The concept of egocentrism in the context of Piaget's theory

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ABSTRACT

In this paper, we trace the origin and development of the concept of egocentrism in Piaget's work. We evaluate a number of criticisms that have been leveled against the concept of egocentrism. Based on our evaluation, we propose a reconceptualization of the concept of egocentrism as a decentering process with different phases that is recapitulated at different stages of development. We provide examples of the decentering process for the sensorimotor, preoperational, concrete-operational, and formal operational stages.

Piaget introduced the concept of egocentrism in his early writings in the 1920s to describe general characteristics of the preschool child. Since its introduction, the concept of egocentrism has received considerable theoretical and empirical attention and has drawn numerous criticisms. Piaget attributed these criticisms to serious misunderstandings of the concept of egocentrism. Indeed, Piaget (1945/1962, p. 285, fn) admitted that the choice of the term egocentrism was "unfortunate", and he apologized (Piaget & Inhelder, 1948/1967, p. 220) for having dwelt on this expression for the last twenty-five years.

In this paper, we trace the origins of the concept of egocentrism in Piaget's writings and examine the subsequent changes to this concept. We examine some of the criticisms leveled against the concept of egocentrism and conclude that the concept of egocentrism remained ambiguous in Piaget's writings. Finally, we suggest a revision of the concept of egocentrism that addresses these ambiguities.

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1. The development of the concept of egocentrism in the context of Piaget's work

The roots of the concept of egocentrism can be traced back to Freud's influence on Piaget. While he was in Zurich (1918–1919) and Paris (1919–1921), Piaget studied various schools of psychoanalysis (Freud, Jung, Adler). Based on Freud's concepts of primary process (i.e., the mode of functioning in service of the immediate gratification of needs) and secondary process (i.e., the regulation and control of needs to attend to the demands of reality), Piaget (1920) initially distinguished between autistic and logical, scientific thought, and in 1922 he introduced the concept of egocentrism as an intermediary level between these modes of thought.[1] However, Piaget soon distanced himself from Freud's concept of primary process, and the meticulous study of his own infants led to a thoroughgoing revision of the concept of egocentrism. From the mid-1930s on, egocentrism was conceptualized as a phenomenon that reoccurs at the beginning of different developmental stages.

1.1. The Freud connection

During his stay in Paris, Piaget was asked to lecture to the Alfred Binet Society on the topic of psychoanalysis (Harris, 1997; Kesselring, 1999). In his lecture, Piaget (1920) discussed basic concepts of three different psychoanalytic approaches, namely, the theories of Freud, Adler, and the Zurich School of psychoanalysis (i.e., Jung, Pfister). Following Freud, Piaget (1920, p. 23) distinguished between two different modes of thinking: autistic or symbolic thinking, on one hand, and scientific or logical thinking on the other. The concepts of autistic and logical thinking are modeled on Freud's ideas of primary and secondary process. Autistic thinking obeys the pleasure principle and is "personal, incommunicable, … confused, undirected, indifferent to truth, rich in visual and symbolic schemas, and above all, unconscious of itself and by the affective factors by which it was guided" (1924/1972, pp. 204–205). It is characteristic of "the child, the neurotic person, the dreamer, the artist, and the mystic" (Piaget, 1920, p. 23, our translation). In the conclusion of his discussion of the different psychoanalytic approaches, Piaget (1920, p. 57) suggested that an important task of psychology is to study individual differences in the relations between autistic thought and rational thought:

> Autistic thinking that forms personal symbols remains with us throughout our lives. However, its role changes with age. In the child, autism is everything. Later, reason develops at the expense of autism but can reason ever completely shed itself of autistic thinking? It does not appear this way. The task is therefore to create … a psychology in order to determine in each individual the exact relations between the level of intelligence and the level of autistic or unconscious life (our translation).

The relations between autistic and logical thinking were taken up again by Piaget in a conference presentation at the International Psychoanalytic Conference in Berlin 1922 (Piaget, 1923). However, he now approached the issue from a developmental and not an individual-difference perspective (Harris, 1997). It is in this context that Piaget (1923, p. 284), for the first time, used the concept of egocentrism: Piaget argued that egocentrism is an intermediate or transitional stage between autistic thought and socialized logical thinking. Piaget based this argument on several functional analogies between autistic and egocentric thought. Egocentric thought displays the three core features of autistic thought: it lacks any form of directed logical sequence, it is not conscious of its own processes, and it is dominated by imagery rather than concepts (Piaget, 1923, p. 279). As further commonalities between autistic and egocentric thought Piaget mentioned, among others, that both are individual and not communicable, and lack clear boundaries between ego and alter ego as well as between ego and external world. To explain the commonalities between autistic and egocentric thought, Piaget referred to functional and

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[1] Piaget (1920) also used the term "symbolic thought" to refer to the characteristics of autistic thought. As we explain below, Piaget's notion of autistic thought is derived from Bleuler, and is not synonymous with the contemporary use of this term as a designator of a particular developmental disorder.

structural factors. Functionally, both types of thought are playful and dominated by the pleasure principle, the adaptation of reality to one's wishes (Piaget, 1923, p. 303). Structurally, both types of thought are characterized by a lower degree of tension and complexity (i.e., there are fewer dimensions in the field of consciousness) (Piaget, 1923, pp. 303–304).

Piaget's books on *Language and Thought of the Child* (1923/1926), *Judgment and Reasoning of the Child* (1924/1972), *The Child's Conception of the World* (1926/1929), and *The Child's Conception of Physical Causality* (1927/1930) present in detail many features of egocentric thinking. Piaget placed the egocentric stage between the autistic stage (lasting from birth to 2–3 years) and the stage of logical thought (7–8 years onward, see Piaget, 1927/1930, pp. 302–305; 1928/1995, pp. 199–200). The stage of autism remained to be modeled after Freud's concepts of primary process and pleasure principle because in autistic thinking, "to every desire corresponds immediately an image or illusion which transforms this desire into reality, thanks to a sort of pseudo-hallucination or play" (Piaget, 1927/1930, p. 302).

Egocentrism manifests itself in ontological and logical forms (Piaget, 1926/1929, pp. 167–168). Ontological egocentrism is due to fuzzy ego-boundaries and the failure to clearly demarcate the subjective from the objective (Piaget, 1927/1930, p. 242). This failure results in the treatment of mental phenomena as if they were objects in the physical world (realism) and the ascription of mental attributes to external phenomena (animism, artificialism; see Piaget, 1926/1929, 1927/1930, pp. 242–244). Piaget (1927/1930, p. 255) expressed this mindset succinctly as follows: "The child vivifies the external world and materialises the internal universe." Realism, animism and artificialism gradually disappear as the child becomes aware of her own subjectivity, which, in turn, Piaget conceptualized, following Baldwin (1897), as a social process (e.g., Piaget, 1923, p. 287, 1926/1929, p. 245, 1927/1930, p. 246, 302).

