Action and Experience : A Naturalistic Approach to Cognition

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ACTION AND EXPERIENCE

A Naturalistic Approach to Cognition

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CONTENTS

1. INTRODUCTION

The purpose of this study is to examine the relation between action and cognition in traditional epistemology and modern cognitive science, to develop a causal notion of motor action that will help us to propose a new way of seeing the interrelation between action and cognition, and to sketch out, on this ground, a naturalistic view of mind, language and their relation to the reality.

Naturalism entails that human cognition and culture must be explained by assuming that natural evolution has produced a biological species capable of originating the historical evolution of society and culture. Human beings are products of natural and social history, and there is no room for a transcendentalism which asserts that every theory of human cognition should satisfy some *a priori* conditions. All problems are, in the final instance, empirical problems.

Naturalism in this study is not opposed to culturalism. On the contrary, our aim is to combine the standpoints of natural and cultural evolution and give support to the view that man is an irreducibly social being.

This view entails the philosophical position of materialism and, thus, denies the existence of self-subsistent immaterial entities. This denial counts for concepts, meanings, ideas, Popperian objective contents of thought, et alia. The nature of human cognition can be explained without immaterial entities. The mind is not a spiritual substance independent of the body. Only physical objects (processes, events, etc.) exist.

None of this entails, however, that we are committed to a physicalistic language. In particular, as we will demonstrate in Chapter 9, it does not follow that the mind should be reduced to or identified with brain processes. The human mind is irreducibly social.

Different reductionistic strategies are, however, quite common in modern cognitive science, and our materialistic notion of mind is to be distinguished from these. Intentionality is a genuine feature of behaviour, and it can be explained without reference to separate mental entities. In other words, this study offers an alternative to those naturalistic approaches that try to get on without a concept of intentionality, mental contents, etc., and which claim that these issues belong only to non-scientific folk-psychology, or to common sense explanations of human behaviour.

A naturalistic explanation of cognition is a complex program, and it cannot be accomplished all at once. Our main concern here is the individual's

cognition: What is required of an individual who is capable of becoming a member of human society? In discussing the features of logic (Chapter 10), for instance, the stress is on the problem of the origin of the ability to think logically. What is the natural natural basis of logical thought?

Our aims are restricted also in the sense that the emphasis is on the overall view. The most important elements of it are presented in Figure 1.1, which is a kind of mind-map that helps to form a comprehensive picture of the different components of the overall view and their relations. In this study we discuss different parts of this structure, and most of the other figures can be understood as extracts of Figure 1.1. Because of our pursuit of an overall view, we must also skip over much of the details necessary for developing a full-fledged theory and concentrate on the most relevant issues.

The structure of this study reflects the relations among the elements in Figure 1.1. Naturalism requires, we believe, some kind of "bottom-up" analysis (as opposed to a "top-down" analysis starting from language). This means that the features of the s-model[1] must be defined first and independently of the other models in Figure 1.1. This definition is given in Chapter 6. The notion of the s-model is an abstraction, it is not supposed to be a description of any real being in nature. It is useful, however, in our analysis of the role of motor action in animal and human cognition. The next step in our bottom-up analysis (in Chapter 7) is to construct the p-model on the basis of the s-model. The result is supposed to apply to the cognition of developed animals and to be useful also in analysing the layers of human cognition. Finally, Part III is devoted to the task of constructing the l-model on the ground of the p-model. The naturalistic bottom-up analysis gets accomplished in the development of this model, and it is supposed to describe some of the important features of human cognition.

The rest of the study consists of supplementary discussion. Part I examines how the role of action is understood in some of the most important and interesting earlier views, and in Part IV we discuss some complementary problems relating to our bottom-up analysis. All of this is subordinated to the analysis in Parts II and III.

The naturalistic approach of this study can be characterized by comparing it to the phenomenological method of Edmund Husserl. Husserl compares (1950, p. 220) two standpoints on the problem of perception, the natural and the phenomenological. From the natural standpoint the act of perception consists of a real object, e.g. a tree, a real man and a real (or causal) relation between the tree and the man. The tree causes an event or a state in the man. Described in real (causal) terms this event or state is not connected to the real tree considered as an external object. In modern terms, the neurophysiological description of a brainstate contains nothing that can connect it to the real external tree; it may be considered in itself even when no tree is causing the state.

Experience is intentional, it is *about* something even when it does not refer to a *real* object. This was the point of Franz Brentano's concept of

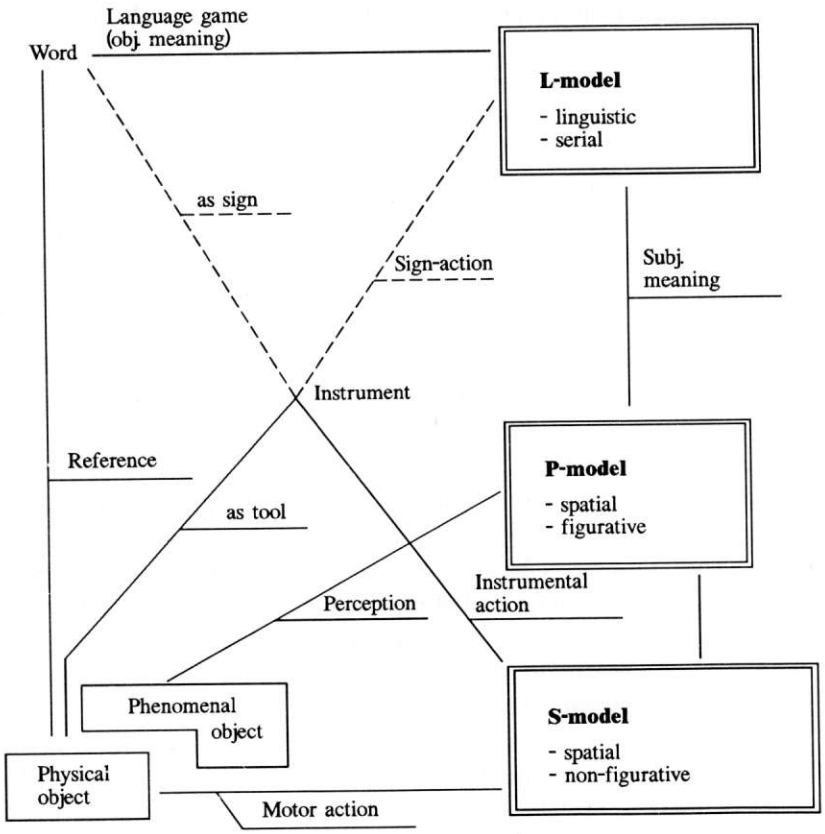


FIGURE 1.1. The structure of action and cognition.

intentionality, which Husserl borrowed from him. Therefore, the natural standpoint is not enough to explain the concept of intentionality. According to Husserl, one must engage in the phenomenological standpoint to understand this.

The phenomenological standpoint puts the real tree and real relations (real in the sense of the natural standpoint) aside, in brackets, as it were. But the relation between perception and the object perceived remains. The intentional experience refers to the intentional object, the noema, through the meaning-giving act of consciousness. There is in the noema an objectified (gegenständlich) meaning (see ibid., p. 223) that realizes the relation between perception and its object.

The problem of this approach is, from our point of view, that Husserl starts from the structure of consciousness and from meanings as abstract entities. In terms of Figure 1.1, Husserl deals with the relation between what we call the phenomenal object and a combination of the p-model and the l-model (Husserl did not distinguish language itself from the the theory of the intentionality of perception). The physical object is left out by the act of "bracketing".

The phenomenology (or phaneroscopy) of C.S.Peirce has, on one hand, similar aims. The phaneron is "the collective total of all that is in any way or in

any sense present to the mind, quite regardless of whether it stands for any real thing or not" (CP 1.284). On the other hand, however, Peirce does not "bracket" real relations outside his theory. Husserl's real relations are comparable to Peirce's dyadic (dynamic) relations, and Peirce describes his own view with concepts like 'dynamic object', 'dynamic relations', 'struggle', 'brute force', etc. The basic problem of Peirce's philosophy is, from our point of view, the inconsistent way in which Peirce combines the "phaneric" (phenomenal) aspect and the "dynamic" aspect. We shall clarify this problem in Chapters 3 and 4. In our naturalistic bottom-up analysis we try to construct the relation between the phenomenal object and the subject on the ground of the physical relation between the physical object and the body. This relation is analysable in terms of motor action and causal relations independently of the analysis of perceiving and verbal thinking.

Maurice Merleau-Ponty has analysed the role of action inside the phenomenological tradition. He engages in a kind of top-down analysis and suggests that the intentionality of perception is based on motor intentionality: the body posits the objects for us to perceive. Motor intentionality presupposes the body image as a peculiar kind of rigid designator (the rigidity is shown by the fact that one can experience pain in the leg even when one has no leg, says Merleau-Ponty). The sense of touch, which relates the objects to the body image, is very important in his analysis.

But this approach will not do here, because we are trying to define intentionality in naturalistic terms. The main feature of intentionality, aboutness, must be explained in terms of causal relations and motor action without reference to concepts involving intentionality either directly or obliquely in concepts like representation, sensation, etc. Merleau-Ponty relies on the primacy of tactility and cannot, therefore, reach the physical object independently of perception, even though his aim is to explain the intentionality of perception by means of the intentionality of motor action. The starting point of this analysis is the consciousness of the subject, i.e., it is a top-down analysis.

The starting point of our bottom-up analysis is the subject as a physical body in its natural environment. The essential question is: In virtue of what does a physical state (a state of the p-model or a brainstate) refer to a physical object (property, relation) in the external world? A physical description of the state as such will not do, as Husserl has already pointed out.

The main thesis of this study is that the significance of motor action (motor movements of the body) is not fully realized in cognitive science in spite of the fact that the role of action has been a traditional issue in the theory of knowledge since Plato. According to Hintikka, Plato emphasized the relation between "knowing that" and "knowing how" (to do something, see Hintikka 1974, pp. 31–49). The subject has been discussed in various schools and traditions from different standpoints. This study concentrates on the epistemic relation between individual cognition and reality and examines the significance of action in this epistemic relation and in the cognitive processes

in general. The aim of the preliminary discussion in Part I is not historical or exegetic. The purpose is to explicate some unsolved philosophical problems concerning the relation between action and experience in order to show in what respects the approach of this study is new and original.

Plato distinguishes between the knowledge of one who makes something and that of one who uses it. In this view, action is a part of cognition in the sense that to know implies an ability to act. If one knows, then one must be able to act. Or in other words, it is "knowledge which *determines* its object" (Pérez-Ramos 1988, p. 150) in the case of the creator's or "maker's" knowledge. The same holds true for the user's knowledge which Plato contrasted to maker's knowledge (Republic, 601 E -602 A). The user reports his experience about the use to the producer. (See Pérez-Ramos 1988, pp. 150–151). This operative knowledge can be contrasted to the Cartesian view where the knower's task is simply to grasp[2] or comprehend ideas (ibid. p. 152).

The distinction between operative and contemplative knowledge, however, is not our concern here. We are distinguishing here, concerning the concept of operative knowledge, between action and cognition by excluding completely the notion of a capacity of sensing or perceiving from the concept of action. Then we shall ask what follows for cognition in respect to this revised notion of action.

This question is new and significant if the notion of action is characterized in terms independent of knowing, i.e., in non-cognitive terms. In other words, we can now ask whether action, described in non-cognitive causal terms, is cognitively significant. It is true that the question about the relation between action and cognition is a traditional one in the history of philosophy, but the starting point has always been cognition, not action considered independently of cognition.

It is illuminating to compare this way of stating the problem to the historical background from which it emerges. It turns out that certain methodological points have to be reconsidered before our way of putting the problem makes sense. To accomplish this we must go back to Descartes.

Descartes raised epistemological questions in a historically new framework. He radically separated the mind from the body by stating that the mind, in contrast to the body, exists outside of space. Consciousness and ideas as contents of thought have no spatial properties. The effect of this dualism changed the nature of epistemological problems. According to Rorty, the Greeks did not even have a word for this Cartesian type of consciousness (Rorty 1980, p. 58). That is, they did not separate the soul from the body as something immaterial. The ability to think was more or less a capacity of the body, not a capacity of a Cartesian spirit that is independent of material substance in space and time.[3] After the Cartesian separation it was hard to relate this consciousness to material reality.[4]

The point is that Descartes posed the problem in a new framework, the Cartesian framework. How is it possible to relate thought and external objects

if the contents of thought, ideas, are so completely different from these objects? The problems of epistemology and the philosophy of mind changed their nature.

John Locke concerned himself with the problem of the one and the many: How are many different objects subsumed under one concept (or idea)? We can take this problem as an example of how epistemological problems were handled within the so called maker's knowledge tradition in which the role of action is central. The conceptions of Hobbes and Spinoza yelded a solution of the problem in Kant's schematism. According to Pérez-Ramos, Kant internalized the notion of the maker's (or creator's) knowledge (Pérez-Ramos 1988, pp. 60–61). He employed the notion in his theory of schemes as mediators between concepts and objects. Kant's schematism gives us some insight into the role action plays in the relation between cognition and reality.

This introductory discussion is not meant to exhaust the topic from a historical point of view. It is only preliminary to the presentation of a causal notion of motor action in Chapter 5, and its purpose is to bring out some interesting aspects of the relevant classical epistemological problems. We are concentrating on the problem of subsumption, i.e., the one-many problem, because it has been an inspiration for developing our theory of causal motor action and its cognitive significance. But this is not the sole reason for our interest in it. This case study also brings out some relevant features of the relation between action and cognition that are useful in our attempt to externalize again the cognitively significant activity of a conscious subject.

The discussion contains also an interpretation of Kant's schematism and its relation to previous epistemological theory (which could be discussed more thoroughly), as well as of the classical views about the role of action in general.

C. S. Peirce and Jean Piaget have studied systematically the problem of the relation between external action and cognition from different standpoints, and both were convinced of the epistemological significance of action. They tried to widen the concept of experience beyond an understanding of it as mere sense experience. Experience, in their view, contains sense perception plus external action. And we shall share this view. Peirce and Piaget did not, however, distinguish external action from cognition in an entirely consistent manner. In particular, as we shall show, the attempt to take account of the resistive, independent role of the material environment in experience is problematic if sensory processes are intertwined in a notion of action. This is the case in both Peirce and Piaget.

Peirce's semiotic theory is helpful in distinguishing between action and cognition in our sense. It contains implicit elements which serve to clarify our own position. For he stresses the independent role of hard facts in experience. From our point of view, the basic defect of Peirce's approach is his failure to analyse the factual element outside of the context of perception and thought. A pragmatist interpretation of the semiotic concepts are, however, suitable for such an analysis.

The semiotic point of view is helpful also in explaining how an ability to understand conventional signs arises from an ability to use material instruments. This leads to a notion of a language game in which language is taken to be a physical system that refers to physical reality.

This viewpoint on language is also based on the conceptions of L. S. Vygotsky, who elaborated Friedrich Engels' thesis that labor and tools were critical in the genesis of human society, language and culture. Vygotsky also commented the pragmatism of John Dewey. Vygotsky and Dewey maintained that tools (hammers, etc.) are semiotic entities in the same sense as words of a language. Heidegger was of the same opinion but did not put the cart before the horse; on the contrary: words get their meanings from tools and not the other way round, as Dewey maintained. A semiotic analysis of instrumental action helps to clarify the point.

The overall picture of the various issues to which the question concerning the relation of action and cognition finally leads us is seen in Figure 1.1. The bottom-up analysis begins in Chapter 6. Here we first present a notion of motor action in causal terms, employing the concept of the s-model. It is a spatial but non-figurative (i.e., not image-like) subcognitive model of the spatial structure of the solid three-dimensional environment.

The model in question is called the s-model because of its relation to spatiality. The s-model is a system or structure that controls motor action in four-dimensional space-time that is occupied by three-dimensional solid objects, one of which is the subject (the agent). The spatial structure of the environment is imprinted into the s-model by virtue of the causal interaction between the acting subject and objects. This interaction can be characterized in terms of mechanical and causal feed-back loops in the s-model that controls the movements of the subject. The s-model, we argue, is cognitively significant in the sense that it mediates the epistemic relation between cognition and reality and, as a subcognitive structure, serves as a basis of higher cognitive structures and processes.

In order to clarify the cognitive significance of this subcognitive structure, we shall sketch out how perceptual capacities can be added to it. The result of this operation is called the p-model. The purpose of it is to describe the cognitive capacities of a subject that is capable of acting and perceiving but has not achieved the level of linguistic thought. The consciousness of developed animals might be one example. The crucial question is: How can we satisfactorily characterize and justify the cognitive nature of the p-model and the causal but subcognitive nature of the s-model?

Our approach requires a bottom-up analysis; that is, we ask how the power of perception is based on structures controlling motor action and what follows for perceptual experience if the s-model is soundly conceived.

With the help of the notion of the p-model we will answer some of the questions concerning the relation between external action and perception. The p-model, we suggest, is a spatial but figurative (figurative in a restricted sense

of being related to the figurative aspects of visual perception) and intentional model of the world as perceived.

It makes sense here to distinguish between the phenomenal and the physical object. We perceive phenomenal objects but act on physical objects. A subject's perception is *about* phenomenal objects; but in motor action we *deal with* physical objects. But it is precisely the physical object that we see as a phenomenal object, and we *cannot* see it except as a phenomenal object.

It must be stressed right in the beginning that we are presupposing the standard situation in which one perceives and acts on external solid objects. Further, we are not referring to two distinct objects when we use the terms 'phenomenal object' and 'physical object', although this seems to be the case. The objects are identical[5] but we can give this identity two different descriptions: a description in phenomenal terms (e.g., phenomenal colours) and a description in physical terms (such as in terms of reflecting light waves).

In the case of language we have a similar but much more complicated situation. The subjective meaning of words are, through the p-model, *about* phenomenal objects; but they *refer*, in the sense of playing a role in a language game, to physical objects. This dual situation of linguistic meaning can be called a Wittgensteinian situation (cf. Hintikka & Hintikka 1986, pp. 161–175).

In our bottom-up analysis, we present next the third element, a cognitive structure called the l-model. It is a system of linguistic (verbal) thought. We will employ it in the presentation of our views about some of the problems language use. The issue cannot be exhausted here, of course, but the present approach is a hypothesis worth considering.

A conscious subject has, in this analysis, two parallel systems or structures controlling behaviour: one for spatial motor action and perception and the other for producing and perceiving signs. From the ontological point of view the two systems do not differ. There is no ground for a mind-body problem in the sense of how a mind, soul, or spirit, supposedly separated from matter, is related to the body. Instead we ask how the l-model is related to the other models and how these together explain the functions of cognition.

The constructive part of this study owes much to the ideas of Jean Piaget and Charles Sanders Peirce, who have much in common despite their differences in interest and focus. Both developed a critical synthesis of traditional empiricism and rationalism based on a Kantian perspective. Both gave action a central role in widening the concept of experience, Piaget in his psychological theory of sensorimotor schemes, Peirce in his philosophical doctrine of pragmatism. This is one of the reasons why they have been chosen as starting points in the examination of the role of action in modern cognitive science, where psychology and philosophy, among other disciplines, try to answer the question: How does the human mind work?

The basic problem, from our point of view, is how to distinguish motor action from higher cognition in such a way that it becomes possible to argue for an independent and fundamental status for the role of motor action. We are

suggesting a solution based on a causal account of motor action. We will demonstrate the cognitive significance of motor action characterized in this manner by showing the relevance of our theory to some of the modern problems and conceptions in the theory of vision and for the philosophy of mind.

Our causal account of motor action has also some bearing on the classical issue concerning the conceptual categorization of experience. The bankruptcy of naive empiricism is generally acknowledged: perceptions do not constitute any independent and unproblematic "rock-bottom" of experience. Perceptions are theory-loaded (Hanson 1969). If our analysis is correct, however, then it follows that the categorical structure of experience, the fact that the world is experienced as consisting of three-dimensional stable objects, is based on non-conceptual causal interaction between the body of the subject and external solid objects. This categorization of experience takes place independently of any conceptual capacities (the notion of conceptuality must, however, be discussed in order to make sense of this thesis, see Chapter 14). That is why we are not exposed to the criticism addressed to naive empiricism.

If this is correct, then a new perspective opens up for a bottom-up analysis of language use. The physical objects exist and are perceived as phenomenal objects independently of linguistic cognition, and the activity of producing signs is understood as a part of our overall activity in the physical (and social) environment. This situation can be analysed in terms of the notion of a language game. The meaning function of words is based on the meaning function of phenomenal objects and is revealed to the subject by the meaning function of physical instruments. The phenomenal object stands for the physical object upon which we act (recall that they are one and the same object in a standard situation), and the word which refers to it performs the same function.

This bottom-up analysis leads to the conclusion that cognitive structures, systems, and functions are based on the ability to act, to use instruments and to produce external physical signs. This is an alternative to theories presented within a Cartesian framework in which the problem of cognition is raised as a mind-brain relation and which end up with notions like language of thought, methodological solipsism, causal powers of the brain, etc. An alternative to the Cartesian framework is to consider the material environment as a necessary part of the functional organization of cognition. That is, external objects belong to the functional organization of mind.[6] For human beings this environment contains both external signs and sign users, i.e., the social environment.

All of the discussion that follows is intended to illuminate the content and implications of our basic thesis: We can develop a notion of motor action as being controlled by a subcognitive (non-conceptual) but yet cognitively significant system that is a causal model of the spatial structure of the solid environment.

Notes

1 We use the term 'model' although the s-model, separately considered, is not isomorphic to the solid environment that it is a model of. The modelling relation between the s-model and the solid environment is established only through motor action of the body (see Chapter 6).

2 We do not, of course, mean: to grasp with one's hands. The corresponding German word 'Begreifen' has these two different meanings, too. Also the Finnish word for 'grasp', namely 'käsittää', is formed from the word 'käsi' ('hand' in English), but the literal meaning is not used anymore.

3 The issue is, of course, more problematic, but it is enough for our purposes to stress the new elements brought into the tradition by Descartes. For further discussion see, for instance, Robinson 1991. Even if the intellect is immaterial for Aristotle, Robinson prefers to call him a non-Cartesian dualist (ibid. p. 211). The problems of this distinction are also discussed by Lilli Alanen (1982 and 1990).

4 Descartes did not deny the role of perceptions. According to him the mind and the body interact (through the pineal gland). Perceptions affect the mind, and the free will is a demonstration of opposite influence. Experience also has a role in the scientific methodology of Descartes (see Blake et al. 1966, pp. 75–103). However, as pointed out already by Spinoza (1955b, p. 46), two substances whose attributes are different, have nothing in common. In other words, it is hard to relate objects and concepts if they are entirely different from each other.

