

Time, Mind, and Otherness

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"The future that death brings, the future of the event, is still not time. For the future that belongs to no-one, the future that man cannot assume, still has to enter into a relationship with the present in order to become an element of time."
(E. Levinas, 1946/1994, p. 68)

"Is now today?" "Mommy, were you there when I was born?"
(K. Helkama, 1981, p. 41)

Starting point: The "Mind and Time" conference in homage to Jean Piaget, to celebrate the centenary of his birth in Neuchâtel

This work grew out of the "Mind and Time" conference held in Neuchâtel on 8-10 September 1996, by the Institut l'Homme et le Temps, Chaux-de-Fonds and the Institut de Psychologie de l'Université de Neuchâtel to celebrate the centenary of Jean Piaget's birth there (Liengme Bessire, Barrelet, Perret-Clermont & Zittoun, 1996; Barrelet & Perret-Clermont, 1997).

The conference consisted of a presentation of current research into time, particularly the relationships between time and awareness; this book is not a report of the conference, but rather an opportunity to develop the subjects discussed during those three days. The project has taken several years to come to fruition, partly because of its ambitious scope – authors from different countries, speaking different languages, different areas of scientific thought, etc. – and partly because of the illness of the main editor, which was beyond our control and which meant that the work has taken a very long time to produce ... we hope that, like good wine, it is all the better for maturing slowly.

This time for reconfiguring a multidisciplinary dialogue seems like only an instant in

relation to the many thousands of years of debate on the subject, for in this book the reader will not only meet writers who were Piaget's contemporaries or influenced by his work, but also echoes of older philosophers such as Socrates and Plato, Lucretius, Aristotle, St. Augustine, Thomas Aquinas, Descartes, Locke, Leibniz, Rousseau, as well as other more recent philosophers, such as Janet.

In choosing this theme, the organizers and co-editors were aware of the humorous side – though the subject itself is a serious one – of situating the work firmly within the region where Piaget grew up, and in particular within its regional tradition of clockmaking (Liengme, 1994; Chollet & al., 1977; Cardinal & al., 1991), as well as in a field that is sometimes regarded as one of the most difficult in human science. In psychology, for example, there is comparatively little research concerned explicitly with the concept of time, although time is of central importance to it. We felt it might be useful to start by reviewing research projects, from many different disciplines, that have studied time. Even though the authors are well aware that they are neither the first nor the only ones² to take a fresh look at the concept of time as central to their discipline, they felt that a consideration of this multidisciplinary perspective might be an original way of honoring Piaget, because even though his writ-

¹ We would like to thank Valérie Tartas (University of Toulouse), a specialist in the relationship between children and time, for her assistance with this introduction. We would also like to thank Pippa Sandford for the translation.

² In particular, from the same publisher: Helfrich, H.E. (1996). *Time & Mind*. Seattle, Toronto, Göttingen & Bern: Hogrefe & Huber Publishers, and from our colleagues: McGrath, J.E. & Tschan, F. (2004). *Temporal Matters in Social Psychology. Examining the Role of Time in the Lives of Groups and Individuals*. Washington: American Psychological Association.

ings explicitly concerned with the concept of time are not central to his work, his “genetic” approach was indirectly instrumental in introducing a new relationship to time in cognitive psychology and epistemology, so paving the way for crucial advances in the field.