Logical egocentrism is on display in a variety of different phenomena (Piaget, 1924/1972). First, egocentric speech is a manifestation of logical egocentrism (Piaget, 1923/1926). Egocentric speech refers to the phenomenon that a large proportion of children's speech consists of collective mono-logues (i.e., children are talking without listening to each other), echolalia, and monologues. Second, logical egocentrism is linked to the failure to properly understand relational concepts such as "brother" (Piaget, 1924/1972, pp. 89–107) or foreigner (Piaget & Weil, 1951/1995), as well as spatial relational terms such as left and right (Piaget, 1924/1972, p. 113). For example, the concept of brother requires the awareness of at least two different points of view because in the same way that, say, Peter is a brother to me, I am a brother to Peter. Third, children do not feel the need to supply proofs for their statements and are not aware of contradictions (e.g., Piaget, 1924/1972, pp. 163–169). Finally, egocentric thinking is characterized by syncretism (i.e., the tendency to think in wholes without taking the parts into account, Piaget, 1924/1972, p. 228), juxtaposition (i.e., the tendency to link thoughts together in an associative manner, without subordinating one thought to another, Piaget, 1924/1972, p. 221), and transductive reasoning (i.e., reasoning from one particular to another particular as, for example, in the statement, "I haven't had my nap yet so it isn't afternoon", Piaget, 1945/1962, Obs. 112b). According to Piaget, logical egocentrism is due to the fact that "the child sees everything from his own point of view, it is because he believes all the world to think like himself. He has not yet discovered the multiplicity of possible perspectives and remains blind to all but his own as if that were the only one possible" (Piaget, 1926/1929, p. 167).

Thus, both ontological and logical egocentrism are due to lack of differentiation, either between the subjective and the external world (ontological egocentrism), or between ego and alter ego (logical egocentrism; see Piaget, 1926/1929, pp. 167–168). Social interaction and the becoming aware of the self lead to a mediation of the child's own point of view by other perspectives and, as a consequence, a universe of relations gradually replaces the universe of absolute substances (Piaget, 1927/1930, p. 250).

Thus, in Piaget's early work egocentrism refers to a developmental stage that is characterized by the unconsciousness of the self and the lack of differentiation between, on the one hand, ego and world, and ego and alter ego, on the other hand. The stage of egocentrism follows, and shares several func-tional features with, the stage of autism, which in turn, is modeled on Freud's concept of primary process. Interestingly, even though Piaget (1951/1995, p. 284) called himself a pupil of Bleuler and acknowledged taking the concept of autism from Bleuler (Piaget, 1920, 1951/1995, p. 284), his

description of autism deviates in important respects from that of Bleuler. Bleuler (1912/1951, p. 420) contrasted autistic and realistic thinking:

> Realistic thinking represents reality; autistic thinking imagines what corresponds to an affect which is as a rule pleasant. The purpose of realistic thinking is to reach a correct understanding of the environment, to find the truth. Autistic functions aim to evoke ideas [of similar] affect-tone (mostly pleasure-toned) and to suppress those of a contrary affect. The realistic mechanisms regulate our relationship with the outside world and subserve survival, nourishment, attack, and defense; the autistic ones create direct pleasure by eliciting pleasure-toned ideas and suppress displeasure by blocking related ideas. Thus there are autistic as well as realistic need-gratifications …. When affects have the upper hand, either momentarily, or as a matter of disposition, logical thinking is suppressed and autistically falsified (p. 420).

However, in contrast to Piaget, Bleuler (1912/1951, p. 404, 1922/1951, p. 435) thought that autistic thinking is directed, not by logical rules but by affective needs; Piaget (1923, pp. 279–280) wavered on this point.

A second difference to Piaget's conceptualization is that for Bleuler, autism cannot be the starting point of development. Rather, it presupposes lower forms of the reality function: "I cannot find a creature, or even conceive of one capable of survival, who does not react first of all to reality and who does not act.… [A]nimal psychology (excepting a few observations on higher animals) knows only the reality-function" (Bleuler, 1912/1951, p. 427). Bleuler's argument that the reality function is (phylo- and ontogenetically) primary and autism is secondary constitutes the core idea behind Vygotsky's (1934/1986, pp. 20–25) criticism of Piaget's theory of egocentric speech.

1.2. Piaget's revised theory of egocentrism

By the mid- 1930s, Piaget had fundamentally revised his concept of egocentrism. This revision emerged slowly in Piaget's work. It encompasses two different aspects. First, the concept of "imitation" (used, for example, in Piaget, 1924/1972) was replaced with that of "accommodation." Second, Piaget no longer considered egocentrism a stage intermediate between autism and logical thought but as a phenomenon that reoccurs at different stages in development. This change in the concept of egocentrism resulted from Piaget's work on infant development.

When Piaget observed the development of his own children during their first 18 months he acknowledged that a decentration process similar to that described in his books between 1923 and 1927 occurs already during the first 18 months. This inspired both, the reconceptualization of the initial stage of psychological development and his egocentrism (decentration) concept. Both changes inspired, in turn, the reconceptualization of the initial stage of psychological development, the final version of which appeared in his first two volumes on infancy in the mid-1930s (Piaget, 1936/1952, 1937/1954).

In a paper on the development of causality in the first year of life – a paper that was based on the observation of his daughter Lucienne (born 1925) – before the British Psychological Society in 1927, Piaget (1927–1928/1977, p. 203) acknowledged the adaptive function of accommodation, but he compared assimilation to the activity of dreams that "deform things in order to satisfy its desire." The clash between assimilation and accommodation results in a paradox: "Babies thinking is made up of a set of movements of accommodation adapted to the world outside. Yet in other respects, the thinking also resembles a sort of perpetual waking dream, with all the characteristics of unadulterated autism" (Piaget, 1927–1928/1977, p. 200). Piaget also pondered the importance of basing psychological development on biological data and discussed whether the initial lack of differentiation between ego, alter ego, and external world is not due to "an unconscious process of assimilation" (Piaget, 1926/1929, p. 36). At the same time, he started to distance himself from Freud's view by criticizing his notion of narcissism:

> In fact, it [Freudian theory] gives to the infant narcissist the qualities of an adult in love with himself and aware of it, as if the infant could clearly distinguish his self from others.… If he is in love with himself, it is not because he knows his self, but because he ignores all that is outside his

dream and his desires. Narcissism, that is to say, absolute egocentricity, certainly gives rise to magical conviction, but only in so far as it implies absence of consciousness of self (Piaget, 1926/1929, pp. 151–152; later, Piaget formulated a more extensive critique of Freud, see Piaget, 1945/1962, pp. 182–193).

In Origins of Intelligence (1936/1952), Piaget depicted the initial stage of development – the sensorimotor stage – as a continuation of the biological process of organization and adaptation. In fact, the same functional invariants – organization, adaptation, assimilation, and accommodation – characterize biological and psychological functioning (Piaget, 1936/1952, pp. 6–8): At every level, "intellectual functioning involves an element of assimilation, that is of structuring through incorporation of external reality into forms due to the subject's activity" (Piaget, 1936/1952, p. 6). At the same time, the incorporation of new elements leads to a modification of the structure, due to the accommodatory aspect of activity. Finally, intellectual adaptation consists of "putting an assimilatory mechanism and a complementary accommodation into progressive equilibrium" (Piaget, 1936/1952, p. 7). Assimilation is thus no longer conceptualized as distorting. Instead, Piaget more clearly worked out the organizing function of assimilation and emphasized that organization occurs correlative to, and in the service of, adaptation.

Second, Piaget's first book on infancy (1936/1952) also signals a radical change in his perspective on egocentrism. Piaget (1970/1972) claimed that infants start their life equipped with diffuse, isolated, and global movement patterns. As a consequence, infants cannot construct meaningful relations between isolated movement patterns, and subject and object remain undifferentiated: "the infant relates everything to his body, as if it were the centre of the universe – but a centre that is unaware of itself … so long as each action still forms a small isolable whole, their sole common and constant reference can only be the body itself, so that there is an automatic centring on it, although it is neither voluntary nor conscious" (Piaget, 1970/1972, p. 21). Following Baldwin (1906), Piaget (1950a, p. 266, 1950b, p. 283, 1970/1972, p. 20; Piaget & Inhelder, 1966/1969, p. 22) characterized the initial lack of differentiation between subject and object in infancy as adualism. Adualism is overcome through the use of schemes in different situations, their subsequent accommodation, and reciprocal assimilation, which leads to the increasing differentiation and coordination of schemes. Thus, the differentiation and coordination of sensorimotor schemes result in breaking up the immediacy that characterizes the relations between self and world during the first few months of the child's life (Piaget, 1937/1954).