5 This is not obvious, because the phenomenal object is the object described from the point of view of an individual consciousness, but the physical object is described in scientific terms. And we do not generally perceive the properties to which scientific terms refer. For instance, we see the phenomenal redness but we do not see the length of the waves of red light. The argument is given in Chapter 14 and is based on the fact that the object of motor action that is considered independently of perceptual capacities (the s-object, that is, the solid three-dimensional object) is, at the same time, a restricted description of the scientific physical object. It is restricted in the sense that only the scientific distinction between solids, liquids and gases is used, not for instance the capacity to reflect light. The s-objects are not coloured.

6 J. J. Gibson stresses the same point by the term "affordance", by which he means "something that refers both to the environment and the animal … [i]t implies the complementarity of the animal and the environment" (Gibson 1979, p. 127).

The cognitive role of action was studied from different standpoints in the so called maker's knowledge tradition. Maker's or producer's knowledge is knowledge that determines its object, and this determination takes place through action. One interesting move in the area is the criticism addressed to empiricism. John Locke's way of dealing with the one-many problem, the problem of how many objects can be subsumed under one concept or idea, is an example of how difficult it is to rely on sensory experience in epistemology. The notion of experience, therefore, was in need of redefinition, and stressing the significance of action was a natural way to widen the concept of experience.

Immanuel Kant's schematism made use of this point, but it internalized the notion of action. If one wants to avoid the idealism that results from Kant's view but take advantage of the critique of empiricism, one might externalize the notion of action. This was, in fact, the purpose of two prominent epistemologists, Charles Sanders Peirce and Jean Piaget. The latter even borrowed his central term, the concept of scheme, from Kant's schematism. From our point of view, both Peirce and Piaget stopped this externalization too soon. Their common problem is that motor action is not completely distinguished from perception, which led to inconsistencies in their thought. There is a lesson to learn in these attempts to externalize a concept of action. Peirce's semiotic analysis, in particular, gives us some tools and enables us to develop new ones for later use.

2. A case study of the cognitive role of action:
The one-many problem in the light of Locke, Hobbes, Spinoza, and Kant

The relation between action and cognition was an important problem in the so called maker's knowledge tradition. Maker's knowledge was often contrasted to knowledge acquired only by sense experience. This was, in effect, a critique addressed to empiricism. We shall concentrate on a specific problem of empiricism, the one-many problem or the problem of subsumption, in order to see what may be learned from such a discussion. We do not suppose, of course, that the case study exhausts the subject.

We begin the treatment with the thought of John Locke, who initiated an epistemological tradition of empiricism deriving ultimately from Descartes' new way of posing epistemological problems, and end up with a discussion of

Kant's Copernican revolution, a critical synthesis of empiricism and rationalism.

René Descartes conceived the mind as separate from the body and from the rest of the material world. Matter exists in space and time, and consciousness is an independent substance which does not possess extension. (See, e.g., Rorty 1980, pp. 45–61.) The epistemological relation between states of mind, ideas, and material objects is hard to explain on the basis of this dualistic assumption. As a rationalist Descartes did not rely on sense-organs in epistemology. The sound basis of knowledge is not, for a rationalist, established by sense perception, even if one admits – as Descartes did – that sense perception plays some role in achieving knowledge. The basic reason why ideas correspond to material objects is, according to Descartes, the fact that God does not cheat. It was a kind of God-established harmony.

The frame for putting the question of the relation between ideas and material objects, the Cartesian framework, can be illustrated quite concretely: Separate the head from the rest of the body and the environment and examine then its relation to the immaterial mind that exists outside of space. The relation between them is a relation between intentional thought-contents and the physiological properties of the brain.

The object can be both perceived and conceived, and the question is: Which one of these two methods is a more reliable way to know the correspondence between ideas, as unextended immaterial entities, and extended objects? The rationalist solution of Descartes was based on the conviction that the senses may be deceptive; thus, knowledge of the relation between objects and ideas must, in principle, be established independently by reason alone.

John Locke argued for an empiricist solution to the problem, but he did not change the Cartesian frame, except by admitting that ideas may have spatial properties. He wrote that "a circle or square are the same, whether in idea or existence" (Locke 1959, vol. 1, p. 175). This is in clear contradiction with the assumption that the mind possesses non-spatial existence, because it does not make sense to say that an entity that has no dimensions is round. But the issue as raised both by Descartes and Locke continued to rely on a Cartesian meaning of the word 'idea' (see, e.g., Rorty 1980, pp. 48–49).

In contrast to rationalists Locke relied on sense experience. One of the problems he could not solve on this ground, a problem which we shall examine more closely, is the one-many problem: How can one concept (or idea) be applied to many objects? The objects that must be subsumed under one concept are different in many respects. There are, for instance, a variety of triangles, and the same concept of triangle must be applied to all of them.

The crucial assumption that makes the one-many problem difficult for Locke is his epistemological principle of similarity (or conformity). He writes that "the ideas of primary qualities of bodies are resemblances of them, and their patterns do really exist in the bodies themselves" (Locke 1959, vol. 1, p. 173). And further: "Our knowledge, therefore, is real only so far as there is a

conformity between our ideas and the reality of things" (ibid., vol. 2, p. 228, Locke's emphasis).

The ideas of primary qualities are produced by these qualities. Locke writes that "simple ideas are not fictions of our fancies, but the natural and regular productions of things without us, really operating upon us; and so carry with them all the conformity which is needed" (ibid, vol. 2, p. 229).

Locke's conception of perception fits well in with a metaphor of Plato: the form of the body (but not the body itself) is conveyed to the mind as the form of a seal-ring is pressed on wax. Locke supposed that this matching principle guarantees the epistemological connection of ideas to objects through the senses.

This theory of passive perception leads to the problem of subsumption. If ideas are produced by bodies through a passive sense-perception which works like Plato's seal-ring, how can the general idea of triangle be the product of many real but different triangles? According to Locke this is a difficult problem, because "does it not require some pains and skill to form the general idea of a triangle, (which is yet none of the most abstract, comprehensive, and difficult,) for it must be neither oblique nor rectangle, neither equilateral, equicrural, nor scalenon; but all and none of these at once" (ibid., vol. 2, p. 274, see also Beth 1956–1957, pp. 365–368).

The problem of general ideas cannot be solved on the basis of Locke's assumptions. One reason for this is the passive nature of sense perception in Locke's theory. Even if one insists that all triangles have in some sense the same form, it is not easy to understand how the common form in an idea could be produced by perceptions understood according to the seal-ring analogy. The forms of triangles are so different that they do not match enough with each other.

It is not enough to say that they have triangularity in common as an abstraction (meaning as an abstract immaterial entity or state of mind). According to Locke's empiricism, abstract ideas of primary qualities had to be based on the senses. There could not be any single and unequivocal basis for any verbal expression concerning triangularity (i.e., a triangle could not be identical in idea and in existence) unless there were a figurative and visualizable idea of a general triangle that matches with real external triangles. But this kind of triangle seems impossible to imagine.

Another approach to the issue, an approach stressing the activity of the subject, had been presented already by Thomas Hobbes, although he considered sensation to be a passive process in which bodies affect the organs of sense and cause "some internal motion in the sentient" (Hobbes 1962, p. 390). He differed from Locke, however, in holding that the memory and imagination of sounds, colours, etc., as well as magnitudes and motions are only internal states and processes, and they only "appear as if they where external, and not at all depending upon any power of mind" (ibid. p. 92). Thus, he gives up the principle of con*form*ity between sensations and external objects.

According to Hobbes the power to act is important to epistemology in the sense that our ability to construct an object of knowledge determines our ability to achieve certain knowledge of that object. Hobbes gives an example illustrating his notion of knowledge.

> "How the knowledge of any effect may be gotten from the knowledge of the generation thereof, may easily be understood by the example of a circle: for if there be set before us a plain figure, having, as near as may be, the figure of a circle, we cannot possibly perceive by sense whether it be a true circle or no; than which, nevertheless, nothing is more easy to be known to him that knows first the generation of the propounded figure. For let it be known that the figure was made by the circumduction of a body whereof one end remained unmoved, and we may reason thus; a body carried about, retaining always the same length, applies itself first to one *radius*, then to another, (...) and, therefore, the same length, from the same point, toucheth the circumference in every part thereof, which is as much as to say, as all the *radii* are equal. We know, therefore, that from such generation proceeds a figure, from whose one middle point all the extreme points are reached unto by equal *radii*. (...) for he that knows that a circle has the property above declared, will easily know whether a body carried about as is said, will generate a circle or no" (Hobbes 1962, p. 6).

For Hobbes, the goal of knowledge is power (ibid. p. 7). The power to construct an object of knowledge guarantees the acquisition of knowledge of the constructed object. It is possible to have geometrical knowledge, because we construct the geometrical figures, and it is possible to obtain knowledge of society, because we know how to create or construct it by a social contract, at least in principle. This methodological conception makes even the notion of a social contract important for Hobbes.

This constructivist method is related to Hobbes's conception of resolution and composition, or analysis and synthesis. Synthesis is "ratiocination from the first causes of the construction, continued through all the middle causes till we come to the thing itself which is constructed or generated" (ibid. p. 312).

The method of synthesis, knowledge, and construction as action (for Hobbes basically physical movement) are related to each other; and, as the example shows, action has the role of exceeding the limits of perception. We do not *see* whether a circle is a true circle, but if we have constructed it, or if we know that someone else has properly constructed it, we know that it is a true circle. This connection between the possibility of true knowledge and constructive synthesis was later developed by Immanuel Kant.[1]

For Hobbes a real material body and the idea of it in the mind are not similar, the perceived objects only appear to be external. Objects are external, but they do not resemble our perceptions.[2] Construction as a process relating ideas and objects does not (in contrast to Locke) require a similarity of matching forms.

Benedict Spinoza rejected the principle of similarity as well. He was asked, which one of the many ideas of a circle is the adequate idea from which all the properties of a circle can be deduced? The adequate idea, according to Spinoza, must involve the efficient or the proximate cause of a circle. And that is expressed in the idea that a circle is the space described by a line of which one end is fixed and the other movable. (See Spinoza 1955a, pp. 34–35.) This is obviously the same process of construction that Hobbes described in terms of solid bodies. Spinoza also stated that even if "a circle existing in nature and the idea of a circle existing (...) are one and the same thing displayed through different attributes" (Spinoza 1955b, pp. 86–87), the ideas representing external bodies, which we call the images of things, "do not recall the figure of things" (ibid. p. 100).

Thus not only is action epistemologically significant as a process of construction, but also similarity in Locke's sense is no longer the principle which explains the relationship between external bodies and the ideas of them.

These traits, namely the significance of action for experience, construction as a method of synthesis, and the denial of similarity as an explanatory principle, were interpreted and united in a new way in Immanuel Kant's philosophy.[3]

Kant did not accept empiricism because of the agnosticism to which it leads, as was exemplified in David Hume. On the other hand, the connection between concepts and objects had to be explained better than by a Devinely pre-established harmony. Kant criticized both rationalism and empiricism, but he did not escape certain Cartesian assumptions. One Cartesian element in his thought was that concepts of understanding and empirical intuitions are completely different. The subsumption of objects under concepts was, however, somehow based on similarity (*Kritik der reinen Vernunft*, from now on KdrV, B 176/A 137). He needed a mediator, therefore, that could (in some sense) be similar, on one hand, to intuitions, and, on the other hand, to concepts.

Locke's use of the notion of similarity (conformity) in the spirit of Plato's seal-ring metaphor was not successful, so Kant had to find another solution.

Kant's new solution required a radical change that Kant called the Copernican revolution. Objects do not produce ideas in a mind which is passive in sense-perception, as was the general idea in empiricism. On the contrary, the mind is active. Objects conform in experience to the pure forms (i.e., forms with no empirical content) of sensibility, space and time, and to the pure concepts and categories (i.e., concepts and categories with no empirical content) of the understanding (see KdrV, B XVI–XVII, B 74–75/A 50–51).

This constitutive activity of mind is, partly, realized by the schemes which are, for Kant, similar both to concepts and to phenomena. They are supposed to be both intellectual and sensible. A scheme as a mediator explains the connection between concepts and objects on the basis of some kind of similarity (KdrV B 177/A 138). A scheme is a way to apply concepts to intuitions given by sensibility, and the result is an object of experience that is

both given in intuition and thought. Kant's theory of schemes is ultimately a way to describe the active role of the human mind.

Locke's notion of a general triangle was not acceptable to Kant. He wrote that there can be no adequate image of a general triangle (KdrV B 180/ A 141). The mediator cannot be entirely sensible itself, but it must be somehow connected with sensible intuitions. Therefore, we must find another principle of similarity that does not work on the basis of Plato's metaphor. The above examples from Hobbes and Spinoza will help us to find it.

If we take a scheme to be a process of construction that takes place in space and time, we can see how it connects concepts and objects. The nature of a circle can be expressed in several ways, but Spinoza's adequate idea of a circle is a privileged characterization, since it tells us how to construct a circle.

To use the concept of a circle, to subsume a circle under its concept, is – after Kant's Copernican revolution – to construct a circle using the method expressed in Spinoza's adequate idea. The relationship of a concept and its method of construction is not problematic. We can either take the method to be the concept[4], or we can say that the relation between the concept of a circle and its method of construction is a one-to-one relationship.

For Kant, the similarity here consists of the fact that a scheme is general and based on an *a priori* rule (KdrV B 177–178/A 138). Generality as continuous activity (stetige Handlung, see Kant 1926, p. 615) explains how a scheme is general: the same method of construction is used successively at different times and places. A scheme as a process is based on a rule which tells us how to construct an object, and the rule is *a priori* because it is based on (or is the same as) an *a priori* concept.

On the other hand, neither is the relation between the process of construction and the different constructed objects problematic. Applying the same method with different parameters (altering the place of the center and the length of the radius) one can construct different circles. The relation of the one to the many is easy to understand.

The similarity between the process of construction and the constructed objects must be interpreted differently. Kant handles this by defining the scheme as a transcendental time-determination. The point is that he had beforehand, in The Transcendental Aesthetic, put time into the intuition as an *a priori* form. So time is the connecting principle between schemes and objects (KdrV B 178/A 138–139). A process of construction proceeds in time and the products of construction exist in time. The act of constructing is not similar to the product in the same way as ideas and objects are (or should be) similar in Locke's approach. In the spirit of Hobbes and Spinoza we can say that the act of constructing a circle is "round" only in the sense that the movements in drawing a circle produce a round figure. For example, the movements of the hand conform to the roundness of the circle with the help of a solid body that instantiates the radii of the circle in the different phases of the process. Locke's notion of a conformity of two round entities (the object and the idea of it) is exchanged for the conformity of an action to the roundness of the object. And

this roundness is determined, in Kant's approach, through the method of construction by an *a priori* concept.

The products of construction, though they do not exactly match with each other, are still similar to each other in so far as they are produced by the same method. The roundness of circles and the triangularity of triangles is determined by a concept through the process of construction. The concept is or implies a rule according to which the act of construction proceeds. This solution works better than Locke's attempt to explain the relation between the concept of triangle and external triangles by means of the general idea of a triangle.

Locke's one-many problem is solved. The idea of a "general triangle" becomes an act of construction. The basic idea of empiricism, the idea that objects produce ideas, is reversed. The human mind constructs or constitutes external objects, categorizes experience according to its own concepts. The schemes are tools and processes of this constitutive activity.

This interpretation of the schemes as constructive processes can be defended as well in the case of Kant's categories of the pure understanding. The primary problem here is not how to subsume objects under concepts but how we can acquire knowledge about the relations between objects, e.g., causal relations. The ideas of construction and synthesis as action (see KdrV B 103/A 77) are, for Kant, the foundation for the possibility of true knowledge. The purpose was to overcome Hume's agnosticism.

The problem of the applicability of Kantian categories culminates in Newton's physics, where mathematics and geometry are applied to nature as physical equations (e.g., F=ma) which describe nature. Why does nature obey such equations? The empiricism of Hume did not explain such correspondence, because the validity of mathematical truths was restricted only to ideas of reason. For Kant, however, the role of mathematics and geometry in physics is that of synthetic *a priori* knowledge. This feature of mathematics is related to the idea of construction.

According to Kant mathematics investigates the general in the particular (KdrV B 742/A 714). To proceed from the general to the particular is to construct the concept, that is, to exhibit the intuition corresponding to the concept (KdrV B 741/A 713, see also Hintikka 1974, p. 160). In mathematics the constructed intuitions are not investigated empirically, what is under examination are their *a priori* aspects: that what follows from the general conditions of the construction must hold for the object of the constructed concept (KdrV B 743–744/A 715–716).

This is basically the same idea as in the case of Hobbes: knowledge of the *method* of construction gives us knowledge of the *result* of the construction. The general aspects of mathematical concepts can be examined *in concreto* by examining the particular products of construction.

Let us take Kant's own example, the equation '5+7=12'. The scheme of quantity is, according to Kant, a number. This scheme is mental activity of adding similar units successively (KdrV B 182/A 246). In accordance with the

basic ideas of constructive mathematics we get: Put five dots in a row with seven other dots, and you literally see that it is as long as the row constructed by the scheme of '12'. This is how Kant described the situation in the preface of his work (KdrV B 15–16, see also Young 1982, pp. 30–31). The need of constructed objects of sensation in proofs makes mathematics a synthetic discipline for Kant.

In geometry the situation is similar. Analytic examination gives only the properties of a triangle which are contained in the defining concept of it (KdrV B 746–747/A 718–719). But this is not enough. One must have access to properties that are not contained in a mere definition but still belong to the object (KdrV B 746/A 718). A geometrician constructs triangles (KdrV B 744/A 716). In geometrical proofs one uses constructions, and this is how proofs go beyond the mere definitions. Thus, geometry is a synthetic discipline.

The schemes have, in so far as they are understood as constructive processes, an obvious role in geometrical proofs. The construction may proceed in the imagination or on paper (KdrV B 741/A 713). In both cases the constructive proofs are based on *a priori* conditions. In the former case the schemes are understood as functioning within the pure forms of sensibility. For instance the pure image of all quantities is space (KdrV B 182/A 142). In the latter case they are understood as real constructions, acts in the world.

Kant emphasized the first aspect, he did not accept the real *circinus et regula* which are not mathematically precise instruments (KdU, p. 12). He also held that concepts of pure reason (in contrast to pure understanding) cannot be schematized; the relation between the empirical world and the intelligible world of the pure reason is different (KdU B 255/A 251–252, KdpV A 122). However, the possibility of an act conditioned by the law of causality belongs to schematism (KdpV 121), and in the preliminary works of *Die Metaphysik der Sitten* Kant writes that acts are subsumed under pure reason by the mediation of the scheme of judgement-power (Kant 1955, p. 233). It is this aspect of the schematism (which Kant did not himself develop) that we underline in our own interpretation. Acts in the world are schemes of the intelligible.

Our starting point is external action. The similarity between concepts and objects is the similarity of the motor movements of the body to the form of external objects. This can be compared to acts of external construction.

For Kant action was primarily action of the pure understanding directed toward sense-perception, he internalized the notion of maker's knowledge.[5] This move made the constitution of nature dependent on the conditions of pure reason. In our emphasis on the external aspect, on the motor movements of the body, we can make use of some of the features of Kant's schematism interpreted as constructive processes. His strategy of using the activity of the subject as a tool of criticism against traditional rationalism and empiricism is worth examining from our own point of view as well. But it requires that the concept of experience is widened. The emphasis must be placed on external action rather than sense-perception. And here we have a lesson to learn from pragmatism.

To sum up: The epistemological problem of the relationship between concepts and objects was formulated within a Cartesian frame of reference in which concepts (ideas) as thought-contents were disconnected from the three-dimensional material world and put into a non-spatial world of reason. A notion of a sort of God-established harmony was then required to guarantee that clear and distinct ideas correspond to objects in the material world. Hobbes, Spinoza and Kant (each in his own way) criticized this idea on the assumption that causality and conceptuality are related to each other in the constructive method of synthesis, which guaranteed true knowledge instead of mere clarity and distinctness. Locke understood, unsuccessfully, the relation of similarity between concepts and objects (in regard to primary qualities) as an image-like conformity in the spirit of Plato's metaphor of the seal-ring: the form of the object is transferred into its concept. Kant, however, understood conformity in terms of constructive action. In the case of constituted objects (nature) and constructed objects (circles, etc.) this conformity can be interpreted so that the form of action accommodates to the form of the object. As generality is for Kant continuous action (stetige Handlung), we find in him a connection between the general and the particular, a connection that is worth considering in the modern context as well.

Notes

1 The relation between analysis, synthesis and construction is not so simple as indicated here. Auxiliary constructions are an essential part of the method of analysis (see Hintikka and Remes 1974). The simplified notion developed here, however, is enough for our purposes. The idea of maker's knowledge, knowledge that determines its object, is related to synthetic method, and according to Kant mathematics is a synthetic discipline because of the need of constructions *in concreto* (see Hintikka 1973, pp. 199–221, and cf. also the discussion later in this chapter).

2 Hobbes' position can be compared to our distinction between physical and phenomenal objects (see Figure 1.1). We perceive phenomenal objects that appear to be external. Phenomenal properties are, however, dependent upon internal conditions. Physical objects are external, but we do not perceive them as physical, that is, we do not perceive atoms, electrons etc. The same object is external as physical but we cannot perceive it except as phenomenal.

3 According to Pérez-Ramos Kant's conception of knowledge is an internalized version of maker's knowledge in which the knower constitutes his world of objects, both material and non-material (see Pérez-Ramos 1988, p. 61).

4 Identifying concepts with methods is natural if we accept (like Wolff 1973, p. 323) the view that knowledge for Kant is not a mental state but mental activity or mental functions.

5 This internalized schematic approach has been applied in modern cognitive psychology. For instance, Ulric Neisser explains some properties of visual

perception with the concept of scheme (see Neisser 1976 and 1978). The constructive nature of visual perception is explicit in an experiment of Gunnar Johansson where people were filmed walking in a darkened room. They had small light bulbs attached to their ankles, knees, shoulders, elbows and wrists. When the movie is shown everyone sees people walking only if the full movie is shown. A single frame shows a meaningless pattern of dots. The perception of walking people is constructed on the basis of all of the moving dots. (See Neisser 1976, p. 39)

Another example is the famous duck-rabbit picture. The same figure can be seen as a rabbit or a duck. A schematic explanation is that it is seen as a duck if a visual duck scheme is activated which at the same time inhibits the rabbit scheme, or the other way round. Michael Arbib has even tried to apply this idea to pattern recognition in AI (see Arbib 1979).

