The Future of Piagetian Theory

The Neo-Piagetians

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CHAPTER 3

A Theoretical Developmental Model

Self-Image in Children

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Theoretical Background

In this chapter, we present a model of psychological development that may be considered "paradoxical" when compared with the usual conceptualizations. This conceptualization is presented in terms of Piagetian theory, from which it derives, but from which it diverges considerably on numerous points.

Initially, our position focused on the mechanism of development, those processes that permit the passage from one organization of behavior to another within each of the broad stages of development (infancy, childhood, and adolescence). In other words, we have attempted to show how the infant comes to infer new meanings from the objects or people with whom he interacts, or how new determinants of behavior are defined (reflexive abstraction).

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More recently, we have attempted to define (a) what the child constructs in the course of development and (b) what makes these constructions possible.

With regard to knowing what is constructed by the child, during the last few years our position has become more radical, in that we have criticized the Piagetian position that states that the child constructs structures or new forms of action or of thought. By way of an alternative hypothesis, we now contend that the child does not construct new *structures* (i.e., new ways for processing information) in the course of development. Nor does he construct, as Piaget believed, either general coordinations of his actions or the logico-mathematical operations of thought. In our view, formal structures of action and reasoning are not constructed but are preformed. Instead of constructing structures, or processing abilities, the child, in the course of development, elaborates on internal *representations* (models or memories) conceived of as structurations or organizations of content. These representations are elaborated by means of the formal structures that the child possesses. It is by the application of these structures that new representations are constructed. The constructed representations reveal or manifest, more-or-less completely, the structural capacities of the child.

The first point leads automatically to the second point, that is to say, to what makes possible the elaboration of new representations, what gives the child the ability to redefine and redetermine behavior differently at the different stages in the course of his development. In this respect, we propose that *new coding capacities* appear successively in the course of development. The appearance of these new capacities is subject to a *genetic regulation;* it thus shows very little dependence on particular interactions that the child engages in with his environment, unless in a broad, nonspecific sense. It should be recalled that for Piaget the construction of new structures is explained by an interactive process between preexisting structures and different environments or different aspects of the environment. For Piaget, the passage from one stage to the next is due to the achievement (or closing) of new structures, and these new structures then reveal new aspects of the environment, with new dimensions engendering new interactions; this process can be endlessly repeated.

We will attempt to schematize our position with the following propositions or postulates:

1. The forms or general structures of our actions (their coordinations) and of our reasoning (their logical operations) are preformed.

2. There exists in the roots of representations, particularly of the body, what we call *sensory representations*. These representations, coupled with preformed structures, determine the initial forms of behavior, that is to say, the initial exchanges with the environment, the sensorimotor organization.

3. Development consists of the construction of new representations (models or memories) of objects, of self and of others, and consequently of new programs.

4. New representations are constructed because new coding capacities appear successively in the course of development. We propose to call *perceptual* those that appear at birth, and *conceptual* those that appear around 18 months, formal or semiotic those that appear at approximately age 10. Table 1 illustrates the progression of the constructions of new forms of representation through adolescence based on the preformed structures existent at birth.

5. The appearance of these new coding capacities is generated by a maturational process that depends only very indirectly on the interactions of the child with the environment (the nonspecific role of the milieu).

6. The construction of new representations occurs according to a succession of periods or of phases (which we have previously described in terms of revolutions) whose occurrence is equally strongly determined by maturational regulation (phase of dissociation, integration, decomposition, and syntheses). Table 2 provides an overview of the elaboration of new representations from birth through adolescence indicating the steps and processes utilized at each stage.

7. The constructed representations are directly dependent on the experiences in which the child is involved; the environment plays a specific role in this construction.

8. These new representations intervene in the functional exchanges that the subject engages in with his environment and that permit their organization (patterns, programs, procedures, and schemes): preformed sensorimotor organization at birth, perceptivomotor organization at around 18 months, conceptuomotor organization at around 10 years, and semioticomotor organization at around

Table 1. Constructions of Systems of Organization

Birth	Sensory representations (preformed) linked with preformed structures + new coding capacities, the perceptual code : Construction of perceptual representations	Sensorimotor organization (preformed)
18–24 months	Perceptual representations (constructed) + new coding capacities, the conceptual code → Construction of conceptual representations	Perceptivomotor organization (constructed)
9–11 years	Conceptual representations (constructed) + new coding capacities, the semiotic code → Construction of semiotic representations	Conceptuomotor organization (constructed)
16–18 years	Semiotic representations (constructed)	Semioticomotor organization (constructed)

Table 2. Elaboration of New Representations

1st Stage	2nd Stage	3rd Stage	Steps	Process
0–1 month	1½–3 years	10–11 years	*Initial global representation* syncretic	
				Sampling of object and action properties by means of new code
1–4 months	3–5 years	11–13 years	*New elementary representations,* separate and juxtaposed	
				Coordination-integration of elementary representations and establishment of correspondence with objects and situations
4–8 months	5–7 years	13–15 years	*New total representations nondecomposable,* rigid with global relationship between them	
				Decomposition-analysis of new total representations in their components and establishment of correspondence with objects dimensions
8–14 months	7–9 years	15–16 years	*New total representations partly decomposable,* with partial relationship between them and with their components	
				Composition-synthesis of the components of new total representations
14–18 months	9–10 years	16–18 years	*New complete representations fully decomposable,* with complete relationship between them and their components	

Table 3. Identity Forms Taken by Objects and Subject

1st Stage	2nd Stage	3rd Stage	Identity Forms	G. H. Mead
At birth	2 years	10 years	Syncretic	Experienced role
3 months	3 years	12 years	Multiple	Conceptualized role
8 months	6 years	14 years	Unique	
18 months	9 years	16–18 years	Typical	Generalized role

16–18 years. Table 3 illustrates the identity forms taken by objects and subject during the first, second, and third stages.

The principal consequences of these propositions are the following: (a) The existence of stages and of periods is determined by maturation; (b) The passage from one stage to another occurs independently of the degree of achievement of preexisting constructions (within certain limits); and (c) The constructed representations are directly dependent on the contents of particular experiences in which the child engages and even on the nature of previous exchanges. For this reason, the constructed representations reveal, more-or-less accurately, the structural capacities or processing capacities of the organism.

In conclusion, it is possible to say that, in the Piagetian conception, the environment plays a nonspecific role despite the interactionist aspects of the model. We are taking the contrary position that, although the environment plays a nonspecific role in the appearance of new coding capacities in steps more-or-less fixed in the course of development, the role of the environment becomes specific in the elaboration of new representations. We have progressively developed this point of view over the past years in various articles (Mounoud, 1976, 1978, 1979; Mounoud & Hauert, 1982a,b; Mounoud & Vinter, 1981).

The Problem

One of the guidelines for our research is related to the nature of the development of self-image in children. Thus, we posed the question: Within development, can a progressive evolution be described from the absence to the presence of self-recognition, or does one witness turn-off points that suggest levels of reconstruction, through new means of previously acquired knowledge?

According to our point of view, during development the child proceeds to successive elaborations of self-image, each of which gives evidence of a new kind of relationship established between the world and himself. The varied images built are always related to his representations of himself and of objects belonging to his physical or social environment. These representations are determined by the kind of cognitive means at the child's disposal. The newly emerging capabilities of coding and translating reality oblige the child to reelaborate the previously built representations (Mounoud, 1979; Mounoud & Vinter, 1981). Indeed, the understanding of reality, achieved first through conceptual and then through formal means, leads the child and the adolescent to new definitions of himself and his environment.

The complexity of the problem of self-recognition is closely related to the concepts of awareness and representation. The very term *recognition* seems to us ambiguous. There is an immediate temptation to pose the problem in terms of the presence or the absence of recognition, and indeed, the majority of studies on this question have initially adopted that orientation. They have attempted to define an age after which the child is able to recognize his own image(s). Every problem dealing with recognition—or, in more general terms, memory or knowledge—raises the question of the accuracy of that recognition, which, itself, can be more-or-less general (I recognize a face of a child's face) or more-or-less specific (I recognize the face of a 5-year-old boy or the face of my child or my face 18 years ago). Consequently, we feel that it is necessary to refer to different kinds of recognition of self or others, with all the intermediaries possible from a *singular* or individual recognition to *schematizing* recognition (Mounoud, 1978).