The discovery of egocentrism at the sensorimotor stage raises the question of how infantile egocentrism is related to the egocentrism displayed by preschoolers, a question with which Piaget (1927–1928/1977) initially struggled. Piaget's (1937/1954, pp. 357–380) answer is that the same process is recapitulated at qualitatively different levels of development – a phenomenon that later on he termed vertical decalage (Piaget, 1947/1976, pp. 147–148). The recapitulation is necessary because concepts that have been acquired at one developmental stage cannot be simply transferred to the next stage but must be reconstructed effortfully at the new developmental plane to meet the demands of the new level of functioning (Inhelder & Piaget, 1955/1958, p. 343).

Thus, both the sensorimotor and the preoperational stage initially are characterized by a lack of differentiation and a subsequent decentration process (Piaget, 1945/1962, pp. 241–242). During the sensorimotor stage, the infant does not distinguish clearly between "the world outside" and her perspective on it. During the preoperational stage, she ignores her own perspective on an object or a material situation. In both instances, there are, in some respects, difficulties in distinguishing between oneself and another person. In his later work, together with Inhelder, Piaget "discovered" a third form of egocentrism at the stage of formal operations (Inhelder & Piaget, 1955/1958, pp. 338–350). In this stage there is again both – an unconsciousness of one's own perspective on "the world outside" and a lack of distinction between interpersonal perspectives (pp. 342–343). Evidently, adolescent egocentrism manifests itself only in specific contexts, such as when tackling new existential situations, learning to know "new" cultures, and participating in intercultural communication in general.

Piaget (1954/1981) claimed that the decentration process involved cognitive and affective components, and he elaborated this claim for the emergence of means-ends behaviour and the will. Means-ends behavior emerges in the second part of the first year of life when infants start to

coordinate two independent schemes, with one scheme assigning an end to the action (e.g., grasping the matchbox) and the other scheme used as a means (e.g., hitting the hand to lower it). For Piaget (1936/1952, p. 154), the differentiation of means and ends and, thus, the setting of goals in advance are the criteria for ascribing intentionality. At the same time, the differentiation between means and ends also leads to the differentiation between value and ideal:

> As soon as there is intention, in effect, there is a goal to reach and means to use, consequently the influence of consciousness of values (the value or the interest of the intermediary acts serving as *means* is subordinated to that of the goal) and of the ideal (the act to be accomplished is part of an ideal totality or *goal*, in relation to the real totality of the acts already organized) (Piaget, 1936/1952, p. 149, emphasis in original).

Means-ends behaviour reflects cognitive decentration because it involves the differentiation between means and goal and the flexible coordination of means and goal to achieve a goal determined beforehand (Piaget, 1954/1981, p. 26).

But means-ends behaviour also reflects affective decentration (i.e., the differentiation of different values and the coordination between them) because certain objects without interest in themselves take on an interest in relation to other objects that are valued: "[T]he value of the means is determined in relation to the value of a particular goal, and labile hierarchies of values arise from activity of this sort" (Piaget, 1954/1981, p. 26).

Affective decentration is also central to exercising one's will. For Piaget (1954/1981, 1962), the will becomes operative whenever we need to weaken a strong behavioral tendency and strengthen an initially weaker tendency. The will thus involves changing perspectives in such a way that "relationships appear that were not given at the start" (Piaget, 1954/1981, p. 64). Piaget compares acts of will to children's success in conservation tasks because in the latter children also need to decenter to overcome a perceptually salient stimulus configuration (e.g., the height of liquid in conservation of continuous quantity). In the case of conservation, decentration is accomplished by incorporating the perceptually salient configuration into a system of operations that link the actual configuration to previous and potential future configurations (Piaget, 1962, p. 142). In a similar vein, we overcome a strong temptation by confronting it with commitments that issue from the past and with the future satisfaction promised by completion of the task we currently are not strongly motivated to do (Piaget, 1962, p. 143). Even though cognitive and affective decentration involve similar processes, affective decentration cannot be reduced to cognitive decentration: "To decentrate in the domain of the will is not to invoke memories through the intelligence, but to revive permanent values, that is to say, to reanimate permanent values, to feel them, which means that it is an affective operation and not an intellectual one" (Piaget, 1962, p. 144; see Piaget & Weil, 1951/1995, for a further example of affective decentration).

To summarize, with his work on infant development, Piaget's conceptualization of egocentrism underwent significant changes. Rather than a stage intermediate between autistic and logical thinking, egocentrism became a phenomenon that reoccurs several times, at the beginning of the sensorimotor stage, at the beginning of the preoperational stage of development and, as Inhelder & Piaget (1955/1958) discovered later on, at the beginning of the formal-operational stage. At each of these stages, the expansion of the cognitive field opens up a new perspective on the world, which is taken to be absolute. At each of these stages, development involves a cognitive and affective process of decentration or relativization. Because the process of decentration reoccurs at different stages, development is not a simple additive or linear process (see Kesselring, 1981, 2009):

> The central idea, then, that I have tried to express by means of the term intellectual egocentrism (no doubt a bad choice) is that progress in knowledge occurs neither as simple addition nor as additive stratification, as if richer knowledge came along merely to augment weaker knowledge, but that this progress rests equally on the continual recasting and correction of earlier points of view through a process which is as retroactive as it is additive. This process consists in the endless correction of earlier "systematic errors" or those which arise along the way. Now this process of correction seems to obey a well-defined law of evolution, which is the law of decentration (Piaget, 1962/2000, p. 244).

1.3. Criticism of Piaget's egocentrism concept

Numerous criticisms have been leveled against Piaget's concept of egocentrism, both from an empirical and a theoretical perspective. The empirical criticism has focused on Piaget's research on perspective taking (Piaget & Inhelder, 1948/1967). Specifically, it has been argued that Piaget considerably underestimated preschool children's perspective taking skills and, that, if perspective taking tasks are stripped of extraneous processing requirements, children much younger than expected according to Piagetian theory demonstrate perspective taking skills (Flavell, 1992). We address the empirical criticism in the conclusion, and focus in this section on theoretically motivated critiques.

One common criticism is based on the interpretation of egocentrism as self-centeredness (e.g., see Isaacs, 1930, p. 74; Merleau-Ponty, 1960/1964, p. 119). However, as Piaget (1962/2000, p. 244) emphasized, the concept of egocentrism has:

> [N]o relation at all to what in ordinary language is called egocentrism (hypertrophy of self-consciousness). Cognitive egocentrism, as I have tried to make clear, stems from non-differentiation between one's own and other possible points of view and in no way at all from an individualism which precedes relations with other people.

A second criticism argues that Piaget endorses a Cartesian view of mind (Wimmer & Hartl, 1991, p. 126) because the concept of egocentrism shares the Cartesian assumption "that the mind is transparent to itself via introspection." This interpretation is at odds with Piaget's (1945/1962, p. 285, fn, 1962/2000, p. 244) statement that egocentrism refers to a lack of differentiation between self and other and that the self is not conscious of this centration. For Piaget (e.g., 1954/1981, p. 28, 41, 1962/2000, p. 244), consciousness of self is by no means primary but is constructed correlatively with the consciousness of other people. In this context, Piaget criticizes Freud's concept of narcissism because it presupposes a consciousness of the self. According to Piaget (1954/1981, p. 38), however, the "infant's primary narcissism is a narcissism without a Narcissus."