Jean Piaget

Jean Piaget was born in Neuchâtel on 9 August 1896, and died in Geneva on 16 September 1980. Throughout his life he demonstrated a passion for intellectual enquiry (Ducret, 1990; Vidal, 1994; Barrelet & Perret-Clermont, 1996). From a very young age he was interested in natural science, with a particular passion for molluscs, and he became a member of the *Club des Jeunes Amis de la Nature*. When he left school he enrolled in the Faculty of Science at Neuchâtel University; in 1921 he obtained his doctorate in natural science with a thesis on molluscs in the Valais, written at a time when new theories were situating the study of biology within a new temporal perspective, following on from Darwin’s ideas of evolution. At the same time, Piaget was interested in the disciplines taught in the Faculty of Arts, such as philosophy, epistemology, and logic. He attended lectures by Arnold Reymond, who invited his students to study scientific thought within its historical context (Piaget, 1931); he read Aristotle, Kant and Bergson, and decided to devote himself more specifically to a question he believed to be fundamental: “How is knowledge possible?” This led him to psychology, particularly child psychology. In 1919 he spent six months in Zurich, where he studied psychology and psychoanalysis, followed by a year in Alfred Binet’s laboratory in Paris, where he worked with Théodore Simon on his research into the development of intelligence and intelligence testing.

Piaget became a professor at the University of Neuchâtel; between 1925 and 1929 he taught psychology, sociology and philosophy of science. He was then invited by Edouard Claparède and Pierre Bovet (founder of the *Club des Jeunes Amis de la Nature* that Piaget had attended as an adolescent) to become Director of Studies at the *Institut Jean-Jacques Rousseau* at the University of Geneva, to conduct research on child psychology to provide a scien-

tific basis for developments in the “New Education” movement. Piaget taught the history of scientific thought and experimental psychology there until 1971, and for the rest of his life was director of the International Centre for Genetic Epistemology. He was also professor of psychology and sociology at the University of Lausanne from 1938 to 1951. He was invited to teach in Paris, first at the *Collège de France* in 1942, and then at the Sorbonne from 1952 to 1963.

Piaget and time

At the end of this Introduction there is a list of publications (books and articles) in which Piaget explicitly dealt with the concept of time. They have been studied and have sometimes generated significant research (notably by Grize et al., 1966; Bovet & al., 1967; Fraisse, 1967, 1979; Cromer, 1971; Ferreiro, 1971; Friedman, 1977, 1978, 1982, 1992; Levin, 1977; Montangero, 1977, 1984, 1996; Montangero et al, 1995; Crépault, 1989; Weist, 1989; Pouthas & al., 1995 and others), but it has to be admitted that the concept of time is not the best-known part of his work and he does not seem to have spent much time on it. Piaget treated time as a category of thought – “How does the individual think about time?” – and he was particularly interested in how children perceive and understand time at different stages of their development, particularly its duration (in terms of start and finish). He studied and described the mental structures that make it possible to acquire the concept of time and the interdependent concepts of speed and acceleration. The questions Piaget posed echo the problems of the ancient Greek philosophers in thinking about speed, as Gardies describes (this volume). Most of all, Piaget studied time by constructing ways of measuring it. This may seem surprising. Why did Piaget regard measuring time as being so important to its relationship with psychology? In the tasks he used for his investigations, Piaget suggests the time of work accomplished (which recalls the world of workers and manufacturers) and the displacement time of moving things (which brings to mind trains going through tunnels or coming into a station). The cultural and clockmaking heritage may have come not only from within the region, but also from within the

family³. Piaget seems to have had little interest in the social, pragmatic, or existential dimension of time. Later in this book, Bruno Latour invites us to return to this question, in time-spaces where the mind is seen to be wrestling with work, instruments, representations, and measurements.

But if Piaget's contribution to the subject were limited to time as a category of thought, we would lose sight of his most important work. In his writing he tackled the question from other perspectives.

His second approach, the most fruitful and most promising in his work, is the introduction of a temporal perspective into the study of psychological processes. Piaget considered and conceptualized the development of thought in its deployment in time, and instituted the so-called "genetic" approach. Inspired by biology, he transposed to psychology the time inherited from natural sciences, reinterpreted the concept of evolution, and imported the concepts of assimilation, accommodation, and equilibration, investing them with an explanatory function.

