FROM THOUGHT TO LANGUAGE TO THOUGHT: TOWARDS A DIALECTICAL PICTURE OF THE DEVELOPMENT OF THINKING AND SPEAKING

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> *In both the evolution of thought in the history of mankind, and the evolution of thought in an individual, there is a stage at which there is no thought followed by a subsequent stage at which there is thought. To describe the emergence of thought would be to describe the process which leads from the first to the second of these stages. What we lack is a satisfactory vocabulary for describing the intermediate steps (…). That means there is a perhaps insuperable problem in giving a full description of the emergence of thought. I am thankful that I am not in the field of developmental psychology!*
>
> (Davidson 1999, 11)

Summary

Lingualism claims there is no thought without language. At the other end of the theoretical spectrum, strong nativist 'Language of Thought' theories hold that public language is inessential to private thought. For an adequate empirical description of the ontogeny of thought and language, however, we need an intermediate position recognizing the dialectical interplay between pre-linguistic thought, language acquisition and the development of full-fledged linguistic reason. In this article recent findings from developmental and comparative psychology are reviewed that highlight the need for such a dialectical picture. These findings concern basic cognitive capacities common to pre-linguistic infants and many non-linguistic animals, specific social-cognitive abilities in human infants that enable language acquisition, and the influence of language on the subsequent cognitive development.

1. *Introduction*

Developmental and comparative psychologists try to earn their living by struggling to describe the emergence of thought and language in evolu-

tion and ontogeny. The project is to characterize the development from non-minds via half-formed minds to proper minds. Philosophy can be quite obstructive to this project—when it takes the form of either of two radical positions. *Lingualism* denies the intelligibility of any kind of thought whatsoever in the absence of language. There just are no half-formed minds, according to this position. There are purely differential responses on the one hand, to be described physically, and full-fledged linguistic thoughts on the other hand, to be described rationally, and nothing worthy of the label 'cognitive' in between (e.g., Brandom 1994; Davidson 1982, 1999). With no middle-ground between the differential responses of rusting iron to humidity here, and the full-blown discursive rationality of adults there, describing the emergence of thought amounts to unravelling the one big mystery how language, and with it thought, emerges out of mindless responses.

Language of thought (LOT) theories (Fodor 1975), in contrast, do not see any substantial role for natural language to play in thinking. According to this position, all thought is manipulation of internal private symbols in an innately specified *lingua mentis*. Natural languages are mere transcriptions of private thoughts, and so acquiring a language in ontogeny does not categorically affect cognitive abilities. In terms of phylogeny, humans share the language of thought with many other species. What makes them cognitively unique is just that their LOT vocabulary happens to be bigger, and that they happen to have a language module that allows for the public exchange of ideas.

Both radical positions are deeply unsatisfying for the purposes of describing the development of thought. Language of thought theories essentially neglect the role, both conceptual and empirical, of discursive practices in the shaping of full-fledged adult rationality. Lingualism, on the other hand, 'over-intellectualizes the mind' (Hurley 2001), rejecting all talk of non-linguistic animal and infant rationality as mere metaphor, and thus flies in the face of perfectly fine common sense and scientific explanatory practices. Developmental and comparative psychology are just elaborated extensions of our common sense folk psychology; as, arguably, is all psychology. And while folk psychology's notion of thinking, as lingualists stress, is probably in a Sellarsian sense modelled on language (in particular, on thinking aloud), this does not mean that thinking and speaking are conceived of as basically identical. Folk psychology seems clearly committed to a deep cognitive realism regarding different animals as well as different stages of humans, to a continuum of cognitive abili-

ties that implies the falsity of the lingualists' drastic dichotomy—eliminativism or fictionalism regarding non-linguistic creatures, but realism regarding speaking creatures. Common sense surely does not have the last word here, but it does have the first, and deviating from this commitment, I surmise, puts the burden of argument on the eliminativist. Not surprisingly, none of the arguments for lingualism presented so far, such as the argument from the holism of the mental, or the argument from the premise that belief requires the concept of belief, which requires language (Davidson 1982), has been met with much enthusiasm in developmental psychology, or common sense (see, e.g., Bermúdez 2003; Glock 2000).

In a similar vein, from a psychological point of view, the ability to speak a language itself must not be taken as a primitive, but stands in need of explanation. Such an explanatory project might not sit well with philosophical accounts picturing language acquisition as a mere conditioning process. (Think, for example, of Wittgenstein when he talks about 'Abrichten', or of Davidson and Sellars in their more behaviouristic-sounding passages.) No question, parrots can be conditioned to parrot. But parroting is a far cry from speaking; and from the empirical point of view of comparative psychology, one of the most impressive findings in recent decades has been how pathetically even human-raised chimpanzees perform in language learning (e.g., Rivas 2005).

From a psychological perspective, then, what we need for describing the emergence and development of thought is a *dialectical* picture that—much in the spirit of Vygotsky (1934/1986)—meets the following desiderata: (a) It does justice to the possibility and existence of non-linguistic cognition in both animals and pre-linguistic humans. (b) It acknowledges specific, uniquely human cognitive abilities as part of the basis of language acquisition, while (c) at the same time recognizing the ways speaking enables, shapes and transforms thinking of very special kinds. In what follows, I will review recent empirical findings from developmental and comparative research to highlight and illustrate the building blocks from which such a picture could be pieced together.