According to a third criticism, the concept of egocentrism implies that the infant is initially an asocial being (e.g., Bühler, 1928, p. 180, 1935, p. 76; Meltzoff, 2007; Meltzoff & Brooks, 2001, p. 172). This interpretation conflicts with Piaget's (1951/1995, p. 278) statement that the infant lives in and is affected by the social world from birth. As a matter of fact, Piaget (1954/1981, p. 38, 40) referred to the initially undifferentiated self-other relationship as symbiosis (for similar characterizations, see Merleau-Ponty, 1960/1964, p. 119; Vygotsky, 1998, p. 233; Werner & Kaplan, 1963, p. 42). A symbiotic relationship implies that there is no distance between the infant and other people, and that the infant resonates with the expressions of other people, which may be essential for early social and communicative development.

An important version of the third criticism has been raised by Borke (1978). Borke argued that given that from age 2 to 3 on children show empathy to each other and comfort a playmate who has hurt herself, children at this age cannot be egocentric. It is certainly true that Piaget did not pay attention to the children's empathic behavior. However, as Hoffman (2000, p. 67–71) has shown, empathy itself follows a decentration process, passing through egocentric and quasi-egocentric phases. Furthermore, Borke's criticism fails to notice that egocentrism can reoccur at different stages. It is possible that the emergence of empathic behavior is tied to overcoming the egocentrism of the sensorimotor stage.

Fourth, in his famous and influential criticism Vygotsky (1934/1986) argued, following Bleuler (1912/1951), that autism and the pleasure principle cannot characterize the beginning of development. By placing the autistic stage at the beginning of development and deriving the stage of egocentrism from it, Piaget misconstrues the starting point as well as the further path of development. However, as we have shown, Piaget changed his view of the beginning of development by the mid-1930, and so he could agree with Vygotsky's criticism, while, at the same time, pointing out, that it did not apply to his later theory:

> The main problem raised by Vygotsky is basically that of the adaptive and functional nature of the activities of the child and of every human being. On this point I certainly agree with him in the main; all I have written (after my first five books) on the Origins of Intelligence as the sensory-motor level and on the genesis of logico-mathematical operations through actions

makes it easy for me today to locate the beginnings of thinking in a context of adaptation which has a more and more biological sense (Piaget, 1962/2000, p. 242; see also Piaget, 1951/1995, p. 284).

However, the concept of autism never entirely disappeared from Piaget's work. He acknowledged that "a certain amount of autism is normal for all people" (Piaget, 1962/2000, p. 244), which is reminiscent of Bleuler's (1922/1951, pp. 446–447) statement that everyday thinking is a mixture of autistic and realistic thinking, with autism being the source of imagination. Furthermore, the notion of autism also lingered on in Piaget's theory of symbolic representation, which emerges first in the form of individual and personal images (Piaget, 1945/1962, pp. 68–72; for a critical evaluation see Gillett, 1987; Müller, Sokol, & Overton, 1998). Moreover, the idea that assimilation distorts reality survived in the view that assimilation dominates over accommodation in play (e.g., Piaget, 1945/1962, p. 280; see Kesselring, 1981, for a critical evaluation). In fact, Piaget at times (1945/1962, p. 290) even continued to define egocentrism as a primacy of assimilation over accommodation, which is not the same thing as a lack of differentiation between ego, alter ego, and world. However, both can be reconciled if the thesis that assimilation has more or less primacy over accommodation is replaced by the idea that the assimilation process can be accompanied by more or less accommodation. Improving the accommodation of a cognitive assimilatory process implies improving the differentiation between perspectives (Piaget, 1970/1983, p. 729).

Fifth, the notion of egocentric language was criticized for a number of reasons (see e.g., McCarthy, 1954, 562–570; Schachter, Marquis, Ganger, & McCaffery, 1977). Piaget (1962/2000, p. 247) himself acknowledged that there are methodological issues in assessing egocentric speech. At the same time, he complained that the concept of egocentric speech was not well understood (Piaget, 1962/2000, p. 246):

> But, and this at first sight was surprising though now and with hindsight explicable, all the opponents (and they are legion!) of the notion of egocentrism chose (almost) exclusively to attack the first chapter [of Piaget, 1923/1926] without seeing the connection with the other two and therefore, as I have increasingly come to believe, without understanding the meaning of this notion! One critic, who set out to show that I was wrong, went so far as to take for a criterion of egocentric language the number of propositions in which the child talks about himself, as if one could not talk about oneself in a way that is not egocentric.

Piaget (1962/2000, p. 248) approved of Vygotsky's proposal that egocentric speech marks the transition to inner speech and that egocentric speech has a function for children and is not an accompaniment of behavior, as Piaget himself had argued in his earlier writings. Piaget also agreed with Vygotsky that egocentric speech has a global communicative function, but he pointed out that egocentric and communicative speech are not social to the same extent because even though the intention underlying egocentric speech is social, its effect is not (Piaget, 1962/2000, pp. 248–249; see Sevastyanov, 1989).

The criticisms discussed to this point primarily concern Piaget's early concept of egocentrism (i.e., egocentrism as a stage between autistic and rational thought) and fail to take into account the further development of this concept in Piaget's writing. Kesselring (1981, 1993), however, raised three criticisms that did take into account Piaget's later modifications of the concept.

First, Inhelder and Piaget (1955/1958, p. 353) suggested that egocentrism is a phenomenon that reoccurs at the beginning of each stage because of problems that arise due to the enlargement of the cognitive field that comes with each new stage. Even though an initial phase of egocentrism was identified for the sensorimotor stage, the preoperational stage, and the formal operational stage, there was no stage of egocentrism specified for the stage of concrete operations. Piaget never provided an explanation of why there was no initial phase of egocentrism at the stage of concrete operations (see Kesselring, 1981, p. 168).

Second, egocentrism is defined as an adualistic attitude or a lack of differentiation between an object and the subject's perspective on it, but an adualistic cognitive structure does not necessarily have to be egocentric. This is because a child with an adualistic attitude tends either to attribute the features of objects to her own actions or to project the structure (schemes) of her mental activity into

external objects. Thus, an adualistic attitude often resembles what Piaget (1926/1929) called "realism", namely the cognitive attitude of attributing one's own mental activity to objective reality (i.e., the physical world). Consequently, when a cognitive structure is adualistic, we should not always attribute an egocentric attitude to it. Piaget himself sometimes speaks of "realism" (1926/1929, pp. 33–168), and, in the social domain, moral realism (1932/1965, pp. 109–196). Other relevant concepts in this context are "phenomenism" or "magic-phenomenistic" attitude (of the babies who think that they can induce directly a desired phenomenon: see Piaget, 1937/1954, pp. 229–256) and "animism" – the attribution of mental and emotional capacities to lifeless things (Piaget, 1926/1929, pp. 169–251).

Furthermore, Piaget himself expanded the egocentrism-concept in the 1940s and 1950s by introducing concepts such as "sociocentrism" to refer to an attitude that is biased by the ideology of a group (Piaget, 1951/1995) and centration of perception, action, and/or attention to one aspect or point of a task (Piaget, 1946/1969, pp. 129–130; 1957, p. 52, 63–90; 1975/1985, pp. 84–100; Piaget & Inhelder, 1966/1969, pp. 43–50; see also Montada, 1968, p. 68).