His third approach is that of historical time. It appears that Piaget only wrote one paper on the subject (Piaget, 1933) but he was probably profoundly influenced by the relationship to time that he learnt from his teachers at the University of Neuchâtel, particularly Arnold Reymond (Piaget, 1925) who studied the history of logical thought, and also from his father, Arthur Piaget, professor of medieval literature, first rector of the University of Neuchâtel founder and first director of the *Institut d'Histoire de la Réforme*. Arthur Piaget trained in Paris when the critical-historical method was at its height; Zumstein (1995) referred to this method as the preferred approach for liberal theology. The Piagets grew up in a social environment marked by bitter controversy and tension (Thomann, 1996; Perret, 2003) between the proponents of liberal theology and the scientific role of history on one side, and the proponents of a simultaneously more pietist and more social form of Christianity on the other; apparently Piaget's mother belonged to the latter group. Both camps had their prominent intellectuals, but the proponents of liberal theology seemed to put their confidence more in Reason, a position that Piaget praised in the book he published when very young, "la Mission de

l'Idée" (1916), while their opponents concentrated more on the psychological experience of people facing difficult times in their lives. Piaget seems to have learnt some important lessons from the critical-historical approach, such as being wary of emotion, the moment, the social pressure of the group, and dogma; he used the critical-historical method as an instrument, originally designed for the critical interpretation of texts and applied by him to analysis of the oral discourse of children, in which he tried to make a "critical interpretation" of their thought. In line with the critical-historical method, Piaget tried to establish the primary sense of what was said within the "historical" context in which it was stated (in the psychological sense, the context is provided by the child's stage of development and the task it is presented with). Piaget wanted to make a critical analysis of what was said (in practice, with the child, through a game of counter-arguments), to examine the forms (in this case, the logical forms) and the concepts brought into play, but rather than applying a historical approach to documents reflecting ideas from the past, he applied it to children's thoughts in the present, restoring them to their place in the micro-history, i.e. to their genesis. In doing this, Piaget used the term "critical method" to describe his method, before describing it as a "clinical" approach to the children's thought.

Our aim in this collective work has been not to retrace Piaget's thoughts on time step by step, nor to examine how they were received, but rather to try to capture the spirit of his work, to take the same "adventurous" approach as our illustrious predecessor, who had no qualms about crossing theoretical and methodological boundaries between disciplines when exploring a subject. So without losing sight of the difficulty of our task, we will look at *time* from a number of different viewpoints.

Can time be an object of thought?

Can time be conceptualized? People have always been interested in time as something that passes, that seems to run away from them, and brings them closer to death. What is time? Can time be an object of thought? Time has a physical, bio-

³ We should add that it was Piaget's maternal grandfather (so not a Piaget) who was a clockmaker ... as the name Piaget says something about you in Switzerland!

logical effect on us; is it possible for it to be simultaneously familiar and unimaginable? It is a paradox that time, with its biological effect on us, can simultaneously be so difficult to represent with our minds.

It seems that we are prisoners of time and completely powerless when faced with it; we cannot speed it up, slow it down or stop it, much less go backwards in it; it imposes its own pace on us, and we cannot change it. As a Chinese proverb puts it, "money can buy clocks, but not time." The subjective duration of a time of absence is longer and more fully experienced than a time during which things happen. We live in a world which is not an abstract universe made up of concepts, including the concept of "time", but one which is made up of generations and networks of people and mediations whose actions, interactions and words not only make up the contents of our memory, but are also the means that make remembering possible. A relationship with time is simultaneously biological, psychological, social, and technical.

Following Piaget's example, the authors' intention is to invite the reader to start from the biological facts and the irreversible effect of what time does to us: neuropsychology will show us the problems of perceiving time; psychology will help us to glimpse the meaning of our very different ways of thinking about time (through observing the time of growth in childhood, through the phenomenological experience of time, the problems of memory transmission, time for learning time, etc.). Throughout this exploration, it must also be remembered that any discussion of time is based on language and logic which themselves bear the marks of their own sometimes interdependent development.

