PIAGET'S LEGACY AS REFLECTED IN *THE HANDBOOK OF CHILD PSYCHOLOGY* (1998 EDITION)

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Abstract: The 1998 edition of the authoritative *Handbook of Child Psychology* (*HCP*, Damon, 1998) was examined to reveal the impact of the work of Jean Piaget on the field of child psychology at the turn of the millennium when *TIME* magazine hailed him as one of the greatest minds of the century (Papert, 1999). The review is set in the historical context of the role played by Piaget since the first *HCP*. Counts of citations and references reveal Piaget to be by far the most cited author in the field. Categorization of Piaget's prodigious output according to research periods (Smith, 1993) show that *HCP* authors have been selectively attentive to Genevan research. Piagetian references represent only a small subset of Piaget's 53 books, and almost none of his 523 published papers. What appears relevant to child psychologists covers only a restricted period in Piaget's work, and generally does not do justice to Piaget's own explicitly epistemological perspective. Analysis of chapters on cognitive development beyond childhood and mathematical thinking augment the quantitative summaries with qualitative detail of the Piagetian influence in these areas. It is suggested that Piaget's own epistemological theory (e.g., Piaget 1947/1960; Piaget & Garcia, 1983/1989) provides a model for investigating how the field of child psychology has adapted to his *oeuvre*.

Key-words: child psychology, cognitive development, epistemology, history of psychology, Piaget's theory

Each new edition of the *Handbook of Child Psychology* constitutes an important event not only in the field of child psychology but in that of psychology in general. As Mussen stated in the 4th edition, the Handbook is intended to " … provide a comprehensive and accurate state of knowledge … in the most important research areas of the psychology of human development" (Mussen, 1983, p. vii). The publication of its 5th edition seemed to us an appropriate occasion to record, to analyze and to discuss the place of Piaget's work in developmental psychology at the end of the century. Similar work was done when the 4th edition appeared in 1983 (Cornu-Wells, Tryphon & de Caprona, 1985). It seemed particularly

apt, as well as fruitful and interesting to us to use the *Handbook of Child Psychology* to reflect on Piaget's status and influence in the field at the historic moment when *TIME* magazine had saluted Piaget as one of the greatest minds of the previous hundred years (Papert, 1999).

Our aim is not to document all the changes that have taken place in the fields that informed child psychology during the last 20 years of psychological research. Our chief intention is to raise some important issues concerning the reception of Piaget's *oeuvre* as reflected in the *HCP*. We intend that this should be an informed first step in investigating these issues, not a definitive final pronunciation on them. With more than four and half thousand pages of the 1998 *HCP* on the one hand and Piaget's prodigious output on the other[1], we cannot pretend to be exhaustive. Nor do we mean to set ourselves as authoritative interpreters of Piaget's work; we share an abiding interest in the Piagetian *oeuvre* and merely hope to be regarded as being able to provide some level of informed commentary on the issues we address. Our aim is much more modest: we wish to propose some tentative answers to the complex question of whether Piaget's influence has waned over the last 20 years, and to point to the parts of his work that have survived or been modified. So, how do we proceed? At one (quantitative) extreme, we could involve ourselves in reporting un-interpreted counts of the word 'Piaget' from the 8000 pages of two 4-volume editions of the *HCP*. Hardly informative, but we find that almost any attempt to categorize the citations by type or quality invites unnecessary controversy. At the other (qualitative) extreme we could try to assemble a team with the broad expertise necessary to dissect and interpret the references to the Piagetian *oeuvre* across the broad canvas of the *HCP*. But how, then, would we deal with the absences of Piaget in the places where we might reasonably expect to find references to his work?

In the end, our compromise is to blend elements of a simple quantitative count of citations in a bibliographic approach complemented by qualitative interpretation of some apparently important issues. To that end, the quantitative focus provides a summary of counts of the citations of Piaget's published works, as well as a collation of the references to Piaget's books and articles that are cited by the authors of the Handbook chapters. To augment and complement these simple actuarial summaries, the qualitative focus reviews two chapters which explicitly refer to the central role of Piaget's concepts in establishing, influencing and informing each author's field of expertise. However, before turning to these analyses, it will be useful to set the *Handbook of Child Psychology* into an historical perspective.

PIAGET IN THE HANDBOOK OF CHILD PSYCHOLOGY

As William Damon (1998) outlined in his *Preface* to *The Handbook of Child Psychology*, this fifth edition of the *HCP* should be considered as the seventh. The very first edition of the Handbook, edited by Carl Murchison in 1931, was followed just two years later by a second revised one in 1933. Both were one volume editions. In the preface to the second edition, Murchisson claimed that "… this first revision bears scarcely any resemblance to the original '*Handbook of Child Psychology*' …. Chapters on topics not subjected to continued research have been omitted" (p. ix). But, one needs only to compare the tables of contents of both editions to see that this claim appears to be not strictly true. Although some authors were eliminated from the new edition to be replaced by others, the chapters that figure in both editions did not have any major revisions. It seems that in those two years, not unexpectedly, the changes in theory were far from spectacular. Consequently, one might conclude that the

[1] The definitive *Bibliographie Jean Piaget* published by the Fondation Archives Jean Piaget in 1989 lists more than 50 monographs and 520 articles in the Piagetian oeuvre along with publication information for the originals and all of the subsequent translations.

publication of a second edition in such a short temporal interval might have been motivated more by commercial interests than for reasons of major advances in the field.

It was only after the second world war, in 1946, that Leonard Carmichael published *The Manual of Child Psychology*, also a one volume edition, that aimed "… to bridge the gap between the excellent and varied elementary textbooks in this field and the scientific periodical literature of psychology" (cited by Damon, 1998, p. xi). Following Murchisson, Carmichael published a new edition of the *Manual* in 1956, this time in a two-volume edition.

Paul Mussen took over after Carmichael's retirement. Possibly at least partly due to the previous editor's insistence, the 1970 two-volume edition was entitled *Carmichael's Manual of Child Psychology*. After Carmichael's death, the two subsequent editions (1983, edited by Mussen, and 1998, edited by Damon) recovered the original title of *Handbook of Child Psychology*. Both of these are four volume editions.

How, then, was Piaget represented in those various publications? Throughout its variety of forms, from 1931 to 1998, the Handbook contained only two original papers by Piaget, each published twice. The first, entitled "Children's philosophies", can be found in the 1931 and 1933 editions[2]. In this 20 page article Piaget expounded his ideas about children's thinking, distinguishing three aspects: realism, animism and artificialism. The examples presented to illustrate his theory of the progressively increasing rationality of the child's thought were taken from *The Child's Conception of the World* (Piaget, 1926/29) and *The Child's Conception of Physical Causality* (Piaget, 1927/30). Like many of the other authors of the second edition, Piaget didn't submit a new article, even though he had published *The Moral Judgment of the Child* (Piaget, 1932/1932) during the intervening two years.

Neither the 1946 nor the 1954 Carmichael editions bore a trace of Piaget's original writing. According to Damon, the new editor had just "dropped Piaget" (Damon, 1998, p. *xiv*). No explanation was given for this quite surprising decision. One should bear in mind that Piaget had received a honorary degree from Harvard University in 1936. Even if this is not enough to attest Piaget's popularity in the USA (see Yeh Hsueh, 1999), the fact that in 1936, all 6 books published by Piaget to that time had been translated into English, suggests that there was at least some potential interest in his work and, consequently that his name should have had a place in the Manual. Moreover, in the 1940s and 50s Piaget's theory was quite widely discussed and criticized in the United States. Indeed, chapters of the 1946 edition mention Piaget's theory (e.g., those of Mead, Jersile, Lewin) and one chapter by McCarthy entitled "Language development in children", reports and discusses at length several replications of Piaget's investigations by researchers in the US. Perhaps Carmichael did contact Piaget who refused. It might also be that, having been approached, Piaget did not send an article.