The third of Kesselring's criticisms involves Piaget's (Piaget & Inhelder, 1948/1967, pp. 209–246) use of the term egocentrism in two different senses. The first meaning is that of initial adualism: An egocentric child does not clearly distinguish between different points of view and is unable to deal with spatial, temporal, quantitative, social etc. relations. The second meaning is the inability to coordinate one's own point of view (in social, spatial etc. respects) with those of other people. Piaget did not elucidate the difference between these two meanings. Of course, a child who takes his own point of view as absolute is *a fortiori* unable to coordinate his perspective with those of other people. But a child who fails to coordinate perspectives does not necessarily fail to differentiate between perspectives. Egocentrism in the first sense (i.e., failure to differentiate perspectives) is apparently more pervasive than egocentrism in the second sense (i.e., failure to coordinate perspectives). This is evident in the three mountains experiment of Aebli, Montada, and Schneider (1968). While sitting in front of a model scenery displaying three mountains, many children admitted that a doll sitting at the opposite side of the model would have a different perspective. These children apparently had overcome absolute egocentrism. But instead of pointing at the photograph which corresponded to the doll's point of view, these children pointed at the photograph which corresponded to their own view. Piaget (Piaget & Inhelder, 1948/1967) considered these children as still being egocentric, although they were able to differentiate perspectives.

It is worth noting that from the early 1960s on the notions of *egocentrism* and *decentration* become rare in Piaget's work – probably as a consequence of the fact that in 1962 Piaget became acquainted with Vygotsky's (1934/1986) severe criticism of his early work (see Piaget, 1962/2000). In the 1960s, another theoretical concept became predominant in Piaget's work – the *autoregulation* concept (Piaget 1967/1971). In the 1970s, when Piaget combined the autoregulation concept with his early *equilibrium* theory (1918, 1957), the synthesis of both resulted in his *equilibration* theory (1975/1985), which remained the fundamental theoretical approach in his last publications. In this new theory, the different decentration phases reappeared as different phases in the process of equilibration. In the following, we show that these phases remain tightly connected with decentration mechanism.

2. Egocentrism and equilibration

In this section, we reconceptualize the concept of egocentrism as a substage or phase of a stage-specific decentration process in the context of Piaget's (1975/1985) theory of equilibration. We reconstruct egocentrism in term of three phases, (a) a phase of strict egocentrism, in which the child does not consider different perspectives or relations whatsoever; (b) a second phase of egocentrism in the broader sense, which implies both a distinction between perspectives and a consideration of relations, yet without their coordination, and (c) a third phase of complete decentration that is marked by the coordination of perspectives. We then will outline how the decentration process manifests itself at the four different developmental stages (sensorimotor, preoperational, concrete-operational, formal operational), using examples from the domains of logical, physical, and social cognition to illustrate this process. The different illustrations are not intended to be understood as implying that there is a global decentration process with the implication that children's performance is homogeneous across different areas of functioning. Rather, depending on children's experience, decentration processes may

follow different timetables in different domains (see Kesselring, 1981, 1993, 2009, for a more detailed treatment).

How do these different phases of egocentrism relate to the process of equilibration? In his book on equilibration, Piaget (1975/1985, pp. 53–60) distinguishes between three types of reactions, which he termed α, β, γ, toward new challenges and perturbations. Type α reactions are characterized by ignoring, repressing, or refusing new challenges and perturbations. This strategy is rational as long as the child is unable to overcome the challenges in question. In the *decentration process,* differences, particularly differences between perspectives, are the main sources of conflict. Thus, the phase α in the decentration process represents an attitude which is marked by a tendency to completely ignore other perspectives and any differences bound to these perspectives.

Type β reactions refer to a subject's attempts to respond to the challenges that he confronts. The subject starts to pay attention to differences and to relate things to each other, but he does not yet put the relations themselves into relation with each other. As a consequence, the attempts of confronting challenges are neither systematic nor completely successful. In the decentration process, type β reactions correspond to the ability to consider elementary differences – differences between cognition and reality on the one hand, and between different perspectives on the other – and to the failure to coordinate perspectives.

Finally, type γ reactions are characterized by the coordination of differences and by their integration into the cognitive system, i.e., the subject puts relations into relation with each other. In the decentration process, this corresponds to the ability to coordinate perspectives and integrate them into the given cognitive system.

This integration is due to two corresponding processes: the construction of a new system of cognitive schemes, which, according to Piaget, relies on *reflecting abstraction* (Piaget, 1977/2001) on the one hand, and *equilibration* – the integration, or coordination between newly built up structures and formerly constructed structures, on the other hand. Reflecting abstraction is an elaborative process by means of which the subject discovers the structural aspects of her cognitive activity. For instance, putting marbles, one after the other, in a receptacle is an action with several structural aspects, one of which is based on the creation of a serial order, and another on the creation of a set with a growing number of elements. Piaget (1961/1966) himself stated that understanding the cardinal and ordinal aspects of natural numbers is due to reflective abstraction on the actions involved in building a set. Reflective abstraction leads to a reversal of the direction of consciousness (Piaget, 1936/1952, p. 155, 1950b, p. 78, 1967, p. 1257, 1975/1985, p. 72; see Kesselring, 1981, pp. 69–73, 164), which refers to the fact that the former perspective has been relativized and integrated into a new system of interpersonal, social, spatial and logical relations, which opens up a new and wider perspective. This new perspective, however, is initially, as it were, once again taken to be absolute.

2.1. Sensorimotor intelligence

Piaget (1936/1952) termed the developmental period during the first 18 months of life sensorimotor intelligence. Sensorimotor intelligence is a practical intelligence on the basis of which infants interact with the world through perception–action cycles. Infants employ action schemes like sucking, pushing, hitting, and grasping to explore and manipulate the world. Piaget (1962/2000, p. 243, 1970/1972, p. 21) characterized the developmental changes that occur during the first 18 months as a Copernican Revolution. The newborn has no self-consciousness and no clear awareness of what effects she herself produces through actions on the world, and what effects occur independently of her actions. By coordinating her actions among each other and, in the social domain, with others, the infant gradually learns to distinguish between ego, alter ego, and world. At the completion of the sensorimotor stage, for the infant, his own action is no longer the whole of reality and instead now becomes "one object among others in a space containing them all; and actions are related together through being coordinated by a subject who begins to be aware of himself as the source of actions" (Piaget, 1970/1972, pp. 22–23). The completion of the sensorimotor stage leads the child up to a reflective level, which, in turn, is tied to representational activity (imagery).

Initially, in phase α, the newborn differentiates neither between self and world, nor between self and other persons. For example, the observation that infants do not track objects that leave their visual

field (Piaget, 1937/1954, Obs. 2, 5) indicates that they do not understand that objects move along trajectories that are independent of themselves.

The β-phase emerges between 8 and 12 months with the differentiation between means and ends, which leads to the construction of relations between two objects simultaneously (Piaget, 1936/1952, p. 233). The elaboration of object permanence (i.e., the understanding that objects are located in a stable universe that is independent of the self) makes considerable strides during this phase. For example, infants are able to retrieve entirely hidden objects (Piaget, 1937/1954, Obs. 34–38). But objects are not yet completely independent of the self, and their locations are not yet relative to each other. This is evident in the A-not-B error: Infants search for an object at a location where they previously found it and not at the location where they saw the object disappear (Piaget, 1937/1954, Obs. 39–45). "The object screen is therefore not considered by the child as something with which the hidden object is in relationship: the screen is still perceived as relative to the subject and not as relative to the object" (Piaget, 1937/1954, p. 192).