Internal biological timers

Françoise Macar's contribution (this volume) discusses the understanding of time from a neuropsychological viewpoint, and shows that perception of duration involves primary processes that might be underestimated in Piaget's theory. She focuses in particular on the mechanisms by which we process durations of seconds or minutes, and presents the current state of basic research in this field. In addition, human and animal studies show that although certain areas of the brain are involved in understanding time,

some (the frontal and prefrontal regions) are more involved than others in processing short durations, although none is specific; however, this does not nullify the hypothesis that they might have specific roles in time processing functions. Macar shows that humans have mechanisms for measuring time that allow them to measure, remember and reproduce the durations of events and actions lasting for a short time, and they can do this without using any instruments. What happens with longer durations?

The rest of the book will examine these longer durations, in relation to the questions raised by *Françoise Macar*. We will find ourselves at the heart of an interactive network of biological processes, human technical and discursive actions, undergoing transformations whose traceability is itself the result of these very interactions.

Memory in time

How does our memory function in relation to these durations and their content? How are our memories of reality established?

Walter J. Perrig (this volume) recalls that even though Piaget concentrated on the genesis of intelligence and mental functions and did not therefore regard memory as particularly important, his work on memory is still renowned, as it demonstrated that memory cannot be dissociated from other cognitive functions and more generally, from the functioning of intelligence. There is more to memory than just remembering. As a specialist in contemporary experimental psychological research into memory, Perrig reviews Piaget's insights, which are still of interest today despite their limitations in terms of design and empiricism. There is still much in his work to be explored and built on.

Timothy A. Salthouse (this volume) considers time as a transformable resource that degrades with age; actual time decreases while age increases, which appears to have repercussions on many types of cognitive functioning. While Piaget focuses on the positive role of the development of cognitive operations on memory, Salthouse takes the opposite view and shows that higher order cognitive functioning suffers an age-related decline (though not in infants or children, of course) that can be accounted for by a reduction in the rate of information remaining

available for processing and in other time-related mechanisms to time. This is a resource-based conceptualization of time.

Elizabeth F. Loftus (this volume) is interested in the processes by which memory becomes distorted in the long-term, and in particular, how false memories are created. Her interest dates back to the famous story that Piaget used to tell about the so-called kidnapping attempt on him when he was a child. Loftus has developed a set of paradigms for experimental study of these false memories created in individuals who have not experienced the events in question. Her research has very important implications, e.g., in the case of false memories of sexual abuse during childhood, when the abuse did not in fact take place. Her studies also demonstrate the limitations of the influence of suggestion in creating false memories, which opens up the way for empirical methods to distinguish between memory and events created by the imagination, and to discover the effects of the latter in both the long- and short-term.

Werner Wippich (this volume) puts Piaget's work into perspective, along with the contributions of Perrig, Salthouse, and Loftus, by examining the explanatory value of time in research into memory. His understanding of the field offers an explanation for Piaget's relative lack of success in dealing with thought in terms of "time"; indeed, in his efforts to build an interactive theory, Piaget was completely committed to the idea that thought is constructed by abstraction. In Piaget's eyes, abstraction is a process that extends the biological processes of equilibration, albeit on another level, by detaching the mind from contents, forms, social dependence, and emotional experiences. But Wippich shows us that in the current state of research, the most recent hypothesis in the field of memory for time is, on the contrary, that associated contextual information and a knowledge of social, natural and personal time patterns are essential ingredients in any reconstruction of the time of remembered events. Memory may result from interplay between general cognitive processes and episodic memory processes. Contextual associations of particular memories may be used in constructing temporal memories. Piaget could not arrive at this conclusion by pursuing his central concern with mental development as a process whereby structures are abstracted from sensorimotor and concrete situations.

Logic, language, and time

The articles in the third part of this book examine logic, linguistics, and psychology, to propose a new approach to the formalization of the concept of time. As Denis Miéville emphasizes in his introduction, with reference to St. Augustine, it seems that there is an awareness of time and yet major problems become apparent as soon as any attempt is made to represent it or analyze it. These articles will try to clarify this question.