However, a comparison of the contributors of the various early editions suggests that Piaget's situation is not unique. Whereas the first and second editions include several European scholars as authors (e.g., Anna Freud, Charlotte Bühler, Susan Isaacs, Kurt Lewin), not a single one appears in the 1946 edition. In his Preface, Carmichael referred to the difficult publication conditions due to the war (Carmichael, 1946, p. *vi*). This difficulty is important not only for understanding Piaget's influence in the US, but, more broadly, the relations between European and American psychologists during and after the Second World War. Apparently, the contacts between the two scientific communities became less frequent

[2] The content of this article, with some slight changes in the first two paragraphs, was also reproduced in the two editions of *Readings in Child Psychology*, edited by W. Dennis in 1951 and 1963, with the title: "Children's ideas". That volume contained an additional chapter of Piaget's entitled "Communication between children", which consists of extracts from *Language and thought in the child* (Piaget, 1923/1926).

than before. Claiming to be a neutral country, Switzerland did not commit to the second world war. However, it continued commercial exchange with Germany, a link interpreted by some Americans as being close to the National Socialist government (for Piaget's position during the war see Vidal, 1996). Apparently, this was also the reason for the Rockefeller Foundation's suspension, in 1941, of the funds that they granted the Institut Jean-Jacques Rousseau[3]. It was only in the mid-1950s that the Rockefeller Foundation started funding the Genevan research again.

But if this might explain Piaget's absence from the 1946 edition, the editing of which was undertaken during a world crisis, it could hardly explain his omission from the 1954 revision. That omission leads us to conclude that, because of Carmichael's own interests in the experimental investigation of psychological processes and his focus on biological factors, the editor intentionally neglected Piaget's theory. The question of why he neglected other European scientists remains open.

It was only in the 1970 edition that Piaget again came to the fore with his article entitled "Piaget's theory". Mussen, the new editor, was well acquainted with the Genevan school. He had corresponded with Bärbel Inhelder in the late '50s and had published a paper by Inhelder & Matalon (Inhelder's young assistant) in his *Handbook of Research Methods in Childhood Development* (Mussen, 1960). In June 1961 while spending a year in Europe, he visited Geneva and was introduced by Bärbel Inhelder to the team of the International Centre of Genetic Epistemology, directed by Piaget. The collaboration soon became a friendship that gave rise to frequent correspondence between Mussen and Inhelder.

Mussen's letter asking Piaget to contribute to the new edition of *Carmichael's Manual of Child Psychology* was sent on June 29, 1965:

> The previous editions had almost no theory, while for the new Manual we plan an extensive opening section on theory, the contents of which are shown in the Outline. The chapters on theory are not meant to form reviews of any particular empirical literature; the remaining two dozen chapters will cover in some detail the observations and experiments that are relevant to particular theoretical points of view. With confidence that a reader of the Manual can find citations of particular empirical studies later on in the book, the writer of chapters on theory may concentrate their attention on providing a general systematic context for the diversity of current child psychology. The ideal chapter on theory will be between 30-50 typewritten pages. It will consider the historical antecedents and developments of a particular point of view about children, it will contain some treatment of methods and problems peculiar to the point of view, and it will be largely an exposition of the principles, formal and informal, that characterize the theoretical position under discussion.
>
> Who can say to Piaget what he should say about Piaget? It is relevant to note, that detailed discussion of the findings of the research coming from your Institute will appear in several later chapters. The chapter presently under discussion is planned to reveal Piaget *cogitator* rather

[3] Founded in 1912 by Edouard Claparède (1873-1940), the Institute Jean-Jacques Rousseau was an internationally famous institution involved in teacher training and child psychology (for a history of the Institute, see Piaget (1959), Vidal (1997), and Yeh Hsueh (1997).

> than Piaget *factor* and permits either an axiomatic or a polemic development of your point of view.
>
> (Mussen, June 29, 1965). (italics in original)

A copy of this letter to Piaget was addressed to Bärbel Inhelder as well, asking her to intercede as much as possible on behalf of the editors. And intercede she certainly did, as witnessed her reply to Mussen just a week later, stating that "Piaget received and even read your letter concerning the new edition of Carmichael; he told me that he would accept with pleasure your invitation to contribute to the new edition. I hope that he will write to you in due course". (Inhelder, July 7, 1965, our translation). Piaget's paper was sent to the editor in November 1967. At first glance, Piaget seems to have complied with the editor's request. Entitled 'Piaget's theory', this short article - the shortest article in that entire edition - consisted of a succinct distillation of Piagetian ideas. In a mere 30 pages Piaget accounted for 45 years of research. In a footnote on the first page, however, Piaget stated that, "As a matter of fact, 'Piaget's theory' is not completed at this date and the author of these pages has always considered himself one of the chief 'revisionists of Piaget'."

It seems that this now famous article was a translation, with slight extension, of a French language article, entitled "Le point de vue de Piaget" (Piaget's point of view) which was about to be published in 1968 in the *International Journal of Psychology*. In any case, it summarized his ideas quite well, and discussed key concepts of his theory (constructivism, assimilation and accommodation, operative versus figurative aspects of cognitive functions, equilibration, and the four factors of development). For those who have routinely criticized Piaget for not having paid attention to social factors, it is worth noting that one of the factors of development is "the influence of the social environment" (Piaget, 1970a, p.721).

Again, it is exactly this same article that was reprinted more than a decade later in the 1983 version of the Handbook. This reproduction, however, cannot be attributed to the editor's ill will. On the contrary, in his Preface to Volume I, Kessen, the Volume I editor, deplored the absence of a Genevan update. "Two butterflies are missing from this collection. The editors had hoped to have a new chapter from Jean Piaget, but he chose in 1978, not to prepare a new contribution. Our further hope, that one of the members of the Geneva group would either comment on or extend Piaget's 1970 chapter or write a new piece, was also disappointed" (Kessen, 1983, p. *x*).

We have no evidence to explain the reasons for Piaget's refusal. One might suppose that in 1978, although still in full scientific activity in the International Centre of Genetic Epistemology, Piaget was not interested in providing a new summary of his theory. Concerning Kessen's second disappointment, however, one can not discuss that without mentioning the delicate problems and questions of scientific inheritance which follow the passing of any important scientist. This leads us to view the absence from the 1998 edition of an article on Piaget's *oeuvre* written by a Genevan scholar as one further logical consequence of the more recent history of the Genevan school.

METHODS OF ANALYSIS

The 1985 French-language analysis of the 1980 edition of *HCP* (Cornu-Wells, Tryphon & de Caprona, 1985) by researchers at the Archives Jean Piaget in Geneva centered exclusively on a number of articles that discussed Piaget's theory extensively. It focused on the way in which two core Piagetian concepts, namely the notions of stage and structure, were discussed by the authors.

For this new edition we have proceeded rather differently. Assuming that the four volumes of the Handbook provide a sample representative of the domain of developmental psychology, we have proceeded to a double analysis: a quantitative analysis complemented by a qualitative one. In order to begin to gauge whether the impact of Piaget has changed over the years, we have undertaken counts of the numbers of author/date citations of Piaget's published work in each of the 1983 and 1998 editions. This investigation is completed by examining which of Piaget's articles and books are actually included in the reference lists of the chapters in the two editions. We have avoided categorizing or evaluating the style or content of these citations and provide merely brute counts for comparison and consideration. Given the breadth of knowledge necessary reasonably to evaluate such citations over some 8000 pages of expert collegial writing, we avoid such potentially tendentious categorization. Finally, two exemplar chapters of the 1998 edition discussing Piaget's impact are selected and reviewed in some detail so that the reader might become more informed about how these counts of citations might appear in practice in the most recent *HCP*.

QUANTITATIVE ANALYSIS

1. Number of citations

Table 1 presents the frequency of citations of Piaget's published work according to the volume of the *HCP* in which the citations appeared for each of the two editions. Although the 4 volumes are organized differently in the two editions, this comparison of the raw counts provides interesting information, related not only to citations of Piaget but to the ways in which the discipline has evolved over the intervening years. This last point is discussed in Damon's Introduction to the 1998 edition (Damon, 1998). Concerning the first point, the comparison of the total number of citations of Piaget in the two editions, 366 for *HCP* 1983 and 228 for 1998, is informative. Considering that the two editions are of different length (3819 pages in the 1983 edition and 4650 pages in the 1998 edition), this difference in counts

Table 1 : Frequency of citations of Piaget in the 1983 and 1998 editions of the Handbook

1983 edition	**Frequency of citations**	**1998 edition**	**Frequency of citations**
Vol I : History and methods	62	Vol I : Theoretical models of human development	70
Vol II : Infant and developmental psychobiology	28	Vol II : Cognition, perception and language	100
Vol. III : Cognitive development	218	Vol III : Social emotional and personality development	27
Vol IV : Socialization and social development	58	Vol IV : Child psychology in practice	31
(3819 pages)	**366**	(4650 pages)	**228**

could be interpreted as even more important. For a partial explanation one might immediately look to the high number of citations in Volume III *Cognitive Development* of the 1983 edition, which, with 218 citations of Piaget in that volume alone, almost matches the entire Piaget citation count for *HCP* 1998. That 1983 volume included chapters that presented and discussed replications of Piagetian empirical investigations in various domains; a focus no longer found in the 1998 edition.