Different ways of thought with and without language should be distinguished for this purpose. First of all, while the philosophical disputes naturally centre around the question whether and to what degree language is *constitutive* of thinking, the psychological side of it, upon which I will focus, is more concerned with the less demanding question whether and to what degree language is *empirically necessary* for certain kinds of thought

and behaviour. Let me distinguish three ways we might talk about thought without language:

(i)   Thinking without speaking any language at all.

(ii)   Thinking about a domain D without (dispositionally) having the requisite explicit vocabulary to talk about D.

(iii) Thinking about a domain D without thinking aloud or (occurrently) speaking subliminally with the requisite vocabulary about D.

(iii) is an interesting topic both phenomenologically (see, e.g., Dennett 1991, on language as a Joycean consciousness machine) and in cognitive psychology dealing with the role of (subliminal) speaking in online-thinking (see, e.g., Spelke 2003).

(i) pertains to animals and pre-verbal infants, (ii) to older children who do speak, but whose explicit linguistic abilities in a given domain lag behind their non-linguistic cognitive abilities. Different theories regarding thought and language emphasize or deny the possibility of (i) or (ii). For example, Davidson's lingualism is officially not concerned with (ii), but only with (i): 'Language, that is, communication with others, is thus essential to propositional talk. This is not because it is necessary to have the word to express a thought (for it is not); it is because the ground of the sense of objectivity is intersubjectivity.' (1994, 234)

In this paper, I will mainly be concerned with (i) in the case of animals and very young children, and with (ii) in the case of older children who do have some command of language, but a very rudimentary one, lagging behind their systematicity in nonverbal action.

In the following, I will first review findings of common cognitive abilities in non-linguistic animals and pre-verbal infants that are best described as simple forms of thinking without words. The second part deals with specifically human cognitive foundations of the emergence of language and culture. These foundations are to be found in uniquely human social cognitive abilities of understanding one another as intentional beings and of entering into shared or collective 'we' intentionality. Once children have acquired a language and participate in cultural practices, however, individual cognitive abilities get radically re-shaped and transformed; this will be the topic of the third part. Finally, in the last section I will try to explore the implications of these findings for a comprehensive picture of the dialectical developmental of thought and language.

2. *The roots of non-linguistic cognition in animals and infants*

Piaget (1952) set the scene for work on the roots of non-linguistic thought in infancy. His and much subsequent research focused on the early development of intentionality in perception and goal-directed action. In these areas, recent comparative psychology has found striking parallels in the cognitive developments of pre-verbal infants and other animal species: both infants and other animals, notably primates, perceive and segment the world around them with a (proto-conceptual[1]) grasp of such basic categories as objects, numerical identity, relations, space, and themselves; they use this grasp in simple forms of instrumental reasoning and inferences, and they act goal-directedly and solve problems in flexible, insightful and creative ways, often involving the use of tools.[2]

To illustrate these common cognitive abilities, let me focus on two philosophically relevant domains: the most basic forms of objective thought, namely object cognition; and the most basic form of practical rationality, namely goal-directed action.

2.1 *Object cognition*

All thinking requires a minimal notion of objectivity: an at least implicit distinction between things perceived and the perceiver, and some sensitivity to the fact that things persist unperceived. The positing of objects, or reification, can be seen as the most basic form of objective thought.

Following philosophical tradition (Strawson 1959), let us distinguish three kinds of object perception and cognition:[3] (a) mere *feature placing*, (b) *spatio-temporal tracking of physical bodies*, and (c) full-blown *sortal object individuation. Feature placing*, on a wide reading ('Lo! Redness!', 'Raining'), is involved in all kinds of sensory receptivity and does not necessarily involve any kind of positing of persisting individuals. *Spatio-temporal tracking of physical bodies,* in contrast, is the most basic form of reification. Here the world is segmented into non-overlapping, bounded bodies that move cohesively and continuously through space and

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1. I follow much philosophical and psychological writing in calling such pre-linguistic cognitive abilities 'proto-conceptual'. In the final section I will briefly turn to the question what that might actually mean.
2. For a comprehensive review, see Tomasello & Call (1997).
3. For an excellent review of philosophical and psychological approaches to these kinds of object cognition see Clark (2004).

time.[4] Though this does not yet supply full individuation under sortals, it does supply some primitive criteria for persistence and countability (Xu 1997). Piaget was the first to study this kind of object tracking, dubbed 'object permanence', in infancy. In manual search behaviour, the simplest form of object permanence appears around 8 months of age. While younger infants would not care about objects that disappear behind an occluder ('out of sight, out of mind'), from this age on, infants actively search behind the occluder and try to remove it—which is plausibly interpreted as an awareness that the object must still be there.[5] While this form of object permanence is still limited in some respects, at around 18 months infants master full object permanence: they now track physical bodies even when their movements are not directly perceivable. In the classic so-called 'invisible displacement task', the infant sees an object disappear in a small container A, which is then subsequently moved into the bigger containers B and C, and finally taken out again. Younger infants tend to randomly search at one location and then give up, while infants from 18 months systematically search all three containers. This is standardly interpreted in the following way: infants track the physical body, even when its displacement is not directly visible, making use of a primitive sense of necessity and reasoning from a negated disjunct: 'It is in either A, B, or C. If it is not in A, then it must be in B or C'.[6]

Research with non-human animals has revealed that many species, including cats, dogs, and monkeys, reach the stage of simple object permanence appearing in human ontogeny around 8 months. The great apes, furthermore, reach the stage of full object permanence mastered by children at 18 months.[7]

Merely tracking physical bodies, however, falls short of providing a full-fledged schema for individuating objects in the proper sense (see Wiggins 1997). Mere spatio-temporal tracking of bodies does not allow a distinction between an A (say, a piece of clay) disappearing and then a B

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4. These have been called 'Spelke objects' in developmental psychology, and 'proto-objects' in research on visual attention (see, e.g., Pylyshyn 2000).