In a discussion of faces, we may speak of recognition as the identification of a global configuration (nose, eyes, forehead, mouth) or the identification of a particular face. In the first case, recognition is schematizing or categorical; in the second, it is singular or specific. These are, of course, two forms of recognition usually regarded as developmentally distinct and, more often than not, are linked to the two first organizers described by Spitz (1957): the smile at 3 months and anxiety at 8 months. The two kinds of recognition correspond to different degrees of perceptual organization.

In other words, recognition refers to a repeated confrontation with a given situation or object. This is the empiricist point of view,

where knowledge arises essentially from the object. From this point of view, it is possible to speak of objects or realities as being novel (i.e., never before encountered), of which there can, consequently, be no question of recognition. In contrast, from a cognitivist point of view, where knowledge arises mainly from the categories possessed by the subject, it is never possible to talk of absolutely novel realities or objects: a given object is always recognizable through those aspects or dimensions that it shares with other objects. All knowledge is thus partially based on recognition. This is the fundamental principle of assimilation, which renders every object recognizable to a certain degree. From this standpoint, recognition does not necessarily presuppose previous contact with the recognized object. It is in this second line of argument that we suggest placing the recognition of one's image. The individual is always capable of recognition, but it is necessary to distinguish the different kinds: more-or-less general or more-or-less specific. The categories of representation providing the basis for recognition may correspond to different levels of elaboration, such as the perceptual level or the conceptual level.

We would like to emphasize that for most authors the child's recognition of his own image is fundamentally a problem of representation. From this point of view, it is possible to reformulate the problem as follows: Of what kind of recognition is the child capable, and to what level do the categories of representations that he is using belong? From this point of view, one would ask about the degree of elaboration of the child's representations of himself at a given moment in his life.

Within psychology, there are many orientations, both theoretical and experimental, for research on the self-image. L'Ecuyer (1975) summarized various conceptions of the organization of self in the child and the adolescent. The majority of these conceptions (Allport, 1961; Symonds, 1951) introduce a division between two modes of self-understanding: one mode is based on perpetual apprehending—deriving essentially from the physical aspects of self—which is usually referred to as the *perception of self*; the other mode is based more on the subject's conceptualizations about the social or affective aspects of self, which is usually referred to as *self-image*. A perceptual apprehending of reality is taken to be the result of a direct and immediate contact, not mediated by representations. The

development of the "self-structure" is translated, within these conceptualizations, as a passage from the perceptual to the conceptual.

We are opposed to such a distinction between self-perception and self-image. At every level of development, the child's perceptions are mediated by representations, which, alone, enable the perceived objects to be given meaning; in the same way, at every level of development, the subject's actions are controlled by the representations of the objects to which they are applied (Hauert, 1980; Mounoud & Hauert, 1982b). Furthermore, we do not think that the child's preoccupations concerning himself pass from a physical to a social self during development. These aspects of the self exist at every age and are elaborated simultaneously by the child.

Each of the various dimensions distinguishable within the self will necessarily be reconstructed by the child in the course of development. It is thus not possible to distinguish, in development, a period of nonrecognition of the self (even in the sensorimotor period) and a period of self-recognition. Nevertheless, Amsterdam (1972) and Zazzo (1973) expressed their research in these terms. In their studies on mirror image, they attempted to set a date for the age of self-recognition in the child. Amsterdam's research led him to propose that the period from 21 to 24 months is decisive for the recognition of self (using Gallup's task as a criterion). Zazzo suggested 27 months, using a criterion based on the child's reactions to a mark placed on his forehead and a flashing light behind him. To say that the recognition of self arrived at by the 2-year-old child constitutes the final result in a process of construction beginning with the absence of self-recognition does not seem to us to be an acceptable theoretical approach.

For us, different forms of self-recognition may be demonstrated at every age of development, just as it is possible to characterize different forms of recognition of people and situations at every age (Widmer-Robert-Tissot, 1980). The relative precocity of one form with respect to another must refer to the criterion used to determine the appearance of self-recognition.

Zazzo (1978) has modified his position with research on the nonreversed (video) image. This research has led him to a belief that the form of self-recognition in the 5- to 6-year-old child is less stable than that of the 3- to 4-year-old. This belief implies that the younger child's self-image is subjected to upheavels and reelaborations.

Authors differ in their ideas about the determinants of the development of self-image. Certain of them, such as Gottschaldt (1954) and Zazzo (1966), invoke external factors. To account for the evolution of the self-image that he noticed in adolescence, Gottschaldt resorted to roles in the social milieu, to which the adolescent is becoming sensitive, and to the ideal self (the development of the "persona"). Zazzo suggested that the models of growing up presented by the adult serve to modify the child's self-image. For other authors, such as Erikson (1968), the principal determinant of the reconstructions of self-image is internal factors. According to Erikson, body growth and the maturation of the genitalia necessitate a reevaluation of the identity achieved in childhood.

From our point of view, neither social nor constitutional factors are sufficient to explain the reelaborations of self-image throughout the course of the child's development. As we have already stated, these reconstructions follow the appearance of new cognitive instruments (*instruments de connaissance*), which are perceptual at birth, conceptual at around age 2, and formal at about age 10–11. But if these modifications in the representations of the self reflect the appearance of new cognitive instruments, the content of these representations is closely dependent on the nature of the interactions that the child experiences with his environment. Relevant aspects of the social milieu constitute the formative factors (e.g., body growth), and social factors thus take on an identical status, within this perspective, regarding their importance in reelaborating the self-image.

Certain authors, notably Wallon (1959) and Mead (1934), have insisted on the interdependence between constructions of the self and constructions of others. For Wallon, the "me" and the "other," which are not initially differentiated, are constructed through a double process of appropriations and exclusions. For Mead, the self is constructed progressively by the interiorization of the roles of each of the partners in a social situation. We would simply like to point out the empiricist tendency of such a position, in which the self is entirely determined by the characteristics of others.

There are some studies in ethology that illustrate the close interdependence of the self-image and the image of the other. These studies concern the influence of the first social experiences of the animal on its behavior in relation to its mirror image (Gallup & McClure, 1971; Schulman & Anderson, 1972).

For us, the interdependence of the perception of others and the perception of the self signifies that the child simultaneously constructs representations of others (or more generally of objects) and representations of himself. This amounts to making oneself, one's body, an object to be known in the same way that the child must learn to know his parents and his various partners; which allows us to draw hypotheses about the development of the self-image from a model of the construction of representations of objects (Mounoud & Vinter, 1981).

Studies of the genesis of the construction of the object or of object relations have led to the attribution of a different status to the object throughout a given developmental period or state (Mounoud, 1977). We put forward the idea that to each object status there corresponds a different status of the self-identity, each one defining a distinct mode of self-image.

Generally, the first level of organization in the exchanges between child and environment is described in terms of nondifferentiation (Wallon, Piaget). The initial status of self-identity would thus correspond to a *syncretic* and nondifferentiated identity, where the self and the other are not distinguished.

Throughout a second phase, the child moves on to partial reelaborations of internal and external realities, in the form of elementary representations and by means of new cognitive instruments. These, in turn, lead to partial objectifications of objects, in the sense that the objects do not exist complete, with a simultaneous set of properties, as seen from the subject's point of view. This "multiple" object will mean that there is a corresponding "multiple" identity, the subject having various partial representations of himself that are not intercoordinated.

The third phase is characterized by coordinations between the different piecemeal elaborations of the object carried out previously. These coordinations bring into being a "total" object (Klein *et al.*, 1966), "unique" and identifiable because it possesses simultaneously the set of characteristics that the subject has been able to discover in it. In the same way, one may envision the child in this phase constructing a total representation of himself, integrating, within a coordinated ensemble, several dimensions of himself. The identity thus elaborated by the child we will qualify as *unique*, the child himself being constituted as a subject differentiated from others.

In the fourth phase, the child constructs a network of inter- and intraobject relations enabling the construction of classes of equivalence between objects ("typical" objects). One could hypothesize a parallel integration of his own identity in a diversified causal and social complex. The child recognizes being similar to others because of certain dimensions of himself. Thus, we may refer to a *typical identity*.