3. C. S. Peirce on facts and percepts

The following discussion is not an exegetical attempt to find out what C. S. Peirce really said. We shall show only that in his efforts to widen the empiricistic concept of experience by means of a concept of action Peirce is entangled in implicit inconsistencies.[1] By explicating these inconsistencies we can clarify the problems involved in the relation between action and perception, which is our basic concern in Part II. In other words, by analysing Peirce we can formulate some of the problems to which we shall suggest solutions later.

Our aim, furthermore, is to interpret Peirce from a naturalistic point of view. We want to see what elements of his philosophy can be used for our own purposes in discussing the relation between causally analysed motor action and perception. As we shall see in later chapters, Peirce's basic concepts are quite useful in sketching a naturalistic conception of language and mind.

The first thing to note is that mere sense perception was not, for Peirce, an adequate basis of experience. According to him "the concept of *experience* is broader than that of *perception*, and includes much that is not, strictly speaking, an object of perception" (CP 1.336). He wrote against Ernst Mach that sensation "has no value whatever except as a vehicle of thought" (CP 5.601). His critique of empiricism followed Kantian lines in stressing the significance of action, but the emphasis was placed on external action.

Empiricism was not sufficient for Peirce, because sense perception cannot adequately account for the compulsive nature of experience. "We perceive objects brought before us; but that which we especially experience ... is an event" (CP 1.336). "Experience generally is what the course of life has *compelled* me to think" (CP 8.330). This compulsive experience of events is something that sense perception alone cannot explain.

The characterization of this compulsive element, i.e., experiencing hard facts as distinguished from experiencing objects of perception, or percepts, was one of the goals of Peirce's pragmatism. The central point is, therefore, the relationship between perception and action. The latter is considered as a means of criticizing empiricism based merely on sense experience, a means of widening the concept of experience. This task was not completed by Peirce. His distinctions between action and perception and between facts and percepts are not quite consistent.

It must be noted that Peirce's conception of experience in general did not fit in with Plato's seal-ring metaphor of sense perception which was the basis of Locke's epistemology. And this holds for Peirce's account of perception, as well. The relationship between perception and its object is already more complicated since "every sensation is partly determined by internal conditions" (CP 5.245). Clearly Peirce was not a naive empiricist.

One of Peirce's motives was a desire to find a way to speak about the real world as an independent object of knowledge. The real world is the external world which he contrasts to what may be called the internal world. But this contrast does not mean that the internal world is unreal as a state of mind. On the contrary, "a dream has a real existence as a mental phenomenon, if somebody has dreamt it" (CP 5.405). If I dream about a monster, then the dream itself is real.

The difference between the internal and the external remains, however, because "the thing dreamt ... retains its peculiarities by virtue of no other fact than that it was dreamt to possess them" (CP 5.405). The monster possesses only the properties that I have seen in my dream. In other words, the content of the dream is fiction, unreal and internal, but the dream itself is a real phenomenon. This means that "the external is necessarily real, while the real may or may not be external" (CP 8.191). The distinction between external and internal is also relative because nothing is "absolutely external or absolutely devoid of externality" (CP 8.191), but the contrast between the external and the internal remains.

The term 'real' may have other aspects for Peirce.[2] In our naturalistic interpretation, the real world is the external world, an object of knowledge. And we are interested in how we experience it. We can, of course, investigate contents of dreams as objects of knowledge. But the contents are not real in the sense that they are about real external objects (there are, after all, no centaurs even if I occasionally dream about them), although they are real as mental phenomena. And this makes a difference. The external real world is the material world, an independent object of knowledge. We are interested in the compelling character of the experienced external world and exclude other aspects from this discussion. There is, after all, a difference between being kicked by a dream horse and being kicked by a real material horse.

Peirce defines the external world alternatively as the world of percepts and as the world of facts. As contrasted to the world of fancy as an internal world, the concepts of fact and of percept seem to have the same referent: the external

real world. A dream horse is neither fact nor percept. One might conclude that facts and percepts belong to the external world and that dreams belong to the internal world. On a closer look this is not enough. The distinction between facts and percepts is important, and it is related to the distinction between action and perception. These distinctions confuse the distinction between the external and the internal, as we shall see.

We can begin with the concept of fact. Peirce characterizes the contrast between fact and fancy like this:

> "We live in two worlds, a world of fact and a world of fancy. Each of us is accustomed to think that he is the creator of his world of fancy; ... For this reason we call the world of fancy the internal world, the world of fact the external world. In this latter we are masters, each of us, of his own voluntary muscles, and of nothing more." (CP 1.321.)

The external world affects us, and Peirce calls "such forcible modification of our ways of thinking the influence of the world of fact or *experience*" (CP 1.321). The real external world "insists upon forcing its way to recognition as something *other* than the mind's creation" (CP 1.325). The world is sometimes hard:

> "Whenever we come to know a fact, it is by its resisting us. A man may walk down Wall Street debating within himself the existence of an external world; but if in his brown study he jostles up against somebody who angrily draws off and knocks him down, the skeptic is unlikely to carry his skepticism so far as to doubt whether anything beside the ego was concerned in that phenomenon." (CP 1.431.)

The situation is clear enough. "That is the reality, and we have to inquire what its nature is. We speak of *hard facts*. We wish our knowledge to conform to hard facts." (CP 7.659.) Facts resist our will, and that is why they are called brutal (CP 1.419). "Now there can be no resistance where there is nothing of the nature of struggle or forceful action" (CP 1.322).

It is precisely this compelling nature of experience that perception alone cannot properly explain (see also CP 1.336) because experience is a broader concept than perception and because we experience events that we cannot accurately be said to perceive. Therefore, when talking about hard facts here Peirce contrasts them to perception, that is, distinguishes them from percepts. It is percepts that we observe, perceive (see CP 8.144).

The same point about the compelling nature of experience is, however, expressed also with the concept of percept, as can be seen from this:

> "Every sane person lives in a double world, the outer and the inner world, the world of percepts and the world of fancies ... fancies can be greatly modified by a certain non-muscular effort, while it is muscular effort alone ... that can to any noticeable degree modify percepts." (CP 5.487.)

The external world is the world of percepts. The above example about a tragic scene in Wall Street continues: "The resistance shows him that something independent of him is there. When anything strikes upon the senses, the mind's train of thought is always interrupted" (CP 1.431). In other words, sense experience interrupts the train of thought, and something independent is experienced. One further example: "Thus, if you are kicked by a horse, the fact of the pain is beyond all discussion" (a letter to Georg Cantor, quoted in Fisch 1986, p. 195). These examples seem to indicate that the real external world *could* be experienced by perception. Isn't a fact of pain something we perceive, a percept?

But what is a fact of pain? John Locke already argued that when you eat too much manna and get your stomach sick, then it does not make sense to say that the pain is a property of the manna. The pain is rather a property of the suffering subject. From this point of view, facts and percepts are different; that is, the pain as a percept is a property of the subject, while facts belong to external real world.

The relation between facts and percepts is not clear on the basis of the example about pain. On one hand, pain is a compelling experience and therefore an indubitable fact, but, on the other hand, pain is a property of the perceiving subject and therefore not an external fact.

So far we have found out that both facts and percepts can be compelling, but facts are not, properly speaking, perceived. And this latter point seems to contradict the statement about the fact of pain.

The problematic relation between facts and percepts can be expressed, in our naturalistic interpretation, by saying that instead of talking about a fact of pain Peirce should have said: a kick of a horse is a fact experienced as a percept of pain. See Figure 3.1. Employing the distinction between phenomenal and physical objects the case is as follows. A physical horse gives a kick. This is a fact. Percepts are facts furnished with perceived qualities; that is, the horse's kick is perceived as a quality of pain. The compelling nature of this percept is now explained by there being a fact as an element of the percept.

The situation can also be described this way. The horse is a physical object, a fact, and its kick is experienced through the kick's effect: the perceived pain. The pain is a property of the subject and therefore internal (not an external fact). Why did Peirce describe the pain as a fact? The answer is found by relating pain to other properties that were, according to empiricists like Locke, secondary qualities. A perceived colour is an effect of an external object, but it

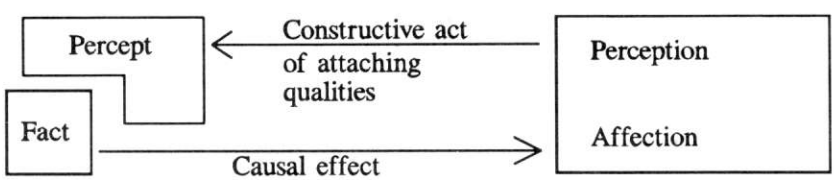


FIGURE 3.1. Facts and percepts in perception.

is, however, experienced as a colour gelonging to an external object out there. Therefore it seems to be a fact.

It is advisable to discuss the issue on the background of the problems of empiricism. George Berkeley's problem was this. Are there, behind the perceived objects (here percepts), some kind of hidden causes (here facts) of perceptions which are not, in themselves, perceived? Since sense perception was, for an empiricist like Berkeley, the only way to obtain knowledge about the external world, there was no way of knowing this. "In short, if there were external bodies, it is impossible we should ever come to know it" (Berkeley 1957, p. 40). The supposed causes were hidden, that is, outside the reach of the power of perception. Thus Berkeley decided to believe that there are no hidden causes. The world consists of visual, tactual, etc. ideas.

This situation illustrates one of the main problems of empiricism. The problem is the following:

1) Sense perception is the only way to obtain knowledge about the external world.
2) Perceived (phenomenal) qualities are internal, they are properties of the perceiving subject, not of the external objects.
3) The possible hidden causes of perceptions (secret powers of nature) are outside the reach of sense perception, therefore they either do not exist (Berkeley) or are unknowable (Hume's agnosticism).[3]

We are not claiming that every empiricist should identify him/herself with this characterization, but it is a useful way to describe the situation from our point of view. In our interpretation, Peirce wanted to solve this problem of empiricism by widening the concept of experience. Therefore he stressed the role of facts that are hard, brute, irresistible and, compelling. But how should we understand the relation between percepts (which are perceived and which can also be compulsive) and facts (which are not perceived)?

Peirce's conception of qualities gives us some further hints. Let's start with points stressing the difference between facts and percepts.

According to Peirce's theory of categories, percepts and facts belong to different categories. For him "the elements of phenomena are of three categories, quality, fact, and thought" (CP 1.423), that is, of the categories firstness, secondness and thirdness. Qualities belong to the first category, the category of feeling, which is an element of consciousness (CP 1.306). Facts belong to the second category of struggle and brute force (CP 1.322, see also 1.427). This fits well in with the view that "facts resist our will" while "mere qualities do not resist ... [because] mere qualities, unmaterialized, cannot actually react" (CP 1.419). Percepts are composed of perceived qualities (see CP 7.625), and they belong to the first category, while facts belong to the second.

Further: "Facts ... concern subjects which are material substances. We do not see them as we see qualities" (CP 1.419, compare to note 1 in this chapter). That is, facts concern matter which we do not see as we see qualities. And it is

"the matter that resists" (CP 1.419). For example, we see a red ball as round and red, we see roundness and redness related to each other in a certain way, but the qualities round and red do not resist. The ball as a real (material) object resists. This distinction between perceived qualities and resisting material objects corresponds to our distinction between phenomenal and physical objects. It seems quite clear that Peirce is trying to get the external real object (which is, for empiricists like Berkeley, unperceivable and, therefore, unknowable and unexistent) within the reach of experience as a resisting material object.

The doctrine of categories tells us also that "Mind is First, Matter is Second" (CP 6.32). Experience starts from perceived qualities, and in order to explicate what it is to experience matter, it is necessary to widen the concept of experience.

The relation of qualities to facts and percepts is a point of interest here. Facts belong quite clearly to the second category, while qualities belong to the first category. Experience of facts involves brute force, it is compulsive, while perception of qualities does not involve brute force, qualities do not resist the will.

Percepts are more problematic. As contrasted to facts they are, according to Peirce, composed of two utterly different kinds of elements. One type of elements consists of qualities. "In the first place, there are the qualities of feeling or sensation ... the elements of 'Firstness'" (CP 7.625). Secondly, there are elements of secondness in the sense that qualities are experienced to be related to each other in a certain way (CP 7.625). This is an important point, and we return to it later.

Qualities are elements of percepts but not of facts, and this makes facts and percepts different. And in contrast to the fictitious world "the reality is altogether dynamic, not *qualitative*. It consists in forcefulness" (CP 2.337, emphasis added). That is, qualities do not belong to the material, real world.

This reading gives the result that facts make up the real, external world, and percepts must be contrasted to facts. Qualities cannot be predicated to facts because perception (of qualities) depends on internal conditions. But experience is a broader notion than that of perception, it involves also struggle and brute force. Percepts consist of qualities, and therefore they must in some sense be contrasted to the real world of facts.

However, this is not the whole story – as is understandable, because this would amount to a view leading quite close to the main problem of empiricism described above. In order to avoid this problem, Peirce had to distinguish percepts from Berkeleyan ideas. This distinction was done by attributing the compelling nature of experience to percepts as well: "Qualities are concerned in facts" (CP 1.419). How are they concerned in facts?

The answer is difficult because qualities are monadic entities which belong to the category of firstness. The elements of this category are what they are independently of anything else. "The being of a monadic quality is a mere potentiality, without existence. Existence is purely dyadic" (CP 1.328). And

mere qualities are not real in the sense that they would resist our will, as was noted above (CP 1.419). But they are not mind-dependent, either. A quality "is not anything which is dependent, in its being, upon mind, whether in the form of sense or that of thought" (CP 1.422).

There are two alternatives. 1) Qualities are cotrasted to the external real world and depend, therefore, on internal conditions; or 2) qualities are not mind-dependent, because they belong to the first category. The issue between these two alternatives is not settled because "whether we ought to say that it is the senses that make the sense-qualities or the sense-qualities to which the senses are adapted, need not be determined in haste" (CP 1.418). As a matter of fact, Peirce did not say clearly how qualities are, at the same time, mind-independent (due to the fact hat they belong to the category of firstness) and not resisting our will (because, as contrasted to matter, "mere qualities do not resist", CP 1.419).

Even if we consider this problem of qualities solved, e.g., by some kind of panpsychism that follows from the category of feeling as firstness, or by taking mere qualities to be real but unactualized potentialities (in which case we should, in our interpretation, discuss only actualized qualities as properties of actually existing external objects), we still have the same kind of problem with percepts. In other words, percepts seem to be both external and internal, as is seen from the following.

There are two types of elements in percepts. Qualities of feeling (which do not resist the will) are of the first type. As to the second type of elements Peirce writes:

> "In the percept, these elements of Firstness are perceived to be connected in definite ways ... These connectives are directly perceived, and the perception of each of them is a perception at once of two opposed objects, – a double awareness. In respect to each of these connections, one part of the percept appears as it does *relatively to a second part*. Hence, it is convenient to call them elements of 'Secondness.' " (CP 7.625.)[4]

The second category brings us to struggle, brute force and facts, real external things. Indeed, according to Peirce we live in "the parish of percepts. It is not inside our skulls, ... but out in the open. It is the external world that we directly observe"; the inkstand before me "is a *real* thing" (CP 8.144). As a real thing the inkstand has an element of "reaction against my will" (CP 8.144).

This means that percepts are of the same nature as facts. The "hardness" of fact, Peirce writes, "lies in the insistency of the percept" (CP 7.659). The difference between facts and percepts disappears, from this point of view. The real inkstand has qualities, does it not? In terms of Figure 3.1: We experience the phenomenal object (composed of qualities) to be the real external object.

On the other hand, the inkstand, "in being real and external, ... does not in the least cease to be a purely psychical product, a generalized percept, like everything of which I can take any sort of cognizance" (CP 8.144). As a

"psychical product" the inkstand must, of course, be distinguished from facts. The conclusion is that the inkstand as a percept has two aspects: It is "hard" as fact, on one hand, and it is composed of qualities of feeling that do not resist the will, on the other hand.

Another way to put the point is the following. The real external world is the world of percepts "that we directly observe" (CP 8.144). On the other hand, "rightly understood, it is correct to say that we immediately, that is, directly perceive matter" (CP 1.419). In other words, we "directly perceive" both percepts composed of qualities and matter that must be distinguished from qualities because "mere qualities do not resists. It is the matter that resists" (CP 1.419). There seem to be two aspects in perception as well. We have come to the point where the limits of sense perception disappear. It is matter that resists, makes up the compulsive element in experience, and now it can be "directly" perceived.

Peirce's attempt to widen the limits of experience leads to a kind of double-aspect theory of percepts. Every percept has a factual aspect and a qualitative aspect which have opposite directions. Seen from the factual point of view, percepts are mind-independent; and seen from the qualitative point of view, percepts are mind-dependent (because, as contrasted to matter, qualities do not resist).[5]

How are these opposite aspects to be connected in the concept of percept? The distinction between facts and percepts seems to be only relative. Sense perception depends on external and internal conditions, and Peirce is trying to combine these two aspects in his theory.

One possible answer is to say that there are some facts that we perceive and some facts that we don't perceive. Perceived facts, i.e., facts associated with qualities, are percepts. In perception things in themselves change to things for us.

This is too simple. This leads us, again, to the problem of empiricism described above. Facts are, on this view, some kind of hidden causes "behind" the perceived objects. In order to avoid the problem of empiricism, facts must be handled differently. Sense perception is too narrow a concept for Peirce. According to him, facts are, therefore, experienced as compulsive and hard, as exercising brute force. Facts are experienced by action (see e.g. CP 1.429).

This is still too simple because there is no room for that aspect of experience which Peirce characterizes by saying that in some sense we directly perceive matter, i.e., we perceive an object as a fact. Also facts have, in a sense, a dual nature. The distinction between facts and percepts seems to be relative from this point of view as well.

The same counts for the distinction between action and perception. It is also relative: In action "our modification of other things is more prominent than their reaction on us" while in perception "their effect on us is overwhelmingly greater than our effect on them" (CP 1.324). Action and perception are intertwined and complementary elements in experience. After all, Peirce did not eliminate sensory processes from his concept of action. The relativity of Peirce's distinctions are due to this.[6]

Further, internal and external are not definitely opposed to each other, either. "We are accustomed to speak of an external universe and an inner world of thought. But they are merely vicinities with no real boundary between them" (CP 7.438). Experience is, on one hand, forced upon us and so external, but it is "*mine* or *yours*, and thus belongs to the inner world" (CP 7.439).

The relativity of distinctions holds for fundamental ontological matters as well. After telling us that the subject of a fact is a thing, a body, a material or physical substance, Peirce writes that this "does not in the least contradict idealism" (CP 1.436). No doubt this is based on his notion of the category of firstness as a category of feeling, which is a mode of consciousness (see, e.g., CP 1.306).

Since our purpose is not to present a complete interpretation of Peirce, we can leave these problems open. But we are inclined to believe that he did not succeed in making these distinctions in a consistent manner. His main problem is concerned with the seemingly contradictory nature of the concept of percept. We will return to this later.

We can, however, anticipate our solution to the problem by referring to an interesting feature in Peirce's formulations. In discussing problems of perception he states that elements of firstness, qualities, are perceived to be connected to each other in definite ways in a percept (see CP 7.625). A traditional way to explain why this happens is to refer to the conceptual organization of perceptual experience.

Peirce connects this observation to a problematic claim that we directly perceive matter (this seems to contradict his other statements according to which matter cannot be properly perceived). Peirce continues (in CP 7.625) that also these connectives of qualities are "directly perceived" and that this has something to do with the category of secondness. This is based on the fact that there are *two* elements (qualities) connected to each other.

This quite abstract conclusion (based on the number of elements connected at a time) changes interestingly if we take literally the point that this has something to do with the category of secondness, and ask: Is it possible that relations between qualities are based on the nature of external real world, its belonging to the same category of secondness? Or, to be more explicit: Is it possible that the attribution of qualities to an object (which enables us to perceive the qualities to be related to each other) takes place in virtue of experiencing the external world as a world of facts? This contradicts the traditional answer according to which this takes place by virtue of concepts (which are, in Peirce's theory, triadic).

This question is the same question that Jean Piaget tries to answer with his concept of sensorimotor scheme. According to Piaget the perceived world is organized on the basis of sensorimotor experience in the sense that qualities are perceived to be properties of the same object because the child has learned to grasp objects. Piaget has, however, similar problems in his distinction between action and perception with the terms sensorimotor schemes and schemes of perception (see the discussion in Chapter 5).

Our suggestion (presented in Part II) is based on the idea that facts in Peirce's sense can be experienced (in a sense explicated later) by a causal model of the solid environment, a model which is based on motor action only. Peirce's discussion opens up this kind of possibility, but he did not explicitly do it. We shall try to make use of Peirce's problems and distinctions in order to develop our own conception.

Notes

1 Most of Peirce's texts to which we refer, are written after 1896. The claim that sensations are partly determined by internal conditions is from 1868, and the discussion about a dream's reality is from 1878–1893. (See Murphey 1961 about the development of Peirce's ideas.) Therefore, the problems discussed below are genuine. But even if the problems were due to the development in Peirce's thought, they would be useful for our own systematic purposes.

2 Lilli Alanen has pointed me out (in personal communication) that Peirce's views about the real may have connections with a scholastic doctrine, according to which a thing may be real without being actually existent. As such it is, however, a mind-independent object of knowledge. This fits well in with the theory of categories where, e.g., qualities as pure potentialities belong to the category of firstness and are as such mind-independent. In this study we are, however, interested in how the actually existing external reality (that belongs to the category of secondness) is responsible for the compelling nature of experience in Peirce's theory.

3 From our point of view the problem is due to the fact that Berkeley did not have available the concept of a physical object as a theoretical object, as an object of common knowledge defined by the scientific community. This social point of view is relatively independent of an individual's private point of view, which is the only point of view in Berkeley's epistemology. Inside Berkeley's restricted viewpoint it makes indeed sense to say that we do not *see* the molecular structure of external physical objects, we do not *see* the wavelength of light, etc. Physical objects are, therefore, unknowable by means of perception alone.

4 Anticipating the discussion in Chapters 6 and 7, it can be noted that the connections between qualities concern also the rigidity assumption, i.e., the assumption that perceived objects are rigid three-dimensional objects. Our explanation to this assumption is in harmony with Peirce's terminology: The s-model (which is defined in terms of two mutually resisting rigid bodies, and therefore belongs to the second category) is responsible for the rigidity assumption. The s-model gives the connections between perceived qualities.

