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## **Consciousness and intentionality in cognitive development<sup>1</sup>**

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Ten years ago, in a target article entitled "Minds, brains, and programs", Searle (1980) introduced a debate on intentionality. He defined intentionality as "a product of causal features of the brain" which cannot be identified to the function of instanciating a computer program. Among the 27 initial open peer commentaries, many were very critical: Douglas Hofstadter qualified the article as a "religious diatribe" and John Eccles saw in it a supplementary dogma of the psycho-neural identity theory (mind-brain identity). It is interesting to analyze the references of this target article and of its 27 commentaries. 59 authors are quoted. Except the references made by John Marshall to authors of past centuries (Freud, Hobbes, Huxley and Mersenne), a single reference, done by Grower Maxwell, is related to works done during the first half of our century and quotes Bertrand Russell. All this debate thus takes place without many explicit acknowledgement of the scientific, philosophical or cultural heritage, in particular of our century!

In his article "Consciousness, unconsciousness, and intentionality", Searle (1989) writes that "all genuine mental activity is either conscious or potentially so". "All of the other activities of the brain are simply non-mental". He also claims that "it is a profound mistake to try to describe and explain mental phenomena without reference to consciousness" and finally that "any intentional state is either actually or potentially a conscious intentional state" (Searle, 1989, p. 194 and 208).

In order to emphasize the importance of this renewal of interest, I mention the announcement of a new target article entitled "Consciousness, explanatory inversion, and cognitive science" by Searle in the review "Behavioral and Brain Sciences" (Searle, 1990).

At spring of 1985 in Villa Olmo on the lakeside of Como, some researchers have celebrated the return of consciousness in cognitive sciences (Italy must be propitious to consciousness). This meeting, organized by Tony Marcel and Edoardo Bisiach led to a

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book published in 1988. In their introduction of this book, Marcel & Bisiach (1988) show with much humour that this coming back of consciousness might be very differently received in the scientific community. Which is what we have just shown about the commentaries elicited by Searle's article in 1980. If these researchers have regained consciousness, their memory seems to remain partly failing. (This is in fact a rather general characteristic of researchers, but also more generally of our contemporary occidental societies.) I was indeed surprised to find out that in this book, no reference was made to Claparède and Piaget who, as I try to recall, conceded an important role to consciousness and intentionality. My way of paying homage to Piaget and Claparède is to show that their theories have always been with us. To make them move in the scientific community from potentially conscious to conscious.

One of the capacities attributed to consciousness by several authors in Marcel & Bisiach's book, among whom Weiskrantz in particular, is the one of control. Now, it happens to be precisely one of the functions that Claparède (1933) attributed to it: He spoke of consciousness as **“a control apparatus”, “an apparatus which makes plans and control their execution”**. I must confess that my (grasp of) consciousness about the importance of consciousness was slow and progressive and that I had to be called upon several times for this awakening to take place.

It is so that last year, I have been invited by my colleague Marco Battacchi from the University of Bologna to participate in a symposium on the theme "Consciousness, self-consciousness, and their development" (Battacchi, 1989), for the congress of the Italian Psychological Society in Trieste (this is again in Italy!). However, it is only a few months later, when I was incited to write a commentary on Michael Lewis's article (1990) entitled "The development of intentionality and the role of consciousness", that I truly began to be interested in the problem (Mounoud, 1990). It is then that I started a new reading of the Piaget of "The origins of intelligence in children" (1936) and of "The construction of reality in the child" (1937), as well as of the long article written by Claparède on "La genèse de l'hypothèse" (1933).

## **Piaget's thesis**

Concerning relations between intentionality and consciousness, the basic Piagetian thesis is that there is no intentionality without consciousness. Intentionality results from grasps of consciousness or from consciousness phenomena. On the other hand, consciousness comes from *disadaptations*, the action being defined as a response to a need. Finally, needs are conceived as the manifestation of a disequilibrium, of a *disadaptation*. "Need must not be conceived as being independent of global functioning of which it is only an indication" (Piaget, 1936/1977, p. 45/58).

According to Piaget, the following connections are present at the beginning of sensorimotor development: Need state => disequilibrium or disadaptation => response or action => grasps of consciousness.

These relations would be subsequently transformed in the following way: consciousness of disequilibrium (of a problem to be solved, of a goal to be reached) => implicative

relations between means and goal (intentionality) => action.

