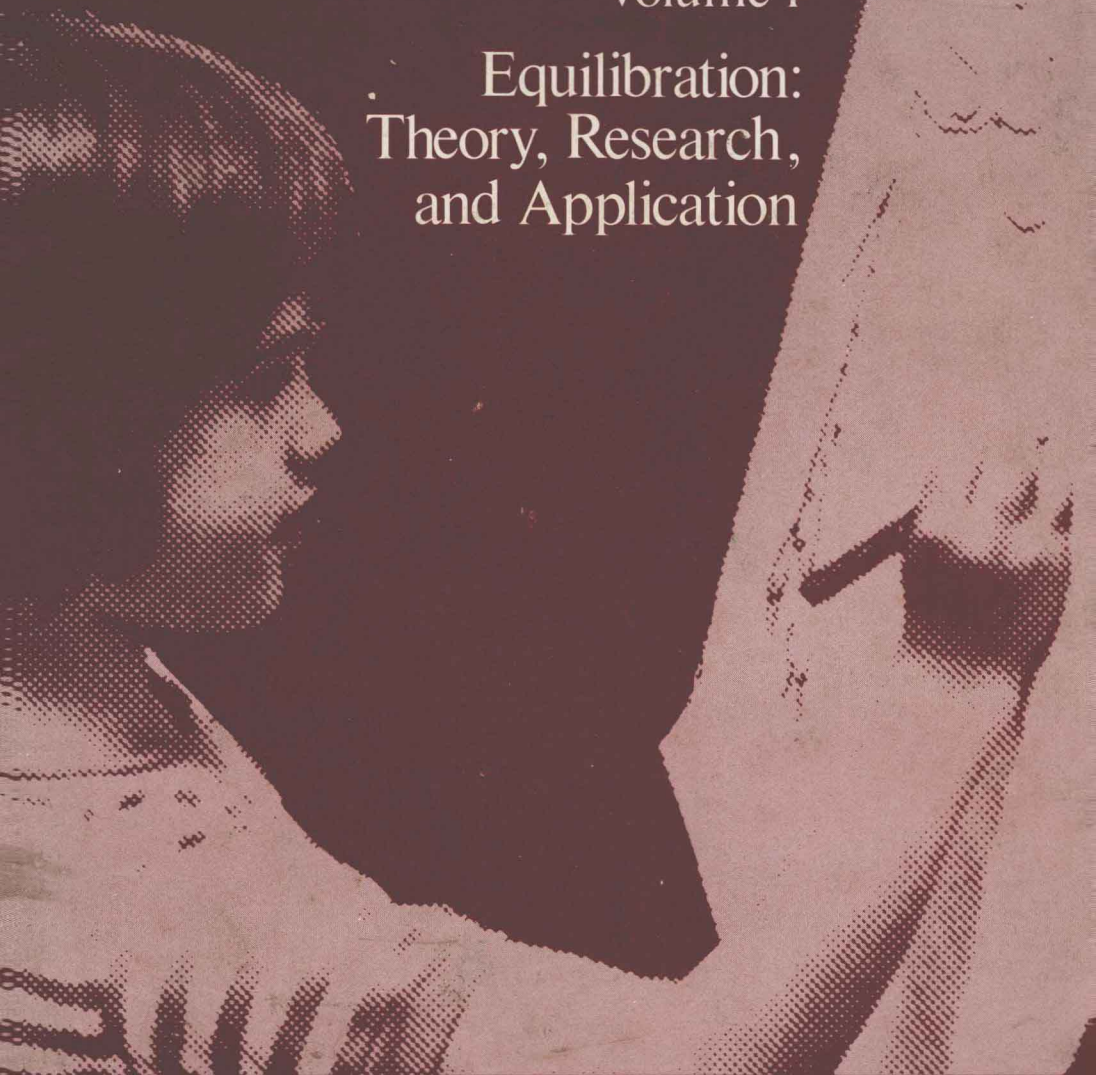


# Topics in Cognitive Development

Volume 1

Equilibration:  
Theory, Research,  
and Application



Edited by Marilyn H. Appel and Lois S. Goldberg

A Publication of the Jean Piaget Society

# Topics in Cognitive Development

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## Volume 1 Equilibration: Theory, Research, and Application