Denis Miéville (this volume) writes as a logician, following Lesniewski and others in examining the conditions under which a developmental logic could be capable of describing the stages of its own progression in time, preserving the traces of its successive conceptual expansions.

Jean-Louis Gardies (this volume) looks at the vocabulary and grammar of time in the vernacular (particularly Indo-European) languages, and at what logicians borrow from them. He gives examples to show that logicians cannot for their part be satisfied with these grammatical resources, which refer only by implication to the constituent functions of the temporal rationality of discourse, as their role is to make an inventory of truth functions. In a stimulating exploration of the history of the understanding of "speed," Gardies shows how, in turn, grammatical resources perfected by scientific procedures can influence natural language. This example of "speed" is taken up again by Bruno Latour (this volume), who also considers how natural resources other than language are transformed by scientific distancing procedures into technological objects, which in turn intrude into human interactions and discourse.

Jean-Blaise Grize (this volume) recalls Piaget's pre-eminent role, which restores the subject to its position as centre of functioning in the study of knowledge. The Piagetian approach is structuralist, but within a constructivist perspective. The author also demonstrates the importance of this approach and draws the conclusion that if the subject is a participant in the development of knowledge, it becomes essential to consider the way in which he or she communicates knowledge, also using natural language and its various mechanisms such as tenses, ideas ("soft ideas", not to be confused with concepts), and schematizations of causes (not the modeling of reasons).

As humans can only be studied in the context of their history, human science must be able to represent an event as a single whole, which cannot be done with models in which the subject is abstracted, but rather using ideas and schematizations, within situations of communication and of the constant effort of interpretation required of the person being spoken to; so this is a process which takes place within time and cannot be abstracted from it. Grize feels encouraged by this approach to revisit the epistemology of the space-time of contemporary physics and the Big Bang.

Piaget held that cognitive development “is a linear, incremental and refining construction,” or to put it another way, that there is development when a rational structure replaces another structure that is less rational, or not rational at all. However, in contrast, Olivier Houdé (this volume) advances a concept of the development of non-regular rationality that progresses by a tortuous path. He refers to Michel Serres, who felt that scientific development follows a timeline that folds and twists and resembles a “crumpled-up handkerchief.” Houdé uses four examples (construction of the object, number, categorization and reasoning) to show how his vision of time in the genesis of knowledge makes it possible to describe observations of babies, children, and even adults. The author demonstrates “steps backwards” which follow “obvious” competencies: “an individual’s development also implies knowing how to inhibit a competitive structure,” and this competition between constructs is what makes time in knowledge development take on the shape of a “crumpled up handkerchief full of folds.” Perhaps one day it will be possible to describe the different stages of this crumpled development? In any case, Houdé says, they won’t be the same as Piaget’s!

Jean-Paul Bronckart (this volume) takes a sociodiscursive interactionistic perspective and considers that the central objective of human and social sciences is activity, while the role of psychology is to account for the action of the individual. Activity is closely related to language, as it is through discourse and evaluation of discourse that it is interpreted, reconfigured, negotiated, etc. The construction of temporality has a crucial role in this general process of reconfiguration. Narratives, in particular, are known for their role in turning events into meaningful actions. Through a detailed analysis of

different forms of speech and texts, Bronckart demonstrates the many ways in which speakers construct their timeline, locate the actions described, and construct their discursive worlds. One hypothesis that Bronckart draws from his survey is that the interest in narrative has led to an underestimation of the contribution of other forms of discourse to the clarification of actions, but that “primary” temporality actually has its roots in leisure – the leisure to narrate.

In these chapters, we have been jumping from language to logic and back, following the processes by which humans think about time. There seems to be a sort of dialectic move between the quest for abstraction out of time towards some kind of universal statements, and an ever present need to embed the frame of reference of ideas in the *here and now* of experience in order to achieve communication. But in both approaches it can be seen that thinking about time is a dynamic, constructive process that leaves its mark on the devices (including the formal devices) it develops. This process is inherent to humans’ efforts to communicate and it is not a solitary activity. Social interactions between participants in a conversation configuring their common tasks, between speaker and audience, as well as the shared intentions and expectations between writers and readers, all contribute to the existence and institutionalization of discursive spaces in which it is possible to reflect on the (multiple, folded and twisted?) timeline.