5. Subsequent research with so-called habituation measures has revealed even much earlier sensitivity to object permanence; see, e.g., Baillargeon (1987).

6. Additional evidence for such an interpretation comes from a recent study showing that children (some years older, though) increase their speed of searching as more alternatives become excluded, i.e. when moving from the first to the second to the third container (Watson et al., 2001). For more work on reasoning from negated disjuncts in apes, see Call (2004). For a philosophical treatment of this form of reasoning in non-linguistic creatures, see Glock (2000).

7. For a review, see Tomasello & Call (1997).

(say, a statue made of clay) appearing, and the same A disappearing and re-appearing. Sortal concepts are needed for such distinctions regarding numerical identity ('Is it the same A?') and full-fledged object individuation. In the case of language users we have clear criteria for mastery of sortal concepts, namely use of count nouns and identity statements. But what about pre-verbal analogues to such conceptual abilities?

Recent studies have once more used looking time and search behaviour as an index of such pre-verbal analogues. When young infants see two objects simultaneously disappear in a box and then only find one, they continue searching. This just requires object permanence and can be done based on mere spatio-temporal criteria. In a crucial variation supposed to tap proto-sortal individuation, however, infants saw an A disappear in a box, then a B appear from the box and disappear again, and then only found one object. Purely spatio-temporal information is of no help here, as it does not specify criteria of identity and distinctness. Younger infants, though capable of object permanence and mastering the spatio-temporal version, fail the proto-sortal version (Xu & Carey 1996; van de Walle et al. 2000).[8] Only from around 10-12 months do infants begin to master the latter, and such mastery has been found to be correlated with language comprehension (Xu & Carey 1996).

These findings lend *prima facie* support to the idea, popular in philosophy (e.g., Quine 1974), that reification comes with language and is therefore uniquely human (Xu 2002). However, subsequent research with non-human primates has documented analogous cognitive abilities in non-linguistic creatures. Both monkeys and apes perform in exactly the same way as human one-year-olds in spatio-temporal and proto-sortal individuation tasks (Mendes, Rakoczy & Call 2008; Phillips & Santos 2007).

In sum, pre-linguistic infants and non-linguistic animals share with mature thinkers the basic roots of objective thought—the ability to track and individuate objects persisting 'out there' independently of being perceived. They use such abilities in systematic and flexible ways in simple forms of reasoning, e.g., in reasoning from negated disjuncts.

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8. It might be objected that this task does not require (proto-)sortal object individuation but just sophisticated feature-placing. Infants see A-features and B-features, but then only find A-features and thus look for the missing B-features. Empirically, this does not seem plausible. Infants in such tasks do not take into account just any property differences between objects. In particular, they have been found to disregard property differences within, but not across kinds, which indirectly suggest that they track the object as of a certain kind and not just as bundles of properties (e.g., Xu, Carey & Quint 2005).

Another prerequisite for objective thought is some rudimentary aware-ness of oneself as an object in space (Strawson 1959). Again we have clear criteria in speaking creatures such as the use of personal pronouns etc., but what could count as a pre-/non-verbal indicator of some such rudimentary awareness in non-linguistic animals? The non-linguistic task standardly employed in developmental and comparative psychology is the so-called 'mirror rouge' task (Gallup 1970). A mark of rouge is surreptitiously applied to the infant's/animal's forehead (infants are distracted, animals often narcotised), and then the subject is placed in front of a mirror. Touching one's own face to remove the mark is interpreted as an indicator of some rudimentary awareness of oneself as an object in space, the 'Me' in the sense of James and Mead. While younger infants and most other species, including monkeys consistently fail the task and treat the mirror image like a conspecific, infants from around 18 months begin to master this task, and great apes have been shown to succeed. (See Tomasello & Call 1997, for an overview.)

2.2 *Goal-directed action and practical rationality*

Infants and many animals do not just sensorily register features. They also perceive, track and reason about individuals, themselves among them. What is more, infants and many animals do not just behave in response to stimulation, such as iron rusts in response to humidity, but act intention-ally. Again, while we have clear criteria for intentional action in speaking creatures, think of: expressions of intentions; non-inferential descriptions of what one is doing; explicit practical inferences; statements about success and failure etc. How do we know this in creatures without language? How do we distinguish mere silent behaviour from silent action? Common sense folk psychology supplies us with an explanatory practice that has a set of rather clear indicators for silent action, indicators that developmental and com-parative psychology as sophisticated common sense have inherited. Here, flexibility and generativity, sensitivity to means-ends structures, hierarchi-cal and sequential behaviour organization, persistence and signs of (non-) fulfilment as a function of goal-attainment are the most prominent ones.