In phase β, infants also begin to coordinate different appearances of an object. Whereas in phase α the object is something that can be touched, smelled, heard and looked at, there is no systematic coordination between the appearances of the object. As a result, infants will not understand that they are confronted with the same object when the object is rotated in front of their eyes such that only its reverse side is visible. For example, when, at the age of 7- to 8-months, Piaget's son Laurent was presented with his bottle such that the nipple of the bottle was invisible, he did not recognize it (Piaget, 1937/1954, Obs. 78). In order to assign the different appearances to one object, infants must notice that changes of appearances can be manipulated, on one hand, but not in a completely arbitrary way, on the other hand, because there is "something" which partially regulates the order of different appearances. For instance, the appearance of the bottle's nipple can be made to completely disappear by turning the bottle around. By manipulating the positions of the bottle, the infant discovers the regularities or laws underlying the ways in which the appearances of the bottle change. The understanding that the reverse side of the bottle appears when it is rotated by 180° is just one part of this discovery. By systematic explorations, infants learn to differentiate between an object and the state into which it is changed (i.e., the new appearance). As a result, infants realize that an object is independent of its states or appearances. The object is not itself one of those appearances, but the invariant according to which its appearances are related. Using mathematical terminology, a material object can be explained as a function by means of which one appearance can be transformed into another one. Infants start to understand the object as an invariant around 9 months of age (Piaget, 1937/1954, Obs. 78, 78a), but this by no means signals that the construction of the object has been completed. Rather, it is not until the second year of life that infants overcome the A-not-B error, and they do not succeed in object permanence tasks in which the object is invisibly displaced until the second half of their second year of life (Piaget, 1937/1954).

Another aspect of the β-phase concerns the infants' understanding of space. Infants' actions are organized in simple reversible groups such as hiding an object under a screen and retrieving it (Piaget, 1937/1954, Obs. 85). However, the spatial groups at this level remain midway between subjective and objective groups because infants cannot yet understand relations that are completely independent of their actions. The infant "does not yet recognize positions and displacements as being relative to one another, but only as relative to himself" (Piaget, 1937/1954, p. 183).

With respect to social development, the transition from the α- to the β-phase is illustrated by infants' understanding that the body of another person is an independent source of causal activity. As a consequence, infants act on someone else's body, not as an inert matter that is merely extending their own action but by releasing the activity of the other body through a discreet pressure (e.g., a mere touch, Piaget, 1937/1954, p. 262). At the same time, a number of different joint attention behaviors emerge. Joint attention behaviours involve the coordination of attention between the infant, another person, and an object. For example, following the pointing gesture or direction of gaze of another person requires that the infant coordinates her own attention with that of another person toward the world (Hobson, 2002; Tomasello, 1999). Joint attention behaviour requires that infants construct relations between themselves and another object that is partially independent of their own direct-edness. For example, in order to understand that another person's pointing gesture singles out an object or event in the world, the infant needs to grasp that the other person is directed toward the

world in a way that is partly independent of the infant's own directedness. Indeed, 8-month-old infants seem to fail to grasp this because they remain focused on the outstretched pointing finger of the other person and do not displace their gaze to the target object (Morissette, Ricard, & Décarie, 1995). But even after the emergence of joint attention behaviours, there are initially still indications that the understanding of the directedness of another person retains a subjective quality. For example, twelve-month-old infants are not able to follow the gaze of another person if the target of the other person's attention is not the first object along their scan path (Morissette et al., 1995).

Finally, at the end of the sensorimotor stage, infants start to take an external perspective on themselves, which is integral to the γ-phase. The ability to take an external perspective on the self is manifest in mirror self-recognition (see Case, 1991; Hoffman, 2000; Lewis, 1992). In order to recognize herself in the mirror, the infant must relate her own embodied, active center to the external, visually displayed body in the mirror. In other words, infant's active, immediate stance toward the world is broken and "reflected" by an external perspective. As a consequence, the infant is able to understand herself simultaneously as agent (looking) and as recipient (being looked at).

The ability to take an external perspective on oneself also manifests itself in different types of new behavior. First, the infant shows empathic behavior, which empirically is closely related to self-recognition in the mirror (e.g., Bischof-Köhler, 1989, 1991; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992). Empathic behavior presupposes that children do not immediately react to the other but rather take the attitude of the other and act accordingly: They consider their own behavior, reflected by the attitude of the other, and are able to comfort the other person if she is hurt. Second, the infant is capable of taking an external perspective toward the self and showing reciprocal collaborative activities that develop at the end of the second and in the third year of life. For example, 2-year-olds are able to master joint problem solving tasks by coordinating complementary roles both spatially and temporally (e.g., Brownell & Carriger, 1990). Whereas in collaborative imitation the agent–recipient roles can be sequentially coordinated ("I give, you take" and then "you give, I take"), in joint problem solving tasks both partners have different and complementary roles (e.g., "My action x is a function of your action y, as your action y is a function of my action x") which leads to a differentiation and coordination of agent–recipient roles for self and other. The flexible coordination of agent-recipient relations likely underlies the emergence of basic visual perspective taking abilities (e.g., Lempers, Flavell, & Flavell, 1977). For example, a two-year-old who is looking at a picture book and asks another person, "What's that?" while pointing to a picture, may understand that the other person who is seated in such a way that her visual access to the picture book is obstructed, may not see the picture. Equipped with these rudimentary visual perspective taking abilities, the two year-old may get up and show the picture to the other person (even though not necessarily in the correct spatial orientation).

2.2. Preoperational stage

The emergence of the scheme of the permanent object provides evidence that a new cognitive function has emerged, namely the semiotic function. The semiotic function consists of differentiated signifier–signified systems, which, in turn, are a prerequisite for symbolic representation. The semiotic function underlies children's abilities to engage in a number of different activities, such as deferred imitation (i.e., imitation in the absence of the model), pretend play, drawing, psychological functions based on mental images (e.g., recall memory), and language. These activities are practiced and refined during the level of preconceptual thought (approximately 2–4 years of age) (Piaget, 1945/1962, pp. 221–244).

The semiotic function advances cognition in a number of respects. Owing to the semiotic function, cognition (a) transcends the immediate here and now, (b) becomes capable of referring to absent objects and/or states of affair, (c) becomes able to use words, symbols (e.g., in pretend play, Piaget, 1945/1962) and external representations (e.g., pictures, photographs; DeLoache, 2004), (d) becomes concerned with truth, and no longer just with practical success – however, an explicit concept of truth arises later, at the stage of concrete operations – and (e) becomes subject to the influence of social factors in a qualitatively new way (Piaget, 1937/1954, pp. 361–364; 1945/1962, pp. 238–240; 1947/1976, pp. 120–122).

At the same time, preoperational thought is characterized by profound cognitive limitations. These limitations are partly due to the fact that the development of the semiotic function requires that the practical concepts of object, space, causality, and time that had been constructed and only practically understood at the sensorimotor stage be reconstructed on a new symbolic–representational plane.

At the level of preoperational thinking, the initial α -phase is characterized by a new kind of adualism in the logical, numerical and social domain: For instance, a child in the α -phase might say, "Mary is small and John is tall", but does not yet state, "Mary is smaller than John" or "John is taller than Mary" (Piaget & Inhelder, 1966/1969, pp. 89–90). The child also lacks the ability to grasp the difference between individual and general concepts. For example, when Piaget's daughter Jacqueline was 31 months old, she cried, upon seeing a slug, "There it is!" When she saw another slug a few yards further she said, "There's the slug again" (Piaget, 1945/1962, Obs. 107). Concepts thus remain midway between the generality of the concept and the individuality of elements composing it. Similarly, when the child happens to observe a sunrise abroad, with a skyline she is not acquainted with, she is not sure whether the sun is the same as she knows from home (Piaget, 1945/1962, Obs. 130).

In the social domain, the child differentiates between what she and another person sees and understands that another person's attentional directedness may be different than hers, but she does not differentiate between how she feels about or sees things, and how another person feels about and sees things. Thus, once again, the child lacks coordination of different perspectives. The consequences of this limitation can be noticed in many different contexts. For example, when a two-year-old observed a playmate hurting himself, she comforted him by offering him her own doll or by getting her own mother, even though the playmate had his own doll, and even though his mother was present (Hoffman, 2000, p. 70).