We feel that it is worthwhile to compare the genesis of self-identity, as we have conceived of it, to the evaluation of role as proposed by Mead (1934). According to Mead, the individual initially activates each of his roles ("lived roles") by means of behavior without being able to refer them to any other role in particular. In the elaboration of self, Mead also distinguished a phase of partial self-constitution, where the child is successively able to adopt the roles of partners in a social situation, without being able to fit them into an organized system of rules as a multiple form of definition of role or self. Next, the individual proceeds to a conceptualization of roles, that is, a "conceptualized role," thus elaborating a unique definition of each one. Finally, the individual arrives at a generalization of roles through which each role is fitted into a socioaffective system or *système relationnel* that enables confrontation with other roles. For Mead, this phase constitutes the "whole self." It is reached when the individual comes to a simultaneous interiorization of the various roles of his partners and of their relationships, which Mead translated as the notion of "generalized others," typical form of definition of the role of self. However, from our point of view, these various phases are repeated several times throughout development, whereas for Mead they characterize development as a whole.

The Method

The experimental population consisted of two samples.[1] One sample of children between the ages of 2.6 and 6.5 was made up of 80 children (40 girls and 40 boys) divided into four age groups. The

[1]We also carried out a pilot study by using a sample of adolescents between the ages of 12 and 15. The results of this study may be found elsewhere (Mounoud & Vinter, 1984) and so will not be presented here.

second sample consisted of 140 children between the ages of 6.6 and 11.5 (70 boys and 70 girls) divided into five age groups.

The subjects were confronted with a distorting mirror made of a sheet of flexible chromed plastic, 23.5 cm × 24 cm, held in an adjustable metal frame.[2] A handle at the base of the frame turned a screw that moved a vertical metal rod flush with the rear surface of the mirror. Rotations of the handle bent the metal frame and thus engendered convex or concave distortions in the vertical axis of the mirror. Each rotation of the handle caused a linear displacement of a marker placed behind the mirror, thus providing a measure of distortion on a scale graduated in centimeters. The nondistorted image of the face corresponded to a scale value of 0. The range of variation used for the distortions was 10 mm on either side of zero point.

It should be stated that the 7- to 11-year olds were confronted with a mirror of a higher quality and precison than that used for the 3- to 6-year-olds. The two mirrors functioned, however, in exactly the same manner.

Experimental Method

Experimental Hypotheses. On the basis of our theoretical hypotheses, it was possible to formulate essentially three experimental hypotheses. If the child has a unique form of identity, he shows concern for accuracy in his choice of image; to do this, he would have to have a clearly defined internal representation. *Accuracy* should be understood in the dual sense of accuracy of the objective image (no distortion) and/or in terms of the stability of the chosen image regardless of the experimental conditions. If, on the other hand, the child has elaborated diverse images of himself (i.e., multiple identity), each one taking into consideration only certain dimensions, then the different experimental conditions should lead to different choices, each revealing particular aspects of his face.

Finally, if the child may be characterized by a typical form of identity, his choices should reflect the establishment of categories

[2]We are grateful to Mr. Christian Husler and Mr. Lucien Pitetti for their ingenuity in constructing this apparatus.

based on the relationships between the various images of himself without a definition of any unique category.

Experimental Design

We employed a factorial design with 3 crossed factors (age, order, and sex), matching on a fourth factor (mirror curvature).

The four age groups in the sample of 3- to 6-year-old children (Sample A) were as follows: 2.6–3.5 years, 3.6–4.5 years, 4.6–5.5 years, and 5.6–6.5 years. Each group was made up of 20 subjects, 10 girls and 10 boys. The five age groups for 7–to 11–year-old children (Sample B) were divided as follows: 6.6–7.5 years, 7.6–8.5 years, 8.6–9.5 years, 9.6–10.5 years, and 10.6—11.5 years. Each group consisted of 28 subjects, 14 girls, and 14 boys.

Two measures were taken for each subject in Sample A, one with an initial concave distortion and the other with an initial convex distortion of the mirror image. Each age group was made up of two independent subgroups, randomly assigned to one of the two orders of intervention (concave-convex or convex-concave).

A procedure based on a repetition of the measures was used with Sample B. Five consecutive measures were first recorded for each subject; the initial distortion of the mirror image was either concave or convex depending on the subgroup to which the child was assigned. We then proceeded to a new measurement after modifying the initial curvature of the mirror (convex or concave).

The measures recorded were expressed as the difference in the number of centimeters between the marker position corresponding to the image selected by the child and its position for the nondistorted image.

Experimental Procedure

The subject was seated facing the mirror at a distance of 30 cm. The experimenter first showed the subject the range of possible distortions. The mirror was then set to either its maximum convex or its maximum concave position.

For Sample A children, each measure was taken under the following conditions: The experimenter produced the deformations in the mirror (passive method). For each step of mirror distortion,

the child had to say if the resulting image corresponded to his "objective" image. He was thus confronted with discrete distortions of his image.

Sample B children, however, were confronted with continuous modifications of their image: they themselves manipulated the handle to bend the mirror (active method) and were allowed to make to-and-fro movements.

Results

Three- to Six-Year-Olds

A repeated-measures analysis of variance was carried out on the data; this analysis essentially involved intragroup comparisons on the curvature factor (within-subjects design) and intergroup comparisons of the effects of age, order, and sex (between-subjects design).

This analysis enabled us to look at, among other things, the effect of the curvature on age and the effect of order on age. As sex did not emerge as a significant differentiating factor for these children (neither alone nor in interaction with other factors), we collapsed the data for boys and girls in the following analyses.

Effect of Curvature to Age. The curvature factor ($p = .001$) and the age × curvature interaction ($p = .001$) seemed to significantly differentiate the children's choices.[3]

Figure 1 illustrates the effect of curvature plotted against age; the values of the points on the graph are the result of summing the two concave measures, on the one hand (concave in the first position and concave in the second position), and summing the two convex measures, on the other hand.

For all ages, the direction of distortion of the selected image was determined by the initial position of the same kind of initial distortion.

By individual age group, the influence of the initial mirror position affected the performance of the 4- and 5-year-olds to a significantly greater extent than that of the 3- and 6-year-olds. The images selected by the 3- and 6-year-olds following initial concave or convex

[3]The age × order × curvature interaction was not significant at the chosen .05 level.