We don't want to say that iron rusts intentionally, or that sweating as such is an intentional action, and we do want to say that annoying a detested neighbour by making his car rust, or going to the sauna for a sweat can be perfectly fine instances of intentional action, because the latter behaviours can have, and the former lack, just these characteristics.

Piaget (1952) pioneered the study of the development of intentional action in preverbal infants. From around 8 months, at the time object permanence begins to emerge, infants' behaviour for the first time displays instrumental structure. Infants begin to engage in sequences of action that bear some means-ends relations such as, e.g., removing an obstacle in order to reach for an object, persistently pursuing their goals, varying the means if necessary, and indicating fulfilment (happiness) or non-fulfilment (frustration). From this age on, infants' instrumental actions begin to incorporate the use of tools in increasingly sophisticated and flexible ways (e.g., Willatts 1985). Infants early in their second year also grasp the basic intentional structure of others' instrumental acts, as indicated in their imitation (see also section 3). When in a recent study infants observed another person perform an instrumental act with a bizarre means (e.g., switching on a light with the head), they saw this only as a means to an end when the other person could not have done otherwise (e.g., because her hands were occupied); they themselves subsequently switched on the light with their hands. In contrast, when the model could have done otherwise, infants saw the means as an end in itself, and faithfully imitated it (Gergely et al. 2002).

Turning to non-human animals, the flexible and insightful use of tools for instrumental purposes in chimpanzees, both in the wild and in experimental settings, is well-known. For example, chimpanzees in the wild flexibly and systematically use stones as nutcrackers in quite sophisticated ways (Boesch & Boesch 1990), and they use different kinds of sticks adaptively for fishing different kinds of insects (Goodall 1986). Best known from experimental settings is probably the problem-solving of Köhler's (1926) apes who—in creative and in insightful ways—used different kinds of novel tools to obtain food from beyond their reach. In addition to familiar documentations of such problem-solving in chimps, more recent experimental research has found that many primate species that have not been reported to use tools in the wild, readily do so in creative and novel ways in experimental settings (Tomasello & Call 1997). Some apes have recently been reported to even store tools systematically for future use (Mulcahy & Call 2006). And in some problem-solving tasks, apes clearly outperform human children up until the age of 6 years (Mendes, Hanus & Call 2007). Also, the systematic use of tools seems not confined to primates. Crows, for example, have been found to actively cast hook-shaped tools for subsequent usage to retrieve food from a test-tube (e.g., Weir, Chappell & Kacelnik 2002).

To summarize the findings from object cognition and instrumental action: we see analogous abilities in pre-linguistic infants and non-linguistic animals that common sense and academic psychology don't hesitate to describe as simple forms of thought. 'The infant sees two objects disappear in a box, finds only one and thus knows there must be another one', or 'The ape wants to eat the nut, knows that using a stone helps, and therefore uses the stone' are natural ways of describing the phenomena in question. In contrast to 'The flowers are looking forward to the spring', they are meant non-metaphorically. Granted, there do lurk serious conceptual challenges regarding the ascription of contentful attitudes to creatures in the absence of full-blown linguistic concepts, in particular regarding the determinacy of content. Does the ape intend to crack the nut, or the brown object, or the thing with the nut-appearance, or undetached nut-parts, etc.? But to common sense folk psychology, the radically holistic manoeuvre to conclude from the fact that there are many things the ape does not know about nuts—say, that they're a product of biological processes, and no prime numbers—that the ape cannot intend to crack nuts, seems more like a *reductio ad absurdum* of radical holism than a serious problem for apes.

3. *From thought to language: social cognition and the acquisition of culture*

As we have seen, both infants and other animals engage in rudimentary forms of objective thought and practical rationality. Why, then, don't other animals begin to talk? Given the remarkable commonalities and continuities in the development of non-linguistic thought in infants and many animals, why do only infants begin to speak a language and grow into a full-blown culture? In particular, why don't even chimpanzees raised in human environments with extensive training in sign language acquire anything close to human linguistic and cultural abilities? Recent research strongly suggests that it is not so much the lack of the right kind of speech apparatus or proto-grammatical abilities[9] that explains why the brutes remain brute, but rather missing pragmatic, socio-cognitive background abilities. Infants and other animals seem to cognitively relate to the physical world around them in basically the same ways. But socio-cognitively,

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9. Contrary to a recent claim by Hauser, Chomsky & Fitch 2002, these might even be present in birds (Gentner et al., 2006).

non-human animals don't relate to each other in the right kind of way to develop language and culture.

3.1 *Understanding persons*

From a broadly Gricean point of view, language has to build upon some basic folk psychology, upon some grasp of conspecifics as persons—as rational agents and potential cooperative and communicative partners. In human ontogeny, as much recent research has found, the first crucial milestone in the development of a folk psychology occurs around one year of age and lays the foundation for language acquisition. (See Tomasello 1999; Tomasello et al. 2005, for an overview.) After having interacted dyadically with either objects or persons for the first months of their life, infants now begin to enter into triadic interactions with other people oriented towards objects. They follow the gaze and the pointing gestures of others to external objects, and they begin to use the pointing gesture in varied ways themselves. They use others' emotional responses towards ambiguous situations to guide their own actions ('social referencing'), and they imitate others' acts on objects and join into collaborative actions.[10] These kinds of behaviour, which co-emerge in systematic and synchronic fashion and which reliably precede and predict language acquisition (e.g., Carpenter et al. 1998a), have been interpreted in the following way. What is dawning here is a simple folk psychology in the sense that children begin to perceive one another as persons with perceptual access to the world and engaged in intentional rational action. Making use of Searle's (1983) taxonomy of intentional phenomena, one could say that just as intention is the biologically and ontogenetically primary attitude with world-to-mind direction of fit, and perception the corresponding primary attitude with mind-to-world direction of fit, so understanding perception and action are the primary forms of folk psychology, or second-order intentionality.