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Volume 1  
Equilibration: Theory, Research,  
and Application

# Topics in Cognitive Development

**Marilyn H. Appel, Editor-in-chief**

*Medical College of Pennsylvania, Philadelphia*

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**Volume 1      EQUILIBRATION: THEORY, RESEARCH, AND APPLICATION**

Edited by

Marilyn H. Appel, *Medical College of Pennsylvania*

Lois S. Goldberg, *Glassboro State College*

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## Preface

Professor Piaget, who at this writing is in his eightieth year, has dedicated his life to the exploration and explanation of the genesis of knowledge. The Piagetian model rests on both a philosophical and a biological foundation, with psychology as the link between these two disciplines.

This volume, the first in a series that will record the official Symposium Proceedings of the Jean Piaget Society, is unique in that it encompasses theoretical, empirical, and applied aspects of Piaget's epistemology. The majority of papers in this collection represent the combined proceedings of the first and second annual symposia of the society. Professor Piaget's address, presented at the First Annual Symposium of the Jean Piaget Society in May, 1971, highlights the papers within this volume. This paper is outstanding in the clarity with which the concept of equilibration is explicated.

It is the intention of the society, through this volume and subsequent ones, to extend the monumental body of knowledge provided by Piaget. The editors hope to implement transmission of the concepts within these selected papers so that they may serve as an impetus for future investigations. We are indebted to those who provided us with the invaluable editorial and secretarial assistance necessary for such an undertaking.

In addition to Professor Piaget's paper, those by Bärbel Inhelder, Hans Furth, and Jeanette Gallagher were presented at the First Annual Symposium of the Society. These were subsequently edited by Calvin Nodine, Rhymes Humphreys, and Jeanette Gallagher and published by the Society in 1972. Revisions and extensions of the original papers are found in the present publication.

Lois S. Goldberg  
Marilyn H. Appel

# Introduction

The four papers that comprise the first section of this collection are devoted to theoretical considerations within cognitive development. Sequentially, the first three papers are intended to provide a logical structure within which an analysis of the Piagetian concept of equilibration is undertaken. Piaget's own presentation, "Problems of Equilibration," is therefore followed by Hans Furth's commentary, which was given immediately following Piaget's address. Gallagher's explication of the concept of equilibration follows, exploring the biological, logical, and cybernetic antecedents of this construct. The final paper within the first section, by J. McVicker Hunt, considers the implications of Piaget's epigenetic view of intelligence as it relates to sensorimotor development.

In Piaget's paper, "Problems of Equilibration," the three classical factors necessary for cognitive development are delineated. In essence, these factors are the physical environment; innateness or hereditary programming; and social influences. It is Piaget's thesis that in addition a fourth factor, equilibration, must be considered in order to provide for coordination between and among the three classical factors, as well as to suggest the notion of the self-regulations that are necessary at all levels of cognition. Three types of equilibration are suggested: the relationship between assimilation and accommodation; the coordination or conflict among subsystems; and the differentiation and integration of part to whole knowledge.

Furth, in reacting to Piaget's discussion of equilibration, raises three questions. The first asks if, indeed, the concept of equilibration is not more closely related to the classical factor of maturation and hereditary programming than it is to physical or social experience. The second question involves Piaget's use of the term *equilibration*. Furth asks for clarification, noting that *equilibration* refers not only to a process but also to a state. The final question touches upon the issue of whether or not there is an affective or humanistic aspect in



intelligence and, further, if this humanistic aspect carries with it some motivational qualities. A brief reply by Piaget then follows Furth's commentary.

Gallagher's paper, "Piaget's Concept of Equilibration: Biological, Logical and Cybernetic Roots," presents an intensive examination of the concept of equilibration. Her paper suggests that Piaget's view of this concept is drawn largely from three interrelated sources. One major source discussed is the influence of the "neobiologists," such as Waddington. Piaget is said to draw analogies between biological and cognitive aspects of self-regulatory mechanisms and Waddington's concepts of "competence," "induction," and "homeorhesis." A second source explored is the influence of the concept of logical necessity, which is said to be reached through a series of progressive equilibrations, explaining not only the transitions from stage but also the transitions between substages. The final source of influence, cybernetics, suggests that through mechanisms such as feedback or precorrection, equilibration can be seen as a stable exchange system that controls the relationship between the organism and his environment.