For Piaget, intentional behaviors (i.e., those based on relations of implication in a broad sense) can therefore only proceed, ontogenetically, to the grasps of consciousness. Intentionality and consciousness develop progressively from the early beginning. However, they do not reach the true status of consciousness and intentionality until the fourth stage with means-ends coordination corresponding, we might say, to the emergence of well-formed relations of implication. Instead of means-ends coordination it may be more appropriate from my point of view to speak of the dissociation or decomposition of initial global schemes, wherein it is not possible to distinguish means and ends (desires and means to satisfy them); they define what Piaget called a global functioning. "The basic fact is not need as such but rather the act of assimilation, which embodies in one whole functional need, repetition and that coordination between subject and object which foretells discrepancy [the correct translation would be implication] and judgment" (Piaget, 1936/1977, p. 46/59).

Before examining Piaget's thesis in more details, it is necessary to make a few comments on structural discontinuity and functional continuity as well as on the different types of object permanence (practical, subjective and objective). Piaget's general project was to use psychogenesis to solve or understand the epistemological problem of the emergence of new forms or structures of thinking or reasoning. His study of sensorimotor intelligence is placed in this framework and his focus was mainly oriented toward what he has called **structural discontinuity**. As far as early stages of development are concerned, he attempted in a like manner to explain the acquisition of new structures, the *sensorimotor schemes*, on the basis of other structures defined by *inherited reflex schemes* (isolated, heterogeneous). If we qualify the structures as mental or psychic, the sensorimotor stage reveals truly for Piaget the *emergence of mental structures*. Previously, there would be, according to him, only biological structures inherent in functioning, as we see later. From this point of view, it is possible to say that for Piaget, the newborn goes from the absence of mental states to their presence, as Lewis mentions it elsewhere in a recent article (Lewis, 1990).

Moreover, this first developmental stage assumed for Piaget another major interest. He was trying to demonstrate, following Baldwin and in the same spirit as Freud, the **functional continuity** between adaptive structures from biology to psychology, from material to functional assimilation. (Human intelligence is only the most sophisticated adaptive means, because in Piaget's terms logical operations, or the general coordinations of action, produce perfect corrections or compensations of certain classes of transformations or disturbances, in opposition to approximate compensations made possible by other types of behavioral organizations such as instinctive, reflex, or perceptual behaviors.)

Now this opposition between structural discontinuity and functional continuity is basic for discussing the Piagetian theses related to sensorimotor development and more precisely the issues of intentionality and consciousness. From the point of view of *functional continuity*, Piaget had no difficulty in admitting, for example, that infant behaviors could be described at all sensorimotor stages as revealing various types of object permanence

and, consequently, various types of intentionality. (The connection between permanence and intentionality seems obvious to me because behaviors revealing object permanence are explicitly goal directed behaviors). By means of the newborn's reflexive behaviors at the first stage, he or she defines invariants (the breast for example) or a first variety of object permanence: "The precocious searching of the child in contact with the breast . . . is a remarkable thing. Such searching . . . must be conceived . . . as the first manifestation of a duality of desire and satisfaction" (Piaget, 1936/1977, p.40, French)/52, English; cf. also Piaget, 1937/1968, p. 94-100/106-113).

With regard to the *structural discontinuity*, however, Piaget qualifies this **permanence** or the structures that determine it as "**practical**" because they only characterize a functioning. They do not exist consciously from the subject's point of view but only from the observer's point of view. [It may be useful to recall that for Piaget there is a primary consciousness, or consciousness of "it is desirable," "it is painful" (Piaget, 1926/1967, p. 112/127)]. "**Subjective**" permanence (stages 3 and 4) will succeed to the practical one; it begins to exist for the subject thanks to his or her consciousness and eventually leads to "**objective**" permanence (stages 5 and 6). This last one is later on renamed practical by Piaget himself. As we will see later, such a change creates other kinds of problems (Piaget, 1947; for a discussion, see Mounoud, 1979). By introducing the distinction between the subject's and the observer's points of view, Piaget tries to reconcile the aspects of functional continuity and structural discontinuity. This distinction corresponds to the opposition that he later sets up between **biological or neurophysiological structures inherent in a functioning** and **mental structures produced by this functioning** (or resulting from this functioning) (Piaget, 1967/1971, p. 257/222). I do not consider these distinctions relevant for qualifying structures. It is one of the arguments that has led me to postulate structural preformation (see Mounoud, 1979).

Consequently, Piaget's position is difficult to define because it is two-sided depending on which point of view he adopts between functional continuity or structural discontinuity. Thus, Piaget (1936/1977) wrote: "**In a sense** [in the sense of functional continuity], there is therefore only a difference of degree between the elementary adaptations and the intentional adaptations. The intentional act is only a more complex totality" . . . "This division is artificial". (p. 133/170), "**But in another sense** [in the sense of structural discontinuity], intention involves a reversing in the data of consciousness: it is henceforth the influence of recurrent consciousness of direction impressed on the action or no longer only on its result. Consciousness arises from disadaptation . . . this influence of consciousness *sui generis* determines intention". (p.133/170). "But this functional continuity in no way excludes a transformation of the structures being on an equal footing with the actual **reversal of perspective in the subject's consciousness**" (p.137/175, my emphasis). "It is this distinction of means and ends which sets intention free and so reverses the act's direction". (p.138/176)