The main evidence for understanding intentional action comes from imitation: straight imitation, but more convincingly imitation in cases of mis-match between the mere behaviour seen and what was intended; imitation of unfulfilled attempts (Meltzoff 1995), differential imitation of accidents versus intentional acts (Carpenter et al. 1998b), and what has been dubbed 'rational imitation' (Gergely et al. 2002, see above). The

10. This bears interesting relations to Davidson's notion of triangulation, a discussion of which, however, goes beyond the scope of the present paper (see Brink 2004; Eilan, 2005; Roessler 2005).

main evidence for understanding perception comes from children's gaze and point following from around age 1, and, somewhat later from around 24 months; from engagement in what has been called 'level 1 perspective taking' (Flavell et al. 1981; Moll & Tomasello 2006), i.e. the ability to understand that different people may perceive different things ('I see something you do not see').

Why do we, folk and professional psychologists alike, class these abilities as cognitive? As in the case of simple individual intentionality, the main reason is that the kinds of behaviour that are the basis for ascribing these abilities to infants manifest a differential, systematic and generative structure that is reminiscent of the inferential structure of full-blown linguistic thought. (I will return to this point in the final section.)

While it has long been thought that no other species, not even great apes, follow humans in the development of this simple folk psychology, some recent evidence led to qualifications of this bland proposal. It has been found that Chimpanzees are in fact capable of a simple understanding of intentional action; for example, they systematically distinguish between unfulfilled acts where the actor is unwilling from those where the actor is unable (Call et al. 2004). They also are capable of understanding perception in the form of level 1 perspective taking, in that they take into account what a conspecific has and has not seen in a food competition task (Hare et al. 2000).[11]

Simple forms of folk psychology thus no longer seem to be uniquely human—infants and chimpanzees share basic abilities of interpreting conspecifics as individual agents.

3.2 *Collective 'we'-intentionality*

Understanding each other as individual agents is surely necessary for entering into a linguistic practice, for one can get a grasp on reference only with a rudimentary notion of other speakers' perceptual perspectives (e.g., Quine 1990) and with a rudimentary understanding of what interlocutors are up to. But to participate in linguistic and other cultural practices, it is not enough to understand others as individual agents. What is needed beyond such simple individual second-order intentionality is the ability

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11. These empirical data fit nicely with a more conceptually derived claim by José Bermúdez (2003) that in the absence of language and the recursive embedding it allows in propositional attitude ascriptions, folk psychology is confined to understanding non-epistemic perception and goal-directed action.

to engage in shared or collective 'we'-intentionality: 'The biologically primitive sense of the other person as a *candidate for shared intentionality* is a necessary condition of all collective behavior' (Searle 1990, 415, my italics). What humans develop early in ontogeny and what other species lack is precisely this propensity for collective intentionality (Rakoczy & Tomasello 2007; Tomasello & Rakoczy 2003; Tomasello et al. 2005).

We are facing collective intentionality when two or more subjects share an intentional 'we' attitude that is not straightforwardly reducible to individual intentional attitudes.[12] When you and I meet and agree to take a walk together, to take an example from Margaret Gilbert (1990), we form and then pursue the joint we-intention '*We* walk together' that is not reducible to the sum of my individual intention 'I walk' plus your analogous one, not even when supplemented with our mutually knowing about these intentions. This irreducibility of collective intentionality becomes even more obvious in the case of more wide-ranging social affairs. 'We play/one plays chess like this' is clearly no sum of 'I play it like this', 'You play it like this' and 'She plays it like this'.

Specific normative dimensions go along with collective intentionality. In simple cooperative actions, the partners bind themselves to acting jointly and are thus committed to the pursuit of a joint goal. And in the case of more wide-ranging social affairs, the way 'one does it' quite obviously fixes a framework of right and wrong moves.

In human ontogeny, simple collective intentionality develops from the second year in the domains of cooperative actions and pre-linguistic communication. Children from the age of one and a half begin to engage in collaborative games with complementary roles and turn-taking structure, and in collaborative instrumental activities with clearly differentiated roles (e.g., Warneken, Chen & Tomasello 2006). In the course of such collaborative acts, they communicate pre-linguistically in appropriate ways, e.g., by pointing to the required place for the partner. When the collaboration threatens to break down, they re-engage the partner and assign him his role (again by pointing; Warneken et al. 2006.[13]) Children

12. For the central works in recent analytical philosophy on this, see Bratman (1992); Gilbert (1990); Searle (1990), (1995), (2005), Tuomela & Miller (1988). For an overview, see Tollefsen (2004).