5 The double-aspect theory of percepts is based on the double-aspect theory of qualities described above. One possible solution to these inconsistencies is to regard the issue from the standpoint of phenomenology, understood as a theory that tells us how the world appears to us. Without actual experience there are no experienced qualities, only pure potentialities (like Kant's pure concepts). And as

pure potentialities they are mind-independent. But in actual experience qualities are perceived to be qualities of objects, and in this contexts the relation between qualities and matter becomes meaningful. Our purpose is, however, to solve these inconsistencies not by returning back to Kant, but by stressing the role of external action as a way to widen the limits of sense experience from a naturalistic point of view.

6 The difficulties of these distinctions between action and perception and between facts and percepts become clear also in the example of the horse's kick. If a horse kicks you, your "modification of other things" will not, most certainly, be more prominent than the horse's modification of you, on the contrary. It is, however, an experienced fact, and Peirce wanted to widen the limits of sense perception with the concept of action where the modification should be more prominent. It is, of course, intuitively clear that there is a difference between to see a horse and to be kicked by a horse. Peirce's formulations just don't apply in every occasion.

4. Peirce's semiotic analysis of experience

The main purpose of our study of C. S. Peirce is to investigate the relation between external action and perception, and Peirce's semiotic theory is quite interesting from this point of view. The lesson to learn from Peirce is his way to widen the concept of experience by means of pragmatist principles. Peirce stops his critique of empiricism too soon. This can be illustrated semiotically by contrasting Peirce's semiotic triad to a concept developed here, the semiotic triangle, where the semiotic role of external action becomes explicit.

In Chapters 8 and 11 we employ the semiotic triangle for our systematic purposes. In this chapter we discuss the properties of the semiotic triangle with the help of Peirce's insights. Our presentation is not, therefore, only an interpretation of Peirce, but also an attempt to develop semiotic concepts for later use. The analysis is subordinated to the systematic aims of the study.

In Peirce's theory, the relation between action and perception is connected to the relation between facts and percepts. The compelling element in experience (the element which goes beyond perception) is factual element, and it is mediated by action, not by the perception of percepts alone (recall the qualifications presented in Chapter 3).

The semiotic approach advises us to look at the situation as a trichotomy. "Every thought is a sign" (CP 1.538). And every sign presupposes three elements: the sign, its object, and its interpretant (see, e.g., 5.484). Every sign must be interpreted to be related to its object. Otherwise it is not a sign, a semiotic entity.

This trichotomy cannot be dissolved into independent parts, "a triadic relation is inexpressible by means of dyadic relations alone" (CP 1.345). But it is possible and useful to analyse separately the different elements of a

semiotic structure. This is a way to understand the triadic semiotic relation better.

Experience of percepts involves, from the semiotic point of view, two aspects. A percept is, on one hand, an object of a sign, namely an object of a perception as an act of perceiving. The distinction between the percept as an object and the perception as a sign is only relative (see Chapter 3), and this relativity will become clear also in a semiotic analysis.

On the other hand, the relation between an object and its sign is not semiotic unless the sign (the perception) is interpreted. A sign is interpreted by an interpretant. This interpretant may be another sign, which must, in its turn, be interpreted by an interpretant, which is possibly a third sign, and so on. Since we are interested in the relation between perception and action, it is advisable to concentrate on a habit of action as an interpretant. Because of our systematic aims we are all the time discussing the case of motor action, bodily behaviour, muscular efforts. The object of action (and perception) is, in our case, an actually existing physical object.

"A habit ... is a general law of action" (CP 2.148). And "the whole function of thought is to produce habits of action" (CP 5.400). The interpretation of a sign which has a percept as its object, is essentially purported to produce a habit of action as its ultimate or final interpretant:

> "The deliberately formed, self-analyzing habit – self-analyzing because formed by the aid of analysis of the exercises that nourished it – is the living definition, the veritable and final logical interpretant" (CP 5.491).

We have not yet reached action which cannot be a logical interpretant, because it lacks generality (CP 5.491), but "*habits will have the power to influence actual behaviour in the outer world*" (CP 5.487). The interpretation of perceptions as signs of percepts leads ultimately to actual behaviour. Perceiving pudding persuades (not necessarily, of course) you to interpret the perception in a decisive way: you swallow the object of your perception. The proof of the pudding is in the eating!

A single act is an instance of a habit of action. If the object of this act is the same percept uoy started from (if you eat the pudding just perceived), then we have a semiotic triangle (instead of triad), where perception, interpretation, and action are layers of the same experience. The ultimate interpretant (a habit of action) is connected with the object by an instance of the habit, a single act. This is illustrated in Figure 4.1. The semiotic triangle can now be analysed and characterized by means of Peirce's insights.

A sign is, generally, "*anything which, being determined by an object, determines an interpretation to determination, through it, by the same object*" (CP 4.531). An object determines a sign, and further, through the sign, an interpretant. In our case, where the sign in question is a perception, a percept determines its sign, a perception, which determines, ultimately, a habit of action. This habit of action is determined by the object through the sign. The resulting structure is the semiotic *triad*.

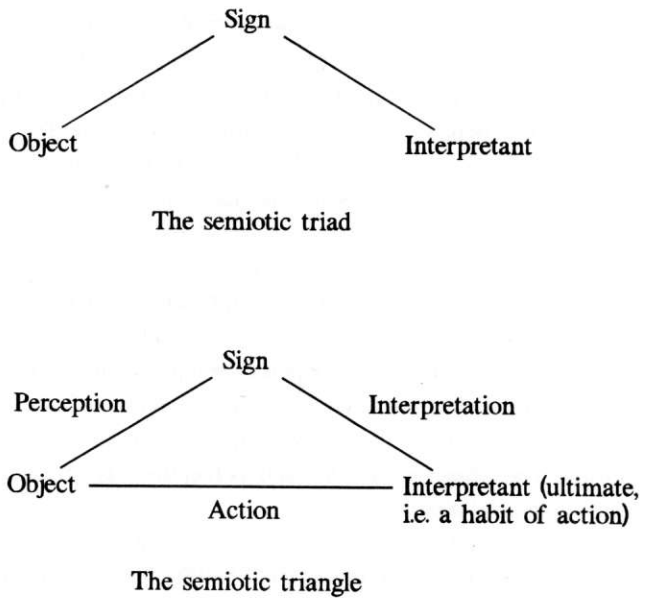


FIGURE 4.1. The semiotic triad and the semiotic triangle.

Action as an instance of this habit, again, determines the object in the sense that in action "our modification of other things is more prominent than their reaction on us" (CP 1.324). Now we have the semiotic *triangle* of perception with the appropriate determinations. The direction of determination is from the percept to the perception, and further to the interpretant, a habit of action, and through action to the percept again. The sight of pudding makes you hungry and you eat it up.

But do we eat percepts? The pudding as a percept is no doubt greatly modified when the pudding disappears into your stomach, and we are obviously dealing with percepts as elements of the external world. But how are perceptions determined by percepts?

The problem is that the semiotic triangle seems to separate action (with its compelling character) from perception, while in Peirce's theory they are not. To perceive pudding is not (in normal circumstances) voluntary. The percept (as an external object) makes us see it. We must pay attention to this.

By interpreting compulsiveness as causal influence we get the situation illustrated in Figure 3.1. The pudding as a fact (a physical object) causes you (through the light) to perceive it as a percept (a phenomenal object). It is this kind of compulsiveness that Peirce exaggerated by using a horse's kick as an example. In the semiotic triangle, however, the compulsiveness of experience related to action is a part of the determination of percepts by action (the pudding disappears), not the determination of perception by percepts.

As the horse's kick example shows, the compulsiveness of experience is in Peirce's theory transmitted through perception, through the side

of the semiotic triangle. This implies two problems that are related to each other. First, it is difficult to distinguish in a semiotic analysis between a horse's kick and, for example, mere visual experience. It is not voluntary to see a horse (in normal circumstances), but it is still different from being kicked by a horse (which is not action according to the definition according to which the modification of other things is in action more prominent). Second, if one follows Peirce's basic aims and tries to widen the concept of experience with the concept of action, then the semiotic *triad* does not make any difference between the dyadic relation in perception and the dyadic relation in action. There is only the side the relation between object and perception available.

The compelling character of experience is present in three different cases, in action (as manipulation), in a perception of a horse's kick, and in visual perception. These cases are, however, unanalysed aspects of the dyadic relation between object and perception. There are always sensory processes involved in action. This is expressed in CP 6.330 by stating that action in general is triadic. The layers of perceiving, acting and compulsion are intertwined in a complicated way. This is a problem for Peirce's semiotic triad. It remains to be seen whether the semiotic triangle is of help in the analysis of these layers.

Experience in wider sense was for Peirce, as noted above, something compelling, something that includes struggle, brute force, animal strength. And this aspect of experience is not triadic but dyadic. In contrast to mediation by a third "pure dyadism is an act of arbitrary will or of blind force" (CP 1.328).

The semiotic triangle has one advantage over the triad: The object of a semiotic relation has a dyadic relation not only to the sign (the perception), but to the interpretant (the habit of action) as well. Separately considered the sides of the triangle are, after all, relations between two elements. But this seems to imply that the dyadic relation between object and perception has nothing to do with action. We perceive objects without acting on them, and this is involuntary as well.

The semiotic triad, when applied to this situation, leads to the conclusion that the relation between the object and the perception (the sign) contains both perception and action as its elements. Otherwise action could not participate in the determination of the sign by its object. This again makes it difficult to distinguish between action and perception as modes of experience which was one of the basic goals of Peirce's pragmatism. Here is one of Peirce's unsolved problems. The triad is not enough. The problem can be solved by means of the semiotic triangle.

The problem can be solved if there is a way to explicate how the object of perception determines its sign in two separate ways: through perception and through action. In terms of the semiotic triangle this amounts to two separate

determinations: 1) the object determines the sign; and 2) the object determines the interpretant.

The direction of the determination through action at the bottom of the triangle should be changed to the opposite (cf. Peirce's definition of action). It is not enough to modify the pudding as aa object by eating it up. The object of action should determine its sign, the perception, through action as well. In other words, the object should determine its sign through the interpretant.

This requirement presupposes a distinction between determination of external objects by manipulating them (the interpretant determines the object) and epistemically significant determination of the subject by the object (the object determines the interpretant) in the very same process of manipulation (exertion of animal strength, as Peirce would say). The epistemically significant determination at the bottom of the triangle should also be distinguished from determination in perception. Peirce did not make this distinction, but Peirce's formulations contain further clues toward this distinction.

According to Peirce, brute force and resistance belong to the second category of fact. Facts are experienced dyadically by exertion of animal strength or effort on the resisting outer world. Exertion of effort presupposes the use of voluntary muscles on outer objects. Facts are, therefore, experienced by means of action in contrast to mere perception (e.g., seeing). The distinction between action and perception is, however, problematic. Facts and resistance seem to be involved also in mere perception.

Action in general is triadic. Dyadic action through which facts and resistance are experienced is also called dynamic action (CP 6.330 and 6.332). This dyadic and dynamic layer of action (or experience in general) consists of our use of voluntary muscles; but it is, separately considered, always blind, brute, and unintelligent (CP 6.332). Dyadic action does not reveal itself as dyadic to consciousness.[1] It lies hidden under the triadic perception, and it cannot be dissolved from experience. Introspection does not help here.

This hidden dyadic aspect of action can, however, be analysed theoretically, and one way get further here is to discuss Peirce's distinctions between different kinds of objects.

Peirce writes about dynamic relationships here, too. He distinguishes between immediate and dynamic object. The immediate object is the object "as cognized in the Sign", while the dynamic object is the object "as it is regardless of any particular aspect of it" (CP 8.183). The dynamic object is "the Reality which by some means contrives to determine the Sign to its Representation" (CP 4.536). The dynamic object is the real, external object that is as it is independently of what we think of it. The dynamic object also determines its sign.[2] In other words:

> "There are Real things, whose characters are entirely independent of our opinions about them; those Reals affect our senses according to regular laws, and, though our sensations are as different as are our relations to the objects,

> yet, by taking advantage of the laws of perception, we can ascertain by reasoning how things really and truly are" (CP 5.384).

The term 'dynamic object' indicates that we are dealing with a dyadic relation of brute force and resistance. "All dynamical action, or action of brute force, physical or psychical, either takes place between two subjects ... or at any rate is a resultant of such actions between pairs" (CP 5.484). Thus the relation between the sign and its dynamic object is dyadic. And the dynamic object "by some means contrives to determine the Sign to its Representation" (CP 4.536). In other words, the dynamic object determines (dyadically) the sign and makes the sign to represent the object (a representation is, generally, anything that represents). And since the second category is the category of fact, it follows that the factual element in perception (or at least part of it) is responsible for the determination of the sign by its object.

The real dynamic object of perception is a cause of the perception, but this is not all there is to it. In visual perception, the light emanating from a physical object is causes visual perception, but perception is not explained by this alone.

A percept is the immediate object of perception, indeed of all knowledge and all thought (CP 4.539). The immediate object is, by definition, "the Object as the Sign itself represents it," and its being "is thus dependent upon the Representation of it in the Sign" (CP 4.536). It is the object "as cognized in the Sign and therefore an Idea" (CP 8.183). Therefore it must be, in some sense, internal (CP 8.354). Perception depends on internal conditions.

From this point of view percepts cannot be facts, they are internal, in a sense. But, on the other hand, percepts are external, because there are factual elements in percepts due to the dyadic relation between the sign and its object. Recall that the "hardness" of fact lies in the insistency of the percept, which is an element of secondness in the percept (CP 7.659).

In CP 7.625 Peirce writes about another element of secondness (in addition to the resistance of the external world), namely about connections among qualities. Qualities are perceived to be related to each other. Qualities are, e.g., perceived to be qualities of the same object, and thus these relations belong to the category of two. But this aspect is not relevant here, because it concerns relations within the percept and not relations between the percept and its sign.[3]

The real world is made up of facts, and the perceived world is made up of percepts. As contrasted to the internal world, it is the same external world which is considered from different points of view.[4] This implies that percepts are also, in some sense, external.

In what sense can percepts be both internal and external? This is the same problem that emerged in the context of the critique of empiricism. Now it has arisen in the semiotic context of discussing the distinction between the immediate and the dynamic objects of a sign. Here, again, it is too simple to say that there are some facts that we perceive (which facts are percepts) and some facts that we don't perceive. The concept of experience remains too narrow.

One further aspect of the situation, namely the relation to propositional knowledge, can be described by analysing how perceptual facts are given in perceptual judgements. "The whole question is what the *perceptual facts* are, as given in direct perceptual judgements" (CP 5.54).

Percepts cannot be identified with facts, but percepts belong yet to the external world. Percepts are not, therefore, our objects of internal experimentation. A percept "is a construction with which my will has nothing to do" (CP 2.141).

So "the only thing I carry away with me is the *perceptual facts*, or the intellect's description of the evidence of the senses". These "perceptual facts are a very imperfect report of the percepts; but I cannot go behind that record". (CP 2.141.) A perceptual fact is a proposition resulting from thought about a percept (CP 2.27).

A perceptual judgement is "a judgement asserting in propositional form what a character of a percept directly present to the mind is" (CP 5.54). As a judgement it is "an act of formation of a mental proposition combined with an adoption of it or act of assent to it" (CP 5.115). A perceptual judgement is, then, an act of mind asserting a propositional perceptual fact.

There are, in sum, three kinds of elements in perception: facts, percepts, and perceptual judgements. Facts are completely external, percepts are both external and internal, and perceptual judgements are completely internal. Now how does this look like from a semiotic point of view?

According to Peirce, a perceptual judgement is "the direct Dynamical Interpretant of the percept" (CP 4.539). A percept, in its turn, is the dynamic object of the perceptual judgement (CP 4.539). The relation between a percept and a perceptual judgement is, therefore, dynamic.

A dynamic relation indicates struggle and brute force, elements of secondness, it is dyadic action (CP 6.330). The relation between a percept and a perceptual judgement is also dyadic. Here the percept is taken to be internal in the sense that it is constructed (CP 2.141, 5.115). Peirce writes also that a perceptual judgement is an index of the percept (CP 7.628). And an index has a direct physical connection (CP 1.372) or a real connection (CP 2.286) to its object.

In other words, the percept as an immediate object of a sign is at the same time and in virtue of its immediateness the dynamic object of a perceptual judgement. The percept is also the immediate object of all knowledge and all thought (CP 4.539). And an immediate object is, as noted above, the object as represented in the sign (CP 4.536). The sign is here the perceptual judgement. Percepts have two aspects also in the sense that they are both dynamic and immediate objects of perceptual judgements.[5]

Above we distinguished between a real object as the dynamic object of a sign and a percept as the immediate object of a sign. Combining this with the relation between a perceptual judgement and a percept we get:

1) A real dynamic object (the object independent of internal conditions) causes a perception (affects the senses), but

2) that what is perceived is a percept which is both external and internal. The percept is external in the sense that it is not fancy, and internal in the sense that it is constructed, it depends on internal conditions. The percept depends on its sign.
3) The percept causes (through a dyad, therefore causes) a perceptual judgement. Here the percept is internal, and the perceptual judgement is its interpretant and, therefore, also its sign. There is no room for a perception as a state of mind that would not be propositional. In other words, perceptions are necessarily conceptually organized.

The problem that remains is the same as before: How can percepts be both external and internal?

In our naturalistic interpretation this can be expressed (see Figure 4.2) as follows:

1') A physical object causes a perception, e.g., by emitting light, but
2') that what is perceived is a phenomenal object, e.g., a red object (and to see it as red requires an eye capable of distinguishing between different wavelengths, etc.).
3') The phenomenal object causes its propositional (linguistic) categorization (there is a brain process responsible for the arising of a linguistic thought, e.g., "there is a red book"; in other words, the p-model and the l-model are physically connected). However, perceptions as states of mind are necessarily propositional (linguistic), there is no room for non-linguistic states of mind (perceptions). From this point of view (and this is the traditional standpoint in philosophy expressed in our terms), the l-model alone is responsible for the organization of the p-model.[6]

The real object (the fact), the percept, and the perceptual judgement are necessary layers of experience. The real object is what it is independently of what we may think of it, the percept is formed or constructed in an uncontrollable way, and the act of perceptual judgement seems to be out of control, too (see CP 5.115).

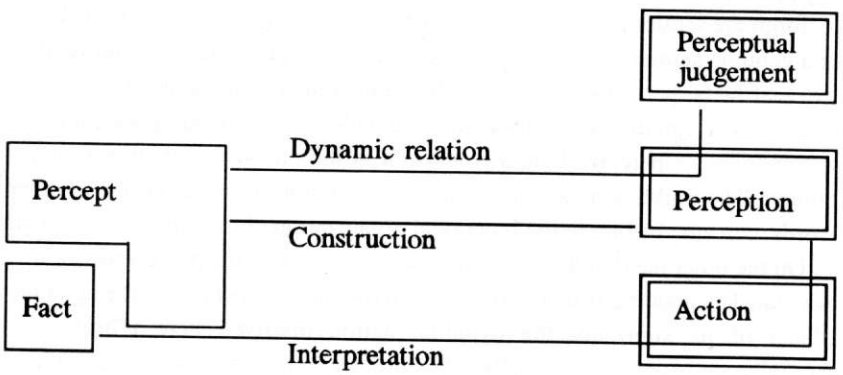


FIGURE 4.2. Perceptual judgements in perception.

Every thought is a sign, and we cannot, as Peirce expressed it, proceed behind the perceptual judgements, and much less behind the percepts. In other words, according to this view we cannot perceive the world except as propositionally categorized, and even if we could, there would still be left the distinction between percepts and facts, immediate and dynamic objects. From our point of view it is important to note that there is a difference between percepts and perceptual facts, and that the semiotic (triadic) structure of perception remains even if perceptual judgements are removed. A percept is the sign of a real external object, and its interpretant is a habit of action.

Human beings necessarily categorize their perceptions, see the environment as cats, trees, etc. According to Peirce (and many other philosophers, too) this categorization takes place in virtue of concepts. We are, however, aiming at a bottom-up analysis. We are looking for a notion of non-propositional, or better prelinguistic[7] perception. Peirce's semiotic approach is of help here. The task is to find out what can be done with a semiotic analysis when the role of perceptual judgements is separated from the semiotic structure of perception.

The dual nature of percepts and their relation to facts (real objects) is explained from the semiotic point of view as follows.

Objects are perceived as objects of some signs. And the sign's "Immediate Object must be in some sense, in which the Sign need not be, Internal" (CP 8.354). Signs can be public, like words of a natural language, and as such they are not internal. Immediate objects are internal and private in the sense that they are always objects perceived by some individuals. Others cannot perceive my perceptions, of course.

In other words, a percept as the immediate object of a sign is the *intentional* object of the sign. It is the object as intended, i.e., as represented or cognized, in the sign. It is that what the sign is (subjectively understood) *about*.

As a semiotic process perception gives meanings to the perceived world, categorizes or conceptualizes it. And this can be said about perception also when the linguistic aspect is abstracted away. Of course, conceptuality must then be distinguished from linguistic representations. Even in this case a percept is dependent on its sign interpreted by some individual subject, i.e., it depends on internal conditions.

From the semiotic point of view percepts can be regarded as internal. There is a genuine semiotic difference between facts and percepts. As contrasted to external facts, percepts are internal, they are signs for an agent. A perceived pudding is a sign that stands for a physical pudding. The pudding we eat is not the pudding *as* perceived, as a percept; it is the physical stuff that satisfies hunger. The pudding as a percept directs the action of an agent. Or in other words, percepts belong to the functional organization of the mind of the agent.

On the other hand, it does not make sense to say that the perceived world is not real. The pudding *is* there. The one and the same object is also the dynamic object of its sign, but the dynamic action involved here ("brute and unintelligent" dyadic action (CP 6.332) through which a real object determines its sign), is not cognizable as such. An object is not the object of consciousness

until it is given a meaning, i.e., interpreted; and as interpreted it is the immediate object of its sign, the percept.

The world cannot be cognized but as objects of some signs, that is, as immediate objects, percepts. But this does not mean that the mere existence of these objects depends on triadic experience. There is no need to speak about two different types of real objects, the real in itself (the fact) as real, and the percept as real. This is why Peirce tends to identify facts and percepts.

A perception is internal as a state of mind, and as such it can be contrasted to external percepts. The problem of the nature of the states of mind is, however, unsolvable, if the problem is formulated in the Cartesian frame described above. A perception is, in this perspective, either the state of a spiritual mind or it is a brainstate. If we want to get rid of immaterial substances, as is our purpose, the only option is a reduction to brain states (or processes). But a neurophysiological description tears off the connection with the percept as an external object. A brain state as such is not a sign of anything. It must be interpreted, and another brainstate cannot function as an interpretant, already because a semiotic structure is triadic. The problems of empiricism have shown that sense perception alone is not able to connect brainstates to external objects. The only alternaive is action which connects brainstates to objects.