Developmental timing

August Flammer (this volume) introduces the fourth part of this work with an invitation to think about the way the various stages of developmental psychology are related to time. Time (or age) is seen as an independent variable. But this approach with time seen as a “variable” has limitations, and leads to an invitation to seriously reconsider the historical nature of development as well as the historical nature of developmental psychology and its social marking. It is only recently that researchers have become interested in how children and adolescents use and think about time, not in terms of Piagetian categories but as a function of their relationship with the “use” of time. This research has led to a demonstration of the existential choices of young people in prioritizing their activities.

Françoise D. Alsaker, August Flammer and Urs Tschanz (this volume) want to understand the values and priorities of the individual and society, by looking at the way in which individuals organize their everyday lives (what they do, when, and for how long). It is very clear that personal management of time is to a very great extent governed by social demands (particularly by schools, which require levels of investment in time that vary greatly from one country to another, and which also impose very different structures on their days) and traditions (including gender stereotypes and expectations).

Carsten Wrosch and Jutta Heckhausen (this volume) feel that human life offers different but constraining approaches to development, with deadlines which affect the adaptive processes that regulate development at a number of timepoints or ages, depending on whether or not they are complied with. Their model is based on a set of constraints and opportunities in relation to which the individual must actively and constantly situate themselves, e.g., in choosing and achieving their goals, managing the consequences of success or failure, etc. Finding one's place in relation to this biological and social time would appear to be an essential engine of development.

But what is biological and social time? Is it a progression? Willem Koops (this volume) describes historical changes in the theory of child development. Like Locke and Rousseau, Piaget is anchored in a firm belief in "natural development" and "objective progress" from the "primitive" to the "civilized." Although it was not these authors' intention, we now know how far this belief has also generated occasionally dramatic prejudices from advocates of eugenics. However, modern research has demonstrated the existence of much more advanced levels of cognitive ability and social understanding in children and even in babies than were demonstrated by the philosophers, psychologists, and educators of the last three hundred years. They are already beings endowed with rationality, and unwarranted "infantilization" could have disastrous effects on education. Reading Koops, one wonders whether, rather than confining young people within a timeline (assumed to be that of growth from incompetence towards the "advanced state" that will be the Adult), psychologists and educators would find it useful to rediscover them by trying to achieve the best possible

communication between human beings in a more horizontal relationship. Its post-modern appeal, yet still inheriting some of the values of the Enlightenment, is echoed in current educational science research, which is aware of the crucial role of social interaction and discourse in the framing of thinking, time perspectives, and agency (Perret-Clermont & al., 2004).

Time for learning

If cognitive, social and emotional development, is not just the mature fruit of time, as if time were the water irrigating the good seeds of the garden – then what kind of relationships to time can educators and learners establish? Is *development* too abstract a concept that should be more realistically replaced by *learning*, as post-Vygotskians tend to tell post-Piagetians? Or are there biologically-induced patterns of activity and of auto-equilibration that have to be respected if the child is to be an active participant of his or her own learning – as Piaget would reply? Instead of entering into this theoretical debate, already addressed to some extent by Koops and others in this volume, Jean-François Perret introduces the reader to empirical studies of existing teaching and learning situations embedded in their complex sociocultural environments in order to understand how institutions and social life frame specific times for formal learning. Of course, in some ways, children and adults "learn" from experience all day long. Yet some kinds of learning require a retreat from reality, some kind of reflections and abstraction. How are the times for these types of learning organized at the public and individual levels?