13. While human-raised chimpanzees in this study did show some social coordination in instrumental problems that needed two individuals for the solution, they did not engage in such communication and re-engagement behaviour. More generally, many researchers have argued that prima facie truly cooperative behaviour in chimpanzees, in particular social hunting, in fact are just sophisticated social coordination: one individual starts hunting at a certain place, then

this age, but not chimpanzees, also seem to have a simple understanding of complementary roles in joint activities, as indicated in their spontaneous role-reversal imitation.[14]

Communication itself is of course a cooperative activity characterized by collective intentionality. Using pointing and other gestures, even pre-linguistic infants make proto-declarative communicative acts that are not just instrumental for attaining some individual end; for example, they point out information that others need, e.g., about the location of a lost object (Liszkowski et al. 2006). In contrast, chimpanzees do not spontaneously point, and the ones who learn to do so in human environments only ever use it proto-imperatively for instrumental purposes (Rivas 2005; Tomasello et al. 2005). Infants' rudimentary 'sense of the other as candidate for shared intentionality' enables participation in these forms of joint cooperative and communicative activities which in turn function as a foundation and scaffold for the acquisition of language (Bruner 1983; Tomasello 2003).

Young children's participation in shared intentional activities is not confined to simple cooperation. Even pre-verbally they begin to partake in activities with collective assignment of status functions to objects and thus with proto-institutional structure, in particular in the domain of playing games. From around 18 months, children begin to engage in games of social pretend play—mostly organized topic-wise around such mundane things as pretending to eat, drink etc. (For example, pretending that a wooden block is an apple, pretending to peel, cut and eat it.) Only human children do so. There are a few anecdotes of pretence-like behaviour in some human-raised animals (see Mitchell (2002) for an overview), but these are difficult to interpret, and it is in general quite clear that no other species habitually engages in pretend play as we know it.[15] Games with established rules are among the paradigmatic examples of activities with constitutive rules and status function assignment ('this piece of wood counts as a queen in chess', 'moving it thus and thus counts as attacking'; Searle 1969, 1995), and games of pretence can be seen as local, ad-hoc analogues of such established games. The two levels of

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the next individual starts hunting, but cannot take the same place, then the third individual has to take yet a different place etc.. See, e.g., Tomasello & Call (1997); Tomasello et al. (2005).

14. For children, see Carpenter et al. (2005); for chimpanzees, see Tomasello & Carpenter (2005).

15. For an excellent review of precursors to pretend play in great apes, see Gomez & Martin-Andrade (2005).

fact and fiction mirror the two levels of institutional phenomena generally—institutional fact put on top of brute facts in line with the schema 'X counts as a Y in context C'. 'This wooden block counts as an 'apple' in our pretence game' is on a par with 'This piece of wood counts as a queen in chess' or 'This slip of paper counts as money in our currency area' (Walton 1990).

These assignments of fictional function bring with them a normative structure of the joint pretence activity. 'X counts as Y in context C' means that in C, X ought to be treated as a Y. Once declared an apple, the block in the block/apple pretence game ought to be treated accordingly in the game. Some pretence acts are inferentially licensed in the game, others are not. Pretending to peel the block/apple, pretending to eat it or to bake a cake with it are licensed; pretending to drive it or pretending to fax it are not (see Walton 1990).

Children from the age of 2 do in fact seem to grasp this normative structure created through joint pretence stipulations, as is indicated by their inferentially appropriate responses to others' pretence acts. When an experimenter pretended to pour tea into a cup, for example, children pretended to drink from the cup. When the experimenter pretended to spill tea on the table, children pretended to clean the table (Harris & Kavanaugh 1993; Rakoczy & Tomasello 2006; Rakoczy et al. 2004). What is more, the children systematically distinguish such pretence acts from superficially analogous behaviours with different intentional structure. When an experimenter pretended to pour from a full but closed container into a cup, they themselves—inferentially appropriately—pretended to drink from the cup. However, when the experimenter made the same pouring movements with the same kind of container, but marked them as frustrated attempts, they—again inferentially appropriately—completed the failed attempt by opening the container and really pouring (Rakoczy & Tomasello 2006; Rakoczy et al. 2004). Interestingly, though children this age have acquired simple forms of language, their competence in action revealed in these studies by far exceeds their explicit verbal competence. Only some years later can children reliably tell explicitly whether the experimenter had pretended, or had actually tried to pour (Rakoczy et al. 2006).

Not only do children themselves act inferentially appropriately in joint pretence games. They also indicate an awareness of the normative structure of such games more directly in their responses to others' mistakes. When in the context of a shared pretence game, a third party entered and then

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confused the pretence identities (status functions) of the objects, children intervened by protesting, criticizing and teaching (Rakoczy 2008).[16]

In summary, pre-verbal children and apes share not only abilities of non-linguistic intentionality, they also share some rudimentary folk psychology, or second-order intentionality. Human infants, however, do not just interpret each other as individual agents, but develop a 'sense of the other person as a candidate for shared intentionality' (Searle 1990, 415) in the second year, and thus enter into collective we-intentionality in the domains of collaboration and pre-verbal communication. Form a comparative point of view, even the pre-verbal communication of human infants is already markedly different from the communication of all other species in that it involves shared intentionality in the form of a basic Gricean cooperative structure. And from an ontogenetic point of view, we know from longitudinal studies (e.g., Brooks & Meltzoff 2007, Carpenter et al. 1998a) that these forms of pre-verbal communication lay the foundation for the acquisition of language—language being a continuation of communication with other means.