Simply considering the lengths of the two publications, even the counts of 336 and 228 might appear, at first glance, to be rather low. In order to evaluate the significance of these levels of citation, we have compared them to the citations in the Handbook to other classic authors[4] more or less contemporary with Piaget, such as James Baldwin, William James, Stanley Hall, Heinz Werner, Eleanor Gibson, and Lev Vygotsky. Interestingly enough, this inquiry shows that the number of references to each of these classic authors in either edition does not exceed 30, with the sole exception of Lev Vygotsky. The citations of Vygotsky total 66 in the 1983 edition and 85 in 1998. We observed that Vygotsky's work is very often cited with and compared to that of Piaget. While in the 1983 edition the two authors appear as opposed, according to the pervasive classical dichotomy, social versus individual, in the 1998 edition they appear grouped together in the constructivist, as opposed to the realist, camp. In this light, the differences appear to be diminished and their complementarities seem accentuated (e.g. Keil, Vol I §7; Rogoff, Vol II §14; Rubin, Vol II, § 10; Ginsburg, Vol IV §7).

2. Piaget's publications referred to in the Handbook

Our second focus for exploration in the distinctly quantitative mode concerns exactly which of Piaget's articles and books actually figure in the reference lists of those authors who do cite him. Our aim was to see if the evidence could help our readers to determine whether some aspects of Piaget's work are seen as more salient or more referred to than are others. To do so we have provided a table containing the titles of all the Piaget publications included in the reference lists, in each edition, and counted the frequency of those appearances for each reference (for the details of this analysis see Appendix). The former count of citations included every individual author/date citation of a Piagetian source in the text of each chapter; the latter count of references includes just the appearances in the chapter reference lists[5]. In order to get a better appreciation of the chronological spread of these citations, we have adapted the table which Smith (1993) established according to Piaget's Autobiography (Piaget, 1966).

Several inferences seem rather easy to make here. At once, it seems quite clear that Piaget's books, rather than articles, are the key sources of references by the authors of both recent editions of the *HCP*. If we look at the publication dates of Piaget's books included in the reference lists, we see that most of them are books published before 1950. Using the mid-point of the century as a convenient arbitrary dividing point, the 91 pre-1950 references out of a total of 140 in the 1983 edition and 83 pre-1950 references out of a 145 total in the 1998 edition seem quite out of proportion to Piaget's output of monographs: 20 up to 1950, and 34

[4] We did not compare with recent authors, because of the more recently common phenomenon of self-citation.

[5] e.g., Chapter 9 in Vol. I 'Dynamic Development of Psychological Structures in Action and Thought', by Fischer and Bidell, contributes 17 counts to the citations table and 14 books and 2 articles to the counts of references, while the following chapter 'Dynamic Systems Theories' by Thelen and Smith adds 4 counts to citations by references to 2 early books.

Table 2: Number of books* and articles** published by Piaget and frequency of appearances in the reference lists of the two editions of the Handbook.

	Books written	Books listed '83	Books listed '98	Articles written	Articles listed '83	Articles listed '98
1896-1914	0	0	0	2	0	0
1915-1918	2	0	0	2	0	0
1919-1921	0	0	0	4	1	0
1922-1925	2	17	7	22	0	0
1926-1929	2	4	11	15	0	0
1930-1939	3	37	40	51	1	1
1940-1950	11	33	25	82	2	0
1951-1966	11	24	20	198	10	10
1967-1976	17	25	28	106	17	22
1977-1980	1	0	4	32	5	3
1981-1992	5	0	10	9	0	0
	54	**140**	**145**	**523**	**36**	**36**

*Excluding the *Etudes d'épistémologie génétique* series
** Excluding the *Reports of International Bureau of Education* and the papers on limnea.

after. With just one exception (*Traité de logique*, Piaget 1949, with a single count in *HCP* 1983), the pre-1950 references are all to books that deal exclusively with Piaget's psychological research, i.e. work on early and middle childhood development as well as the construction of number, space and time concepts.

Indeed, the trilogy of books first published in the 1930s, *Moral Judgment* (1932 – 10 reference counts in 1983 and 12 in 1998), *Origin of Intelligence* (1936 – 15 and 16), and *Construction of Reality* (1937 – 12 for both editions) seems to account for a vastly disproportionate number of book references. Apparently, their importance has not diminished over time. In the decades since the 1983 *HCP* chapters were written, another 6 Piaget titles have appeared and we have had more opportunity to consider further the import of the 1970s work in particular. But neither the pre-post 1950 balance, nor the 1930 trilogy seem to have altered much in our perception of their import for the field. Not unexpectedly, books from the last two periods of Piaget's *oeuvre* do not appear in the 1983 lists, but do have some impact by 1998. On the other hand, although some books focusing on questions related to epistemology are also referred to by some authors, these references do not appear to be representative of Piaget's later work.

Now, if we compare the overall number of Piaget's papers referred to by the authors who cite his work, we see that it remains stable across the two editions of the Handbook – 36 article references in each. However, it is one single article, Piaget's summary article of his own theory from the Handbook of 1970 which is the most cited paper. With appearances in 9 reference lists in the 1983 edition, it already accounted for one quarter of the article total. By the 1998 edition, it appears 13 times, now matching the status of the 1930s monographs. It seems as though it persists up to today as one of the key references to Piaget's work in the English-speaking world. Again, these counts must be seen in light of Piaget's prodigious output of journal articles. Of the 523 articles written by Piaget, only 17 are cited, even though more than 200 of them are available in English. In light of the commonly held view in academia that publication of journal articles has precedence in advancing knowledge, the

absolutely minimal influence that Piaget's journal articles apparently have on the field, as reflected in these *HCP* counts, is quite astonishing.

While we acknowledge the folly of drawing conclusions on the basis of a series of apparently superficial counts of citations and references, we are tempted to make the following observations. Although it might have been useful for scholars to explain the often superficial understanding of the Piagetian *oeuvre* by references to *how* Piaget was read in the English-speaking world (Case, 1998; Lourenço & Machado, 1996), our conclusion seems to be based more directly on *what* of Piaget was read. It is as if in the field of child psychology, at least, that the more recently published monographs of Piaget and the entirety of his articles are lacunae of which nothing is said, still less used. Of those Piagetian articles, only one, which succinctly summarizes the books to which authors of two editions of the *HCP* already refer, is of value.

QUALITATIVE ANALYSIS

In order to complement our rather crude actuarial summary of the citations and references of Piaget's publications in two editions of the *HCP*, we have reviewed two chapters of the 1998 Handbook in more detail in order to reveal less incompletely the current impact of the Piagetian *oeuvre* on the field. Clearly, the editors of the *HCP* selected scholars regarded as authorities in their particular fields. Indeed, the unchallenged status of the *HCP* as the definitive and authoritative account of the field depends exactly on that selection. For our purposes, our additional criteria for selection were as follows. Firstly, because we wanted to use the chapter accounts to complement our quantitative summary, we short listed those chapters which contained high numbers of citations of Piaget. Secondly, we aimed to focus on chapters by authors who, by their publications records, might be regarded as being well-informed about the Piagetian *oeuvre*. Our final criterion reflects our own shortcomings in the face of this vast field; we chose topics about which we hope that the reader might indulge us as being considered as not uninformed. In combination, we considered that this left us with but two suitable foci:

Chapter 19 "Cognitive Development beyond Childhood", David Moshman from *Volume II Cognition, Perception and Language* (pp. 947-978)

Firstly, with 16 direct citations of Piaget's works, and a reference list including six Piaget book titles and a chapter in an American collection, this chapter is second only to that of Fischer and Bidell (Chapter 9, Volume I) for sheer number of citations. Secondly, Moshman explicitly gives central place to Piaget's work in his review. He described as "classic", *The Growth of Logical Thinking* (Inhelder & Piaget, 1955/1958), "the first full-length treatment of cognitive development beyond childhood" (p.948), contrasting this with the one page quantitative, psychometric account of adolescence that had appeared in the second edition of the Handbook published just one year earlier. Thirdly, the Genevan account of cognitive development beyond childhood is an area with which we are not unfamiliar (e.g. Bond & Jackson, 1991; Bond, 1995a,b; Bond, 2001; Inhelder 1954/2001; Tryphon & Vonèche, 2001).