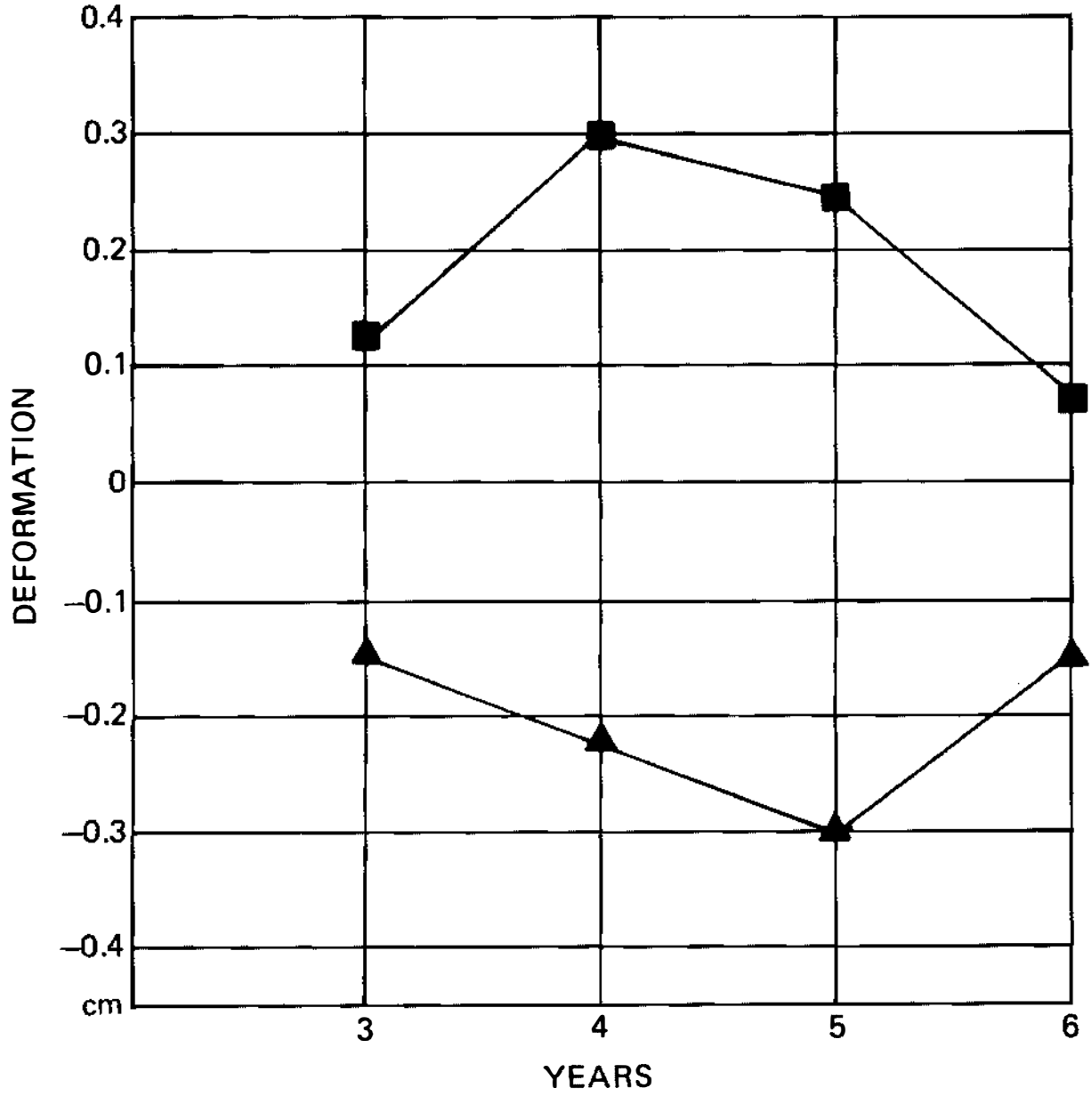

Figure 1. Effect of curvature in relation to age; ■ = concave measurements; ▲ = convex measurements.

distortion were much closer together than were those chosen by the 4- and 5-year-olds.

We verified that this effect of the curvature with respect to age had an equal effect on the performance of the children on an intra-group level. What emerged was that, regardless of the order of taking the measures, the initial curvature of the mirror had a greater influence on the 4- and 5-year-olds' choices than on those of the 3- and 6-year-olds. However, this effect was more clearly evident for those children passing from concave to convex. Apart from that, the 3- and 6-year olds distorted themselves, on average, less than the 4- and 5-year-olds.

The influence of the initial mirror position on the choice of mirror image showed that this choice appeared to depend on the

external conditions at the time. The 4- and 5-year-olds were more sensitive to the initial values of distortion than were the 3- and 6-year-olds. The chief characteristic of the self-image elaborated by these children thus seemed to be its inaccuracy, in the sense of instability. This image did not reflect a stable definition of facial traits but resulted from a choice that took different facial aspects into account according to context. A concave distortion (fattening) of the face probably revealed certain facial dimensions that were sufficiently recognizable to enable these children to identify themselves with the image reflected in the mirror, and a convex distortion (thinning) created others that were equally pertinent.

In contrast, the image elaborated by the 3- and 6-year-olds was accurate inasmuch as their choice altered little with the experimental conditions. Their choice was thus made on the basis of a stable set of facial dimensions, apprehended globally.

Order Effects with Respect to Age. Only the order factor was significant ($p = .0007$). None of the interactions involving this factor was significant. If concave and convex measures are separated, order was significant only for the concave ($p = .0029$).

The values of the points in Figure 2 were the result of the sum of the two measures for the subjects: concave and convex or convex and concave, depending on the order of measurements. Regardless of age, the two orders, concave-convex and convex-concave, led the children to make different choices. The order effect was the same in both cases: the means of the children's choices corresponded to the kind of distortions initially encountered (concave for the first order, convex for the second). Although the age x order interaction was not significant, the 3- and 6-year-olds' choices nonetheless tended once again to appear more stable than those of the 4- to 5-year-olds. An asymmetry may be observed between the effects of an initial concave and an initial convex distortion of the mirror: starting with convex seemed to have a greater effect on the second measure than starting with concave. The order effect was therefore greater for the concave than for the convex measures.

The same kind of interpretation carried out for the effect of the curvature may be extended to the effect of the order: the more the individual referred his choices to an accurate and stable image, the less he was affected by the order of taking the measures.

Overall, the children's choices were partially determined by the order of the measures: the nature of the first measure (concave

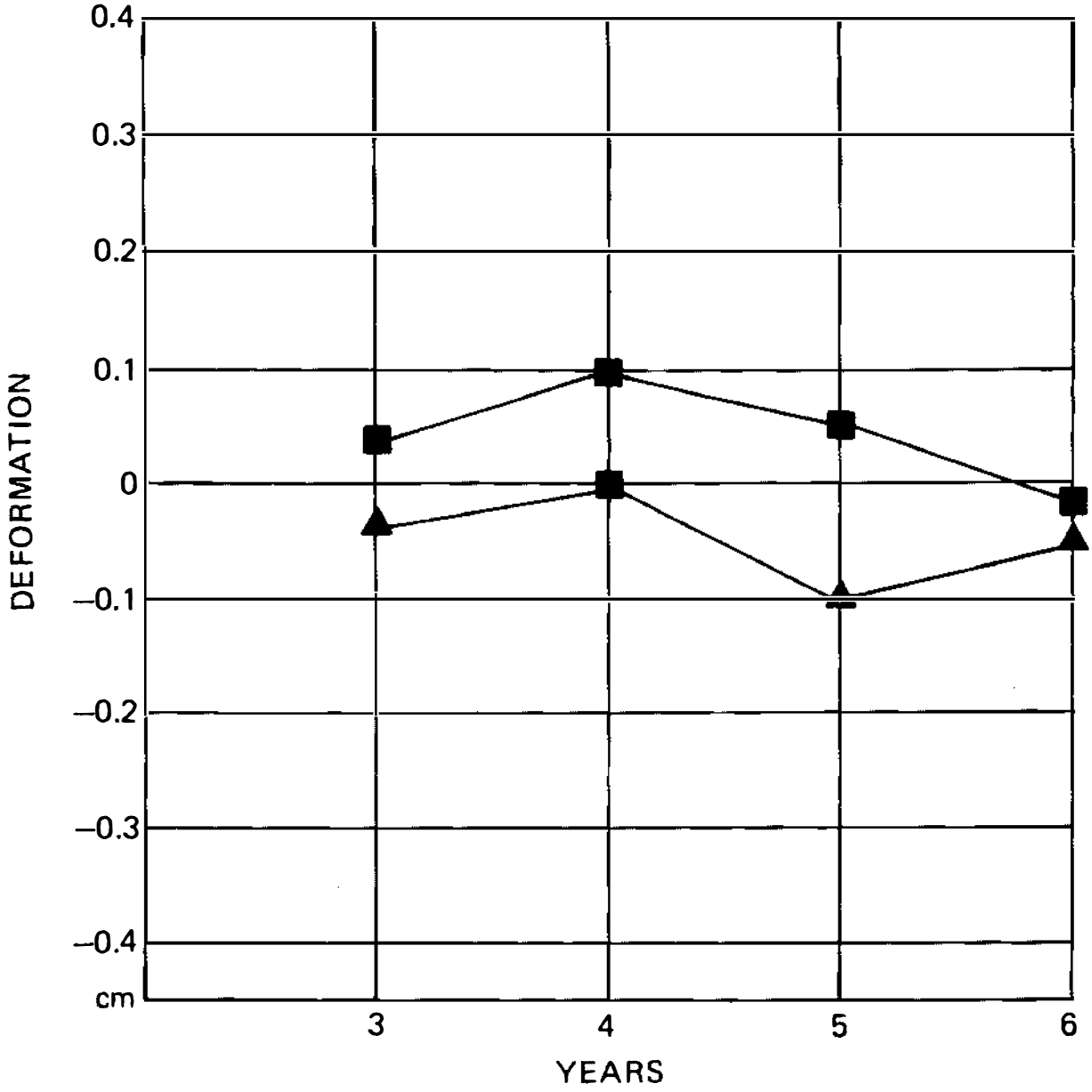

Figure 2. Effect of order in relation to age; ■ = concave-convex order; ▲ = convex-concave order.

or convex) oriented the direction of distortion of the chosen images. The 3- and 6-year-olds nevertheless tended to show a more consistent stability in their choices than the 4- and 5-year-olds.