Children in their second year also begin to enter into collective intentional practices with proto-institutional structure, in particular, joint games, around the same time they begin to acquire language. Here their cognitive abilities, as indicated by their systematic actions, by far exceed explicit verbal competence.

4. *From language to thought: the development of linguistic cognition*

The acquisition of a natural language has specific cognitive prerequisites: social cognition and, particularly, shared intentionality, the latter being a prime candidate that makes humans, and only humans, ready for becoming linguistic, or so I would like to argue. But language acquisition does of course have its cognitive consequences, too.

From a philosophical point of view, the central question is how language constitutes new forms of thinking. In the following, I will deal with the much narrower, empirical psychological question of how language in fact changes and shapes cognition. Of special interest here are areas where there is some pre-verbal cognitive competence—that is, where some thinking

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16. For similar results in the domain of simple non-pretence rule games, see Rakoczy et al. (2008).

without words is possible in the first place, in contrast to areas such as, say, theoretical physics where we do not even know what thinking pre-verbally could mean. Here, much recent research has focussed on the areas of numerical and spatial cognition.

Regarding numerical cognition, many habituation studies have shown that pre-verbal infants and other primates share two simple abilities of representing numerosity—a so-called 'subitizing' system for simultane-ously tracking very small numbers (< 4) of objects (this, again, is just more complex object permanence) and an approximate analogue magnitude system for roughly estimating the sizes of assemblies of individuals.[17] But these systems are narrowly confined in their application, and of course a far cry from anything approaching mathematical cognition proper. One prominent hypothesis recently pursued in this context is that language, and in particular the acquisition of the counting routine, is the medium that transforms the limited cognitive abilities residing in these primitive systems into truly general mathematical competence (Carey 2001; Spelke 2003).

Regarding spatial cognition, quite similarly, pre-verbal infants and other animal species share some basic though domain-limited abilities for spatial cognition (e.g., Wang & Spelke 2002). Here the acquisition of spatial language has been found to dramatically increase the flexibility and relational complexity of spatial thought (Hermer-Vazquez, Spelke & Kasnelson 1999; Spelke 2003; see also Carruthers 2002, for a general account along such lines).[18]

However, the one example that most clearly illustrates the need for a dialectical picture of the development of thought and language is the development of increasingly sophisticated forms of folk psychology. As we have seen, pre-verbal infants, and to some degree apes, develop some rudimentary folk psychology and interpret one another as individual inten-tional agents capable of perception and action. Some such rudimentary folk psychology is part of the foundation of language acquisition. But clearly, such rudimentary folk psychology is quite rudimentary indeed. Above all, it does not yet involve a full-fledged notion of propositional attitudes organized around belief as the most central one. Consequently, an explicit distinction between appearances and reality is still missing. Though

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17. For an overview, see, e.g., Carey (2001); Feigenson, Dehaene & Spelke (2004).

18. Here I am dealing only with the, somewhat simplified, question of how language (singu-lar) shapes cognition. Cross-linguistic research documents impressively how different languages (plural) differentially shape spatial cognition, e.g., through the acquisition of egocentric versus allocentric frames of reference (Haun et al., 2006).

it does allow for some rational action explanation based on perception and intention, it does not yet permit reconstructing others' practical reasoning in the form of practical syllogisms based on premises in the form of belief and pro-attitude (Perner 1991).

More sophisticated folk psychological abilities have been found to emerge ontogenetically around the age of four. Children this age begin to predict and rationally explain actions based on false beliefs (Wimmer & Perner 1983; for an overview, see Wellman et al. 2001) and to explicitly master the appearance-reality distinction (Flavell et al. 1983). Further developments in reflexive self-consciousness such as growing self-control and autobiographical memory go along with these developments (Perner 1991).

Much recent research has documented the language-dependence of this developmental step.[19] First, numerous correlation studies have found that 4-year olds' folk psychology is highly correlated with language input and competence; here different studies have stressed different aspects of language, among them general linguistic competence, pragmatic competence and specific tensed 'that'-complementation (deVilliers & deVilliers 2000). Still, pure correlations are difficult to interpret. A second line of research has more convincingly used a training methodology and found that training with specific linguistic material, mostly complemented propositional attitude discourse, significantly boosts false belief and related understanding (Hale & Tager-Flusberg 2003; Lohmann & Tomasello 2003). Finally, research with deaf populations has documented that while native signing deaf children develop false belief reasoning in parallel to hearing children, orally educated deaf children with delayed linguistic competence reveal a dramatic delay, sometimes of several years, in their development of folk psychology (deVilliers 2005).[20]

In sum, while simple forms of folk psychology—understanding conspecifics as perceiving and acting subjects—seems to be a common non-/pre-linguistic cognitive heritage of human infants and other apes, sophisticated folk psychology, centred around the notion of belief, arises much later in human ontogeny, and is essentially dependent on language.[21]

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19. For an overview, see Astington & Baird (2005).

20. So, Davidson might be partly right: you do need language to have the concept of a belief. But this does not mean that you need the concept of belief to have beliefs, as he claims.