For Piaget **functionally equivalent behaviors**: practical, subjective and objective object permanence, including all the research activities and types or degrees of intentionality - can be **controlled by different processes or structures** due in particular to the emergence of conscious phenomena. These consciousness phenomena generate the elaboration of new meanings and new connections between meanings which correspond to what Piaget

has called **implication** in a broad sense (among which inferential implication is a particular case; see Piaget, 1963/1968). Thus, invariants from the first two sensorimotor stages, or practical permanence, are due to *biological structures* or structures described as inherent in a functioning in opposition to invariants from the last two sensorimotor stages, or objective permanence, which are due to *mental implicative structures* resulting from the subject's functioning itself. Between these two levels there is for Piaget no transmission of any particular structure, but **only transmission of a functioning** "that is capable of going far and learning almost limitlessly" (Piaget, 1967/1971, p.297/257). I clarify my disagreement with this thesis later on.

In summary, Piaget, as I understand him, tries to explain the transition from biological structures inherent in a functioning to mental structures produced by this functioning, the sensorimotor structures defining the emergence of consciousness, of intentionality, of intelligence, of mental processes. This emergence has been situated during the fourth sensorimotor stage in a partially arbitrary way, as Piaget has emphasized many times (see in particular Piaget, 1947). But simultaneously, with respect to the functional continuity, from the very beginning, the infant's behavior can be described from the observer's point of view as intentional and as exhibiting invariants or practical object permanence. What strikes me most about Piaget's position is the following: The emergence of *conscious meanings*, of *mental structures* producing *relations of implication*, does not depend on any type of representation. Nevertheless, he spoke about consciousness as producing an **internal translation** (Piaget, 1937/1968, p. 185/212). Indeed for Piaget these conscious meanings are inherent in sensorimotor schemes and their co-ordinations. It is well known that for him representations appear only at the sixth sensorimotor stage and result, at least partly, from the interiorization of imitative actions (Piaget, 1945). Piaget's position proceeds from an attempt to reconcile idealist or spiritualist theses with materialist ones.

Amazingly, Piaget has repeated this attempt in two books published 38 years after *The origins of intelligence in children* (1936/1977): *The grasp of consciousness* (1974a/1977) and *Success and understanding* (1974b/1978). In these two books, Piaget presents a thesis very close to the one I have just described. But this time, he opposes **sensorimotor intelligence** (renamed **practical intelligence**) to **representative intelligence** (or discursive or conceptual; **"thought"** strictly speaking for Piaget). The sensorimotor intelligence (from conscious or mental in 1936) has become the first level (role played by the reflex structures in 1936) - "the biological level with its automatic coordinations and its automatic control networks, ensuring the material conditions for behavior," as Hauert (1990, p.8) sums it up. "The second level is the conceptual level where the construction of conscious cognition is realized." Together with Hauert, we have criticized this second Piagetian thesis of 1974 in different places (Hauert, 1980, 1990; Mounoud & Hauert, 1982a and 1982b).

However, Piaget's main contribution is to have conceded, following Claparède (1933), a major role to these conscious phenomena and to the **implicative relations** as opposed to the organization of **causal relations** related to action. A partially comparable opposition has been reintroduced by Marcel (1983) between conscious and unconscious perception.

## My own Position

My own attempt to reconcile continuous and discontinuous aspects of the cognitive and motor development is based on the concept of representation as an internal organization of contents (Mounoud, 1979).

The exceptional abilities of humans to modify behavioral determinants during development could be explained by the emergence at various periods and in particular at birth of new coding capacities. These new capacities would force the organism to *retranslate*, *redefine*, *reinterpret* and *rethematize* some of the information accessed, that is to say to construct new representations, new frames of reference, new categories. The construction of these representations would be made through a relatively slow and complex process requiring a few years. I have described several times and again recently this construction process, so I do not present it here (see Mounoud, 1984, 1986a and 1986b, 1988; see also Vinter, 1990). This process goes along with grasps of consciousness which consist of *implicative* or *inferential links* or *meaning relations* as defined by, Piaget. However, these phenomena would be **transitional** and these representations could be qualified as **declarative**. One particularity of the model is its recursive character. Consequently no stage, including birth, begins with the absence of representations.