Moshman notes that "[i]n many respects, Piaget's account of these results was continuous with his earliest theorizing about adolescent cognition" (p.948), making one of those numerous *HCP* citations to Piaget's first decade of work, this time to *Judgment and Reasoning in the Child* (1924/1928), and concluding that, "[t]he issues highlighted by Piaget, however, continue to set much of the agenda for research and theory"(p.949). In reviewing the literature in order to address his self-imposed central question, "Does cognition develop

beyond childhood?" the author comes to the conclusion, "Thus, Piaget's theory is challenged both by claims that cognitive development is limited to childhood, and by claims that it extends beyond adolescence"(p.949). The reader's superficial conclusion here might be that whatever way one looks at it, Piaget must have been wrong.

However, Moshman turns to the classic indicator of physiological development, puberty, to conclude that the features of *qualitative* change, *progressive* change and *internally-directed* change are those that should be addressed in considering whether cognitive development continues beyond childhood. Of course, the author posed a plausible positive answer as to whether evidence satisfies those criteria; "A negative answer to that question would make this a very short chapter" (p.950). In sum, the chapter provides "evidence for cognitive changes beyond childhood sufficiently like puberty to be labeled 'developmental' ", but the author warns that "[O]ur core conception of development comes from the realm of biology, however, and may be misleading in the realm of cognition." (p.952). What chance, then, Piaget, biologist?

Quite reasonably, the chapter extends far beyond the account of the transition from less mature to more mature forms of reasoning in scientific contexts that forms the core of the classic Inhelder & Piaget opus. In citing his own earlier (1995) conclusion, "Reasoning, then, is epistemologically self-constrained thinking", Moshman goes on to distinguish three forms of reasoning – case-based, law-based, and dialectical – and reviews the research evidence relevant to each, "proposing a meta-cognitive, constructivist, and pluralist conception of human rationality." (p.948). In conclusion, Moshman finds surprisingly strong support for Piaget's proposal that hypothetico-deductive reasoning plays an important role in mature thought "but is rarely seen much before the age of 11 or 12", and observes that "[T]he theory of formal operations – strictly construed as the logical model proposed by Inhelder and Piaget (1958) – no longer plays much role in the literature" (p.972).

In the light of this more detailed review of this chapter, it is easy to see that the earlier numerical summaries of citations and references to Piaget would do considerable injustice to Moshman's treatment of the Piagetian *oeuvre*. The objective citation counts (author, date) do not include another dozen or so direct allusions to the Genevan account by name. Moreover, whole sections of Moshman's account are imbued with an undeniably Piagetian orientation: "The issues highlighted by Piaget, however, continue to set much of the agenda for research and theory." (p.949) While the simple counts in Tables 1 and 2 might help us quickly to see where Piaget still has an influence and what work remains influential, they do very little to inform about the quality or style of the impact. Even if the counts give us a hint about what is included, they can not, by their very nature, inform us about what might have been included but is missing.

While the absence of any mention of the Inhelder–proposed summary "Discussion of recent research on the formal operational stage" (Monnier & Wells, 1980), neither French-language references, nor a single reference drawn from the core Genevan journal *Archives de Psychologie* might not be unexpected, the absence of references to at least three researchers who have spent professional lifetimes studying empirically Piaget's conception of the development formal operational thinking, Shayer from the UK (e.g., Adey & Shayer 1994; Shayer, 1989; Shayer & Adey, 1981), Lawson from the US (e.g., Lawson, 1985; Lawson, 1993; Lawson, Karplus & Adi, 1978), and Noelting from Canada (e.g., Noelting, 1980a,b; Noelting, Coudé & Fiset, 1993; Noelting was Inhelder's assistant during the last part of the *Growth of Logical Thinking* research) remains both puzzling and noteworthy. Smith's well-referenced review of the status of Piaget's logical model argues that its position is not yet unequivocal (1993, pp.153-161).

Even with 16 citations to Piaget's work, Moshman's reference list contains just the usual suspects – there are no surprise inclusions there. Perhaps Piaget's 1970b FONEME paper 'Intellectual evolution from adolescence to adulthood' published simultaneously in French, Italian and English might have been expected, along with two later monographs co-authored with Rolando Garcia which provide Piagetian reflections on the issue of logical models from the end of Piaget's life. *Towards a logic of meanings* (Piaget & Garcia, 1987/1991) might easily be argued as relevant, especially given the two pages Moshman dedicated to 'Logical Reasoning' (p.956f). But what of *Psychogenesis and the History of Science* (Piaget & Garcia, 1983/1989)? In his last writing, Piaget still recurs to the Inhelder investigations that formed the empirical backbone of *The Growth of Logical Thinking* (see Bond, 2005): "The only answer possible appears to be that, on the basis of the propositional operations constructed, such as conjunction, implication, and exclusive or nonexclusive disjunction, which enable the subjects to reason about simple hypotheses and to evaluate these by deriving from them logically necessary consequences, the subjects then apply this logic to the problems we present them with." (Piaget & Garcia, 1987/1991, p.83). A closer recent reading of the Genevan history of the formal thinking *oeuvre* (e.g. Bond, 2001) might help us more easily to determine the extent of the supposed continuity of Piaget's ideas on formal thought and to understand why the subject matter of *Growth of Logical Thinking* was constrained to children solving school-science problems. Perhaps Inhelder's own description of adolescent reasoning (Inhelder, 1954/2001) better reveals her own important contribution to Piagetian theory (see Greco, 1988, p.17).

Chapter 7 "The Development of Children's Mathematical Reasoning: Connecting Research with Practice", Herbert P Ginsburg, Alice Klein and Prentice Starkey
from *Volume IV Child Psychology in Practice* (pp. 401-478)

Firstly, the chapter on mathematical reasoning by Herbert Ginsburg and his colleagues provides nine citations to the work of Piaget, referencing four monographs and two articles - clearly the leader for Piaget citations in the fourth Handbook volume, where child psychology meets practice; in this case, American grade school educational practice in mathematics. Secondly, the chapter explicitly allocates Piaget a key role in "the long and distinguished history of research on mathematical thinking" (p. 401) and, in the introductory section devoted to history, credits him as the most influential figure in the cognitive revolution. Thirdly, Ginsburg, who claims to be the chief author of all but the 'RESEARCH' section (endnote p.468) includes in his *c.v.* a well regarded introductory text to the work of Piaget (Ginsburg & Opper, 1988). Finally, we hope to be seen as not uninformed in the area of children's mathematical reasoning where research connects with educational practice (e.g. Grobecker & Bond, 1999; Bond & Fox, 2001; Bond, 2002; 2003, Bond & Parkinson, 2007; Callingham & Bond, 2006).

According to Ginsburg, it was the Piaget-inspired change which snatched away the "theory, drill and testing" win that Thorndike's connectionist approach had over Dewey's earlier constructionist view, a constructionist view which "Dewey proposed … one year before Piaget was born." (p.405) The authors conclude that Piaget "influenced the field in at least four ways: (a) his theory of number, (b) his constructivist approach, (c) his theory of equilibration, and (d) his clinical interview methodology." (p.407) Ginsburg *et alii* present a brief summary derived from *The Child's Conception of Number* (Piaget & Szeminska, 1941/ Piaget, 1952), noting (on p.407) that "his (*sic.*) book" was "written with the often unacknowledged but important collaboration of Alina Szeminska". Piagetian scholars are

aware that Szeminska, "whose name was somehow deleted from the American translation" (Gruber & Vonèche, 1995, p.290) was not the only omission from the translation for Anglophones; parts of several chapters, dealing with the logical modeling, also went missing (Vonèche, personal communication). Curiously, the considerably later translations into German (1965), Spanish (1967), Italian (1968), Portuguese (1971), Russian (1969) and Japanese (1965) apparently did not require such expurgation. Indeed, it does matter *what* one reads of Piaget, rather than *how* one reads it.

The lessons that psychologists and educators took from Piaget's work on number included the view "that children's thought is dramatically different from adults'"; "that mathematics education should be tied to the Piagetian conception of the child's cognitive development"; and, moreover, "that number is a fascinating subject to study" (p. 407). Unfortunately, the education / Piagetian theory link was used to limit unnecessarily what mathematics concepts children should experience. Ginsburg *et al.* quote Piaget as "boldly proposing" a hypothesis of a necessary link between the construction of number and the development of logic: "a pre-numerical period corresponds to the pre-logical level" and "[L]ogical and arithmetical operations therefore constitute a single system that is psychologically natural …" (p. 407).