Seven- to Eleven-Year-Olds

Effect of Taking Repeated Measures with Respect to Age. It will be recalled that five measures were initially taken for each subject, concave or convex, according to the order in which the mirror curvatures were produced. The analysis of potential tendencies in these repeated measures was carried out by comparing, for each subject, the first measurement with either the last measure or the mean of measurements. A statistical analysis of these data for each age group

(analysis of variance with polynomial correction) revealed no significant tendencies at the chosen .05 level, which means that statistically the five measures may be treated as equivalent to a single measure. Nevertheless, we feel that a qualitative analysis of the tendencies arising from taking repeated measures is of interest.

At age 7, a general decrease in the distortion of the chosen images could be perceived. At age 8, there is a tendency toward stability (i.e., each time choosing images that were equally distorted). At age 9, we see as much constancy as diminution (especially for the convex measures) or indeed augmentation (especially for the concave measures). It is worth noting that to diminish the distortion of the chosen image for the convex curvature is to move toward the territory of concave curvatures. At age 10, the children hardly modified their choices, which were images as distorted for the first trial as for the successive trials. Finally, at age 11, the modifications that arose over the five measurements primarily consisted of a decrease in the distortion and, secondarily, of a constancy of distortion for the concave measurements and an augmentation of distortion for the convex measurements.

There was an analytic aspect to the behavior (*fonctionnement*) of the 7-year-olds: over the five measurements, they extracted more and more subtle cues from the mirror image, which enabled them to approach their objective image. This behavior was possible only when the internal image to which the children referred in making their choices was not too rigidly defined. Between ages 8 and 9, a coherence or consistency appeared in the way in which the children were affected by the initial curvatures of the mirror: essentially, a decrease in distortion for the convex measures and an increase for the concave. These children seemed able to establish relationships between the different images with which they were confronted, leading to coherent modifications of their choice, always tending toward a fattening of the image. The stability of the 10-year-olds' choices was evidence of the existence of a fairly precise internal reference.

At age 11, a progressive inversion of the 9-year-olds' tendency emerged: the choices began to veer toward a thinning of the face. One might feel that, after age 10, the children proceeded to the construction of new images of themselves.

For the following analyses, the five consecutive measures taken for a given subject have been averaged; these are the means that were

compared to the measures obtained after changing the mirror curvature.[4] The statistical analysis of this set of data was identical to that carried out for the 3- to 6-year-olds' data. The results are as follows:

The curvature factor ($p = .0001$) and the order factor ($p = .001$), on the one hand and the order × curvature ($p = .0022$) and age × order × curvature ($p = .0094$) interactions, on the other hand, significantly differentiate the data. In addition, the age factor ($p = .0047$) and the age × order interaction ($p = .437$) are significant if a quadratic distribution of the data with respect to age is hypothesized. First of all, we will analyze the effect of curvature with respect to age; then the effect of order with respect to age; and finally the simultaneous effects of order and curvature with respect to age (the only interaction interpretable from a statistical point of view).

Effect of Curvature with Respect to Age. Regardless of age, these children chose much more distorted images when the initial mirror curvature was concave rather than convex (see Figure 3).

Compared to the 6-year-old children, the 7- to 9-year-olds appeared to be much more influenced by the initial mirror position, whereas at ages 10 and 11 the children's choices tended to be quite similar. Furthermore, the 8-year-olds and especially the 9-year-olds opted specifically for concave distortions of their images, which distinguished them from every other age group in the study.

Order Effects with Respect to Age. At each age, the children passing from concave to convex chose more distorted images than those going from convex to concave, for whom the mean of the chosen images were symmetrical with respect to the abscissa (see Figure 4). The 7- to 11-year-olds chose more distorted images for the concave than for the convex condition; this was particularly characteristic of the 8- to 9-year-olds and the 10-year-olds, an effect that is shown statistically by the fact that the age × order interaction was significant as long as the data are assumed to be distributed quadratically.

On an individual basis, we found that, at 8–9 years of age, the children's images were very far apart from one another (more than

[4]We would like to point out that we also carried out the statistical analysis of the data using the fifth measurement obtained for each subject instead of the mean of the five measurements. Absolutely no difference was found between the results of this analysis and the analyses presented here.

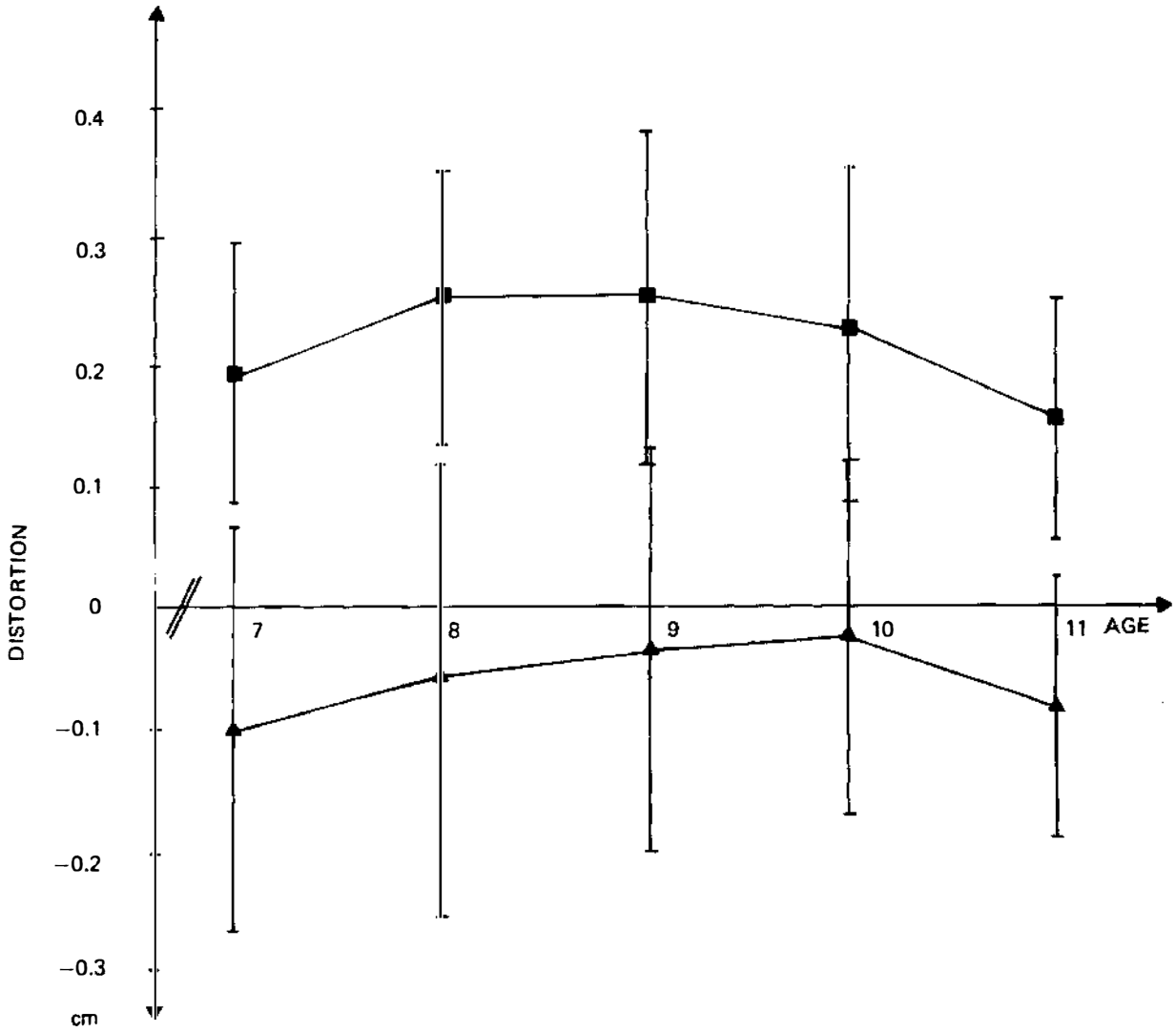

Figure 3. Effect of curvature in relation to age; ■ = concave measurements; ▲ = convex measurements.

3 mm apart) for the convex-concave order and close for the concave-convex order (between 0 and 1.5 mm apart), whereas at ages 10 and 11, there was no difference from this point of view between the two orders. Compared to Figure 4, this graph shows an even greater asymmetry between the order effects, in favor of the concave-convex order.