In this perspective, the newborn's exceptional competencies are explained by *preformed representations* qualified as sensorimotor. These representations would be above all *procedural* in nature (an article written by Bresson, 1987, has encouraged me to introduce the opposition between procedural and declarative representations). They account for the intersensorimotor coordinations that characterize the newborn's behavior. During their first weeks, infants behave in certain situations as if the **surrounding world** were **intelligible**: Numerous stimuli constitute for them organized patterns of information in response to which they produce organized action patterns (e.g., early prehension, imitation). This initial organization (which depends on phylogenesis and embryogenesis) ensures an initial perceptive and behavioral unity which need not be explained at the level of ontogenesis or, at least, its explanation should be facilitated. **But** more or less **simultaneously**, infants behave as if the situations they confront constitute "polymorphous sets" or a "**confusing and ambiguous universe**" without precise functional meaning (in other words with problematical situations), as, for example, in their *awkward* attempts to reach for objects between the 2nd and the 5th months (from approximately the 6th to the 20th week) or in their *unskillful* attempts to retrieve a hidden object (the A-non-B error) between the 8th and the 10th months (all these situations can be characterized by a disequilibrium state). Thus, infants need several months to be able to **recategorize** situations and **re-organize** or **re-plan** their actions. It is not before 6 months that infants become able to grasp in a partly adapted manner a visually perceived object, not before 1 year that they succeed in regulating or in **accurately planning in advance** the orientation and the shaping of the hand as a function of the size and orientation of the object, not before the age of 16 to 18 months for their grasp to be regulated as a function of the object weight inferred from its size and/or texture, and not before 20 to 24 months for their prehension to adjust to reciprocal orientation between two objects (cf. in particular Hofsten, 1989; Lockman, 1990; Mounoud, 1983).

It seems as if the infant possesses at birth **action procedures** (or sensorimotor procedural representations) adapted to a set of situations. These representations would be by nature unconscious or relating to a **non reflexive consciousness** (cf. Marcel, 1983) as all automatic or automatized behaviors can be considered unconscious in nature. The emergence of new coding capacities constrains the infant to elaborate new representations which I have called perceptual and which go along with reflexive consciousness; these representations would be **declarative** and would correspond to what Piaget called the implication relations related to the consciousness phenomena. They are **new meaning relations** between objects and the infant's actions, between objects or between parts of objects, between actions or between various phases or segments of a complex action. On the basis of these perceptual representations **new action procedures** or procedural perceptuomotor representations will be elaborated.

Another way of expressing the same story would be to say that infants, in the course of their development, construct knowledge (or concepts) which must lead them to construct new know-how. Development would therefore be a matter of shifting not only **from practical know-how to conceptual or mental knowledge** (as argued by Piaget), but also, and in an equally large extent, **from conceptual knowledge to new unconscious know-how**. Rey (1934) spoke of the withdrawal of active intelligence during automatization processes. It is in this way that new know-how, new skills are learned and automatized (prehension, walking, imitation, localization, etc). As it is at birth, every time that we are dealing with constituted know-how, we are dealing with adapted behaviors which manifest a satisfying integration in relation with one or several econiche(s). These behaviors do not necessarily demand reflexive consciousness, intentionality or subject-object differentiation. These behaviors can be qualified as "direct" or "immediate", which does not mean for me that the behavior is defined by the structure of information, but much rather that there is an **optimal adequacy between** the organization or **the structure of stimulations** accessed **and** the organization of **the action procedures** (or **procedural representations**) of the subject, as I have stated elsewhere (Mounoud, 1990). If one studies the adapted functioning of an organism in his ecological niche, as Gibson did (1966), it is possible to speak without prejudice of direct perception because, in this case, there is an optimal coupling between the organism and its environment . . . On the other hand, in the Gibsonian view, it is not possible to analyse the process of development (p. 404)

To conclude, it is possible to consider development as an alternation between (a) periods of adaptation (adaptations in the different domains are more or less optimal according to the experiences realized) and (b) periods of reorganization. Periods of adaptation are characterized by automatized behaviors that can be described as reactive or as interactive; periods of reorganization are characterized by transitional grasps of consciousness (mental or psychic conscious activities) which give to the infant's behavior an active and intentional character. These functioning modes depend on subjects planning abilities and vary as a function of their developmental level and the situations confronting them.

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## Two conceptions of the sensorimotor stage

Piaget	Mounoud
biological structures inherent in functioning	preformed (procedural) "sensorimotor" representations, automatized behaviors
consciousness ==> intentionality, implicative relations	grasps of consciousness and intentional activities, perceptive (declarative) representations
mental structures produced by functioning	constructed (procedural) "perceptuomotor" representations, automatized behaviors
emergence of consciousness and intentionality as constituting phenomena of the mental structures (intelligence)	emergence of consciousness and intentionality as transitional phenomena necessary to all development and learning processes
= genesis of psychism, of intelligence, of mental activities (from the absence of mental activity) thanks to determined by biological structures (called inherent)	= genesis of new means to plan and to control action based on on anterior means, thanks to a new coding system (perceptive) a functioning