The secret key that unlocks our understanding of the post-Piaget work into number and mathematics education is contained in two succinct sentences, one from Piaget and the preceding sentence from the authors of the chapter: "Indeed, the Piagetian study of basic concepts of number did not require any examination of culturally transmitted mathematical knowledge. '[T]here is no connection between the acquired ability to count and the actual operations of which the child is capable' (1952. p. 61)" (p.407).

Herbert Ginsburg is generally regarded as well-informed about Piaget's theory; his 1988 volume with Sylvia Opper, *Piaget's theory of intellectual development* was the third edition of a text which served as a core adoption in child development courses in psychology and teacher education; his recent, *Entering the child's mind* (Ginsburg, 1997) focuses on the use of the 'Piagetian interview' for research and teaching. It is then welcome, and not surprising, that references in this chapter paint Piaget as a genetic epistemologist rather than (only) a developmental psychologist, and that Ginsburg holds the 'clinical interview' as a lasting contribution to a field still dominated by the use of severely limited standardized tests: "Piaget's method was not 'unscientific'; rather, it was based on a distinctive theoretical approach (Ginsburg, 1997). In recent years, as understanding of Piaget's work has deepened, the tide has changed and interview methods of one kind or another are considered respectable methods" (p.408). The authors note elsewhere (p.460 fn.) that educators in the US seem to have a distaste for the word 'clinical' with its connotation of pathology; apparently, they substitute words like 'flexible' or 'informal'. It seems doubtful that they would, then, even consider the term 'critical method' introduced by Piaget in his foreword to the (French) third edition of *Judgment and Reasoning* in 1947 (Smith, 1993, pp. 56-60). This latter term could acknowledge the method's philosophical underpinnings and rigor, as well as Inhelder's distinctive contribution to this aspect of the Genevan method.

The authors report that researchers adopting a research focus more closely aligned to the socio-cultural approach of Vygotsky now make a number of claims which are quite at odds with expectations derived from Piagetian theory. The most startling is that babies from the youngest ages have conceptions of numerosity and numerical reasoning that Piaget overlooked (pp. 411-412). In a review of the *HCP* written for *Human Development*, Cole (2000, p.372) remarked on 'the ongoing saga of infant precocity' thus: "In the previous handbook, it was considered important news that Piaget had underestimated the cognitive capacities of 4-5 year olds with hints that some capacities ... might be present at or near birth.

When the most recent edition of the *Handbook* was undertaken, it was becoming close to dogma that a very large number of 'core capacities' were present as early as they could be tested for ...". In explicit contradiction to the Piagetian view quoted earlier, the authors conclude that "counting proves to be a powerful intellectual tool that children use in the construction of informal (as distinct from formal, school-based) mathematical knowledge" (p.413) and, following Gelman & Gallistel (1978), that "at no point in development is children's counting a rote (non-conceptual) activity", with this representing "a sharp break from the tradition of Piaget" (p.414). Indeed, "informal mathematics is more fully developed and powerful than many have realized" (p.417) and should inform early pedagogical strategies.

While the chapter's authors rehearse the well used lines, "In contrast to Piaget, Vygotsky stressed the contribution of social factors to intellectual development", and, "Except for early speculations (Piaget, 1962[6]) about the effects of peer interaction on cognitive development, Piaget himself neglected issues of social experience (Ginsburg, 1981) that are of obvious importance for the educational enterprise", surely they don't fall in line with the position roundly critiqued by Chapman (1988, p.370): "No-one familiar with Piaget's sociological theory could conceivably refer to him as an 'individualist' in any meaningful sense." (Chapman, 1988, p.370) "He describes human life as immersed, from the very outset, in a social environment which has the power to change 'the very structure of the individual, because it not only compels him to recognize facts, but also provides him with a ready-made system of signs, which modify his thought'." Nevertheless, Ginsburg *et al*. do not seem sensitive to, or aware of, the necessary tension inherent between general claims for the central role of socio-cultural influences on the one hand (*passim*) and the specific claim that "the basic components of informal mathematical knowledge are *universal* across diverse cultural and social class groups" (p. 413).

A vast portion of the balance of this chapter focuses on the role of the ubiquitous textbook in American mathematics education, even for the youngest school-children, including the obviously trite partial justification that "Piaget himself wrote textbooks" (p. 429). The Standards of the National Council of the Teachers of Mathematics (again, in the US) are reviewed along with the roles of the publishing industry and political conservatism in constraining the possible impact that constructivism might have in the elementary mathematics classroom. Standardized testing and the promise of Cognitively Guided Instruction in mathematics are also quite closely examined.

Again, this chapter by Ginsburg and his co-authors refers directly to Piaget or Piagetian theory in more than a dozen places that we did not count as author/date citations; his research agenda and method continue to imbue the field. In that light, what might be seen as 'missing', i.e., uncountable in this chapter? Given the central role that operational conservation during physical transformation plays in Piaget's conception of number development (p. 407), it seems curious that no empirical research evidence is adduced in this chapter directly to contradict the Piagetian position which takes central place on the first page of the first chapter of the *Number* book, "Our contention is merely that conservation is a necessary condition for all rational activity" (Piaget, 1965[7], p.3). The research section is attributed to Ginsburg's co-authors, and perhaps this *sine qua non* of the Genevan perspective

[6] Ginsburg refers to the 1962 edition of *The moral judgment of the child*, published in New York by Collier books.

[7] Ginsburg refers to the 1965 edition of *The child's conception of number*, published in New York by N.N. Norton.

is considered to be already *passé*, having suffered a death by a thousand small cuts. Yet, according to Smith (1993, *passim* esp. pp. 87-96; see also Smith 1992, 1996), the theoretical and empirical status of conservation is not unequivocal. Piaget's insistence on disregarding a conception of number based on counting has both important philosophical origins in Russell (1919) and consequences for psychogenesis and epistemology (Piaget & Garcia, 1983/1989, p.5; pp.131-132). Empirical studies well–founded in a Piagetian approach still confirm the viability of Piaget's ideas about conservation of number (Sophian, 1995) and the development of children's construction of addition (Grobecker & Bond, 1999). Given the scope and length of this chapter as it is, is it asking too much to expect that the research of Steffe (e.g., 1988, 1992), Sinclair (e.g., 1990) and Bideaud (e.g., Bideaud 1988; Bideaud, Meljac & Fischer, 1992) who bring decidedly Piagetian approaches to the study of number might have been included?

Ginsburg has obviously had to walk a tightrope between his role of key author of this chapter and that of one of the key players in this research domain; he is the single or joint author of a remarkable 26 titles in the reference list. A chapter without reference to Ginsburg's own basic research work, his interpretation of Piaget, his roles as champion of the *méthode clinique/critique*, developer of diagnostic mathematics tests, and textbook author / consultant, would have been considerably shorter as well as much less comprehensive.

CONCLUSION

Piaget's Twin Legacies for Child Psychology

In retrospect, one might view Piaget's reception in the US from the very beginning of his scientific career as falling into three different periods. The first period started in the late 1920s - early 1930s and was devoted to the discussion of Piaget's theory of the child's developing mind (Parrat-Dayan, 1993). After some three decades of decline, Piaget's work was rediscovered in the 1960s - early 1970s. During this period, a large number of scholars spent their time replicating Piagetian research on conservation, seriation, etc., reinterpreting the theory, aiming at rendering it more accessible to the American scientific community (see for example, Bruner, Olver & Greenfield, 1966; Elkind, 1970; Flavell, 1963). This was the first wave of a series of replications. A second wave of replications and critical discussions can be identified during the early 1980s after Piaget's death. During this period, the initial apparent enchantment with the discovery of a new theory seems to have been followed by rejections of part or of the theory as a whole. Of the various publications devoted to Piaget's work at that time, the most extreme of the provocative titles demanded: "Should we burn Piaget?" (Cohen, 1981). In "Beyond formal operations", one of the authors suggested that the issue was not just the stage of cognitive development beyond formal operations, but the researchers' stage of theorizing beyond Piaget (Broughton, 1984, also cited by Lourenço & Machado, 1996). About two decades later, in the light of the analysis that we have sketched, it looks as though we could still ask whether this latter stage has still not been reached.