Effects of Curvature and Order with Respect to Age. The initial measurements (concave or convex) scarcely differentiated the age groups (see Figure 5). Generally speaking, the images defined by the initial measurements were at their most distant for the 9-year-olds and at their closest for the 11-year-olds. The second concave measurements corresponded to the first concave measurements, except that they showed to a greater extent the fact that the 7-year-olds and

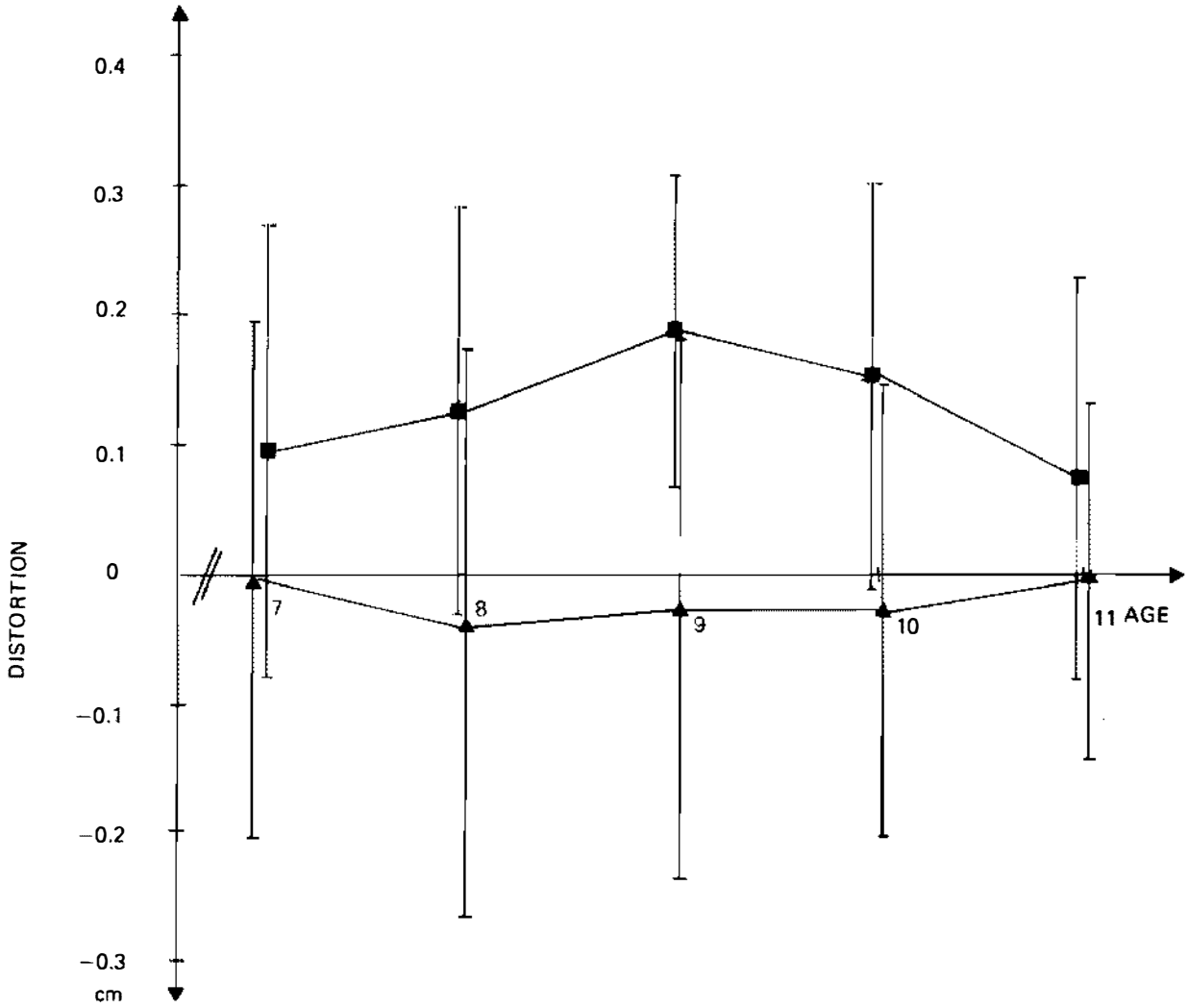

Figure 4. Effect of order in relation to age; ■ = concave-convex order; ▲ = convex-concave order.

the 10- to 11-year-olds distorted themselves less than the 8- and 9-year-olds. Finally, the second convex measurements were clearly different from the first convex measurements and radically differentiated the age groups. If the 7- and 11-year-olds chose minimally distorted images (although on the average they were leaner), the 8- and 9-year-olds chose concave images and thus tended to move toward the image chosen following an initial concave curvature of the mirror. It all seems as if, although influenced by the initial mirror position (of first measurements), the 8- and 9-year-olds sought to establish a relationship between the diverse facial dimensions revealed by the different mirror curvatures in order to arrive at coherent choices. The diverse images selected by the 10- and 11-year-olds in particular

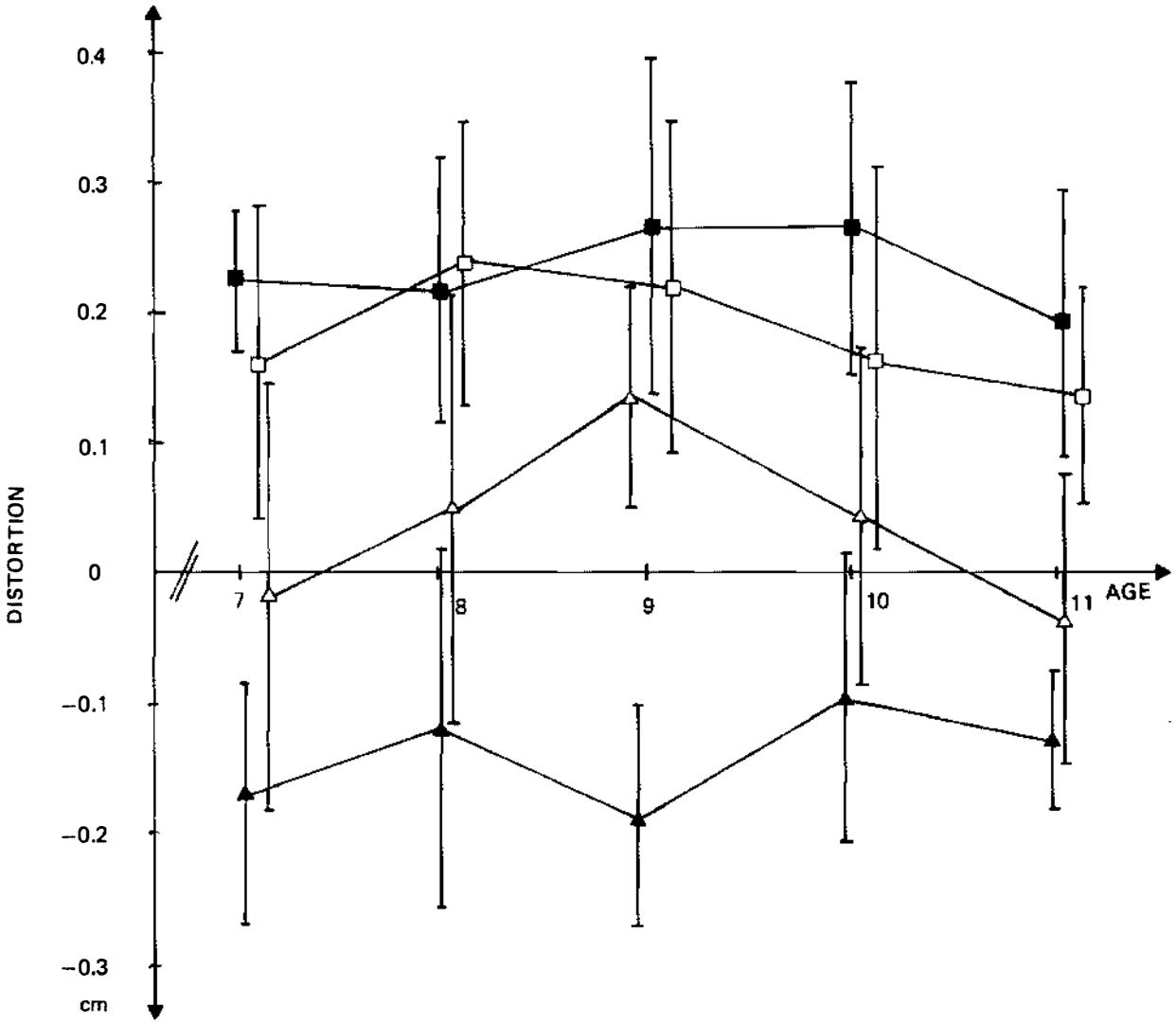

Figure 5. Effect of curvature and order in relation to age; first measurements: ■ = concave; ▲ = convex; second measurements: □ = concave; △ = convex.

converged on a single image, situated within the range of convex distortions.