21. For an elaborated philosophical argument that full-fledged belief-desire folk psychology (but not the more rudimentary infant folk psychology) requires a natural language as a meta-representational medium, see Bermúdez (2003). For a similar approach trying to reconcile

5. *Conclusion*

The recent findings in developmental and comparative psychology reviewed so far illustrate the need for a dialectical picture of the development of language and thought, a picture meeting the following three desiderata: (a) doing justice to the common pre-linguistic cognitive abilities in humans and other animals; (b) acknowledging species-specific human (social) cognitive abilities as part of the foundation of language acquisition, and (c) recognizing the ways speaking a language shapes and transforms thinking.

(c) is relatively uncontroversial nowadays, except, perhaps, amongst hard-nosed nativist LOT theorists. Interestingly, after having been dead for some time, a moderate Whorfianism currently seems to be experiencing a renaissance in psychology, yielding a newly booming field of research on the role of language and languages in shaping cognition (see, e.g., Gentner & Goldin-Meadow 2003). Even many broadly Fodorian modularity theorists now assign a relatively substantial role to language in cognition. The basic idea here is that language functions as a domain-general glue to bind together encapsulated information from separate modules (e.g., Carey 2001; Carruthers 2002; Spelke 2003). Similarly, from a connectionist perspective, Andy Clark and Annett Karmiloff-Smith have argued that initial know-how represented in local networks gets re-described into domain-general know-that, inter alia through the acquisition of language (Clark & Karmiloff-Smith 1993; Karmiloff-Smith 1992; see also Dennett 1993).

More controversial and challenging is the question of how we should describe the common pre-linguistic abilities in infants and other animals. Do they deserve the title 'cognitive'? Radical lingualists say 'no'. Only full-fledged participation in discursive practices counts as cognitive, descriptions of infant and animal rationality are discounted as metaphorical. What infants and animals do is no more than complex discrimination, on a par with iron's responses to humidity. Thought and language come together as one big package. LOT theorists, in contrast, say 'yes'. Infants and animals think just the same way as adults do, limited only in the scope and expressability of their thoughts.

The truth probably lies in an intermediate position. On the one hand, the abilities of animals and infants in the domains of object tracking,

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philosophical approaches (in particular, Sellars) with psychological ones (in particular, Vygotsky) see Garfield et al. (2001).

problem-solving and social understanding—to name just a few reviewed here—clearly go beyond dumb discrimination, and even beyond Dummett's (1993) 'proto-thoughts' of superimpositions of spatial images on spatial perceptions. In contrast to complex but largely pre-programmed and inflexible behaviours such as a spider's nest-weaving, they deserve the title 'cognitive' because they are flexible, systematic, general, and compositionally as well as (proto-)inferentially structured in ways analogous to the structure of linguistic cognition (see Clark & Karmiloff-Smith 1992; Bermúdez 2003; Hurley 2003). Lingualist functionalism views thoughts as defined through their position in the systematic network of language-entry moves, language-language moves and language-exit moves (Brandom 1994; Sellars 1974). Analogously, folk and academic psychologists alike ascribe non-linguistic thoughts in line with their position in a systematic network of reliable responses to states of affairs, (proto-)inferential relations among each other, and practical reasoning relations to action. In contrast to the lingualists' dichotomy—rusting iron, animals and infants fall on the discrimination side, adult speakers on the reason side—what this suggests is a gradation of cognitive abilities along phylogenetic and ontogenetic lines. 'There is certainly a continuum of possibilities between proto-conceptual and fully conceptual behaviour (and in the case of some of the higher primates, it may be that the line is blurry)' (Putnam 1999, 161). One of the pressing conceptual questions, though, is how to spell out exactly the non-linguistic analogues of full-blown conceptual and inferential abilities. In the absence of language as a formal vehicle, what model of drawing inferences should we look for other than relating sentences as premises and conclusions? Should non-linguistic (proto-)inferences be modelled on causal reasoning (Bermúdez 2003)? Or is there a viable truth-functional notion of material inference applicable at the non-linguistic level?

The following questions are just as difficult: in which ways exactly does non-linguistic thought—granted that there is such a thing—fall short of being full-fledged thought as we find it in speaking creatures? And how exactly does language re-shape cognition? Clearly, lack of determinacy and restrictions of scope set apart non-linguistic cognition from full-fledged thought. Malcolm's and Wittgenstein's dogs can think something like 'The cat went up this tree' and 'My master is coming', though they can't think 'The cat went up the biggest oak tree in this country' and 'My master might come the day after tomorrow'. But why exactly is this? Where is the line to be drawn between what can and what cannot be thought without

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language[22]? Regarding language's role in re-shaping thought, Putnam has noted that 'one must not make the mistake of supposing that language is merely a 'code' that we use to transcribe thoughts we could perfectly well have without the code' (1999, 48). But what exactly beyond such transcribing does language do?

All in all, the problems we are facing in describing the emergence of thought are certainly deep ones, as Davidson noted, but in contrast to his categorical pessimism, they might not be insuperable. We know, at least in principle, what kind of conceptual and theoretical solutions we are in need of. To date, however, the fact that in talking about non-linguistic cognition we haven't got beyond using 'proto-' so much—meaning not much more than 'somehow but not fully like the real thing, but I don't know exactly how and why'—highlights the challenges we are still facing. It is still 'somewhat surprising how little we know about thought's dependence on language' (Schiffer 1994, 593).

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