Our examination of the *HCP* editions reveal that Piaget is by far the most referenced author in the field of child psychology. It seems that his work continues to nourish discussion and experimental research in the field. In spite of this, however, we must conclude that the impact of the Piagetian *oeuvre* is restricted by virtue of which parts of it appear to be relevant to child psychology at the end of Piaget's century. These relevant parts seem to be selective in four important senses: They represent (i) a small subset of Piaget's 53 books, and (ii) virtually none of his 523 published papers. What appears relevant to child psychologists (iii) covers

only a restricted period in Piaget's work, and (iv) generally does not do justice to Piaget's own explicitly epistemological perspective.

Is it, then, legitimate to say that there is a correct way of reading Piaget as Case (1998) suggested, when he stated that "Piaget was often read with empiricist glasses in the USA" (p. 754)? Or are there, perhaps, as suggested by Lourenço & Machado (1996), two ways of reading Piaget: from outside his theory and from within his theory? Our conclusion must be that it is not only a question of *how* one reads Piaget but also *what* one reads of Piaget. But, perhaps, these go hand in hand. What one reads of Piaget will determine how it is read; and how one reads Piaget will determine what of Piaget is read. While the field as a whole continues to concentrate disproportionately on the 1930s trilogy of books and Piaget's own summary article of his work to the late 1960s, then there is little chance that the vast bulk of the Piagetian *oeuvre* will even be noticed. As long as researchers focus on any particular concept of the theory, that is, to isolate it and decontextualise it, it will always be possible to find some argument or empirical evidence to invalidate it. It is only when they are read in their larger epistemological framework that the various concepts under scrutiny can recover their coherence. But, as shown earlier, Piaget's epistemology[8], even more than his "child psychology", remains even today largely ignored by the English speaking scientific community. For the *HCP* authors is the issue one of being empirically minded and thereby regarding theory as of somewhat secondary importance? In the field of child psychology, it appears that Piaget's empirical epistemology is reduced to an empirical, even experimental psychology. For the broadly defined field of child or developmental psychology as represented in the *HCP*, is Piaget's epistemology then destined to remain unimportant; a theoretical gloss to be attended to when the never-ending empirical investigations are complete?

Our two focus chapters provide only partial answers to this question. Both clearly recognize the epistemological focus of Piaget's empirical work. For Moshman, it is clear that epistemological questions are still important in the study of reasoning beyond childhood. The references, however, steer clear of Piaget's epistemological interests. For Ginsburg, Piaget's focus on conservation has been surpassed by the focus of the field on counting;the importance of conservation for Piaget's epistemology seems to pass un-noticed. Recent informed Piagetian commentary (esp. Smith, 1992; 1993; 1996; Lourenço & Machado, 1996) provides both argument and evidence that these specific issues of Piaget's logico-mathematical modeling of formal operational thinking and conservation at the concrete operational stage continue to be the focus of epistemological argument and empirical research; and in both cases the evidence remains, at its most damaging, not unequivocal.

Has then, Piaget left twin legacies for the field of child psychology? The first is the huge corpus of work that has been, *de facto*, the subject of this review of the *Handbook of Child Psychology*. The second, is more subtle and less obvious, but it could be even more compelling to those who take seriously a conception of genetic epistemology. Perhaps what the field is telling us—what the 'legacy' of Piaget is—is not only a huge body of theorizing and research findings, but also the fundamental problems posed as child psychologists adapt to the demands placed on the field by the very existence of Piaget's research. The overall legacy, as reflected in the *HCP*, tells us only a little about Piaget's genetic epistemology and a great deal about the development of child psychology as we researchers still struggle to adapt to Piaget's remarkable *oeuvre*. Inasmuch as Piaget, for a certain time, investigated how

[8] The 3 volumes of *Introduction to Genetic Epistemology* (Piaget, 1950) still have not been translated into English. However, these volumes have been translated into Italian, German, Spanish and Japanese.

children's intelligence developed as they interacted with the world around them, merely ignoring or assimilating the incomprehensible, it is possible to envisage parallel developmental studies of researchers in child psychology as we interact with our environment, still dominated by the work of Piaget: a legacy not yet explored by the field but certainly displayed in the field. This review points to the evidence of this legacy, reflected in the *HCP* citation data, both by the number of citations and the actual books and papers cited.

Interestingly, Piaget's epistemological, rather than merely psychological interests, already provides us with ideas for understanding these developments both in the field of psychology itself (*The Psychology of Intelligence*, 1947/1960), and in research scientists more generally: In *Psychogenesis and the History of Science*, Piaget and Garcia examined the mechanisms of development in the development of scientific thought within several disciplines over time. They established the generality of the same constructive process at all levels of thought from an initial awareness of an object of study in its properties prefixed as the *intra* stage, then to an *inter* stage of seeing relationships constituted by the operational make up of the object of study, and finally to a *trans* stage in which various inter stage structures are related one to another and integrated into a transcendent structure, with this transcendent structure of the *trans* stage then also forming the *intra* stage of the next, new constructive process (Piaget & Garcia, 1983/1989, pp. 273-4).

To many in the field of child psychology, this universal three stage constructive process within the sciences appears to be little more than a shift in attention from a focus on overt behaviors to relational structures or to equilibration mechanisms, and therefore is usually treated as little more than an arbitrary choice of a research focus by the researcher. However, from the viewpoint of Piaget's genetic epistemology, this triad marks an *order* of development of the researchers' assimilatory mechanisms, the researchers' theoretical perspectives, that determines the emergence of the new object of study at each level, that is, what the researchers 'see' as the object of their psychological study. The mechanism is that of proceeding from the peripheral characteristics inward to the productive mechanisms just as it is in the child (Piaget, 1976, p. 86). In that light, how will the positing of specific, so-called mini-theories to explain phenomena in child psychology benefit advancement in the field as a whole? No comprehensive theory in the living sciences can long ignore its various planes of thought and this means that activity at every level must be reflexive in not only explaining its own object of study but by implication explaining its own functioning and therefore its own epistemology.

The interpretations of the Piagetian contribution to the field, as represented in the chapters of the 1998 *Handbook of Child Psychology*, then, seem to reflect a vast range of apparent adaptations to the *oeuvre*. At one extreme, its presence seems to be ignored – implicitly or explicitly irrelevant. At the other, Piaget's contributions are regarded as having defined the field; a few seem to have worked to understand, or at least, to recognize those epistemological principles. In between, we have a variety of combinations of accommodating to some extent aspects of Piagetian empirical psychology and assimilating the remainder of the *oeuvre*. Our empirical evidence from the *HCP* indicates that this usually includes ignoring Piaget's epistemology. Do these interpretations then collectively display the phenomenon of researcher development in the field of child psychology on the one hand, and the generality of the principles of genetic epistemology at work in psychology on the other: a twin Piagetian legacy of his science to the field, along with the responses by the field to his science?

REFERENCES

Adey, P., & Shayer, M. (1994). *Really raising standards. Cognitive intervention and academic achievement*. London: Routledge.

Bideaud, J. (1988). *Logique et bricolage chez l'enfant*. Lille: Presses Universitaires de Lille.

Bideaud, J., Meljac, C., & Fischer, J. (Eds.) . (1992). *Pathways to number: Children's developing numerical abilities*. Hillsdale, NJ: Erlbaum.

Bond, T. G. (1995a). Piaget and Measurement I: The twain really do meet. *Archives de Psychologie, 63*, 71-87.

Bond, T. G. (1995b). Piaget and Measurement II: Empirical validation of the Piagetian model. *Archives de Psychologie, 63*, 155-185 and reprinted in Smith, L. (1996) *Critical readings on Piaget.* London: Routledge.

Bond, T. G. (2001). Building a theory of formal operational thinking: Inhelder's psychology meets Piaget's epistemology. In A. Tryphon & J. Vonèche (Eds.), *Working with Piaget: Essays in honour of Bärbel Inhelder* (pp. 65-83). Hove: Psychology Press.

Bond, T. G. (2002). Ready for school? Ready for learning? An empirical contribution to a perennial debate. *The Australian Educational and Developmental Psychologist, 18*(1), 77-80.

Bond, T. G. (2003) Relationships between cognitive development and school achievement: A Rasch measurement approach, In R. F. Waugh (Ed.), *On the forefront of educational psychology* (pp.37-46). New York: Nova Science Publishers.

Bond, T. G. (2005). Piaget and the pendulum, In M. R Matthews, C. F. Gauld & A. Stinner (Eds), *The Pendulum: Scientific, Historical & Educational Perspectives* (pp.303-313). Dordrecht: Springer.