This is a semiotic way to put the point that external objects are necessary parts of the functional organization of mind. The question is: What makes a brainstate a state of mind? And the answer is: Interpretation, the brainstate is interpreted to be the sign of its object, and the only way to stop an endless series of brainstates is a habit action as a final or ultimate interpretant. Mind is necessarily triadic. If we take one element out of its semiotic context, the semiotic triangle, then the semiotic nature of all elements is lost. We are not dealing with a sign anymore.

This dilemma of the externality and the internality of a percept cannot be solved unless the object of perception is reached both as a fact (independently of its being perceived), and as a percept (as perceived).

Through perception alone this is hard indeed. The dynamic and dyadic connection between a real object and its sign does not reveal itself to consciousness. According to a semiotic analysis, consciousness is bound to deal with signs, that is, triadic relations only. "The object of representation can be nothing but a representation of which the first representation is the interpretant" (CP 1.339). This leads to an endless series of representations each of which is, for consciousness, the object of the former representation. In other words, there are two endless series that begin from a sign. A series of interpretants, and another series of objects. One conclusion of this endless series of objects is that according to the semiotic analysis, (triadic) sense perception alone cannot reach the real external world as a world of facts.

The endless series of representations proceeds from a sign to its object. We get the object as a sign by taking its sign as interpretant. But we can end up with nothing but an object as represented by a sign, i.e., we reach the immediate object, never the dynamic object of the sign. This endless series of

representations is a semiotic way to express the main problem of empiricism. Perception does not reach the external world independently of our way of representing it.

However, in order to avoid the main problem of empiricism Peirce thought that it is possible to reach the real object somehow. "But an endless series of representations, each representing the one behind it, may be conceived to have an absolute object at its limit" (CP 1.339).

Just how is this? By using the regression in the opposite direction. In the next sentence Peirce writes that there is an infinite regression of interpretants as well. However, Peirce wants to stop this regression with a final or ultimate interpretant. "Finally there is what I provisionally term the Final Interpretant, which refers to the manner in which the Sign tends to represent itself to be related to its Object" (CP 4.536). The final or ultimate interpretant, "the real and living logical conclusion", is a habit of action (CP 5.491). Sense perception cannot avoid the infinite regression. What about action?

There are two ways through which a sign can be related to its object. The direct way through the representation relation of perception is the route of traditional empiricism. Kant reversed this relationship by his Copernican revolution which gives the subject an active role in sense perception. But he did not reach the thing in itself, the world independently of its being perceived. His conception of the epistemological significance of action culminated in the schematism of understanding; but the notion of action was internal.

Peirce chose a different approach by stating that triadic relations cannot be dissolved into separate dyadic ones, and the third element in the semiotic relation is the interpretant. So we have to use the other way through interpretation, without loosing the tri-relative nature of the situation out of sight.

The process of interpretation begins by feeling, the emotional interpretant, through which any further significate effects are produced, and "such further effect will always involve an effort. I call it the energetic interpretant" (CP 5.475). The effort may be muscular or mental. If it is muscular, then we are dealing with motor action. A habit of motor action can be regarded as a logical interpretant, and the energetic interpretant produces the logical interpretant in the same sense as the emotional produces the energetic one (see CP 5.486). The process of interpretation which starts from the emotional interpretant, ends in a habit of action as a logical interpretant. "Therefore, there remains only habit, as the essence of the logical interpretant" (CP 5.486). "The real and living logical conclusion *is* that habit; the verbal formulation merely expresses it" (CP 5.491).

As noted already, an individual act cannot be a logical interpretant because it lacks generality, but the habit "conjoined with the motive and the conditions has the action for its energetic interpretant" (CP 5.491). In other words, there is a kind of interpretation relation also between a habit of action and an individual act.

Through the process of interpretation we have come to actual action by which facts and the resistance of the real world can be experienced. This is a

different route. The connection between the sign and its object goes through two sides of the semiotic triangle, and the activity of the subject has the same direction as the semiotic determination in the triangle. The activity through perception has the opposite direction. This is one of the differences between action and perception.

This suggests immediately the possibility of reaching this way the real object independently of its being perceived. Because of the laminated structure of experience this does not reveal itself to the cognizing subject who is able to reach only the practical effects of the dynamic object. This is what the pragmatic maxim tells us (CP 5.402, see also Eco 1981, pp. 191–193).

Peirce has also another way of speaking about the possibility of reaching the object as such, or the dynamic object, namely by unlimited investigation (see, e.g., CP 8.183)[8] which leads to the ultimate opinion to be reached. The final interpretant, the last link between a sign and actual action, is "that which *would finally* be decided to be the true interpretation if consideration of the matter were carried so far that an ultimate opinion were reached" (CP 8.184). It consists in the way "in which every mind would act" (CP 8.315) in contrast to actual action.

The object as cognized in a sign, that is as an intentional object, a percept, is contrasted to the object "as it is regardless of any particular aspect of it, the Object in such relations as unlimited and final study would show it to be" (CP 8.183). This is the dynamic object, the object of dynamic or objective science. Since we are interested in individual cognition and not in general methodology, we shall not discuss this aspect further here.

Although this future result of objective study is related to the way in which every mind would act, not to the actual action, there is, however, in action a layer of dynamic relation to the dynamic object.

This dyadic relation between action and its object is not completely independent of the sign's representation relation. In addition to this, the sign is related to its interpretant "in such a way as to bring the interpretant into a relation to the object, corresponding to its own relation to the object" (CP 8.332). The only possible way of bringing the interpretant into a relation to the object so that this relation corresponds but is not the same relation, goes through action distinguished from perception but controlled by perception. In other words, Peirce actually speaks here about the semiotic triangle instead of the semiotic triad. This point is not, however, elaborated any further in Peirce's texts.

By combining these two aspects, namely the aspect of the future result of objective study and the aspect of the actual dyadic relation through action, we may conclude that we "can only *indicate* the real universe; if we are asked to describe it, we can only say that it includes whatever there may be that really is" (CP 8.208). The description is given by unlimited study, but the indication relation is dyadic relation which is realized by dynamic action. The future study is for Peirce the only possible way to raise the actually uncognizable dynamic object to the conscious level. But this is only a future possibility.

The object of dynamic action, the dynamic object, is something which "the Sign *cannot* express, which it can only *indicate* and leave the interpreter to find out by *collateral experience*" (CP 8.314). There is no way to express with signs what the real world is like independently of the conditions of interpretation, i.e., conceptual conditions; but the scientific community may find it out by means of future research.

The indication relation is, however, not a future relation. An index, the device that indicates, is "a sign determined by its dynamic object by virtue of being in a real relation to it" (CP 8.335). An index "is essentially an affair of here and now" (CP 4.56).

An index involves a real relation here and now, a direct physical connection (CP 1.372), it is "really and in its individual existence connected with the individual object" (CP 4.531). The reading of a thermometer indicates the atmospheric temperature which acts upon the thermometer "in a purely brute and dyadic way" (CP 5.473).

From a semiotic point of view, then, the experience of facts is related to indices. The problem is, how the indices of existent individuals (that's what the objects of genuine indices must be, see CP 2.283) are produced in experience. An existent individual is the dynamic object of a genuine index. The dynamic object produces the index through a dynamic relation between them. Now there are two possibilities: the index is produced either through perception or through action.

In perception the subject is active in the sense that the percept is constructed. The theory-ladenness of perceptions leads to the problem of empiricism described above. As Peirce noted, the Berkeleyans deny the second (CP 5.81), and it is the second, i.e., hard external facts, we are discussing.

The percept as an intentional object is the immediate, not the dynamic object of knowledge. The indicative relation between the percept and the perceptual judgement is a dyadic relation in the mind, the judgement is an index of the percept as an immediate object. The percept is real only in the negative sense that it is not in propositional form (CP 5.568).

The percept is the furthest limit the consciousness can reach through sense perception alone. And the percept cannot be the index of a dynamic object because it is constructed. There is more to it than a real relation between a dynamic object and a percept.

Thus we are left with action. Action in general is triadic (see CP 6.330), obviously in the sense that it is normally controlled by perception. But there is a dynamic element in it, a dyadic relation between a habit as the final logical interpretant and a dynamic object as the object of action (which is an instance of the habit). This is action where we use our voluntary muscles. The dyadic element in it is motor action considered independently of the rest of the semiotic triangle, independently of perception and interpretation.

In motor action (in contrast to perception) the activity of a subject is dominating. The subject determines the object. If we use the semiotic triangle here we get a triangle where the direction of the determination is this: A real

object as an immediate (intentional) object determines its sign, the sign determines through interpretation a habit of action, and the habit determines through actual action the real object as a dynamic object.

This dynamic object should produce its index into the acting subject. This cannot take place by perception because the percept cannot be an index, it is constructed. The apparent determination in perception (apparent in virtue of the semiotic triangle just described) does not produce the index. The bottom of the triangle is left, but the direction of the determination is wrong, it goes from the subject to the object. In spite of this apparent direction action should produce the index into the acting subject. This is the conclusion to which the above analysis leads us. Peirce did not tell how. Our suggestion is that motor action creates the s-model into the acting subject (in principle) independently of any perceptual capacities. And it is precisely this independence that makes it possible to draw the bottom line into the semiotic triad and change it into a triangle. This requires a causal notion of motor action, which notion is presented in Chapter 6.

Notes

1 By interpreting dyadic action as causal influence we get, again, the situation where the dyadic relation between an object and the perception of it (state or process of mind) amounts to a causal effect through the light. But we do not, properly speaking, see the waves (of light). The problem is to find the epistemically significant dyadic relation in action as distinguished from perception. This is the only way to really widen the empiricistic concept of experience.

2 In CP 8.314 Peirce decides to use the term 'dynamic object' instead of 'real object', because the distinction between the immediate and the dynamic object can be made also in the case of fictive objects. In discussing facts and percepts we may ignore this possibility and restrict ourselves to the case of a real, material object which is perceived.

3 We have discussed the subject in Chapter 3.

4 This distinction corresponds to our distinction between physical and phenomenal objects. The difference is that so far we have considered physical objects as theoretically defined scientific objects which are not, properly speaking, objects of an individual's private experience (through perception and action), but objects of the common experience of the scientific community. Peirce is, however, trying to integrate the dynamic object into individual experience. This task is accomplished by the s-model. See Chapters 6 and 14.

5 These two aspects of a percept can, perhaps, be related to the distinction between the meaning or the content of the sign and the sign-vehicle. For example, the word 'pudding' consists of some spots of ink like 'p', 'u', etc. The word is here considered as a sign-vehicle, as a physical entity. The meaning of the word is a different matter. Considering the perceptual judgement as a linguistic

representation, we can express the two aspects of percepts by maintaining that the percept as a dynamic object determines the perceptual judgement as a sign-vehicle. As an immediate object the percept is related to the meaning or content of the perceptual judgement.

In terms of our bottom-up analysis (see Figure 1.1) this is as follows. A p-model state as a physical state of the brain causes an l-model state as a sign-vehicle. The subjective meaning of a linguistic representation (l-model state) is given in terms of the p-model states as phenomenal representations of external objects. We interpret (subjectively) the word 'pudding' in terms of our personal experiences of puddings.

6 Our aim is, on the contrary, to show how the causal and therefore non-conceptual s-model organizes the p-model (and the l-model, too).

7 It turns out that we have to distinguish between propositional and verbal (or linguistic) in order to accomplish our bottom-up analysis. We return to the issue in Part III.

8 Here Peirce comes close to our term 'physical object' as a theoretical object defined by the scientific community. The difference is that we are not referring only to a future possibility of unlimited research. For our purposes it is enough that the scientific distinction between solids, liquids and gases will most probably not be changed by future research.

5. Jean Piaget on action and cognition

Piaget's overall stand was not unlike that of Peirce's. Both of them criticized traditional epistemology on Kantian grounds and stressed the role of action. Piaget was, however, oriented to psychology more than to philosophy.

Piaget's theory of child development has the same defect as Peirce's pragmatic epistemology. The attempt to emphasize the cognitive significance of action is troubled by a distinction between action and perception that proves to be insufficient. Piaget is, however, more definitive in explicating his thesis: The cognitive structures of perceiving and thinking are based on an independent fundament, cognitive structures of the motor control system. And the main purpose of locating his problems is to see more clearly the tasks that our bottom-up analysis has to accomplish.

Piaget's psychological theory emphasizes the significance of motor action. He has a specific concept for it: the sensorimotor scheme. According to Piaget motor action plays central role in behaviour. The sensorimotor schemes, he says, are genetically and cognitively independent and basic in regard to perceiving and thinking. The structures and processes of perceiving and thinking are based on the structures and processes of sensorimotor action. Sensorimotor structures are formed during the child's early development in the course of sensorimotor interaction with the environment.

In order to argue for this independence one should, however, distinguish consistently between the sensorimotor schemes on one hand, and the schemes of perceiving and thinking, on the other.

As the term 'sensorimotor' already suggests, Piaget's conception of motor action contains elements of sensation, and it is not clear how these elements are to be distinguished from higher cognition. The intuitive difference between grasping an object with one's hands and mere watching the object is not enough, because visual processes normally are used in the sensorimotor scheme of grasping as well. And the obvious inability of small children to use natural language does not self-evidently rule out the possibility of intellectual (conceptual) abilities at this stage, as the debate between Piaget and Chomsky shows (see Piattelli-Palmarini 1980). The distinction between sensorimotor and other schemes deserves more attention.

A sensorimotor scheme is an organized series of motor acts which is formed in the process of reiterating action in the same or similar circumstances (see Piaget and Inhelder 1969, p. 4). Motor acts are performed under sensory guidance, that is why the scheme is called sensorimotor.[1]

As noted above, the role of action is, in Piaget's theory, stressed by the claim that sensorimotor schemes are independent and basic in relation to perceiving and (linguistic) thought. The priority of sensorimotor schemes is described by Piaget in several ways. Perceptions are, for instance, regarded as subschemes integrated into the sensorimotor schemes. The visual perceptions of the Pavlov's dog are integrated into a reflex scheme (Piaget 1971, p. 179). That is, a motor reflex scheme is the basic mode of experiencing and acting in the environment, and visual perceptions are attached to the cognitive structure controlling motor behaviour.

The role of perceptions is also intermediary in the sense that they provide sense data in figurative form, while the basic form of the interaction of the organism and the environment is non-figurative motor action (ibid., p. 248). Figurativeness is a main difference between the sensorimotor schemes and the schemes of perception. And vision seems to play a central role in perceptual schemes.

The sensorimotor schemes are, in Piaget's theory, independent also in the sense that the structures of higher cognition are formed and organized on the basis of the sensorimotor structures which are formed first. For example, the child's conception of permanent object is based on the ability to manipulate the material objects. Visual coordination takes place on the ground of the already formed sensorimotor scheme of grasping. The child sees the object from different perspectives, but does not learn to associate these different images together as images of a one and the same object, until the sensorimotor scheme of grasping (manipulating with hands) has formed, until it has learned to take hold of the object.[2]

The problem of independence in Piaget's theory has three aspects. First, the sensorimotor schemes should be independent of the logical operations of linguistic thinking. Second, they should be independent of the higher sensory

processes like vision. Third, the sensory element of the sensorimotor scheme should be analysed so that the former distinctions are not empty. In other words, the sensory element of a sensorimotor scheme must not contain features which would destroy the intuitive idea that motor interaction with the environment creates independently cognitive or subcognitive structures serving as a basis of higher structures.

About the first aspect Piaget says that sensorimotor schemes are practical concepts the limitation of which is that they are not representations. However, they coordinate action and they function in the same way as representations in that they organize the subject's experience, not in cognition but in practice. Intelligence is based on these sensorimotor schemes. Logical operations have their ground on the properties of the sensorimotor schemes or "practical intelligence". (See Piaget 1980b, pp. 164–165.)

Piaget is not perfectly consistent with his terminology. Sometimes he uses quotation marks with this kind of phrases (e.g., "practical intelligence" and "practical concept"), sometimes not. Obviously he tries to tell us that the terms 'concept' and 'practical concept' (as well as 'logic' and 'the logic of action') are somehow both similar and different but he doesn't always bother to explicate exactly how this simultaneous similarity and dissimilarity is understood.

One way to understand the logic of action or the practical intelligence (or "the logic of action", "the practical intelligence") is consider it as referring to the fact that there are objective physical conditions into which motor action must accommodate itself if it is to succeed. Action must be consistent in regard to objective conditions. The problem is, how this accommodation makes up a system of practical logic, and how to characterize the relation between the logic of action and the logic of linguistic thought (some comments about physical and logical structures are made in Piaget 1970).

By emphasizing that motor control processes are not representations Piaget obviously means that they must be different from linguistic (propositional) representations. However, if the sensorimotor scheme is an *organized* series of motor movements that are *accommodated* to objective conditions, then it must be regarded as a representation of some sort.

The objective physical conditions must somehow be represented in the brain. Or to be more precise, the sequence of movements that make up the scheme is coded as some kind of program the realization of which depends on sensory input during the realization, but which has a permanent structure.[3] This permanence is that which makes it a scheme, a habit of action. And this structure just represents the relevant features of the environment.

The representation of the relevant physical conditions consists of programs of motor action accommodated to that environment. These are sometimes called motor representations.[4]

The point in making the difference between a logic of action and a logic of linguistic thought is that the former one is not represented verbally, but has analogous functions. A real relationship (e.g. a ball is in a box) may be

represented either in the structure of the sensorimotor schemes (of taking balls from boxes) or in linguistic representations ("there is a ball in the box, let's take it"). In the latter case we have a proposition that is true or false, the former case is about action that succeeds or fails. The conditions of successful action can, in this context, be analysed in terms of classical dynamics (mass, force etc.). This is what the sensorimotor schemes are about, in one sense.[5]

The first aspect of the independence claim amounts to saying that the logic of action is independent of the logic of linguistic thought. Now it has become a commonplace to say that sensations are theory-loaded (see Hanson 1969). Why not the sensorimotor schemes, that is, the sensory element in them?

In order to argue for this independence one should be able to show how this sensorimotor structure gets organized by itself so that linguistic (or conceptual) structures do not affect this process in any crucial way. Then one should show how linguistic thought can be structured on the baisis of this independent system of sensorimotor schemes.

Piaget's attempt to do this is criticized e.g. by Noam Chomsky (see Piattelli-Palmarini 1980). Chomsky claims that there is in every man an innate nucleus, a cognitive structure, that grows and matures just like biological organs and is responsible for the fact that all natural languages have the same universal grammar as their basis. Why is the logic of action not based on this nucleus? According to Chomsky nobody has succeeded to explicate how this nucleus could be builded during the ontogenesis. It must, therefore, be innate. If it is innate, then it cannot be based on sensorimotor experience received during the ontogenesis. Therefore Piaget's attempt to base the logic of linguistic thought to the practical logic of sensorimotor schemes fails.

We return to the relationship between linguistic thought and action in later chapters. Here it will suffice to note that innateness does not imply that there cannot be any logic of action as a basis for the logic of linguistic thought. The possibility that there is in every man an innate nucleus explaining the universal grammar, does not really settle the question of the priority between motor action and the logic of linguistic thought. The cognitive capacities of the innate nucleus can be formed on the basis of motor action during the phylogenesis, if not during the ontogenesis. They can be part of our inherited biological structure. The features of the environment on which the structuring of the sensorimotor schemes depends (that there are solid objects for us to manipulate) have most probably been the same during the course of evolution. The innate nucleus can be innate but yet based on the sensorimotor experience. The hand is fitted to manipulate rigid objects. Why not the programs controlling the motor movements of the hand?[6]

From this point of view the debate amounts to this: Is it possible, that the logic of linguistic thought is based on the logic of action developed to our forefathers during the evolution, or must the innate nucleus have some other ground of development during the evolution?

The second aspect of the independence claim concerns the relation between sensorimotor schemes and the processes of perception, typically vision. The

above example according to which grasping is prior to seeing is not conclusive. It is hard to design experiments with babies in order to find out what they really see and do not see. It is hard to find empirical evidence that would support the claim that cognitive structures are created only "through an organization of successive actions performed on objects" or that "no knowledge is based on perception alone" (Piaget 1980a, p. 23). Action and perception are not easy to separate in the behaviour of a baby, and there are too many disturbing factors in the situation. Therefore it is not clear how the visual processes used in sensorimotor schemes are to be distinguished from visual processes in perceptual schemes. This makes the independence claim problematic as well.

This difficulty leads immediately to the third aspect of the claim. Even if one succeeds in disentangling seeing from grasping one should be able to show that the sensory processes guiding motor movements, the sensory element in the sensorimotor scheme, are not conceptually organized in the same sense as visual perceptions. This may coincide with the first aspect of the claim, but it is also possible that the conceptual organization is not linguistic. It is possible that there are, somehow and somewhere, conceptual structures beneath both linguistic thought and sensory processes. This is something that Lucia Vaina seems to suggest, as we shall see in Chapter 7.

For the time being we take, for the sake of the argument, the conceptual organization of perceptions for granted, until another possible explanation of this organization is found. It is, then, possible that the sensory elements in the sensorimotor schemes are also conceptually organized. This possibility is open as long as a consistent distinction between sensorimotor and perceptual schemes is not available.

In the next chapter we try to rule this possibility out by developing a causal conception of motor action that contains no sensory elements. The problem of the different levels of sensory processes can be ignored if this attempt is successful.

The third aspect also leads us to more or less metaphysical problems. Isn't it possible that the distinction between the sensorimotor and the sensory level is really the distinction between touch and vision?[7]

In order to claim that the sensorimotor schemes are independent and basic in relation to perceptions, one must distinguish consistently between the sensorimotor and the sensory schemes so that the sensorimotor schemes cannot be identified with the sense of touch, or any other sensory process. This is difficult because there are sensory elements in the very concept of the sensorimotor scheme.

In other words, in order to cope with the problem, one should define the sensorimotor scheme so that it does not contain any sensory elements, or if it does, these elements must be clearly non-conceptual in nature. Piaget's definition as such (sensorimotor schemes are series of motor acts performed under sensory guidance) does not satisfy this condition.

Notes

1 It is, by the way, interesting to note the similarity between Peirce's and Piaget's characterizations. According to Peirce habits are acquired as consequences of the principle that "multiple reiterated behaviour of the same kind, under similar combinations of percepts and fancies, produces a tendency – the *habit* –actually to behave in a similar way under similar circumstances in the future" (CP 5.487).

2 A variant of this approach in cognitive science is Marvin Minsky's theory of frames, where the knots of a visual frame representing different perspectives are suggested to be connected to each other by anticipations of motor action, anticipations of moving around the object or rotating it with hands (see Minsky 1980).