Alain Mercier, Maria Luisa Schubauer Leoni, Elisabeth Donck et René Amigues (this volume) set out to study the temporal dynamics connecting learning and teaching within the "didactic contracts" which implicitly manage academic situations. Social time is not a single entity providing a framework for the efforts made by both sides. On the contrary, careful observation of academic work shows that there are different patterns of time, such as that of "teaching and learning time", which is managed by the teacher to ensure progress in the text that has to be made known to the student (it could be said that the teacher "reads" the knowledge to the student).

So this time is linear and almost cumulative (except that it has to succeed in linking the new knowledge to the old knowledge *and* succeed in seeing that old knowledge that has become obsolete is forgotten in the face of new knowledge). And there is learning time, which is the student's time, which has two aspects – there is a private dimension, in the form of a spiral when the student goes back over the knowledge already learnt to study it, revise it, understand it anew and interpret it for his or her own purposes (particularly the purpose of responding to the present task); and there is a public dimension, a time which could be said to be derived from the teacher's time: in the appropriate way, at the right time, students must give evidence of their his participation in the life of the class and of their ability to demonstrate their knowledge, or more precisely, to demonstrate that it can be thought that they know what they need to – as they have given the right answers, their adequate responses can make it thought that they know the knowledge. Here again is the “folded,” “twisted,” or even “crumpled” time of Serres and Houdé, along with Bronckart's multiple forms of discourse. But what does the subject learn?

Jacques Perriault (this volume) observes the relationship to time involved in distance learning situations (through interactive video conferencing, in the case of a university course in law). This way of communicating knowledge raises a crucial issue, the question of time – time to understand, to manage, to anticipate. This is all the more important as distance learning is new, and students interpret it on the basis of their experience of other situations with media (radio, television and video), or traditional teaching situations. This “hybridization” of traditional learning with episodes of distance learning can be disruptive, as these types of working have different or even opposite constraints. For example, its very nature means that videoconferencing creates a larger number of items of information to be processed on different levels (content of the knowledge, as well as managing exchanges, operating the technology, etc); it has its own internal clock which changes the dynamics of learning, and causes students to use time in a different way from a traditional course. Time needs to be re-examined in new teaching situations. And the student has to find a new way of organizing their

time for internalizing the knowledge, for personal study, and for making their knowledge their own.

We have been accustomed to thinking of learning as taking place within a chain of cultural transmissions from generation to generation, and as a task specific to young people supported by their parents and educators. Pierre Dominicé (this volume) takes his turn in questioning our traditional understanding of time as a predetermined arrow pointing in one direction. This very specific cultural representation of time, and consequently of personal biography, cannot withstand the pressures of today's transformations of society. Changes in health and life expectancy, in the labor market, technology, gender relationships, etc. lead to changes in the rules of the game of social life which have to be relearned all over again each time. From the viewpoint of an educational specialist, Dominicé questions the concept of development; he says that adults “will have to learn to adapt to breaking and breaching as transitional stages in their biography.” Learning is not only about formal or scientific knowledge and preparation for work, but also about learning at a personal level to face a more complex social life. But then, in this complex world, what is the role of formal adult education programs? Dominicé has observed adults who enrol on a course, and paradoxically by doing so lose the time to learn anything other than the prescribed content of formal knowledge and techniques that they are being taught. The learning process cannot be isolated from the wider processes in society that transform reality. The complex tasks of lifelong development described in this volume by Wrosch and Heckhausen need special support to be achieved. Where will this support come from? Perhaps from looking again at the concatenations of the generations, and the relationships between them, the dialogue between generations might be a clue to discovering the cultural resources available. “Perhaps the time has come to consider adults and young people as partners in the same adventure (...) of the same emerging world,” says Dominicé, reminding us of Koops' comment; and, he adds with a fresh (but still traditional) look at the timeline, “the creative dimension of adulthood will have to be found by the right mix of cultural legacy and fabrication of the future.”