Bond, T. G., & Fox, C. M. (2001). *Applying the Rasch model: Fundamental measurement in the human sciences.* Mahwah, NJ: Erlbaum.

Bond, T. G., & Jackson, I. A. R. (1991). The Gou protocol revisited: a Piagetian conceptualization of critique. *Archives de Psychologie, 59*, 228, 31-53 and reprinted in Smith, L. (1992) *Jean Piaget: Critical assessments.* London: Routledge.

Bond, T. G., & Parkinson, K. (2007, in press) Children's understanding of area concepts: Development, curriculum and educational achievement, In M. Wilson, G. Engelhard & M. Garner (Eds), *Advances in Rasch measurement* (Volume I), Maple Grove: JAMPress.

Broughton, J. (1984). Not beyond formal operations but beyond Piaget. In M. L. Commons, F. Richards & C. Armon, (Eds.), *Beyond formal operations* (pp. 395-411). New York: Praeger.

Bruner, J., Olver, R., & Greenfield, P. (1966). *Studies in cognitive growth*. New York, London, Sydney: John Wiley & Sons, Inc.

Callingham, R. C. & Bond, T. G. (2006). Editorial: Research in mathematics education: Insights from Rasch measurement, Special Issue of the *Mathematics Education Research Journal* (pp 1-10). Melbourne: MERJ.

Carmichael, L. (Ed.). (1946). *Manual of child psychology*. New York: John Wiley.

Carmichael, L. (Ed.). (1956). *Manual of child psychology*. New York: John Wiley.

Case, R. (1998). The development of conceptual structures. In W. Damon (Ed.) *Handbook of child psychology: Vol. II Cognition, perception and language* (5th ed., pp. 745-800). New York: Wiley.

Chapman, M. (1988). *Constructive evolution*. Cambridge: Cambridge University Press.

Cohen, D. (1981). *Faut-il brûler Piaget?* (Should we burn Piaget?). Paris: Editions Retz.

Cole, M. (2000). Struggling with complexity: *The Handbook of child psychology* at the Millenium. *Human Development, 43,* 369-375.

Cornu-Wells, A., Tryphon, A., & de Caprona, D. (1985). La lecture de Piaget dans le *Handbook of child psychology*. *Catalogue des Archives Jean Piaget, No XI,* pp. IX-XX. Genève: Archives Jean Piaget.

Damon, W. (Ed.). (1998). *Handbook of child psychology* (5th ed.). New York: Wiley.

Elkind, D. (1970). *Children and adolescents. Interpretive essays on Jean Piaget.* New York, NY: Oxford University Press.

Flavell, J. H. (1963). *The developmental psychology of Jean Piaget*. Princeton, NJ: von Norstrand.

Gelman, R., & Gallistel, C. R. (1978). *The child's understanding of number*. Cambridge, MA: Harvard University Press.

Ginsburg, H. P. (1981). Piaget and education: The contributions and limits of genetic epistemology. In I. E. Sigel, D. M. Brodzinsky & R. M. Golinkoff (Eds.), *New directions in Piagetian theory and practice* (pp. 315-330). Hillsdale, NJ: Erlbaum.

Ginsburg, H. P. (1997). *Entering the child's mind. The clinical interview in psychological research and practice.* Cambridge, MA: Cambridge University Press.

Ginsburg, H., & Opper, S. (1988). *Piaget's theory of intellectual development.* New York: Prentice Hall.

Greco, P. (1988). Préface. In J. Bideaud, *Logique et bricolage chez l'enfant* (pp. 1-18). Lille: Presses Universitaires de Lille.

Grobecker, B. & Bond, T. (1999). Children's construction of addition. *Archives de Psychologie, 67,* 95-122.

Gruber, H., & Vonèche, J. (1995). *The essential Piaget.* New York: Aronson.

Inhelder, B. (1954/2001) Les attitudes expérimentales de l'enfant et de l'adolescent, *Bulletin de Psychologie, 7* (5) 272-282. Translated by T. Bond as The experimental approaches of children and adolescents. In A. Tryphon & J. Vonèche (Eds), *Working with Piaget: Essays in honour of Bärbel Inhelder* (pp.193-209). London: Psychology Press.

Inhelder, B., & Piaget, J. (1958). *The growth of logical thinking from childhood to adolescence*. London: Routledge & Kegan Paul. (original work published 1955)

Kessen, W. (1983). Preface to Volume I. In P. Mussen (Ed.), *Handbook of child psychology* (pp. IIX-X). New York: Wiley.

Lawson, A. E. (1985). A review of research on formal reasoning and science teaching. *Journal of Research in Science Teaching, 22,* 569-617.

Lawson, A. E. (1993). Deductive reasoning, brain maturation and science concept acquisition. Are they linked? *Journal of Research in Science Teaching, 30,* 1029-1051.

Lawson, A. E., Karplus, R., & Adi, H. (1978). The acquisition of propositional logic and formal operational schemata during the secondary school years. *Journal of Research in Science Teaching, 15,* 465-478.

Lourenço, O., & Machado, A. (1996). In defense of Piaget's theory: A reply to 10 common criticisms. *Psychological Review, 103,* 143-164.

Monnier, C., & Wells, A. (1980). Discussion of recent research on the formal operational stage. In L. Apostel et al. (Eds.), *Cahiers de la Fondation Archives Jean Piaget,* No 1 (pp. 203-242). Genève: Fondation Archives Jean Piaget.

Murchisson, C. (Ed.) . (1931). *A Handbook of child psychology.* Worcester, MA: Clark University Press.

Murchisson, C. (Ed.). (1933). *A Handbook of child psychology* (2nd ed. revised). Worcester, MA: Clark University Press.

Mussen, P. H. (Ed.). (1960). *Handbook of research methods in childhood development.* New York: John Wiley.
Mussen, P. H. (Ed.). (1970). *Carmichael's Handbook of child psychology.* New York: Wiley.
Mussen, P. H. (Ed.). (1983). *Handbook of child psychology.* New York: Wiley.
Noelting, G. (1980a). The development of proportional reasoning and the ratio concept. Part I - Differentiation of stages. *Educational Studies in Mathematics, 11*, 217-253.
Noelting, G. (1980b). The development of proportional reasoning and the ratio concept. Part II - Problem structure at successive stages; problem-solving strategies and the mechanism of adaptive restructuring. *Educational Studies in Mathematics, 11*, 331-363.
Noelting, G., Coudé, G., & Fiset, C. (1993). Logic as resulting from the dialectical interaction between operative subject and constraining field. *Twenty-third Annual Symposium of the Jean Piaget Society*, Philadelphia, PA, June.
Papert, S. (1999). Jean Piaget. *TIME. The Century's Greatest Minds*. (March 29, 1999. No. 13.), 74-75 & 78.
Parrat-Dayan, S. (1993). Le texte et ses voix: Piaget lu par ses pairs dans le milieu psychologique des années 20-30. *Archives de Psychologie, 61*, 127-152.
Piaget, J. (1926). *Language and thought of the child.* London: Paul Kegan. (original work published 1923)
Piaget, J. (1928). *Judgment and reasoning in the child.* London: Paul Kegan. (original work published 1924)
Piaget, J. (1929). *The child's conception of the world.* (original work published 1926)
Piaget, J. (1930). *The child's conception of physical causality.* (original work published 1927).
Piaget, J. (1931). Children's philosophies. In C. Murchison (Ed.), *Handbook of child psychology* (pp. 377-391). Worcester, MA: Clark University Press.
Piaget, J. (1932). *The moral judgment of the child*. London: Routledge and Kegan.
Piaget, J. (1949). *Traité de logique: Essai de logistique opératoire*. Paris: Dunod.
Piaget, J. (1950). *Introduction à l'épistémologie génétique* (3 Vols). Paris: Presses universitaires de France.
Piaget, J. (1952). *The child's conception of number.* London: Routledge and Kegan. (original work published 1941)
Piaget, J. (1959) L'Institut des sciences de l'éducation (Institut J.-J. Rousseau) de 1912 à 1956 [The Institute of educational sciences (Institute J.-J. Rousseau) from 1912 to 1956]. In *Histoire de l'Université de Genève. Annexes: Historique des facultés et des instituts* (pp. 307-316). Genève: Librairie de l'Université Genève.
Piaget, J. (1960). *The psychology of intelligence*. New York: Littlefield Adams. (original work published 1947)
Piaget, J. (1966). Autobiographie. In *Revue européenne d'histoire des sciences sociales, Vol. 4*, No 10, 129-159.
Piaget, J. (1968). Le point de vue de Piaget. (Piaget's point of view). *International Journal of Psychology*, *3*(4), 281-199.
Piaget, J. (1970a). Piaget's theory. In P. H. Mussen (Ed.), *Carmichael's Handbook of child psychology* (pp. 703-732). New York: Wiley.
Piaget, J. (1970b). L'évolution intellectuelle entre l'adolescence et l'âge adulte (Intellectual evolution between adolescence and adulthood). In *FONEME*, Third international convention and awarding of FONEME prizes 1970, Milan, May 9-10, 1970 (pp. 149-156). Milano: FONEME.
Piaget, J., & Garcia, R. (1989). *Psychogenesis and the history of science*. New York: Columbia University Press. (original work published 1983)