3 In other words, it is a kind of script.

4 J.S.Bruner's way to make the point is to distinguish between enactive (i.e. motor), iconic and verbal representations (see Bruner 1966). The problem for both is the same: to tell how sensorimotor schemes (motor representations) work and are related to other schemes (other modes of representation).

5 This is also a point of contact between Piaget and Peirce that deserves to be mentioned. Namely, as Peirce writes, the laws of dynamics "are very much like logical principles, if they are not precisely that. They only say how bodies will move after you have said what the forces are" (CP 1.348). The physical environment where we act, obeys the laws of dynamics, and our habits of action have to accommodate to these laws. The obvious next step is to relate habits of action to logic as principles of thought. Piaget's project resembles this Peirce's idea of relating the laws of dynamics (through habits of action) to logic as habits of thought. And it is worthwhile to ask how Peirce's terms 'dynamic action' and 'dynamic object' are related to this idea. Piaget has summed his views about the issue in terms of physical and operational structures (Piaget 1970, pp. 37–44, see esp. p. 43).

6 According to Colwyn Trevarthen there is evidence for "innate mechanisms that pattern movements before they become guided by perceptions, and that provide intrinsic constraints on experience" (Trevarthen 1984, p. 350). Trevarthen distinguishes between movements for locomotion and prehension of objects, on the one hand, and communicative behaviour, on the other. The notion of the s-model suggests that also the former innate mechanisms may be relevant in the search for the innate nucleus of language as well.

7 This is what George Berkeley suggested: Visual ideas are signs, like words and sentences in a natural language, that stand for the tactual ideas, and that's all there is to it (see Berkeley 1957, p. 67). With this we loose the intuitively acceptable conception that motor action must accommodate itself to the real objects, the real circumstances, and that perceiving, if it is to be successful, must not contradict the sensorimotor experience.

Berkeley's idealism started from the concept of consciousness, and because it turned out to be impossible to reach the objective reality through perception alone, Berkeley denied it altogether. All that we perceive consists of visual, tactual, etc. ideas. The program of naturalism is to start from external reality and explain consciousness on this ground.

In order to investigate the cognitive significance of action we shall first present a causal notion of motor action that is independent of any cognitive abilities. This notion is not assumed to apply as such to any individual organisms. It is developed as a thought experiment. It turns out, however, that the topology of the solid three-dimensional objects of environment can, in principle, be projected into the moving subject through motor action defined in entirely causal terms. This independent object structure is assumed to be a possible basis of perceptual capacities, and some modern problems of visual perception are then discussed from this perspective. A more general approach to perception can be developed by adding a power of perceiving to the subject capable of motor action only. Here we use the results of the above analysis of Peirce's semiotics.

The resulting notion of a non-linguistic mind capable of acting and perceiving only is, of course, a theoretical abstraction that is useful in our combination of a genetic and a bottom-up approach. It is not directly applicable to human subjects. As we shall see later in Chapter 13, the situation is more complicated. However, we believe that the notion is relevant in discussing the nature of human cognition and suitable for analysing the mind of developed animals. What is most important from our point of view, the structure of action at this stage contains an implicit semiotic relation the basic defect of which is that it cannot be conceived as semiotic by the subject (the animal mind) itself.

The ontological assumptions required in our analysis are few. It is enough to presume that there are three-dimensional solid bodies and causal effects between them. Note that there are, in fact, two kinds of causal relations between the subject and the object: causal effects 1) through motor action and 2) through perception, e.g., vision (recall the semiotic triangle). This implies that we cannot be satisfied with physicalism if it entails that we can use only physical terms in describing objects. For example, we may handle, manipulate with hands, external rigid objects, say apples. A physical description of an apple (of its place, shape, size) is enough for describing the motor movements needed here. But in order to say that the apple is red, we need the phenomenal redness. We do not see the molecular structure reflecting certain wave-lengths, neither do we see the waves themselves. That is, we do not see the physical properties of the apple that cause us to see it as red. We would not see the apple as red if we did not have an eye capable of distinguishing between different wave-lengths. In other words, the phenomenal redness depends on internal conditions. Therefore we can distinguish between physical redness that is a property of the apple, and phenomenal redness that is, in fact, a relation between the apple and the perceiving subject. In this sense the phenomenal terms are indispensable, but note that this does not entail any changes in the

physicalistic ontology. There are no self-subsistent phenomenal objects in addition to the physical ones. (For further ontological discussion see Chapter 14.)

In the philosophy of mind, the most important consequence of our analysis is the methodological principle that external objects belong to the functional organization of mind. The apparent objectivity of phenomenal properties, the fact that we experience the phenomenal redness to be the redness of the external apple, is a manifestation of this. Mind is basically an acting mind, be it animal or human, and the notion of cognitively significant motor action that is developed below, requires actual manipulation of external rigid objects. This already entails the necessity of overcoming the Cartesian frame in the philosophy of mind. If we are on the right track, then the mind cannot be reduced to the brain because one essential element of the semiotic triangle is missing, the external objects.

6. The s-model: motor action in causal terms

One way to avoid the difficulties due to the theory-ladenness of perceptions is to describe motor action as an explicitly non-conceptual process, as a series of motor acts which is or in principle can be executed without or independent of any conceptual competence or sensory capacities. This independence also makes our approach different from earlier theories.[1]

This is the first step in our bottom-up analysis. We do not claim that the system controlling motor action in human beings is functioning literally as the model described in this chapter. It is an abstraction that is useful in discussing how the human mind has been evolved and what kind of layers there are in the structure of mind.[2]

The intuitive idea of the suggested solution is perhaps best to present by means of an example, a simple moving automaton. The example is from Johnson-Laird (1983, pp. 403–404), but we have developed the automaton for our own purposes.

This is what Johnson-Laird describes. A box with four wheels is moving on the table. When it comes near the edge of the table, it whistles and changes its direction, and does not fall on the floor. The same happens every time it gets near the edge. The box has no "eyes", no outer indicators which could tell it about the nearby edge. It has just four wheels under a closed cover. How does it work?

The explanation is simple. Inside the box there is a piece of paper with thickened edges which has the same form as the table. On the paper there is a small box moving with four wheels. The movement of the small box on the paper is transmitted to the wheels of the automaton in such a way, that the place of the automaton on the table always corresponds to the place of the

small box on the paper. When the small box reaches the thickened edge of the paper it changes its direction (by gravitation) and makes the automaton to do the same.

Now let's change the automaton a little. Suppose there is a tank of water inside the automaton and a couple of solid material objects on the table. Suppose further that there is a mechanism which drops some water on the paper in front of the small box whenever the automaton collides with a solid body on the table and cannot continue its movement in that direction. The paper gets thicker when watered, naturally. Next time when the automaton comes towards the same place, the small box behaves just like near the edges, and the automaton does not collide. In a way the automaton "learns" the places of the objects on the table. If we suppose further that the paper gets its previous thickness when it gets dry, the automaton also "forgets" the places of the objects. If we change the places of the objects on the table, the automaton gradually adapts itself to the new situation.

The small box and the piece of paper on which it moves form a kind of model of the automaton on the table. The connection between the model and the modelled is realized mechanically, through physical feedback loops. This is why we can call the model (physically) causal.

From the point of view that the model is a model of the spatial arrangement of the objects on the table, we can say that the model is a spatial model, or *s-model*, for short.

The automaton and the objects in its environment are three-dimensional solid bodies, therefore the situation can be analysed in terms of classical dynamics.

We assume here that the causal mechanism of the model works properly. The possibility of its going out of condition does not affect the point, which is: The automaton can be analysed in non-cognitive, non-conceptual terms, it has no cognition, no concepts, no intellect, no mind – you can put it anyway you like.

In other words, although the s-model is a kind of representation of the environment and the automaton in it (we prefer to call it a model, not a representation, in order to avoid the terminological problem of Piaget), the s-model is not conceptual in the sense that the realization and the functioning of the model does not require any conceptual abilities of the automaton. The s-model and that of which it is a model belong together completely to the causal order of things. The s-model and the connection between it and its environment are described in physical causal terms. If someone insists on taking the automaton to have a power of sensing, we can maintain that this capacity is non-conceptual in nature. It does not make sense to say that this simple mechanical device has concepts.

The above example shows how it is in principle possible for a subject to form a spatial model of the solid material objects in the environment on the basis of motor movements alone. A natural question is: Do human beings make use of this kind of model? How does it, possibly, work together with (or beneath) human consciousness?

This empirical problem cannot be exhausted here, of course, but a look at only a couple of collections of articles (Wade and Whiting 1986, Vaina 1987a) shows that the role of motor action is raised up in different contexts.[3]

Some general qualifications can be made here, however. In the case of the automaton described above, the spatial model, the s-model, is a two-dimensional projection on a plane (the paper). It is a figurative model or a picture of the environment. This figurativeness is really not necessary. The s-model can as well be built in terms of programs of motor movements. These programs need not be in any sense *similar to* or *pictures of* the environment.

A hand moving along a round object performs a round movement, but the neural system making the hand to move need not in any sense be "round" as such, as disconnected from the moving hand. The moving hand is a necessary part of the relation between the motor control program of making a round movement and a round object in the environment. Without the hand there cannot be any connection. In other words, the hand (a solid object, by the way) is a necessary interpreter of the s-model. Another kind of limb may well perform a different kind of movement when connected to the same motor control program (supposing that the movement is not corrected on the ground of *sensory* feedback).

The figurativeness makes it easy for us to see the relationship between the model and the environment, but it is not necessary for the functioning of the model.

The figurative way of though is not only unnecessary, but misleading as well. It invites us to think that the s-model has a connection with the environment in virtue of its own internal physical properties alone. This is a mistake, because the very point is that the s-model is a causal model of the environment only when it is actually realized through the movements of the subject in question. The s-model must always be interpreted by means of motor action, and if the physical structure of the subject is changed (e.g., the size of the wheels of the automaton), then the s-model fails to be a model. This point goes out of sight if one stares at the figurativeness of the model in the example. In terms of Peirce's semiotic theory: The paper in the automaton is an icon or can be considered as an icon (a sign which refers to its object by virtue of its internal properties), but the s-model is generally not an icon, it is an index (a sign which has a real dynamic relation to its object).

The s-model is built (and also interpreted, i.e., related to that what is modelled) only through the actual motor movements of the subject. This means that the subject is able to imprint into the s-model only some properties of the solid material objects of the environment. It seems obvious that features like the position, the size and the shape of the object can be imprinted into the s-model.

The imprinting depends, of course, also on the properties of the subject, its own size, its ability to move, and it depends on the properties of the s-model, too. For example, objects too small or too big, differences of shape too small or too big may not have the respective effect on the s-model. In general, the

properties relevant for the manipulation of objects are imprinted on the s-model, and this depends also on the manipulatory abilities of the subject.

The imprinting of the object into the s-model takes place through registering the movements. An imprint of an object is simply (in the case of the automaton) a part of the model-space where the model-subject will not move itself, because the real subject cannot move itself in the same place where another solid object lies. In this way the solid objects determine causally the structure of the s-model. Two solid objects cannot occupy the same spatial position at the same time, and this physical fact is registered by the subject capable of moving itself and capable of directing its own movements.[4]

The sensorimotor schemes of Piaget are guided by sensory processes. They are not, therefore, in principle independent of any perceptual abilities. Yet in contrast to perception and conceptual logic (logic that comprises representation and thought, see Piaget 1980b, p. 165), the role of sensorimotor schemes is basic. With the concept of the s-model we can explicate how this fundamental role is achieved.

The sensorimotor scheme consists of motor action and sensory processes. The sensory processes have two basic functions. They guide the movement and they carry information about the results of the motor movement. It is this latter function that is central in Piaget's concept of *accommodation*. Accommodation is the result of the influence of the environment, the changes which the reality makes in the sensorimotor schemes (see, e.g., Piaget 1975, pp. 16–18). And the starting point of experience at this stage, according to Piaget, is the subject's own action, not the object. In other words, or in the terms of the causal s-model, accommodation at this stage is the imprinting of the objects into the s-model through motor action; and the experience concentrates on the s-model as the result of motor action in principle analysable in causal terms, independent of any sensory or conceptual abilities.

Assimilation, the opposite point of view into action, is defined by Piaget as the integration of new objects into previous schemes (Piaget 1980b, p. 164). It is behaviour where the subject not only takes the objects modelled in the s-model for its objects of motor action, but is also able to anticipate the results of motor acts, and is able to perceive objects as objects of possible motor acts. To use Piaget's own example (ibid., p. 164), a new object must be seen to swing in order to assimilate this new event into the previous schemes of grasping swinging objects.

This anticipation requires more than the s-model is capable to provide. In assimilation the sensory element of the sensorimotor scheme becomes urgent.

The generalizing assimilation (see Piaget 1975, pp. 44–45), the use of the same sensorimotor scheme in manipulating new objects, requires the ability to restructure, to update, one's s-model according to sensory input, which means that the s-model must be changed by perception. The recognizing assimilation (see ibid., p. 46), as an ability to recognize not objects but one's own motor action, requires the treatment one's s-model as an inner object – which is also

impossible without further capabilities. The same holds for reversibility, the origin of constancy (see Piaget and Szeminska 1975, p. 122).

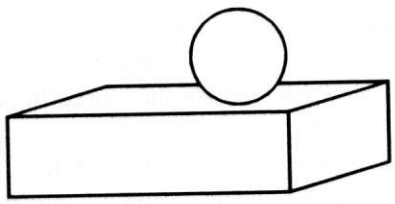
All this means that the sensory processes guiding motor action play a central role, and that assimilation is not analysable in terms of the s-model determined causally by motor action. Sensory processes must be added in the picture, and the relationship between motor action and perception is changed.

The relation between the s-model and sensory processes is left to the next chapter. It is, however, illuminating to characterize the nature of the s-model by comparing it with Stephen Kosslyn's idea of a spatial medium. We shall not discuss it in the chapter about perception, although Kosslyn relates his medium with sensory processes, because our purpose is to interpret it in terms of the s-model, that is, to get it work by means of motor action rather than by means of perception.

S.M.Kosslyn distinguishes between two ways in which visual information can be represented: description and depiction. He lists seven differences between these two ways of representation (Kosslyn 1983, p. 35). An example of description is this:

ON (BALL, BOX)

which is depicted like this:



Description employs discrete symbols, has a symbol for relation and rules for symbol combination, while depiction has nothing of the kind. Description is abstract and unambiguous, depiction concrete and ambiguous. Depiction makes use of a spatial medium and symbol-for-point correspondence, and description not.

In depiction mental images exist in a physical brain as states of a spatial medium. The spatial medium is like a matrix with a limited number of points which can have two values, e.g. 1 and 0. A ball is represented in the matrix when, say, the zeros form a round figure on the background of the ones. Kosslyn compares the spatial medium with Plato's example where the form of a seal-ring is imprinted on the wax (cf. Chapter 2!).

The spatial medium is a way to explain how a mental image can exist in a physical brain, to explain the mental rotation of visual images (images are rotated mentally in order to see whether two differently situated three-dimensional objects are similar or not), and to explain how mental imagery can be qualitatively different from the thinking that underlies language use.

Kosslyn's spatial medium resembles the s-model discussed above in certain respects, especially in comparison with description. The important difference is, however, that Kosslyn's spatial medium is a figurative mode of representation, tightly connected with the visual perception.

From Kosslyn's point of view spatiality is a feature of the visually perceived reality, and the brain is a spatial thing itself. A simple matrix structure in the brain represents the spatial structure of the reality. This is not an odd idea since it is well known that in the visual cortex there are various detectors (line detectors, etc.) which react to different features of the retinal image.[5]

The s-model, on the contrary, is not figurative, and it is not based on the feature analysis of the retinal image like visual perception (or one aspect of it, cf. the discussion of vision in the next chapter). As a matter of fact, the structuring of the s-model is not (in principle) a process of perception at all.

The basic difference between these mediums is the connection with the external real world. In both cases this connection can in principle be analysed in causal terms, but Kosslyn's spatial medium is designed for making use of the retinal image, it works like Plato's seal-wax, but the s-model is based on motor action. The connection to external objects is different.

The difference is crucial in connection with a problem of vision: The visual information coming from a material object to the eyes simply is not enough for the visual processes. The causal effects of the light emanating from the scene just are not enough for producing visual perceptions. We need some further assumptions, like the rigidity assumption of David Marr (see the discussion below), and we need a constructive approach, like for instance that of Ulric Neisser (see Neisser 1976).

The need of a constructive approach means that the structuring of the spatial medium, the genesis of the depictive representations, cannot be explained in terms of a causal connection between the object and the medium through the eyes. The causal connection is, however, possible by means of the s-model.

The s-model can be a medium of imagery without being figurative, if there is a connection between mental imagery and motor action control, as has already been proposed. The s-model is not connected with the spatial structure of the world in virtue of its own spatial properties. The only way to explain the connection is motor action.

Our approach does not require anything figurative in the head. The programs controlling motor action are not "similar to" the solid material objects. No similarity is needed. The seal-wax analogy is misleading. Piaget is right in telling us that the figurative perception is something secondary.

Notes

1 For an historical review of the issue see Scheerer 1984.

2 George Lakoff speaks about cognitive models with a preconceptual structure that

is a result of "our capacities for gestalt perception, mental imagery, and motor movement" (Lakoff 1987, pp. 302–303). Problem of this approach is, from our point of view, the fact that motor action is not distinguished from perception and imagery. Therefore his approach is not directly useful in our bottom-up analysis. The interesting aspect is, however, that in linguistics there seems to be a trend to seek preconceptual spatial models of cognition for theories of grammar. Our bottom-up analysis is, we suggest, one alternative here.

3 L. M. Parsons, for example, suggests that "what distinguishes the objects is that they are associated with habitual spatial transformations, which are produced by the motor control system of the body" (Parsons 1987, p. 173). According to him, the properties of motor action influence on the mental imagination of spatial transformations, e.g., the mental rotation of three-dimensional objects. Parsons writes (ibid., p. 174) that it is not known why this influence takes place, perhaps it does not signify anything intrinsic about the subject, he suspects. Why not? From the point of view of the s-model, it would certainly be most natural that this influence does signify something intrinsic about the subject.

J. H. R. Maunsell presents some physiological evidence for two visual subsystems. According to him one of them is concerned primarily with shape, colour and pattern and with identifying or categorizing objects on this ground. The other subsystem is more involved with spatial considerations. (Maunsell 1987, p. 59, see Maunsell's article for further references to distinctions of the same type.)

Maunsell does not connect the spatial nature of the visual experience with motor action, in the manner of Parsons who connects motor action with spatial imagination. The connection would be a natural one, and is, in fact, suggested by Lucia Vaina whose model of object recognition contains "a functional representation useful for object manipulation and action comprehension" (Vaina 1987b, p. 102). We return to some problems of vision in the next chapter. Here it is enough to point out that spatial representation (not necessarily figuratively interpreted) and motor action seem to play a role in vision.

The suggestion that there is a cognitive or subcognitive structure not realized in terms of figurative representations, is supported by investigations which propose that motor coordination is not "an iconic representation of instructions". On the contrary. "The topography of movement emerges fundamentally from the organization of the limbs and joints into functional units assembled for specific tasks and operating within particular environmental constraints" (Thelen 1986, p. 110).

One further result that supports the present approach comes from neuroscience. J. Paillard suggests, on the basis of the investigations on monkeys, that there is "a segregation of modules that separately control a 'tool-hand' able to power-grip and a 'palpatory-hand' tuned for the tactile exploration of the world" (Paillard 1986, p. 428). Our suggestion is, of course, that the "palpatory-hand" is related to a spatial model of the world's spatial structure.

Still another theoretical proposal stressing the possible role of motor action comes from Marvin Minsky's theory of frames. One problem in the frame theory is the question: What connects the visual perceptions from different perspectives

so that they are connected to each other as perceptions of the same object, although they may not be similar at all? Minsky proposes that anticipations of motor action are the connecting ties (see Minsky 1980).

4 We ignore the obvious possibility that the subject is able to remove some solid objects of the environment. The purpose of this discussion is only to show in principle the possibility of this kind of imprinting.

5 However, if this figurative mode of representation is assumed to be connected in some straightforward way to the feature analysis of the retinal image, then it is easy to show how this view is, if not altogether wrong, at least insufficient. One glance at the illustrations in Julesz (1971) shows to anyone that in some situations stereoscopic vision has just nothing to do with retinal figures. Our suggestion is, of course, that this is due to a non-figurative system of spatial representation. In our terms, stereoscopic vision may be based on the s-model.

7. Motor action and visual perception

In Chapter 6 we pointed out that the figurative (or iconic) nature of the model in the automaton is not only unnecessary in the more general case, but also a misleading property when postulated to the s-model. On the other hand, it can be useful when we discuss the issue further.

In the case of the automaton, we have a kind of God's eye point of view on the situation. The automaton, on the contrary, has no eyes and no points of view. Now let's speculate a little, let's postulate a kind of inner eye, a mysterious homunculus (not to say an immaterial mind) into the automaton. The homunculus sits on the small box, looks at the paper, and *sees* the place of the automaton in the environment. It can direct the motor action and guide the automaton where ever it decides. And this takes place on the ground of what it sees in the model.

The function of the s-model has now changed. It is not only a causally determined structure, but also a model which enables purposive, planned motor action. The ends of the action are, of course, in the head of the homunculus.

Unfortunately, the homunculus theory of mind is not an alternative to be taken seriously. It only raises the same problems at another level. So we must change the design of the automaton.

If we direct the eye from the inner world to the outer one, we get a more familiar situation. The subject sees the objects of the environment and guides its motor action in the perceived world. Let's say it has a model of the world as perceived, a *p-model*. In other words, it is a model of the phenomenal world.

In the automaton the homunculus first looks at the model inside the device. The model is a map of the environment. The homunculus sees the movements

of the automaton in the environment as movements of the little box on the map. When we equip the automaton with an external eye, we come close to the situation described earlier in Chapters 3 and 4. That is, the world we see is a "map" of the world we act in. These two worlds make up the one and the same world we live in (if our sense-organs do not err, luckily they seldom do). We act on physical objects but see them as phenomenal objects, these very same objects.

Traditionally the model of the world as perceived, the p-model, is understood as a product of the senses, and vision plays a central role here. It is difficult, however, to explain how the p-model gets its categorized structure representing the world as solid material objects. One problem of the theory of vision is the so called cognitive impenetrability of this categorization. That is, the categorization takes place in the early visual system, before the verbal semantic phase (according to Marr 1982, see the discussion of vision later in this chapter).