Compared with the 6-year-olds, the 7-year-old children no longer chose images that were as accurate and relatively independent of the initial mirror position. On the contrary, they appear to have been affected by the changes in the curvature of the mirror, although to a smaller extent than the 4- and 5-year-olds. Above all, the greatest contrast between the 3- to 6-year-olds and the 7- to 11-year olds was that the third-order interaction of age × curvature × order became significant for the latter group. To us, this finding suggests that children between the ages of 7 and 9 are progressively establishing relationships between various images of their face revealed by the mirror,

and that they manifest a systematic preference for fatter images. Between ages 10 and 12, on the other hand, children abandon their preference for fatter images, and their choices tend toward similarity. The analyses of repeated measures shows, in accordance with the results, a consistency in the choices of the 10-year-olds and a tendency to incline toward thinner images at age 11. From our point of view, the age of 10 indicates a detachment from the period between 3 and 9 years of age. From age 11 on, children begin to construct new images of themselves.

We have not yet discriminated the data for boys from those for girls, as we found sex not to be a significant factor. Nevertheless, it may be remarked that the girls had a tendency to distort themselves more than the boys, regardless of the initial mirror curvature for the 9- to 10-year old girls, and following an initially concave curvature for the 7- to 8-year old girls.

Discussion

Despite the noticeable differences in the experimental design and the methods used, we will discuss the results obtained for each age group with respect to the results for all the groups together. We will also formulate hypotheses about the kind of effect resulting from these differences with the aim of varifying that the differences in the results obtained from the 3- to 6-year-olds and the 7- to 11-year-olds are not artifacts of methodological differences. However, it should be noted at the outset that neither at ages 3–6 nor at ages 7–11 were there any general effects that held for the whole set of age groups; it thus becomes difficult to attribute the differences to methodology.

In Figure 6, we have plotted the effects of curvature with respect to age for all of the age groups studied. For concave and convex curvatures alike, the children distorted themselves more or less according to age; regardless of the curvature of the mirror, the 4- and 5-year-olds distorted themselves most. These results are in clear contradiction to those of Gottschaldt (1954) who showed that only adolescents choose distorted photographs of themselves. Still, according to their age, the children in our study opted for images that were more or less far apart when the curvature of the mirror was modified.

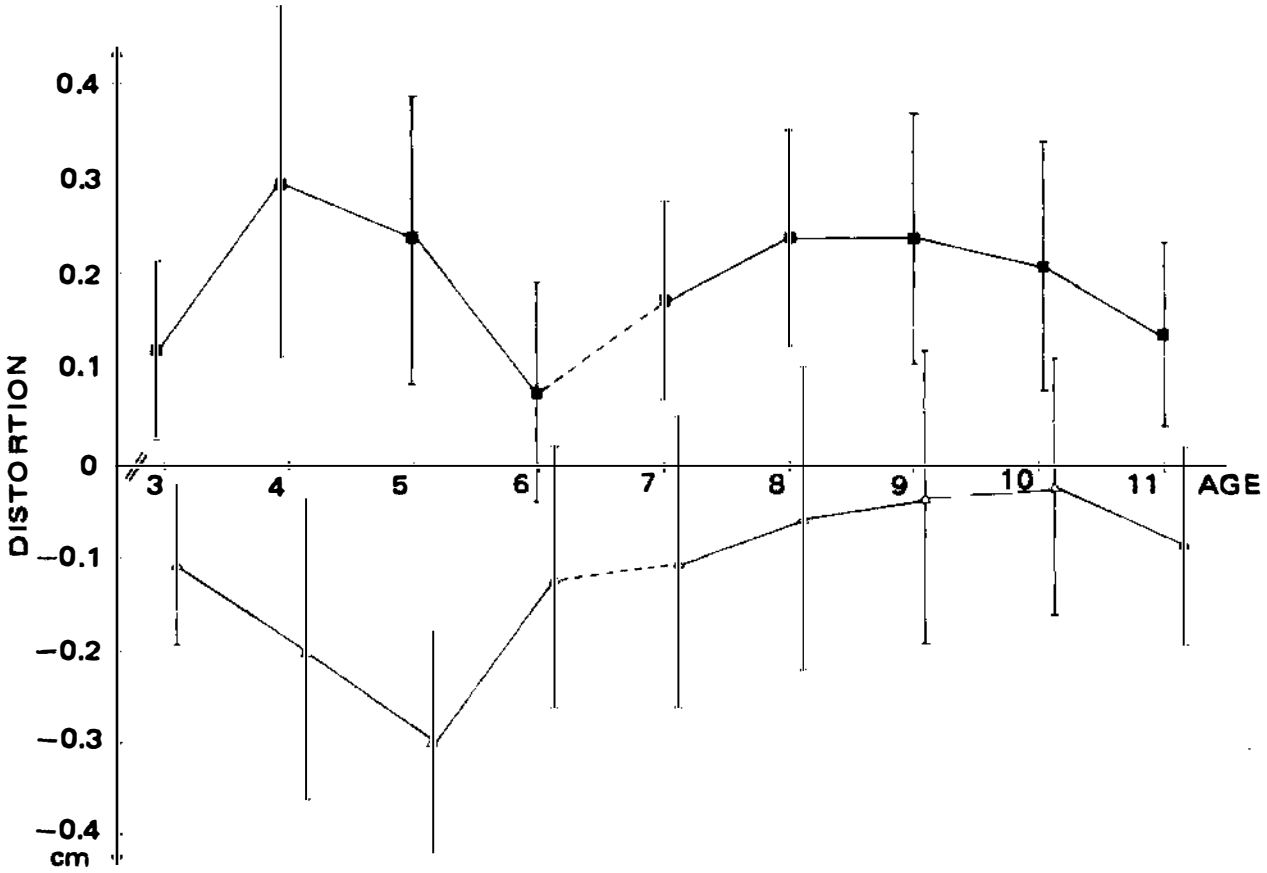

Figure 6. Effect of curvation in relation to age; ■ = concave measurements; △ = convex measurements.

The 4- and 5-year-olds chose images of themselves that differed according to the mirror position or to the order of taking measurements. Thus, they did not seem to possess a unique and accurate image of themselves; instead, they accepted the fact that diverse images might fit them. For us, their choices are to be referred to different internal representations of themselves, each independently constructed with respect to certain particular dimensions of their faces. It is in this sense that we propose the term *multiple identity* to characterize the form of self-identity of these children.

In contrast, compared to the 4- and 5-year-olds, the 3- and 6-year-old children chose images that were similar for the different mirror curvatures. This consistency suggests that they had constructed relatively accurate images of themselves. Six-year-old children have elaborated internal representations of themselves and therefore reflect unified self-definitions, simultaneously encompass-

ing a collection of facial aspects. The form of self-identity of these children may be qualified as unique.

The form of identity belonging to the 3-year-old children was related to the unique kind, but the consistency of their choices over the experimental conditions was less marked than that of the 6-year-olds. Thus, 3-year-olds may be placed in an intermediary phase between that phase of complete upheaval in relations with reality, where we have described a kind of syncretic identity (between 18–24 months and 3 years), and a phase of partial reelaboration of this relationship, which synthetizes the multiple form of identity.

The images chosen by children between ages 3 and 6 for the initial concave or convex mirror incurvations were more-or-less symmetrically placed on either side of the objective image. After age 6, and specifically at ages 8, 9, and 10, this no longer held true: the children distorted themselves to an average degree in the concave and hardly at all in the convex curvature (if we consider the means of the convex measures). But above all, the third-order interaction becomes significant, denoting the coherence or consistency introduced into the choices made by these children. They managed to establish relationships between the various facial dimensions revealed by different mirror curvatures and thus were able to opt for images presenting one kind of characteristic. Compared to the 6-year-old children, they seemed to be more affected by the initial mirror curvatures, yet without resembling the 4- to 5-year-olds. The great difference from the latter lies precisely in this peculiarity of the 7-, 8-, and 9-year-old children, that they grouped different images of themselves into one category. We propose to qualify this kind of identity as a *typical identity*. The marked preference of these children for fatter images may be a result of their parents' appreciation of "nice chubby cheeks," a sign of good health!