Another example involves the hide-and seek game. A 3-year-old child may not understand the logic of the game of hide and seek. To illustrate, take the case of the 3-year old son Theo of the developmental psychologist Heinz Wimmer:

> Heinz is hiding in the pantry. After some searching Theo finds him. Heinz asks, "How did you know I was in here?" to which Theo answers, "Because I opened the door." Then it is Theo's turn to hide. Right in front of Heinz (!) he "hides" in the pantry. Heinz plays along and calls out, "Where are you?" Theo giggles and answers, "in the pantry." (Perner, 1991, p. 153)

Similarly, preschool children do not understand the concepts of secret or surprise. For example, a 3-year-old may say, "Mum, to your anniversary I have a surprise for you, you know, it's an embroidered napkin!" (see Peskin & Ardino, 2003).

In phase β, children are able to handle distinctions (Piaget, 1937/1954, p. 373, 1945/1962, Obs. 107, 108), but fail to coordinate them. Thus, they may hold that Mary is *smaller* than John, but they confound tallness with age and do not understand that one person may be taller but nevertheless younger than the other (Piaget, 1946/1969, pp. 219–250). Children fail to make transitive inferences: Provided with a number of coloured sticks, they may ascertain that "*the green one is shorter than the red one*", and thereafter, that "*the blue one is shorter than the green one*", but they are unable to conclude that the blue one is shorter than the red one, too. Moreover, they do not succeed in ordering 12 wooden sticks which differ slightly in length: They arrange a small group of three or four sticks according to length, but remain unable to order the whole set of sticks according to length (Piaget, 1941/1952, pp. 122–157).

In the social domain, children in the β-phase will make a distinction between how they see an object (a turtle upside-down) and how another person, positioned directly opposite to the child, will see the same object (right side up; Flavell, 1992); thus, the child will now take simple spatial orientations into account (see also Hobson, 1980). The child now will also differentiate between her own and another person's understanding of a situation (i.e., the child will demonstrate false belief understanding). For example, the child will correctly predict that another person, who saw an object being placed at location A, and who is ignorant to the subsequent transferal of this object to location B, will search for the object at location A, even though the child herself knows that the object is at location B (Wimmer & Perner, 1983).

In these perspective taking tasks – currently often referred to as "Theory of Mind" tasks – the child differentiates between her own and another person's perspective by constructing spatial relations between the other person and an object (turtle task) or temporal relations between another person and

different contexts (false belief task). In the turtle task, the child needs to realize that the internal features of the object (its top and bottom) appear reversed to another person seated opposite to herself. In the false belief task, the child needs to understand that the other person's knowledge of the object's whereabouts is limited to the previous location (i.e., before the transfer of the object) and does not incorporate information about the current location of the object. Piaget himself (1932/1965, pp. 29–50) described a similar failure to integrate perspectives in the context of preschoolers' games with rules. Preschoolers hold the rules of the games for sacrosanct, but they do not understand their purpose, for this would presuppose the integration of the perspectives of the different players. As a consequence, preschoolers think that, once the game is over, everybody won, as if winning and enjoying oneself were synonymous.

Children in the β-phase also fail to understand the rules that apply to spatial reference systems. This difficulty is manifest in preoperational children's coordination of left-right orientations. A 4- to 5-year-old who is sitting in front of another person may be perfectly able to imagine what it is like to sit at that person's place, but she is not yet able to coordinate left and right in a system of spatial relations involving two persons, one sitting opposite to the other (Piaget, 1924/1972, pp. 98–101; Piaget & Inhelder, 1948/1967; see also Cox, 1978). To overcome this difficulty, she has to imagine the whole situation from an overarching perspective by constructing relations (left-right with respect to one's own body) between relations (left-right with respect to another person's body). This ability as well as the more difficult abilities to coordinate two spatial, social, or logical relations in general, presupposes a second order representation, the realization of which marks the onset of phase γ (see Kesselring, 1993, 2009).

The construction of spatial reference systems is even more complex if the system does not contain just one object but several objects which can be regarded from different perspectives (or in different positions). This is because spatial reference systems not only require the coordination of relations between the object and its observer(s); rather, in addition, they require the coordination of the relations between relations that hold between different objects. An example of the complex demands involved here is the reproduction of the horizontal and vertical lines in a drawing. When a 5-year-old is shown a tilted bottle, half filled with water, and asked to mark the water surface in a drawing of the tilted bottle, she will not be able to do it correctly. Many children draw the water surface right-angled to the walls of the bottle. Similarly, a chimney on an oblique roof and trees on a mountain slope are drawn rectangular to the roof or mountain slope (Piaget & Inhelder 1948/1967, pp. 375–418).

A final example that illustrates the ability to put relations into relations with each other comes from the domain of social understanding. Specifically, around 7-years of age children acquire what has been termed an interpretive understanding of mind, which becomes manifest in the understanding that two people may come to different conclusions about the meaning of an abstract painting (Carpendale & Chandler, 1996; Chandler & Lalonde, 1996). The interpretive understanding of mind goes beyond simple false belief understanding. Whereas false belief understanding requires the understanding that differences in the amount of information are linked to different actions, the interpretive understanding of mind requires that different beliefs about a situation can result between parties that are privy to the *same* information (Carpendale & Chandler, 1996). Thus, the different interpretations must be subsumed to the same configuration and must be related to each other as equally valid with respect of the information supplied in this situation. This task requires the coordination of both interpretations within an overarching system that comprises them both.

2.3. Concrete operations

The main feature of concrete operations is higher level conceptual and operational thinking. It emerges at age 7 to 8 and begins to be overlaid by formal operational thinking by age 11 to 12. Whereas in preoperational thinking signs refer only to material objects, acts and events (or imagined ones), at the level of concrete operations they refer to notions, mental entities (like sets and natural numbers) and to operational schemes.

Piaget did not observe any behaviour indicative of an initial egocentrism at the beginning of the concrete-operational level. Quite to the contrary, according to Piaget (1923/1926, 1924/1972) the onset

of concrete-operations signals that the thinking and reasoning of the child become logical and social. In the social domain, playing games according to rules promotes the development of perspective taking (Piaget, 1932/1965, pp. 84–100), the acquisition of the attitude of mutual respect, and the understanding of the *Golden Rule* ("Don't do to others what you don't want that the others do to you"; see Piaget, 1932/1965, pp. 395–406).

Moving beyond Piaget, we propose that a kind of centration occurs also at the level of concrete operations (see Kesselring, 2009). This egocentrism manifests itself in the cognitive domain as a centration on *given things* (natural numbers instead of negative and/or rational numbers), and in the social and moral domain in the child's focus on the small group of persons he lives with. We use the development of number (Piaget, 1941/1952) and time (Piaget, 1946/1969) to illustrate the cognitive centrations (see Kesselring, 1993).

When a child enters primary school, he or she masters counting and knows what a number is, but confounds numbers and sets of objects. The basic type of number is called natural number because it can be represented by a set of material ("natural") objects. Operating with natural numbers opens up a new domain with its own types of relations. These need to be constructed and then coordinated with each other. The most elementary types of numerical relations are *differences* (the difference between 5 and 3 is 2) and *ratios* (the ratio between 12 and 3 is 4). The concept of *difference* can be explained by addition (when $n + 4 = m$, then 4 is the *difference* between m and n), and the *ratio* concept can be explained by multiplication (if $4 \times n = m$, then 4 is the *ratio* between m and n).