A favorite answer of philosophers, especially since Kant, is to speak about the conceptual nature of our experience, of the conceptual categorization of the world (e.g., Vaina 1987a). The nature of this kind of non-verbal conceptuality is, unfortunately, often left open.

Our own suggestion, which is based on a causal account of motor action, can be developed from the following, tentative suggestion: A subject has an access to the s-model through the perceived (phenomenal) external world. Unfortunately, the phenomenal world is internal only in the relative sense that phenomenal qualities depend on internal conditions. The s-model cannot be seen. The map of the automaton can be projected outside (in our thought experiment) only because it is an icon. The s-model, in the general case, is not. We must try another approach.

We see the world primarily as an object of motor action, and by looking outside, instead of inside, we give the experienced world its spatial structure which cannot be *seen* from the inside (we have no inner eye, and there is nothing figurative to be seen). We interpret the visual space in front of us with the s-model. The s-model gives the object structure to the perceived phenomenal qualities, and the resulting p-model appears to be in front of us, although it is internal, in a sense. The only thing there *is* in front of us is the one and only real world, but phenomenal properties, e.g. perceived colours, are added. The p-model, just like the s-model, is not internal if the boundary between external and internal is the skin. External objects belong to the functional organization of the p-model as well as of the s-model.

The profit of this approach is that the object structure of experience is neither a product of some theory-loaded perceptions, nor a product of some kind of non-verbal concepts. The object structure is produced by motor experience independent, in principle, of any capacity of sensing or conceptualizing, because the s-model (in virtue of which the object structure of the environment is transferred into a subcognitive structure) is analysable in causal terms only, without reference to sensing or conceptual capacities. This

principle does not rule out the possibility that after the perceptual powers are there for use, then they are also used. The model may be restructured on the ground of perceptual information, without actual acting. The p-model is, from this point of view, a hypothetical s-model. On the ground of what we perceive, we assume that there is a certain solid reality to which our action must conform if it is to be successful.[1]

The p-model is constructed on the basis of the structure of motor experience. The s-model is now connected to a figurative form. But the figurativeness is not in the brain. The only figures we need are the forms of the solid objects that are there in the world for our movements to follow. It is neither necessary nor even probable that retinal images, the projections of these figures, are transferred somewhere in the head where their spatial existence should be understood somehow (if they are, their role is secondary and deals with feature analysis, rather than with spatial analysis, see note 4 of Chapter 6; cf. also the discussion of Kosslyn's spatial medium in the previous chapter). Although the s-model is a model of the world's spatial structure, it is not spatial in itself. When it is separated from actual movements which are needed to connect its states to the structure of the world, it is no a model of anything.

This is the principal point. But when the subject has perceptual abilities it will, of course, make use of them. Once the p-model is at hand, the primary role of motor action giving a structure to the experience becomes implicit, functionally secondary. The p-model is updated on the ground of sensory information, and the role of motor action is really put to test in situations where the senses err, and the compelling character of motor experience becomes evident (we can't walk through the wall).

The s-model presupposes, in order to be a correct model, that the rigid objects of the environment do not move themselves but stay where they are. If they move they must be touched again. There is a certain time-lag in the s-modelling in a changing environment. The power of perception enables the subject to have a real-time model of the environment.

The p-model, in contrast to the s-model, really represents the world to the subject. It stands for the world as an object of motor action.[2] The p-model also takes care of the task usually given to concepts: the totality of visual, tactual, tastily etc. perceptions are organized as perceptions of solid three-dimensional objects. In our account this organization is due to a clearly non-conceptual process, where solid objects make a causally determined imprint on the s-model. The perceived properties are attached to the s-model states which act of attaching makes them p-model states.[3]

All this means that sensory processes guiding motor action play a central role, and that Piagetian assimilation is not analysable in terms of the s-model determined causally by motor action. Sensory processes must be added in the picture, and the relationship between motor action and perception is changed.

In Piaget's theory, the development of child can be interpreted as a process where the functional role of perceptions (typically visual) increases and is

finally dominating. The child perceives the world after having learned to manipulate it. An example of this is the scheme of the permanent object which develops at the sensorimotor level. At an early age the object covered with a blanket is taken to be non-existent; later it is actively searched for under the blanket. The child is now able to take the object as an object of motor action even when it is not actually seen.

In terms of the causal s-model: At the first stage the object is an object of motor action only when it is actually grasped, when the object is being imprinted on the s-model. The visual images are not connected to a state of the s-model. They cause only fumbling.

At the second stage the actually seen object (but only the actually seen object) is an object of motor action. Features discovered by perception are attached to the s-model states, and the child is able to grasp what it sees.

At the third stage an object not actually seen can be an object of motor action, that is, the object is modelled in the p-model which has now got an independent status in that it guides motor action, makes anticipation possible. The functional priority of motor action as a constructor of the s-model is gone, and the functional priority of perception as a reconstructor of the p-model directing motor action has come.

From the evolutionary point of view it can be noted that the functional primacy of the p-model is not necessarily an outcome of ontogenesis only (as seems to be the claim of Jean Piaget). It may as well be the case, and probably also is, that the p-model is a phylogenetically formed structure that matures and gets tuned during the ontogenesis and perhaps needs motor experience in the ontogenesis in order to get functioning. In this sense it can be innate, but this alone does not undermine our thesis of the priority and epistemic significance of motor action.[4]

The perspective of evolution gives us one more way to characterize the relation between the s-model and the p-model. Konrad Lorenz discusses fixed motor patterns in his evolutionary theory (Lorenz 1973, p. 81). The point is that they are performed without the help of receptors (ibid., p. 82). These fixed motor patterns are innate information, an inherited skeleton of behaviour. Some patterns are perfectly ready for successful use without any prior individual experience of the situation. Animals can also learn routes with the help of sensory capabilities, but after that they follow the route literally blindly on the ground of a learned pattern. And the pattern is performed without the aid of receptors. See Lorenz (1973) for numerous examples.

In our terms: The functional primacy of the p-model has not yet been completed in the course of evolution. The animal constructs its s-model by employing sensory processes, but once the model has been constructed, the animal relies on its s-model only. From our point of view, evolution means increasing functional significance of the p-model.

Now we can return to an issue raised up above, namely to some problems of vision. A common question not only in the psychology (cf., e.g., Piaget), but also in philosophy, is the following: Why do we see the world as three-

dimensional rigid objects which have their backsides as well, although we never see the objects from all perspectives at the same time?

Philosophers sometimes explain this fact by referring to the conceptual nature of experience. The object structure of the perceived world is a result from the act of conceptualizing. Piaget took for granted (see Piaget 1975, pp. 195–196) that the objects of perception are intellectual entities.

David Marr formulates the problem in terms of the rigidity assumption (Marr 1982, p. 210). The early visual system assumes that in front of the subject, there are three-dimensional rigid objects. This must be *assumed,* because the information that there are such objects, cannot be inferred from the light emanating from the scene and, what is important, this information does not come from the later visual system. The early visual system is cognitively impenetrable.

The causal effect must be interpreted. But why is it interpreted so that we expect to see rigid objects?

The traditional answer (that this happens because we use concepts) is difficult to apply here, because the later visual system, which takes care of the semantic analysis, is not involved here. The world is seen as rigid objects before and independent of seeing the world as cats, trees, etc. This is usually expressed by saying that the early visual system is a relatively independent module which is cognitively impenetrable.

So the rigidity assumption can be explained neither by the causal effect of the objects, nor by the influence of the late visual system, the cognitive structures responsible for the semantic categorization of the visual experience.

The present approach which stresses the independent role of motor action, suggests one answer to this question: The rigidity assumption comes from the system controlling motor action, the s-model, and is really not an assumption but a result of motor experience. The early visual system uses the s-model in categorizing the visual experience into rigid three-dimensional objects, independent of the verbal-semantic categorization or even independent of perceptual features like colour, shape (the figurative aspect), etc.

The problem of the proposed conceptual nature of this categorization can be examined by comparing the present approach with Lucia Vaina's model of visual perception.

Vaina suggests the following serial organization of the visual processing (see Vaina 1987, pp. 102–105):

1. The analysis of the stimulus according to its different dimensions; the image is analysed and described.
2. The computation of structural percepts according to the object's salient properties. At this stage the object is categorized on the basis of its visual characteristics. This is perceptual categorization.
3. The association of all the specific perceptual descriptions into a concept of the object. The point is that the association includes not only perceptual features, but also other information useful for recognition and, what is important from our point of view, for manipulation. The role of the object in action counts here.

4. The verbal semantic stage. The object is associated with a name and is represented in a verbally mediated representation.

What about the rigidity assumption? Vaina's model apparently handles this by distinguishing the verbal-semantic stage from the earlier stage where a concept of the object is formed. Verbalization is based on an earlier and more fundamental act of conceptualization.

The object of manipulation is most often a rigid three-dimensional object, so the rigidity assumption is used here already. On the other hand, features like shape, colour and texture (Vaina's examples of features analysed at the second stage) can be analysed without the rigidity assumption. At least a memory and a system which indexes such features do not presuppose that the features belong to solid objects.

The motive for calling the third stage a conceptual stage is apparently the need to associate different features to one object. Here the object concept is needed. The nature of this prelinguistic but conceptual categorization is, however, an open question. Its goal is the recognition and identification of objects, and this is supposed to take place on the basis of concepts. Action control proceeds at the same stage as the description of the object.

Vaina connects object manipulation with the third stage, the stage of preverbal conceptualization, but does not base the conceptualization on the ability to manipulate. On the contrary, the object manipulation seems to be based on the conceptualization, although it is not said explicitly.

The present approach gives the fundamental role to the action control system. The system of object manipulation is able to pick up rigid three-dimensional objects and make them present, in the s-model, for the senses as a basis of the association of perceived features. A preverbal concept of the visual object, or a cognitive state categorizing the visual experience into rigid objects, is formed when the output of the perceptual categorization is associated with the states of the s-model, in which the object structure of the world is already imprinted.

The causally analysable system of motor action control is responsible for the conceptual function which Vaina puts at the third stage of visual processing, and there is no need to talk about dividing the semantic stage in two parts, one of them being the stage of object categorizing. The representative function of perceptions and the verbal-semantic stage are both attached to the object structure which is formed independently on the basis of motor action.

There are two different ways in which causal processes play a role in cognition. The object of vision, for example, has causal effects on the brain not only through the eyes but through the system of motor action control as well (when it is manipulated). The latter route offers a possibility for the object structure of the world to be represented in the brain. Why would higher cognition ignore this possibility? The light emanating from the scene is not enough for the categorization of the visual experience into objects, but the

causal interaction in motor behaviour is able to produce this categorization. It is not necessary to invent some kind of preverbal concepts to explain this categorization The s-model takes care about it. This aspect of the organization of perceptions, commonly taken to be a function of the concepts, is analysable in causal terms only.[5]

There is, however, a kind of semiotic relation between the phenomenal object and the physical object (which are, be it remembered, actually the same object in the standard case we are discussing): the phenomenal object (the object as perceived) stands for the physical object (the object of motor action). This comes close to Vaina's suggestion that the semantic stage of visual perception consists of two stages: preverbal perceptual categorization and verbal semantic phase (Vaina 1990, p. 75). In our terms, the p-model is responsible for the perceptual categorization. And what is most important from our point of view, this semantic (or semiotic, see Chapter 8) relation is analyzable in causal terms and is in this sense non-conceptual.

Another interesting point in Vaina's paper is the distinction between what can be called a 'what' system and a 'where' system. And the fact that there is evidence that this distinction can be made also in monkey's visual system (ibid. p. 61), supports our suggestion that the notion of the p-model is suitable for the analysis animal cognition.[6] That is, the s-model is responsible for the 'where' aspect and the p-model for the 'what' aspect as well as for non-verbal semantics. The basic difference between Vaina's suggestions and our approach concerns the notion of conceptuality. The semiotic distinctions developed on the ground of Peirce's theory make it possible to present a semiotic analysis of the p-model in causal terms.

Notes

1 The phenomenal world stands for the physical world. In Peirce's terms, from what we see we make an abductive inference that there is a physical (real) world, the spatial structure of which corresponds to the spatial structure of the phenomenal world. And by motor action we can confirm whether this inference is correct or not.

2 For George Berkeley visual ideas stand for tactual ideas. In our approach the world as perceived (the phenomenal world) stands for the world as acted on (the physical world). It is the one and the same world, but our two ways of experiencing it enables a real representation relation. This rather metaphoric characterization of a "real representation relation" shall be developed further when we connect Peirce's semiotic ideas to it in the next chapter.

3 There is more to it than mere association of phenomenal qualities with the s-model. The semiotic discussion of the next chapter will clarify the issue a bit.

4 Cf. also the discussion of the so called innate nucleus in Chapter 5.

5 M. A. Arbib's model of visually guided behaviour (developed with D.House, T.Collett and S.Udin) is based on a similar idea. In explaining depth perception on

the basis of visual feature analysis (which was shown to be insufficient by Julesz) the model refers to motor control system: "... it is the up to the motor system to compute the three-dimensional location ..." (Arbib 1987, p. 425). Arbib also emphasizes the dangers of relying on feature analysis alone (ibid. p. 425). The difference between Arbib's approach and ours is that he is trying a top-down analysis, which – as H.T.A.Whiting points out when commenting Arbib's paper – has little to say about where the motor schemes come from (Whiting 1987, p. 450). Our bottom-up approach purports to show how cognitive structures may be constructed on the basis of the s-model, a (sub)cognitive structure created by motor action.

6 As a matter of fact, animals are quite commonly considered to have spatial cognitive maps (see Thinus-Blanc 1988).

8. A semiotic approach to perception

A semiotic approach based on C.S.Peirce helps us to develop further our conception of motor action and its relation to perception. But before going to the issue itself, it should be noted that we shall interpret Peirce's conception of the categories in a way that fits in with our materialistic ontology. And we shall use the semiotic terminology of Chapter 4, especially the semiotic triangle (which is not Peirce's concept), without thereby indicating that we would be presenting or analysing Peirce's thoughts. The semiotic concepts are used for our own systematic aims.

Ontological issues are discussed more thoroughly later in this study. Here we shall only state briefly that we agree with Peirce's general characterization:

> "First is the conception of being or existing independent of anything else. Second is the conception of being relative to, the conception of reaction with, something else. Third is the conception of mediation, whereby a first and second are brought into relation" (CP 6.32).

We just take matter to be that what exists independent of anything else. Dyadic action, brute force, i.e. motor action in causal terms, is that through which the matter is experienced as existent. The matter is divided into subject and object. Second is the active living organism, the subject. First and second are in a real, i.e., causal, relation, but that relation is not cognized until it becomes a mediated relation, until it is mediated by a triadic sign.

First and second are *brought* into a *mediated* relation when the s-model is used as a medium of action control. This does not happen until the subject is capable of perceiving. Perceptions, the states of the p-model, are (a mode of) the third in virtue of which the first, the material environment, becomes an object for consciousness.

Let us illustrate the case with the semiotic triangle presented in Chapter 4. In Figure 4.1 there are the semiotic triad and the semiotic triangle. The triangle is modified from the Peircean semiotic triad by stating that in the act of perception the object produces its sign, a state of mind, which is interpreted by an interpretant. This interpretant can be any other sign, but ultimately the interpretation tends to lead to action. Of course, we do not usually act on all the objects we see, but generally speaking the environment as an object of our perceptions, is also the object of our action.

Using the terms of Chapters 6 and 7 we can present the triangle differently by putting the p-model on the top of the triangle (a p-model state is a sign). The s-model is in the place of the interpretant, so an s-model state interprets the p-model state by virtue of the fact that the s-model state is a habit of action. The s-model state is, therefore, a final or ultimate interpretant which is instantiated in actual action.

From this point of view the perceiving subject interprets that what it sees in terms of motor action. The world as perceived is interpreted as a potential object of action. The states of the p-model are, in effect, relations between perceived features of objects and possibilities of action or anticipations of action on these same objects.

In other words, a p-model state is a sign of the object. But it is not a sign until it is interpreted. If action is left out, the subject is just perceiving, the interpretation takes place in terms of anticipations, and we have the semiotic triad instead of the triangle.

If the perceiving subject is also acting, we have the semiotic triangle. In this case it is not easy to separate the layers of action and perception in the overall activity of the subject. Introspectively it is impossible if we assume, following Peirce, that consciousness is triadic. The relation between a solid object and the s-model is dyadic, from which it follows that a subject capable of s-modelling only (e.g., the automaton in the example presented in Chapter 6) is not conscious. This seems plausible enough. We perceive the object of our action and ourselves as acting. The s-model is not, by definition, an object for us. So we cannot by introspection decide that anything like it cannot be functioning in us.

Let us say that action realizing the causal relation between a subject's s-model and external physical objects is *s-action*. Now s-action is not anything we should expect to find as such in humans or animals, in phylogenesis or ontogenesis. Yet it can be an important concept in analyzing the layers of experience, as we are trying to show.

Piaget's sensorimotor scheme is not a mode of s-action, but contains it as an element. Without s-action the sensorimotor scheme is not able to accomplish its intuitive task: to accommodate the behaviour into objective physical conditions. The sensory processes guiding the scheme (in virtue of which the scheme is not s-action) are, however, functionally something secondary.

In Piaget's theory the child builds the scheme of a permanent (perceived) object on the basis of sensorimotor experience. In terms of our semiotic

triangle this is as follows. At the sensorimotor level the direction of determination is not from the object to the p-model (at the top of the triangle) and not from the p-model to the s-model as in the perceptual schemes, but the other way round. In s-action (relating the object and the s-model) it is the subject that is active, but the direction of epistemically significant determination is the opposite, from object to the s-model directly through the bottom of the triangle. The object structure of the environment determines the structure of the s-model.

Now the s-model is a model of the object structure of the solid environment. The shaping of the Piagetian scheme of a permanent object is interpreted to be a process where the perceived properties of the environment are attached to the states of the s-model. The s-model determines the p-model, affects on perceptions, and the subject becomes conscious of the environment as perceived potential objects of action. In the process of perception the subject is active, it categorizes the perceived environment into objects. This seems to be, and is often held to be, due to the internal features of consciousness, but is actually, according to our analysis, due to the object structure of the environment itself (via the s-model).

The Piagetian view of the development of child from the sensorimotor level to the perceptual level can be interpreted to be a change of the direction of determination in the semiotic triangle. The already categorized perceptual experience is, at the perceptual level, functionally primary in guiding the behaviour.

The categorization of perceptual experience takes place at the sensorimotor level, be it explainable on the basis of ontogenesis or not. In both cases it is possible that the categorization is based on s-action.

The semiotic triangle of the sensorimotor scheme has a seemingly contradictory feature. At the bottom of the triangle, in the dyadic relation between the object and the s-model, the semiotic determination and the action of the subject have opposite directions. In motor action the subject is active and often changes the world. In this sense the determination is directed from the subject to the object. But this is not semiotically (epistemically) significant. What is semiotically significant is the structuring of the s-model, in which process the object determines the s-model.

At the end of Chapter 4 we concluded that Peirce's approach seems to require that in dynamic (i.e., dyadic) action the dynamic object should produce an index into the acting subject. Now this is precisely what takes place in the semiotic triangle of the sensorimotor scheme in virtue of s-action (recall that the direction of this determination is opposite to the direction of activity).

In Peirce's terms this means that the s-model is an index. The relation between the s-model and the object is a real one in Peirce's sense, as is required of an index.

Index is a sign, and of every sign Peirce requires that it is triadic. It must have an object and an interpretant. What could be the interpretant of the s-model as an index, as a sign?

An immediate suggestion is that the subject takes the index to be a sign of an object, that is, interprets it. This is what Peirce had in mind in examples like: A symptom is an index of a disease. A pointing finger is an index of the pointed object.

Here this will not do because the s-model cannot, by definition, as such become a conscious object for the subject in the same sense as the symptom becomes an object for the doctor. When we separate s-action in our thought experiment we have no semiotic triangle. We have only a dyadic relation between the object and the s-model with two directions of determination. The determination from the object to the s-model is indexing, and the opposite determination is action, namely s-action.

One possibility to get interpretation into this thought experiment is to define interpretation to be the action itself through which the s-model is structured. The semiotic triad involved in s-model as an index, is a degenerated triangle where the semiotic determination (indexing) and the determination in action are accomplished in one and the same dyadic relation.

The problem of this degenerated case is that there is no triadic structure, therefore no consciousness, either. This is not found in a subject capable of perceiving. The degeneration of the triadic structure into a dyadic one forces us to conclude that we are not dealing with a real sign here. It seems to be the case, from this point of view, that the s-model is not a sign and, therefore, not an index. This follows also from Umberto Eco's criterium: A state of the s-model cannot lie (if the system functions properly), therefore it is not a semiotic entity (see Eco 1979, pp. 6–7).

There is, however, another possibility. In the semiotic triangle of the sensorimotor scheme the s-model determines the p-model. In other words, it is interpreted by perception. An object of action is interpreted in terms of phenomenal features.

The problem in this case is that only the phenomenal world can be a conscious object. Our conception of the world as physical (in contrast to phenomenal) is a theoretical conception. But at this level of our bottom-up analysis the theoretical conception is not available, because language is lacking. Therefore the s-model as an index is doomed to be outside the reach of consciousness. A subject capable of acting and perceiving only cannot conceive the world as physical, or at least this is where our semiotic analysis leads us. In Chapter 11 we shall show that the world as physical is, from a semiotic point of view, brought within the reach of consciousness through instrumental action, but it is another story.

The s-model is an index of the real world, the subject itself cannot consciously interpret it as such without the power of perception. C.S.Peirce wrote that we can "only *indicate* the real universe; if we are asked to describe it, we can only say that it includes whatever there may be that really is" (CP 8.208). Modifying this we can characterize our approach by stating that motor action creates an index (the s-model) of the real world. Introspectively we cannot use it for describing the world, because it as such is not an object of our

own consciousness, but if this study is on a right track, then the s-model is a subcognitive structure modelling the spatial structure of the solid objects in the environment.

To be more accurate, the s-model is in Peirce's sense a genuine index. "An *Index* or *Seme* ... is a Representamen whose Representative character consists in its being an individual second. If the Secondness is an existential relation, the Index is *genuine*" (CP 2.283). A state in the s-model is a model of a real relation between two existent individuals, the object and the subject as rigid material bodies.

Now what can be said about the p-model from the semiotic point of view?

According to Peirce a sign "may be *iconic*, that is, may represent its object mainly by its similarity, no matter what its mode of being" (CP 2.276). This creates difficulties, because it is seems unnatural to say that p-model states as states of mind are similar to the perceived objects. At least not if similarity is to be understood in terms of figurativeness. In our account, there are no images in the head, the retinal image is the last figurative entity we have to deal with.

