner, the end of education is the development of the power and sensibility of mind. Intellectual excellence is the highest perfection which man is capable of achieving, and the perfection of this excellence enables man to create an interior culture of his own. The role of education is to lead not merely to the enrichment of society, but to the enrichment of the individual, and this is achieved by enabling every man, at his own level and within the limits of his own capacities, to pursue the excellence of intellectuality. The school, conceived as an entry-way into the life of the mind, is the institution whereby intellect is awakened and developed so the pursuit of excellence as intellectuality may be carried on in optimum fashion.

The curriculum for Bruner in this school in which in-
tellectuality is the goal consists of "that which is worthwhile knowing." This includes the studies in the tradition of liberal learning, physical and biological sciences, social sciences, mathematics, language and literature, music and art, and "the human condition," which presumably refers to psychology, ethics, metaphysics and religion. These studies are to be presented to the students as structured by the leading minds of each discipline and the students are to be led to discover and to recreate these structures for themselves so they will make them their own. And these structures are to constitute the curriculum from the earliest point in the child's school experience. The curriculum, in technical terms, is to be presented in the form of a vertical spiral whereby the key ideas of each structured discipline are to be presented, and re-presented, again and again, each time in a more sophisticated form and each form is to parallel the level of cognitive development which the child has attained. In this way, the learner moves from a weak and simple grasp of a subject, which, Bruner insists, is nevertheless an honest one, to succeeding stages in which his grasp becomes increasingly powerful.

Bruner suggests that the knowledge of art involves a different mode of knowing than the way of knowing which is science. Each depends on a completely different "grammar." The understanding of science is based on a grammar of logic or strict rationality and the understanding of art is based
on a grammar of metaphor. However, the two ways of knowing are not separated by an unbridgeable gap. There are strongly artistic elements in science, elements in which intuition and inspiration operate as in the example of the work of the truly "creative" scientist, whose hypotheses come to him by just such artistic insights. And there are "scientific" elements in art, since the truly successful artistic creations almost always succeed through the exercise of consummate technique. Discovery, as a way of gaining knowledge, must incorporate within itself techniques for the mode of knowing which is art, by its emphasis on the intuitive elements in learning, as well as those for the mode of knowing which is science, by its emphasis on the analytic and logical elements in learning. But Bruner stresses the need for recognition of these two modes, and knowing, unless it can encompass both the ways of art and of science, is severely impoverished.

**Identifying Bruner's Predecessors**

Bruner's theories have been anticipated by a number of scholars in many fields and representing many intellectual traditions. His concept of knowledge as structured by the disciplines is almost the same as that which was developed earlier by Philip Phenix, the educational theorist at Teacher's College, and, less comprehensively, before Phenix, by Alfred North Whitehead in addressing himself to the problem of the teaching
of mathematics. Bruner's ontology (or view of the nature of reality) is another expression of the philosophy of science of the contemporary school of quantum physics -- Nils Bohr, P. W. Bridgeman, Werner Heisenberg, notably, among them. Bruner's psychological theory which is most relevant to his writings on education, is based on the developmental model of Jean Piaget.¹ His conception of motivation is based on the competence motivation theory of Robert White, his colleague at Harvard. And one aspect of his view of readiness states that psychological competencies, given the nature of human development, appear in a certain sequence, and that the sequence of material-to-be-learned is to be matched to the sequence of achieved levels of competence. This is the principal of "necessary antecedence," identified by Whitehead (but obvious, even without identification, to any teacher).

Bruner's method of learning, which is discovery, is the method advocated by Piaget, and by a whole group of educational theorists such as the McMurry brothers and Herbert Spencer, in the last century, and, more contemporaneously, William Bagley and Henry Morrison. But the most important educational theorist advocating discovery in learning was John Dewey, himself, and of course, his followers, who say that only in problem-solving or inquiry or reflective thinking did there occur the kind of active participation on the part of the student

¹ His emphasis on the effect of culture on development resembles, strongly, the views of cultural anthropologists such as Hallowell, Kluckhohn, and Medawar.
which resulted in learning.