In phase α, a natural number is considered to be an *object set*. The number 12, for instance, is exemplified by a dozen marbles, or by the set of the months or apostles. Therefore, the inversion of numerical operations is not yet well understood. If we invert an addition or a multiplication, then in some cases we get a natural number ($8–7 = 1$, and $12: 4 = 3$), but there are many other cases in which this does not occur. What is the result of 7–8 or of 4:12? A child in phase α is not bothered by this question, for she is not yet interested in inverting numerical operations. This changes, however, in phase β, when the child enters the domains of (small) negative numbers and fractions. From now on, the relational aspect of numbers becomes apparent and predominant. That is why from then on the number 0 and negative numbers are understood as numbers, too, but numbers which no longer are exclusively bound to the concrete instantiation in object sets (or their figurative representation). The child begins to explore relations between numerical relations and thus discovers proportionality. Yet, proportionality remains an empirical concept because the child is unable to generalize the relations between numerical relations. As a result, the child is not able to explain the principle of proportionality: $a/b = c/d$. He understands that $4/12 = 1/3$, but does not always succeed when asked to extrapolate: 5/15, 6/18, 8/24, etc. Thus, the so called "scheme of proportionality" is still lacking. Furthermore, children fail in handling large numbers and do not understand what irrational and infinite numbers are.

Finally, in phase γ, children succeed in coordinating numerical differences and relations (ratios) whatsoever and are able to handle the relation between two quotients v/x and y/z – a relation of the second degree. Only then do they really grasp the concept of proportionality, which represents an elaborated version of invariance, related to several modes of reversibility: The equation $a/b = c/d$ can be inverted in many different ways; $b/a = d/c$; or $a/c = b/d$; or $d/b = c/a$, etc. If invariant, this relation stands for *proportionality*; if it varies, it represents a *(mathematical) function*.

The inability of children in phase α to handle proportionality influences their comprehension of the concept of time. They confound the angle covered by the hands of the clock with the duration these stand for, and they think we "see" the passing of time when we look at the movement of the hands of a clock. They do not yet distinguish clearly between the spatial character of the dial-plate and the non spatial character of time. In phase β, this distinction becomes clearer, and time is no longer confounded with movement or with the angle covered by the hands of a watch. This differentiation is a necessary condition for elaborating the idea of proportionality. The absence of the proportionality scheme explains why the child does not realize that in measurement the underlying unit must be invariant. It also explains why the child neither has a good grasp of temporal regularity, nor any understanding of the assumptions underlying measurement. Instead, the child believes that if she claps her hands quickly, then time will run fast, and if she claps her hands slowly, then time will run slowly (Piaget

1946/1969, pp. 129–130). In addition, the child is not able to compare the velocities of different moving objects (e.g., a car and a train), if these objects do not move simultaneously nor with the same velocity. These problems are not mastered until phase β, when the child learns to integrate the two movements in the same temporal-spatial reference system, conserving the temporal and spatial units (Piaget, 1946/1970, pp. 225–252). And when we ask a child to make, on a piece of paper, one dot per second (to the beat of a metronome) for a duration of 30 s, she believes that the number of dots she puts down depends on the instrument with which time is measured. If she knows that she makes thirty dots during the 30-s interval when the interval is measured using a watch, she does not know how many dots she will make when the 30-s interval is measured using a sand glass (Piaget, 1946/1969, pp. 200–205).

Piaget explained the construction of time concept in a way similar to that of natural numbers. The series of natural numbers is a synthesis of ordering (first, second, third, etc.) and constructing sets of elements (cardinal aspect of the number). Similarly, time is a synthesis of two aspects – sequence of events and duration. But in contrast to natural numbers (or spatial extension), time cannot be illustrated with the help of object sets, and time has no constant natural unit. Who guarantees that the hands of a clock run really regularly? We simply *assume* that our most precise clocks and watches *are* regular. If, however, the movement of all regular clocks and all physical movements were accelerated in the same way, then we would not notice it (Piaget, 1946/1969, p. 76). Because the concept of time is more abstract than that of natural numbers, children begin to understand time measurement only in phase β and master it completely only in phase γ, whereas they succeed in handling natural numbers already in phase α.

In the social and moral domain, the concrete-operational child understands that a rule is based on the mutual expectations of the members of a group. This mental attitude, however, can lead to a centration on the group of friends or peers with whom the child likes to play, cooperate, and exchange ideas (Lickona, 1983, chap. 9). We may imagine a mafia group the members of which respect each other and cooperate successfully but commit crimes against people who do not belong to the group. Such behaviour usually counts as being amoral. In Kohlberg's theory (1981, 1984), the difference between a group morality and a morality related to society as a whole is manifest in his distinction between levels 3 and 4. Reflection on human rights takes place only on the postconventional level (i.e., after level 4). For establishing criteria of a moral norm applicable to the larger society, it is worthwhile to refer to *human rights*.

2.4. Formal operations

At the level of formal operations, children exhibit the ability to reason in a hypothetico-deductive fashion, and thus, to subordinate reality to possibility. At phase α, adolescents do not sufficiently differentiate between the level of hypotheses and the level of fact. For example, adolescents may generate all possible solutions for a problem, but they are not able to work out the implications of these different possibilities for empirical testing (Müller, Sokol, & Overton, 1999). At phase β, adolescents start to confront the hypotheses with empirical tests, but the experiments they design to test the hypotheses are not yet completely systematic (Inhelder & Piaget, 1955/1958, pp. 73–75). At phase γ, the testing of hypotheses and searching for the relevant causal factors become systematic (Inhelder & Piaget, 1955/1958, pp. 75–76).

The level of formal operations coincides with the period during which adolescents enter the adult community. At the beginning of this level, they do not have any realistic plans for their own future. When they start arranging their relation to adult society, they tend to overvalue their own significance (phase α). As Piaget (Inhelder & Piaget, 1955/1958, pp. 340–341) observed, many adolescents behave like messianists, thereby displaying a behaviour that is typical of an egocentric attitude. Thereafter, they enthusiastically promote socially important goals, such as justice, protection of the environment etc. But at the same time, their behavior is often inconsistent with these goals (phase β). For instance, they help cleaning a brook, but leave their own litter at the banks of the brooks. Acting in adult society presupposes consistency between one's thoughts and actions – something which even most adults do not have at their disposal.

3. Conclusion

In this paper, we traced the origin and changes in Piaget's concept of egocentrism. We examined a number of criticisms of this concept, and, in part, in response to these criticisms, suggested a reconceptualization of the concept of egocentrism. Specifically, we distinguished between two types of egocentrism that are part of decentration process that itself consists of three phases and is recapitulated at each of the four different stages.

We mentioned that previous empirically-grounded criticism of the concept of egocentrism mostly focused on preschoolers' perspective taking abilities. According to these criticisms, Piaget underestimated these abilities (e.g., Light, 1983; Newcombe & Huttenlocher, 1992). However, based on our reconceptualization of the concept of egocentrism it is important that future research on perspective taking takes into account the stages and phases of the decentration process. The empirically based criticisms of Piaget's concept of egocentrism mostly failed to do this (in addition to suffering from methodological problems, see Waters & Tinsley, 1985). We acknowledge that task demands and information-processing requirements may additionally impact children's performance on perspective taking tasks (Flavell, 1992; Hobson, 1980; Kesselring, 1993).

Finally, Piaget's concept of egocentrism goes beyond simple social perspective taking, to which it lately has been reduced. Rather, egocentrism has cognitive and affective aspects. In this paper, we have focused on the cognitive aspect; clearly, the affective aspect needs to be further elaborated. Furthermore, egocentrism refers to the lack of making distinctions and constructing relations. The decentration process, therefore, is constituted by the systematic construction of logical, numeric, spacial and social relations – relations whatsoever –, which is consistent with Piaget's claim that "The logic of relations is immanent in all intellectual activity; every perception and every conception are the making of relationships" (Piaget, 1937/1954, p. 209).

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