Finally, in "Sequential Order and Plasticity in Early Psychological Development," J. McVicker Hunt explores some issues that he suggests are raised by Piaget's epigenetic view of intelligence. The first issue concerns the selection of criteria in the determining of levels, structures within stages, and the stages themselves. The process for defining the Hunt-Uzgiris scales of sensorimotor development that follows is illustrative of the concern for the determination of levels or landmarks within stages. The second issue examines ordering within stages, necessitating validation of the sequential organization of intellectual development hypothesized by Piaget. The third issue raised is that of the nature of transition or transformation within or between stages. Hunt suggests that these transitions are implied by changes in behavioral organization based upon coordination of systems, motivational qualities, and generalizations. The final issue relates to the processes or causes that underly these transitions and is investigated by means of the assessment of object construction in five samples under varying learning conditions. The reported results suggest that environmental circumstances substantially influence the rate of sensorimotor development.

Piagetian-inspired research has proliferated both within the United States and abroad. Outstanding among contributors to the extant body of research has been Bärbel Inhelder, Piaget's long-time collaborator. Her paper opens the second section, which presents five research papers notable for their investigation of a wide variety of topics with varying populations, in diverse geographic locations.

With "Information-Processing Tendencies in Recent Experiments in Cognitive Learning," Inhelder summarizes research findings that attack the problem of examining transitions between substages through conservation and class inclusion experiments. Four successive steps are labeled: juxtaposition, opposition, compromise, and integration. Inhelder suggests that these results demonstrate

that development cannot be considered as a branching process of refined differentiations, but rather as the interaction of different subsystems. These interactions, as they lead to conflict situations, are said to require reciprocal assimilation between varying subsystems in order to approach a higher order of structuration.

Using the Hunt-Uzgiris scales, Uzgiris longitudinally examines infant development within the sensorimotor period for consistency of structural organization across various domains. General concepts extracted from these results are reported in her paper, "Some Observations on Early Cognitive Development." Three levels of organization within the sensorimotor stage are delineated: the utilization of subcomponents in actions; the regulation or modification of actions by outcomes; and the implicit or nonovert adaptation of actions equivalent to thought. Uzgiris cautions that these findings are not meant to be conclusive. It is therefore suggested that these structurations be examined in future investigations under varying circumstances.

Jonas Langer has approached Piaget's equilibration thesis through a wide variety of research hypotheses. In "Cognitive Development During and After the Preconceptual Period," Langer describes ongoing research that investigates the development of transductive preoperations during the representational stage, from approximately 2-5 years, and its manifestations in physical, social, and personal preconcepts. Children were questioned regarding a series of four family portraits, spanning approximately 15 years, and were asked to make judgments on the relations between pictures as well as between the individuals portrayed. Langer also presents some considerations of developmental filiations between operative and figurative thought along with some comments on the question of the interactive aspects of cognitive development.

In "The Emergence of the Child as Grammarian," Gleitman, Gleitman, and Shipley present demonstrations of some young children's awareness of syntactic and semantic properties of language. Rudiments of such "metalinguistic" functioning are shown in 2-year-olds, who gave judgments of grammaticality in a role-modeling situation. The growth of these abilities is documented for a group of 5- to 8-year-old children who were asked explicitly to give judgments of deviant sentences. Adultlike behavior in these talented subjects was found to emerge in the period from 5 to 8 years. Possible relations of metalinguistic functioning to other "metacognitive" processes are suggested.

After a brief review of the structuralist position, Lavatelli reports in "Environment, Experience, and Equilibration" her findings based on an examination of logical development among the Houk-Lo boat people of Hong Kong. She suggests that the rate of logical development is not a function of socioeconomic status itself but of the opportunities within an environment that provide the interactions necessary for logicomathematical thought. Teaching techniques and specific activities that foster the transition to logical thinking are presented for incorporation within the preschool curriculum.