Pluritemporality of humans and artefacts

Does time leave traces, or is it because an event becomes an object of attention that its trace creates time? A teacher deliberately establishes traces of what has been worked on in class, traces and notes that students must rework in order to be able to demonstrate that they have learnt them, i.e. that they have become capable (according to a certain number of standards) of taking account of the knowledge learnt in their social relationships and scientific discourse; this is how *memory* of the knowledge is transmitted. But is it really knowledge that is involved here? And where does this transmission and memory fit on the timeline? Does time – or the timeline of memory – exist as a shared construction of the mind or is it a “folded and twisted” reality that only has the appearance of being shared? In this book, we have seen how individuals make great mental efforts, through language and reason, to locate themselves – and locate other people – along timelines. But these timelines seem to multiply, crumple up, run alongside each other, or cross. Bruno Latour (this volume) asks us to think much more seriously than the Western philosophical tradition tends to do about the *manufacturing* of time.

Certainly the psychological efforts mentioned above are based on mediations that displace and transform their objects according to procedures whose ingeniousness is explored in relation to the linguistic dimensions, in part 3 of this book; but we should also study the ingeniousness of other technical and scientific dimensions. Tartas (2000, 2001) has shown, in an extension of Vygotskian research into the role of symbolic tools and mediations in the structuring of thought, the importance of the instruments made available to the child so that it can situate itself within time. Time experienced is time marked by the culture within a social framework which itself is marked by a philosophy, taking shape through narratives (Halbwachs, 1925, 1949; Hall, 1984; Valsiner, 1993; Brockmeier, 1995). Latour (this volume) takes as his basis numerous studies of the history of science, techniques and philosophy, not forgetting the distancing and poetic process of humor, and takes us into a sort of scanner producing images in five rather than three dimensions: time-space is then perceived as enriched by the *agency* of human beings subtly weaving together interactions from many places, times and types of material.

We are now a long way from the hypothesis of “pure spirits” (“pure” because foreign to all places, historical events and bodies). We are a long way from the position of a Master Clockmaker, set in an unhistorical world, out of space and time, in a position that might be the location of the axes of the coordinates, and able to see (and to foresee – the terms have become synonymous) human development as the unfolding of potentialities, and all scientific efforts as the mere unfolding of determinations made visible step by step. God – but which god? – on his balcony. We are back to Piaget! For it seems that this was the question he started with (Perret-Clermont, 1996). In his first book, written when he was still very young (“La Mission de l’Idée”, 1916), a spirited pamphlet addressed to the pastors of the Protestant church in Neuchâtel, Piaget revolted against dogmatism and pietism, in a sort of “pre-immanentism,” calls in it for Christ’s mission to be seen as an *Idea*. For Piaget, the Messiah is an *Idea* made incarnate to save the world from its barbarism by developing Reason, the guiding intelligence that inhabits every human being. Reason is universal. It certainly seems to have come down from that balcony. If we have understood the young Piaget’s act of faith correctly, it confirms Latour’s hypothesis that sees in Piaget’s inability to think of time as having been “manufactured” the mark of a secularized theological heritage, the fruit of a theology constructed with categories of thought taken from a modernity that is trying to make the world intelligible through formalisms and unchanging doctrines, without seeing the creative work that produces and marks them, and without seeing the organizations and institutions that create the regularities observed. A world where everything is so well ordered, scheduled and “understood” that there is no longer any place for a novel interweaving of new interactions and inventions, for surprise and the unknown, for otherness. A world where there is nothing more to be thought about. And if there is nothing more to think about, nothing more to wait for ... perhaps there is no more *time* either.

The reader will have understood that this work is an invitation to revisit in their relation to time the very foundations of different (and yet inter-related) disciplines such as psychology, philosophy, logic, linguistics, the history of science and techniques, and theology. This revisiting may be *poetic*, in the etymological sense, in

other words, creating sense for our time, a visitation as a quest fully embedded in this supposedly "known world," but with a passionate expectation of nevertheless discovering something unknown, something new, a surprise! A longing for otherness... a sense of time...

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