After age 9, we witnessed, on the one hand, a proximity in the images selected by the children for concave-convex curvatures of the mirror and, on the other hand, a loss in the privileged status of the concave distortions compared to the convex. When repeated measurements are taken, we have seen that, at age 10, children maintain a constancy in their choices, a tendency that, at age 11 is accompanied by an incliniation to choose less and less distorted images. We hypothesize that, between ages 10 and 11, children move on to

new elaborations, on a higher plane of representations of self (and others). Around ages 10–11, the child acquires new (formal) capacities of representing himself to encode the realities with which he is confronted. The appearance of these new realities provokes a return to a symbiotic, participatory form of relationship with reality, where the child takes account of a large number of dimensions of reality—but in an undifferentiated manner—in his various exchanges with his environment. During this phase of development, the child manifests a fairly accurate, yet intuitive and nondifferentiated, knowledge of himself (his face), hence the proximity of images and the consistency of choices observed for the 10- to 11-year olds. The early imitations of which babies seem to be capable at birth are also evidence of a similarly accurate but intuitive knowledge, which may be ascribed in babies to an automatic functioning of their body schematism (*schématisme corporel*) (Maratos, 1973; Meltzoff & Moore, 1977).

It seems possible to us to compare the two recognition modes based on a multiple or unique self-identity to those described by Carey and Diamond (1977) following from the research of Levy-Schoen (1964). These authors showed that children under age 10 identified their own faces on the basis of particular and isolated traits, whereas children over age 10 based their recognition judgments on the whole facial configuration. These authors saw the explanation for this new capacity of the child over age 10 to encode configurations of the whole face in maturational changes in the right hemisphere. From our point of view, this opposition of a recognition based on a particularization of traits from a mode based on the global configuration of the face also makes it possible to differentiate between the 3- to 4-month old baby (who distinguishes only certain specific facial traits—Spitz, 1957) and the 8- to 9-month-old baby (who recognizes single faces). There are other differences between the 4- to 5-year-old child and the 6- to 7-year-olds, the 11- to 13-year-old adolescent and the 14- to 15-year-olds. The first of these recognition modes is a result of the partial and fragmentary aspect of the representations possessed by the child, whereas the second is based on total representations of reality.

Now let us see to what extent the differences appearing between 3- to 6-year-old children and 7- to 11-year-olds may be explained by

methodological differences. The active method, as opposed to the passive method, may enable the subject to be more precise in his choices of his own image and consequently to select less distorted images. In fact, it was the 6-year-olds with whom the passive method was used, and yet, it was they who showed the greatest accuracy in their choice of image. This hypothesis does not therefore stand up in this form.

The effects introduced by taking repeated measures may be of at least two kinds: they may *favor familiarization* or habituation with respect to the distortions, so that the children would opt for less and less distorted images; they may also serve to *accentuate the contrast* between the concave and the convex distortions, the subject having suffered a certain perceptual anchoring in relation to the kind of distortion to which he became accustomed. From this point of view, one could expect that the second kind of distortion encountered by the child would have less effect on his choices; these choices would be for less distorted images, closer to the first kind of distortion.

Let us examine the first of these hypotheses, which suggests a learning effect, that is, an improvement in performance. If this is indeed the case for certain ages (especially at ages 7 and 11) this tendency is far from being the norm for our results in general. For there to be learning, the subject must be able to extract information from the task in hand and must be able to use this information in the following trials on this task. Thus, the representations used by the child should be neither too rigidly nor too accurately defined, or else the taking of repeated measurements would be translated by a constant performance (at age 10). From this standpoint, a worsening of performance (an increase in distortion) would mean either that the subject has not succeeded in using the information extracted from the first trial by the start of the second, or that he is trying to arrive at a referential image, a subjective standard clearly distinct from the objective standard of the distorted image. To us, it seems more likely that the second alternative would explain the increased distortion found with the 7- to 9-year-olds, and that the first would explain this tendency for the 11-year-olds.

The second hypothesis stipulates that, over repeated measurements, the children would undergo a perceptual anchoring effect with respect to the kind of distortion they are faced with and thus

would define their choices, after the change of mirror curvature, in terms of these anchor points. If at first sight this seems to have been the case for the children having the concave-convex order, it was not so for the children passing from convex to concave. Thus, the anchor points can be formed only if they conform to the nature of the subject's representations. Now, if we examine the curve for the convex measures when these came second (Figure 5), we see that the influence of anchor points in the concave condition increased between ages 7 and 9 and then decreased after age 10. This finding means that the anchor effect can really manifest itself only if the subject is capable of establishing relationships between the various images proposed to him.

Thus, these hypotheses, which fit perfectly well into our theoretical framework, permit the rejection of an explanation of the difference based on methodologies.

Conclusions

The genetic evolution shown here between ages 3 and 11 illustrates how the image of his own face elaborated by the child is dependent on his "interpretive frameworks" and their development. This evolution would make no sense if the child came to know his physical image only through "direct" perception, not mentioned by his interpretive frameworks or representations.

In this conclusion, we would like briefly to outline the theoretical conception of child development underlying our research. This theoretical conception has been set out in several articles to which the reader can refer (Mounoud, 1979; Mounoud & Hauert, 1982a,b; Mounoud &Vinter, 1981). We consider the face an object of representational elaborations just like any physical object. Thus, we would not expect results very different from ours if any other object (e.g., an apple) were to be placed in front of the mirror instead of the face.[5]

Temporal *decalages* could obviously occur, but the general genetic evolution would stay the same. The results obtained by Bert-

[5]Similar studies are being planned.

menthal and Fisher (1978) would make this hypothesis quite likely.

Throughout development, the child constructs new representations (models or memories) of objects, of himself and of others. These representations are conceived as internal structurings or organizations of contents and are elaborated by means of the cognitive instruments available to the child. They comprise what we have previously called the subject's *interpretive frameworks*: the set of the subject's "categories" permitting him to apprehend reality. At the same time that he is elaborating new representations, the child constructs new action programs (skills or aptitudes) that organize his exchanges with his milieu.

From our point of view, the baby possesses, from birth, a set of representations, of a categorical kind, of both himself and the external world. It is particularly because of these representations that the newborn is capable of early imitation and the various intersensorimotor coordinations. But each of these kinds of behavior (imitations or auditory-visual coordinations, for example) disappears, only to reappear later in development. These "momentary" disappearences signify, to us, that the child is elaborating new representations, by means of new cognitive instruments. The representations already constituted, which play the role of "support" and from which new significations may be elaborated, intervene in the construction of new representations.

It is also necessary, when categorizing the construction of representations, to take into consideration the nature of the child's translations or encodings of his environment or his own body. We distinguish four kinds of codes: the sensory code, the perceptual code, the conceptual code, and the semiotic code. These correspond to the four successive levels of the construction of representations: the sensory level, correlative with the perinatal phase: the perceptual level, reached at around 18 months (perceptual representations); the conceptual level (conceptual representations), reached at around 9-10 years of age; and the semiotic level reached at around 16–18 years of age.

The appearance of these codes (or new coding capacities) is generated by a maturational process that depends only very indirectly on the child's interaction with his environment (i.e., the milieu plays a nonspecific role). The acquisition of new coding capacities constrains the child to reorganize his exchanges with the environment; these

upheavals define the stages, beginning with a general uniform organization of behaviors, which itself contains the program for ulterior organizations (Mounoud, 1976). The passage from one stage to another takes place, to a certain extent, independently of the degree of completion of the preceding constructions, contrary to Piagetian theory.

Within a given stage, the elaboration of new representations is carried out according to a similar scheme of development. We have tried to characterize, with the development of the self-image, four phases in the construction of representations of the self.

We have distinguished an initial phase, where representations are global and syncretic, where the form of self-identity is qualified as syncretic and undifferentiated. Next comes a phase where new elementary representations are elaborated, in isolation from the others and with no relationship to them. We have made a correspondence between this phase and a "multiple" form of identity. Then, new, total, but rigid and nondecomposable representations are constructed during a third phase because of the coordination and integration of the preceding elementary representations. Here, we have defined a "unique" form of identity. Finally, in a fourth phase, these total representations become decomposable, and the child masters the systems of correspondence or relationship existing between the parts of an object. We have qualified as "typical" the form of identity corresponding to this level.

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