Piaget, J., & Garcia, R. (1991). *Toward a logic of meanings*. Hove and London: Erlbaum. (original work published 1987)
Russell, B. (1919). *Introduction to mathematical philosophy.* London: George Allen & Unwin.
Shayer, M. (1989). Hewers of wood and drawers of water. In P. Adey, J. Bliss, J. Head & M. Shayer (Eds.), *Adolescent development and school science* (pp. 39-57). London: Falmer.
Shayer, M., & Adey, P. S. (1981). *Towards a science of science teaching.* London: Heinemann Educational.
Sinclair, H. (1990). Learning: The interactive reaction of knowledge. In L. P. Steffe & T. Wood (Eds.), *Transforming children's mathematics education: International perspectives* (pp. 19-29). Hillsdale NJ: Erlbaum.
Smith, L. (Ed.). (1992). *Jean Piaget: Critical assessments.* London: Routledge.
Smith, L. (1993). *Necessary knowledge: Piagetian perspectives on constructivism.* Hove: Erlbaum.
Smith, L. (Ed.) (1996). *Critical readings on Piaget.* London: Routledge.
Sophian, C. (1995). Representation and reasoning in early numerical development: counting, conservation and comparisons between sets. *Child Development, 66*, 559-577. Reprinted in L. Smith (Ed.). (1996) *Critical readings on Piaget.* London: Routledge.
Steffe, L. (1988). Children's construction of number sequences and multiplying schemes. In J. Hiebert & M. Behr (Eds.), *Number concepts and operations in the middle grades (Vol. 2)* (pp. 119-140). Reston VA: The National Council of Teachers of Mathematics.
Steffe, L. (1992) Learning stages in the construction of number sequence. In J. Bideaud, C. Meljac, & J. Fischer (Eds.) *Pathways to number: Children's developing numerical abilities* (pp. 83-98). Hillsdale NJ: Erlbaum.
Tryphon, A. & Vonèche, J. (Eds.). (2001). *Working with Piaget: Essays in honour of Bärbel Inhelder.* Hove: Psychology Press.
Vidal, F. (1996). Ignace Meyerson et Jean Piaget: une amitié dans l'histoire. In F. Parot (Ed.), *Pour une psychologie historique. Ecrits en hommage à Ignace Meyerson* (pp.61-73). Paris: Presses universitaires de France.
Vidal, F. (1997). L'Education nouvelle et l'esprit de Genève: une utopie politico-pédagogique des années 20. *Equinoxe : Revue de Sciences Humaines, 17*, 81-98.
Yeh Hsueh (1997). Jean Piaget and the Jean-Jacques Rousseau Institute. Jean Piaget Society Annual Conference, Santa Monica, CA, USA, June 20.
Yeh Hsueh (1999). With the true imagination of a creator: Jean Piaget's honorary degree at Harvard University in 1936. Jean Piaget Society Annual Conference. Mexico City, Mexico, June 3.
(1989). *Bibliographie Jean Piaget.* Geneve: Fondation Archives Jean Piaget.

Other sources:
Inhelder, July 7, 1965. Letter to Mussen.
Mussen, June 29, 1965. Letter to Piaget.
Mussen, June 29, 1965. Letter to Inhelder.

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APPENDIX: PIAGET'S BOOKS AND ARTICLES REFERRED IN THE TWO EDITIONS OF THE HANDBOOK

Title of publication	Date of original	Date of first English translation	Frequency of citations 1983	Frequency of citations 1998
Language and thought of the child	1923	1926	11	6
Judgment and reasoning in the child	1924	1928	6	1
The child's conception of the world	1926	1929	3	8
The child's conception of physical causality	1927	1930	1	3
The moral judgment of the child	1932	1932	10	12
The origins of intelligence in children	1936	1952	15	16
The child's construction of reality	1937	1954	12	12
The child's construction of quantities	1941	1974	3	1
The child's conception of number	1941	1952	5	4
Classes, relations et nombre	1942		1	2
Play, dreams and imitation	1945	1951	11	7
The child's conception of time	1946	1969	1	
The child's conception of movement and speed	1946	1970	1	
The psychology of intelligence	1947	1950	5	9
The child's conception of space	1948	1956	5	2
Traité de logique	1949		1	
The origin of the idea of chance in children	1951	1975		1
Essai sur les transformations des opérations logiques	1952		1	
Logic and psychology	original English	1953	1	1
Growth of logical thinking	1955	1958	8	7
Logique et équilibre	1957			1
Early growth of logic in the child	1959	1964	4	1
The mechanisms of perception	1961	1969	1	1
Six psychological studies	1964	1967	3	1
Sociological studies	1965	1995		4
Insights and illusionss of philosophy	1965	1971		1
Mental imagery in the child	1966	1971	3	1
Psychology of the child	1966	1969	3	1
Biology and knowledge	1967	1971	3	5
Memory and intelligence	1968	1973	2	1
Structuralism	1968	1971	2	2
Science of education and psychology of the child	1969	1970		2
Principles of genetic epistemology	1970	1972		1
Psychology and epistemology	1970	1971	1	
Understanding causality	1971	1974	1	2
Epistemologie des sciences de l'homme	1972			1
Experiments in contradiction	1974	1980	1	
The grasp of consciousness	1974	1976	2	4
Success and understanding	1974	1978	2	2
The development of thought: equilibration of cognitive structures	1975	1977	4	6
Behavior and evolution	1976	1978	1	1
Formes élémentaires de la dialectique	1980			1
Possibility and necessity	1980	1987		3
Psychogenesis and history of science	1981	1989		2
Towards a logic of meanings	1987	1991		5

Morphisms and categories	1990			1

Other books	Date of original	Date of first English translation	Frequency of citations 1983	Frequency of citations 1998
Learning and the development of cognition, Inhelder et al.	1974	1974	6	1
Cheminements des découvertes de l'enfant, Inhelder et al.	1992			2

Articles	Date of original	Date of first English translation	Frequency of citations 1983	Frequency of citations 1998
Une forme de comparaison chez l'enfant	1921		1	
Children's philosophies	original English	1931	1	1
Le mécanisme du développement mental		1941	1	
The diagnosis of mental operations and theory of intelligence	original English	1947	1	
Autobiography	1966- completed	1952	1	3
Intelligence and affectivity	original English	1954	1	3
Les stades du développement intellectuel de l'enfant et de l'adolescent		1955	1	
The general problem of the psycho-biological development of the child	original English	1960	1	
Le temps et le développement intellectuel de l'enfant		1962	1	
L'image et la pensée		1963	1	
Development and learning	original English	1964	1	2
Logique formelle et psychologie génétique		1965	1	
Psychology and philosophy	original English	1965		1
Nécessité et signification des recherches comparatives en psychologie génétique	1966	1974	1	
Response to Brian Sutton-Smith	original English	1966	1	1
Cognitions and conservation: Two views	original English	1967	1	
Les méthodes en épistémologie	1967		1	
Epistémologie et psychologie de l'identité	1968		1	
Genetic epistemology	original English	1969		1
Intellectual evolution from adolescence to adulthood	1970	1970	4	2
Piaget's theory	original English	1970	9	13
Theory of stages in cognitive development	original English	1971		1
The role of imitation in the development of representational thought	1973	1984		1
Comments on mathematical education	1973	1973		1
Foreword, in Explorations in child development	original English	1975		1
Possible, impossible et necessary,	1976	1979	1	2
Some recent research and its links with a new theory of groupings	original English	1977	1	
Essay on necessity	1977	1986		2
Les correlats	1977		1	1
The psychogenesis of knowledge and its epistemological significance	1979	1980	3	
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