Attempting to integrate Piagetian research into classroom practices, which is essentially what Lavatelli has done in the previous paper, Stephens, in her paper "Application of Piagetian Theory to Remediation of Reasoning," suggests three guidelines: present activities that are motivating but not frustrating at the child's level of development; emphasize experiences that are activity-oriented; and provide a teacher with a knowledge of Piagetian theory and the ability to assess reasoning as defined by the Geneva school. With these guidelines, two remediation projects were undertaken, one with congenitally blind subjects and the other with mentally retarded, socially maladjusted subjects. With factors determined in previous research, a modular approach that provides sequential activities based on a common factor or basic cognitive ability was developed. The modules include systems and variables, reproductive imagery, and cooking. The goal of this research was to utilize these modular systems as an intervention technique for a period of at least 15 months in order to determine if a significant change in cognitive development was effected.

Implications derived from the Piagetian model and its related research are applied to curricula within the three papers that comprise the final section. Both Barbara Presseisen and Marilyn Appel present innovative Piagetian-based curricula in the areas of social studies and science, respectively. Lois Macomber's paper, which opens this section, is not related to a particular curricular area but instead offers a detailed description of the preoperational child's thought and its implications for education.

Macomber's paper, entitled "Some Implications of Jean Piaget's Theory for the Education of Young Children," delineates four modes of thinking that characterize children in the preoperational stage. They are transductive thought, egocentric thought, magical thought, and animistic thought. She discusses the inability to conserve, to use reversibility of thought, and to display perceptual constancy during this prelogical stage of development. Changes in curriculum and instruction consistent with an understanding of the preoperational child are proposed. Suggestions for modification of the physical classroom and its equipment are made, along with a redefinition of the teacher's role in such an educational environment.

Presseisen's paper, entitled "Piaget's Theory Applied to a Social Studies Curriculum," suggests that the application of Piaget's theory to curriculum can be seen through an examination of the changes in the development of curriculum. Key elements in curriculum design are suggested: content, process, instructional design, management plan, and evaluation. Presseisen suggests that these elements must be taken into account if Piaget's theory is to be examined more effectively as a basis for curriculum development in the social sciences. She continues with a consideration of Piaget's thoughts on social education. Finally, she describes an actual social studies program under development that applies Piaget's theory to its curricular organization. Included is a description of how

the application has been made, what constraints were placed upon the testing of the program, and what were some tentative results of the testing.

In her paper, "The Application of Piagetian Learning Theory to a Science Curriculum Project," Appel describes an individualized program that has evolved from the process of curriculum development in science over the last 50 years. Three stages in science curriculum development are discussed: fact-centered (Stage I); process-structure focus (Stage II); and individualized and interdisciplinary (Stage III). Appel goes on to describe and compare the three major programs that have had the greatest impact on science teaching in the past 15 years. These include the Elementary Science Study (ESS), Science—A Process Approach (SAPA), and the Science Curriculum Improvement Study (SCIS). A program entitled "Personalized Approach to Science Education" (PASE) is discussed in terms of a theoretical model of curriculum design and its relationship to the Piagetian model of development and learning.

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**PART I:**  
**THEORY**





## CHAPTER 1

# Problems of Equilibration<sup>\*</sup>

Jean Piaget

University of Geneva, Geneva, Switzerland

The title “Equilibration” refers to one factor that I think is essential in cognitive development. In order to understand the role of this factor, we must relate it to the classical factors that have always been understood to be pertinent in cognitive development. There are three such classical factors: the influences of the physical environment, the external experience of objects; innateness, the hereditary program; and social transmission, the effects of social influences. It is clear that all three are important in cognitive development. I will begin by discussing them separately. But as we discuss them, I think we will see that no one of the three is sufficient in itself. Each one of them implies a fundamental factor of equilibration, upon which I shall place special emphasis.

I will start by discussing the role of physical experience. It is clear that this is indispensable in cognitive development. There can be no development without contact with physical objects, that is, contact with the physical environment. In terms of classical empiricism, the role of acquired experience simply amounts to perceptions that we draw from objects and associations among perceptions. As I see it, there never can be pure association in the classical sense in which the empiricists mean it. The manner of linkage that always intervenes in the whirlpool of associations is in reality an assimilation in the biological sense of the term, an integration of external data into the structures of the subject.

Any action on the part of a subject gives rise to schemes of assimilation. That is, an object can be taken into certain schemes through the actions that are carried out on it; each of these schemes of assimilation goes hand in hand and with an aspect of accommodation of the schemes to the situation. Thus, when a subject takes cognizance of or relates to an object, there is a pair of processes

<sup>\*</sup>Translation by Eleanor Duckworth