The end of education, for Bruner, which is the promotion of intellectuality, is the same as that urged by Robert Maynard Hutchins. The conception of education for excellence, which is, nevertheless, a goal within reach of all men, is the same as Harry Broudy's conception of self-cultivation, or excellence, which Broudy discussed earlier in an essay and which is developed more extensively in his recent book, *Democracy and Excellence in Secondary Education*. And Bruner's conception of a proper curriculum is similar to the curricula proposed by Sidney Hook, Jacques Maritain, and the Harvard Committee which wrote *General Education in a Free Society* among, undoubtedly, many other advocates of a traditional curriculum of liberal studies.

Finally, Bruner's aesthetic theory is very closely related to Benedetto Croce's intuitionism, in which Croce states that there are two forms of knowledge -- the intuitive and the logical, and that each form lays as significant a claim to truth as the other in the realm in which it must be applied.

There is, in fact, only one aspect of Bruner's theorizing which cannot be traced back to an earlier statement by another scholar, and that deals with his hypothesis concerning readiness. Bruner, as has been seen in the discussions in Chapter 3\(^2\) and Chapter 8,\(^3\), states that knowledge, structured by

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\(^2\) See pp. 49ff.

\(^3\) See pp. 173ff.
scholars, can be translated into thought-forms appropriate for each level of cognitive development, and, indeed, should be translated because later learning is better learning when the child has encountered basic concepts earlier in simpler form. In addition, in his most recent studies he indicates that readiness can be speeded, and that it is desirable that the teacher bring about this result. However, although this hypothesis is original, there has not as yet been any conclusive evidence that it is valid, and, possibly, some evidence that it is not. And so, this "original" doctrine of Bruner's, unproven and perhaps unprovable, cannot itself provide a very strong basis for the contention that Bruner is an educational theorist of great originality.

In conclusion, it may be seen that every one of Bruner's theories has been anticipated in the twentieth century intellectual tradition by a scholar or scholars of note. Those who would claim for Jerome Bruner the status of original thinker in the field of education theory are profoundly mistaken. 

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4 With the sole exception of the hypothesis discussed above.
Evaluation of Bruner's Contribution as an Educational Theorist

Bruner as Synthesizer

It has been the major burden of this study to demonstrate that Jerome Bruner is not an educational theorist of originality, and it is to be hoped that this contention has been conclusively proven in the many chapters which appear above. However, to say that a scholar is not original is not the same as saying that he is not important, or that he has not made a significant contribution to the thought of his field. The question, then, arises concerning the importance of Jerome Bruner (in spite of his lack of originality) for contemporary educational theory.

One of the earlier reviewers of The Process of Education referred to Bruner's theories as "not novel, but novelty synthesized." Perhaps a better description of his work would be to describe it as "a novel synthesis." In Bruner's theories, there are found, in combination, elements of philosophical "neo-nominalism," or, perhaps, logical positivism, together with neo-Aristotelianism. There is a view of the worthwhile-ness of the traditional studies which are to be learned by the Deweyian method of reflective thinking. There is an inordinate respect for the authority of the community of scholars as the only proper source to identify what is to be known.
This is balanced by an equally strong regard for the ways of learning which are the child's own, as they become revealed in the course of his cognitive development from birth to maturity. And this regard is emphasized to the point where it is demanded of the scholars that they devote their attention to translation of their erudition into the terms which the child can comprehend at each level of his development. There is strong respect for scientific learning in this essentially scientific age, which is balanced by just as strong a respect for artistic learning, in an age when such learning is often neglected. And there is emphasis on the need to master the way of knowing which is appropriate for science as well as that for art, and for an awareness that, ultimately, creativity in science is dependent on the artistic mode. There is emphasis on the effect of culture on determining the ways of development of the child, but strong emphasis, as well, on the need for the child to develop an interior culture of his own, using the learning of the instruments of the culture to enrich and fulfill himself to his own, highest capacity.

Bruner's most important contribution as an educational theorist is in his capacity to synthesize the emphases, the instrumentalities and the values expressed in many strands of educational theorizing in the past decades, and to synthesize them into a whole which, in terms of his own aesthetic theory, contains a great deal of "effective surprise." He puts together all sorts of ideas which hardly seem to belong together, but,
somehow, they seem in his synthesis to be quite convincing—they occasion a "shock of recognition" which leads one to think that they are put together as they should be. Further analysis might lead one to question this or that element, or even the synthesis as such, and, perhaps, to doubt that it can be classified as great art rather than of lesser quality. But that an effective synthesis has been made can surely not be denied.

A Matter of Style: Bruner as Popularizer

Another contribution of Bruner's lies in his capacity to popularize ideas and concepts which are not usually thought of as capable of arousing the imagination and enthusiasm of any but a small number of experts in a discipline. This can undoubtedly be attributed to his wonderful talent as a literary stylist. Bruner can take an essentially technical concept, such as the concept of structure or that of intuition, or that of "competence motivation," and, while he does not always succeed in making it simple, nevertheless he almost always succeeds in making it understandable and, even more important, not merely interesting, but exciting, thought-provoking, inspiring, perhaps fascinating. Not everything he has written in the field of educational theory provokes all these responses in all his readers. But these are adjectives which can properly be used to describe a great many of the responses to his books and papers and speeches, and they are, alas, not often
evoked by the writings of scholars.

In 1960, Harry Broudy, the noted educational philosopher, presented a paper in which he discussed the need for self-cultivation, or the pursuit of excellence. In this paper, he included very many of the same ideas which are to be found in Bruner's essay, "After John Dewey, What?", and, indeed, Broudy's paper was written before Bruner's. Broudy's language is surely correct, properly formulated, and his ideas are clear. But the total effect is one of ponderousness, even of dullness. Bruner's essay sparkles, his ideas delight and enthuse, there is a sense of the novel and the exciting in every paragraph. Ideas similar to Broudy's here expressed in Bruner's prose, come to life in a way, alas, in which in his own essay, they do not. This example may be multiplied many times over and with the same conclusion: Bruner is a superb popularizer — his ideas create enthusiasm because he writes splendidly. This gift of his, undoubtedly enhanced by use and perhaps improved by practice and effort, represents an important aspect of his contribution as an educational theorist.

The Effect of the Popular Press

It was conjectured in Chapter 1 that the warm, enthusiastic praise which The Process of Education and On Knowing received from the journals of the popular press, journals with influence and wide circulation such as Time, The Saturday Review, the book review magazine of the New York Times, etc.
had much to do with the great popular success which these two books enjoyed. This might be attributed to a series of factors. The literate general public, highly critical of and displeased with the state of American education, was interested in what appeared to be a position charting new directions for the American school to follow. Bruner's books appeared to chart these new directions, and, since they were written so well and with elegance and eloquence of expression, they were capable of arousing the general public. Surely a dull, pedestrian, typical committee report could not have captured so much attention nor sold nearly so widely as did *The Process of Education* even if *Time* and *The Saturday Review* had exalted it. And it is very much to be doubted that these journals would have so praised a typical summary report even if it contained the same ideas as Bruner's and the members of the Conference had they not been presented in such striking form.

The popular press established Bruner's claim to significance as an educational theorist it might be hypothesized. The educational establishment, recognizing in his theories nothing which many among its ranks had not said before, did not participate in the popular enthusiasm until such time as this enthusiasm forced them to take note of him, and to take him seriously. It was possible for the "establishment" to take him seriously because he approached them as a spokesman for the scholarly community, with respect, with sympathy and understanding, with trust in their ability to make the American
school overcome its problems, and with an offer of cooperation in this enterprise. His criticism of their shortcomings was implicit and not explicit, and constructive rather than destructive. Although their acceptance of his ideas is not complete, due not so much to hesitation in receiving an "outsider" as to serious reservations about the complete validity of his doctrines, nevertheless the educationists themselves have come to look upon Bruner as a man whose views on education deserve respectful consideration.

It might be concluded, then, that, although Bruner is not original, nevertheless, in his educational theory, he is a skillful synthesizer, an adept popularizer and a gifted stylist. He is a man of broad learning and wide interest, a scholar in his own special discipline, of distinction, and an intelligent and thoughtful observer of the problems of education. His theories raise many questions, and his answers to many of these questions have many shortcomings. Nevertheless, they are serious and important questions, and many of the answers are challenging. Jerome Bruner's insights into the problems of education are worthy of serious attention from members of the education profession.
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