Another characterization of Peirce is that an icon is "a sign which is determined by its dynamic object by virtue of its own internal nature" (CP 8.335).

What is the internal nature of a state of the p-model? Peirce's characterizations are obviously inspired by a paradigmatic example of a picture and its object, that what it is a picture of. But according to the conception sketched above a p-model state is, at bottom, a cognitive structure that relates processes of perception to processes or anticipations of motor action. A p-model state is interpreted to be a sign of an object through motor action on the same object. A habit of motor action is an interpretant of a p-model state. This conception of the p-model in terms of action coincides with Marx W.Wartofsky's account of a model as a mode of action (see Wartofsky 1979).

The internal nature of a p-model state is that it is a mode of action. This means that the relation between object and perception in the semiotic triangle just cannot be enough in connecting a state of the p-model with its object (as is the case in Marr's theory of vision as well).

Interpreting Peirce in this way we can say that a state of the p-model is similar to the object just so far as it produces (through the s-model) motor action along the contours (the figure) of the object. With the same movements we can draw a picture which is similar to the object in the traditional sense. That is all the figurativeness we need and can have. There are no pictures, images, or figures in the head.[1]

The images we introspectively think to exist in the mind are rather anticipations of acting along the figures or drawing the figures. Recalling the terms of Chapter 2 we can say that the only conformity there is between a state of mind and an external object is the conformity of movement between following a contour and drawing a line. Mental images are only projections into the external world.

This fits in with Peirce's statement that an icon "does not stand unequivocally for this or that existing thing"; its object "may be a pure fiction, as to its existence" (CP 4.531). A picture may be drawn without the existence of a resembling object.

In other words, the object of an icon is not necessarily a real object, it is an intentional object. This counts for p-model states, too, because the causal effect from objects to p-model states is not enough to guarantee that an object represented by a p-model state (a sign) really exists as a three-dimensional rigid object. And if we interpret similarity as suggested above (in terms of modes or forms of action mediating the object and its representation in the p-model), then a p-model state satisfies these two criterions of icons in Peirce's sense. In a nutshell: A p-model state is an intentional, iconic, behaviorally projected representation.

What is it for a p-model state to be an intentional state? Peirce's semiotic approach is not enough here, because there is a major difference between Peirce's view and the situation here. Peirce's analysis of perception involves genuine symbols and propositional meanings: "We can know nothing about the percept, – but only experience it in its totality, – except through the perceptual judgement" (CP 7.659). And perceptual judgements are general (CP 5.150).

Therefore, in spite of the fact that Peirce's icons are not general (CP 1.372), the percepts are not, in Peirce's theory, accessible for us as icons but only through (propositional) perceptual judgements.[2]

We are, however, developing our view from the bottom. That is, in postulating a power of perception (the p-model) to a subject capable of moving and s-modelling, we are not (yet) concerned with linguistic meanings or Peirce's genuine symbols. Our task is, then, to investigate in what sense the states of the p-model are intentional.

As noted above, the p-model states are intentional in the traditional sense that the objects they represent are not necessarily real objects. It is possible for a state of the p-model to misrepresent (without the model's going out of condition, cf. the s-model) because the causal effect from the perceived object cannot alone produce a respective representation in the p-model (a p-model state can lie, which fact makes it a genuine semiotic entity in Umberto Eco's sense, see Eco 1979, pp. 6–7).

Another point following from the above considerations is that the perceived reality is categorized into three-dimensional rigid objects in virtue of the structure of the s-model. According to our view this categorization takes place entirely in causal terms. However, a common view is to regard this perceptual categorization as a function of concepts. This entails, from our point of view, that the categorization is a part of the meaning-structure given to the perception by concepts. And to the extent that a meaning-giving act (which categorizes perceptions in our view) is a crucial feature of intentionality, we may conclude that the (ultimately causal) categorization of perception is one sense in which the p-model is intentional.

This sense of intentionality resembles the notion of intentionality of Maurice Merleau-Ponty, and cannot be compared to Husserlian phenomenology, as is the case with Peirce. According to Merleau-Ponty the intentionality of perception is grounded on a more fundamental form of intentionality, namely that of motor intentionality (see Merleau-Ponty 1962). The body posits the objects. Motor acts (bodily movements) bring the objects within the reach of experience, make them accessible to perception. The fundamental difference is our materialistic ontology which Merleau-Ponty obviously does not share. For him the causal relation between a real physical object and the body of the subject is not enough for the establishment of the epistemic relation. The relation is established by a body image which is a representation in the mind, on one hand, but, on the other hand, is also rigidly fixed to the body of the subject (cf. the phantom leg). The tactual sensations are in a privileged position because they are necessarily connected with a certain place of the body image.

This approach shares the problems of Piaget (it seems to be inspired by Piaget, too) and of Peirce presented above. Our causal account does not require body image and tactual sensations as mediators of this kind.

Using Peirce's terms we can characterize the p-model this way. As a sign (an icon) a p-model state must be interpreted, and this interpretation takes place in terms of action. The fact that genuine symbols are not involved means simply that we have only ultimate (final) interpretants at hand. A p-model state (in a subject having only an s-model and a p-model) is necessarily an ultimately interpreted sign, i.e., a state of the p-model is interpreted down to habits of action.

There is no reason to deny that our hypothetical subject capable of p-modelling and s-modelling may have habits of action. According to Peirce habits are, on the other hand, involved with generality (and recall also Kant's definition of generality as continuous activity). In this sense it is possible to attach general (but not linguistic) meanings to p-model states.

Applying the principle (a modification from Hintikka 1975) that intentionality is intensionality, i.e., that meaning-structures are the source of intentionality, in this case of non-linguistic meanings, we may conclude that the intentionality of p-model states is their ability to have a meaning in terms of habits of action. And this amounts to a conception of motor intentionality, but understood causally.[3] A p-model state's intension is its meaning which, in its turn, consists of general habits of motor action, the interpretants of the p-model state as a sign.

It makes also sense to express the content of the motor intentionality of p-model states in terms of possible worlds. The possible worlds must simply be interpreted as possible courses of action. To perceive the world, to give a meaning to what is perceived, is to be continuously conscious (in an elementary sense) of the objective conditions and possibilities of motor action.

Another way to characterize this kind of motor intentionality in terms of prelinguistic meaning is to compare it to Husserl's and C.S.Peirce's views.

Peirce distinguished between the percept and the perceptual fact.

The perceptual fact is a kind of report of the percepts, "the intellect's description of the evidence of the senses" (CP 2.141). Perceptual facts are "given in direct perceptual judgements" (CP 5.54). That is, a perceptual fact is a "proposition resulting from thought about a percept" (CP 2.27).

A percept, on the contrary, "cannot be represented in words" (CP 2.27, see also 5.568). The perceptual facts are propositional while the percepts are not.

In Chapter 3 we noted that percepts have a dual character. On one hand, the percept "is the reality" (CP 5.568). The construction of a percept (note that it is constructed) and even the judging what is perceived are not under the control of the will (CP 2.141, and 5.115). On the other hand, "percepts are undoubtedly purely psychical, altogether of the nature of thought" (CP 8.144). And one of the three kinds of psychical elements in percepts is their "generalizing or associating element" (CP 8.144).

Husserl's notion of noema has these two aspects as well. On one hand, it is, according to Husserl, a principal mistake to think that in perception one does not reach the thing in itself (das Ding selbst, Husserl 1950, p. 98). The real object of the perceiving "intention" is the thing, the natural object, the tree out there in the garden (ibid., p. 224). Also Peirce told us that, "rightly understood, it is correct to say that we immediately, that is, directly perceive matter" (CP 1.419).

On the other hand, the noema is not transcendent but immanent, after bracketing the real relations the relation between perception and that what is perceived (the noema) is left in "pure immanence" (ibid., p. 220). And the objectified meaning (gegenständliche Sinn) in the intentional object (ibid., p. 223), as the corner-stone of the noema (ibid., p. 322), resembles Peirce's generalizing element in the percept.[4]

Since we are not aiming at a systematic study in comparing Husserl and Peirce we leave the subject, and continue with the question inspired by the brief comparison above: How to characterize a non-linguistic meaning-giving act changing a real transcendent object to a real intentional object which a state of the p-model is about?

For Peirce objects are not only objects of perception but also objects of action. That is his way of solving the basic problem of empiricism. If we take the non-linguistic meaning to be generality in terms of a habit of action we getthe following. The meaning which the p-model state gives to a perceived object, is an anticipation of an instance of a habit of action which takes the perceived object as its object (of action).

The aboutness of the p-model state is its ability to connect itself with (deal with, manipulate) the object through motor action. This refers to the future, and as Peirce told us, whatever "is truly general refers to the indefinite future"; the mode of being of the general is "*esse in futuro*" (CP 2.148).

Now, is a p-model state a representation, a semiotic entity, or a state of mind? Is it all of them at the same time?

The behaviorists once opened the skull, looked in and said: "Damn, I cannot see any thoughts there. Any talk about them must, therefore, be unscientific."

In a sense they were right. A brainstate, or in our case a p-model state, as such – that is, as described in terms of the internal features of the subject having the p-model – is not an intentional state. What makes it intentional is its potential causal connection (through motor action) with the outer object. The causal connection through the eye (some light detector in the case of our hypothetical automaton) is not enough.

To put it from the semiotic point of view: a p-model state as a brainstate is not a semiotic entity. It is not taken to be a sign of something. In the previous chapter we discussed shortly the case of a so called inner eye looking at a figurative map representing the outer spatial world. It is not needed. The map is out there waiting for to be looked at.

The p-model is projected outside. We experience the p-model as external, as a world of external phenomenal objects. It is the same real world that is also the object of action.

As Husserl put it, it is the same real object that is there both from the natural standpoint and from the phenomenological standpoint.[5] The same real object, that tree out there in the garden, is a semiotic, meaningful entity, it is taken to be a sign. But at this level of analysis (we are discussing the possibility of non-linguistic meanings, there is no language involved here) it is the sign of itself. The perceived tree is taken by a subject to be a sign of the very same tree as an object of action. The object of perception is a meaningful entity in the sense that it functions as a sign for the subject. The interpretant of this sign is a habit of action which has a possible future instance, a single act manipulating the sign itself (but not as a sign anymore). Already Peirce pointed out that percepts are signs for psychology (CP 8.300), and it is this aspect which is important. Percept's role in the structure of action is to function as a sign.

Unlike Husserl we are not completely bracketing the tree of the natural standpoint. Following Peirce: The tree as a dynamic object is external, and it is in a causal (dyadic, dynamic) relation with the subject. This causal relation cannot, however, be conceived as causal in perception (we do not *see* the molecular structure of the object, the wavelength of the light, we do not *see* how light affects the retina, etc.). The mind is triadic, and the real objects can be conceived only as objects of perception. But, after all, it is the same object (see Chapter 14 for further discussion about this point).

The mind is not "in the head". It is triadic interaction between the subject and the object. The elementary mind of our thought experiment has three elements. The rigid three-dimensional object, the p-model state caused by the object in an act of perception, and the s-model state consisting of a program (a scheme) of motor action realizing a different causal relation to the object. The real object out there is a necessary part of the functional organization of this mind. Leave it out and you have no mind.

We can express this also by stating that the p-model has, too, a dual character. It is internal in the sense that a p-model state is a sign of the external object as phenomenal, and it depends on internal conditions how the external object appears to the subject in perception. And the process of perception takes

place "in the head", it is a neural process. But this is not enough. The p-model is also external in the sense that the external real object (physical object) is a necessary part of the functional organization of mind. It appears to the mind only as phenomenal, but it belongs to the functional organization of mind as physical, although this latter aspect is not introspectively apparent.

This latter aspect seems to contradict the intentional nature of mind. One point in Husserl's notion of intentionality was, as noted above, the need to discuss the relation between the perception and the perceived independently of the latter's being a real object, i.e., the need to get along with the notion of intentional object alone.

From the semiotic point of view this amounts to the fact that a perceiver cannot grasp the relation to the perceived as a purely causal relation. If the causal (dyadic, dynamic) relation is abstracted away, as it necessarily is in introspection, the constitution of the object seems to be purely internal, it seems to depend on purely internal conditions. But using the semiotic triangle as a tool of theoretical analysis (instead of the triad only) the seemingly internal conditions prove to be constituted on the ground of external conditions. The aboutness of the p-model in terms of possible future action connecting the subject and the object is not destructed by this.

A semiotic analysis tells also what makes a brainstate to stand for something external. We have two descriptions of an object of perception (as a physical, and as a phenomenal object), we have two descriptions of an external sign, say a word (as a dot of ink on a paper, and as a meaningful string of letters), and we have two descriptions of a brainstate: A neurophysiological description, and a semiotic description. The latter description requires that it is connected with its object and its interpretant. A brainstate becomes a semiotic entity by virtue of the triadic structure of perception and action. But nothing is added into our ontology.

Using Peirce's classification of the elements of the percepts (qualities, reaction against the will, and the generalizing element, see CP 8.144), the discussion this far can be summed up as follows. A percept's reaction against my will is due to the fact that the perceived object is also the real object in the sense that it is in causal (dynamic, forceful) relation to the perceiver. The causal effect has two routes: through sensory organs and through motor action. The third element, the generalizing factor, is due to the fact that the perceived object is taken to be a sign interpreted by general habits of action. The first element consists of perceived qualities, which subject we have not discussed yet.

Peirce takes the qualities to be qualities of feeling, they belong to the first category. Our aim is to discuss the subject on the ground of a naturalistic ontology. Matter is first, according to our basic assumptions, which means that we must reinterpret Peirce's doctrine of the categories.

In a non-linguistic meaning-giving act, as we have characterized it above, the mind categorizes (in virtue of causal interaction through the s-model) the experience, and this gives it "an abstract X" as an object to which perceptual qualities can be attached by the subject. In other words, only perceptual

qualities are within the reach of consciousness. The physical object cannot be perceived, strictly speaking. The s-model functions unconsciously, and its ability to organize the perceptual qualities by virtue of its causal relations to the physical object is not within the reach of consciousness. Therefore the physical object has the same function here as "the abstract X" in theories where philosophers begin to abstract perceptual qualities away from the perceived object and are left with an unconcievable "X" as a substance or a "Träger" of the qualities.

In contrast to Peirce (see CP 1.422), this amounts to saying that qualities do depend both on the mind of the subject and on the perceived objects. An object's property of reflecting certain wave-lengths does not make it red for a subject that cannot distinguish between different wave-lengths. In this sense the colour 'red' is a relation between the object's property of reflecting light waves and the subject's ability to differentiate between respective wave-lengths. The fact that human beings see colours depends on the fact that they have eyes to see them with. The structure of the eye and the cognitive abilities needed here are inherited information, a kind of biological *a priori*, to use Konrad Lorenz's term.

To sum up, the non-linguistic meaning-giving act has three elements. First, it categorizes the experience. The result of this is a real external object to which, second, perceptual qualities (as relations) are attached. The product of this attaching is an object of perception which is, third, meaningful in the sense that it is a sign of itself as an object of action. This semiotic meaning-relation is, however, hidden.

Our hypothetical subject with the cognitive capacities of a p-model constructed on an s-model thus gives a non-linguistic meaning to a perceived object. The object (as perceived) stands for the possibilities of action.

It is, however, slightly exaggerating to call the subject intentional if these possibilities are never realized, that is, if perception does not lead to action, or if the device moves around quite accidentally, without a purpose.

This defect can be removed by postulating some elementary needs or desires which attribute preferences to different possibilities of action. Action is explained by referring to a belief and a desire causing the action. The belief is here a p-model state which is intentional by virtue of having a causal relation to the object in two directions, through perception and action.

Notes

1 This is not to say that the feature analysis of the retinal image has no role in visual perception. The point is, rather, that it is not possible to explain (recall Marr) vision through this way only. The figurativeness of the retinal image is something secondary, that what counts is motor action.

2 It is interesting to note, in passing, that this fits well in with Husserl's conception of intentionality, if we accept the interpretation according to which inten*t*ionality

is intensionality (see Hintikka 1975). That is, intentionality of perception is due to a meaning or a meaning-structure (here: semiotic interpretation) given to a perceived object in the act of perception.

3 The intentionality of perception in terms of motor action is causally analysable in the same sense as functions can be analysed causally. We can say that the function of a thermostat is to keep the temperature at a certain level, and that the thermostat has a "goal". There are, however, only causal relations involved. In the same way, a p-model state is a sign of a perceived object, and the interpretant of the sign is a habit of motor action. Terms like 'sign', 'interpretant', and 'motor intentionality' have the meaning given above, but there are only causal relations involved. For example lightwaves from a banana to the eye, and a habit of eating bananas when hungry. There is a semiotic structure inherent in the structure of this kind of action.

4 Note that Husserl does not describe the objectified meaning as non-propositional like Peirce in regard to percepts. Second difference is that Peirce does not "bracket" completely real relations outside his theory. Husserl's real relations are comparable to Peirce's dyadic (dynamic) relations, as is pointed out above.

5 It was not, however, possible to reach the real object with the phenomenological method. The case is different in a naturalistic approach.

The next step in our bottom-up analysis is to examine how linguistic competence can be acquired by a subject that acts and perceives, i.e., has a p-model. Some general remarks concerning philosophy of mind are required here. A great deal of modern discussion seems to share our aim to get rid of irreducible intentional contents, states and processes. From our point of view, the basic defect of this discussion is the fact that the problem of mind is stated inside the Cartesian frame in spite of a general strive to criticize Cartesianism. Any attempt to reduce intentional states to brainstates is a case in point. In contrast to this we have presented the principle that external objects belong to the functional organization of mind. Intentional states are reducible only to the system of interaction between the subject and its environment. The aboutness of intentional states is due to the motor intentionality defined earlier, and to the semiotic relation inherent in the structure of external action.

Linguistic thought is not in principle different from this ontological standpoint. We just have to add external signs and social environment to the functional organization of mind. This is reductionism in the sense that we don't need any Cartesian (or Popperian) mind in our ontology, but human mind is still irreducibly social, it cannot be reduced to brainstates.

The structure of mind is a different problem. Linguistic competence changes qualitatively the situation. In order to give a genetic explanation to the fact that human beings use natural language, it is necessary to show the connection: What kind of cognitive capacities were required of our forefathers when they began to develop natural language, and how did they achieve these capacities?

This problem is analysed here with the notions of the p-model and the l-model (needless to say, we are able to present only some preliminary remarks). We treat the problems of logical syntax and semantics separately. It is necessary to discuss philosophy of logic because any naturalistic program must – if it is to be convincing – explain how the capacity to think logically is achieved during the evolution and early social history.

It should be understandable that we concentrate on the logical form of sentences. Our aims in philosophy of logic are restricted. We are searching for a description of the logical competence that a subject must have before it can start to acquire natural language. In other words, we are not looking for a basis of all mathematics even if arithmetic is a central discipline for us, precisely because arithmetic is counting. And counting can be understood as manipulation of rigid objects – from which it follows that the s-model contains implicitly some necessary (but not necessarily sufficient) cognitive capacities.

The other side of the coin is the fact that the sentential theory of inference is a Boolean algebra just like arithmetic, or to be more precise: it is arithmetic of 1 and 0. Here is, we suggest, the genetic connection in the field of logical

thought. An animal's ability to act in the environment of three-dimensional solid objects contains a logic of action that is transformable into principles of counting and sentential inference. As Piaget pointed out, there are physical structures that correspond to our operational structures (Piaget 1970, p. 43). In our terms, the functional principles of the s-model (and the p-model), which correspond to the physical structures, are there to be acquired (possibly in a modified form) by the l-model. The l-mode, in its turn, makes it possible for an individual to be *conscious* of the principles of logic (and counting).

The semantic aspect of the genetic problem can be solved by a semiotic analysis. As noted before, the structure of action described by the p-model contains an implicit semiotic relation: the phenomenal object stands for the physical object. The question is how this semiotic relation can be conceived by introspection. There are several theories stressing the role of a material instrument as a sign, a semiotic entity. From our point of view, it is important that an instrument is organized into the structure of action. It can, therefore, also uncover the hidden semiotic relation which is transformed into a relation between two phenomenal objects which are both directly observable. This observability makes their relation conceivable. And because the instrument's ability to refer is general (it refers to *all* objects to which it is used, *all* jobs that are done with it, etc.), it gives rise to general concepts that classify things into large categories. The genesis of completely conventional signs (words) is tied to the use of instruments. Meaning is use, according to Dewey and Wittgenstein. This seems acceptable from our point of view as well. And the common use of material instruments is the first social habit, the residence of the "meaning" of that instrument. After this kind of social habits are established, not before, can conventional signs be acquired. The use of signs is learned by the use of instruments. The original language-game is a game with instruments.

9. An outline of a materialistic concept of mind

Without breaking the Cartesian frame (see Chapter 1) the problem of mind amounts to separating the mind and the body as distinct substances and then discussing the possibility of their interaction. The organ of thinking is the brain, and the relation of mind to reality goes through the pineal gland (or perhaps the left hemisphere) to the sense organs (for perception) and the whole body (for action). The problem of mind is interpreted as a problem of how to relate a separate spiritual entity, the mind, to the physical brain. This way of stating the problem, the Cartesian framework in the philosophy of mind, is still prominent in cognitive science, although the details and terminology are different.

The modern computer analogy – the hypothesis that mind and brain are related in the same way as a computational program and the physical computer running it – differs from the view of Descartes in the demand that the program must be physically realized. A really Cartesian mind is supposed to work without any material realization.

The computer analogy fits in with the Cartesian framework in that it discusses the problem of cognition as a problem of the relation between the mind and the brain. This frame is questioned neither in Jerry Fodor's methodological solipsism nor in John Searle's criticism of this kind of approach, in spite of the fact that they represent different approaches to the problem of mind. Fodor's methodological solipsism cuts off the semantic relations to the external world, and we are dealing only with syntactic relations and the brain.

Also Searle ends up with a notion of the causal powers of the brain. Mental phenomena, he writes, are caused by processes going on in the brain (Searle 1984, p. 18). Mind is related to the causal powers of the brain. The Cartesian framework is not questioned.

The computer analogy compares humans with computers. Computers are symbol-driven symbol manipulators, they function on the basis of well-defined symbols and representations. Computational processes are formal processes defined over representations. This means that computers work on the basis of the formal properties of the representations only, they don't care about the semantics, about the content. So why couldn't human minds get on with the same arsenal? The claim that human cognition can be investigated without semantic properties, on the basis of formal syntax only, is the main thesis of Jerry Fodor's methodological solipsism (see Fodor 1980).

According to Fodor's solipsistic method the relation between mind and brain can be considered in isolation, in the Cartesian framework. The scientific world-view has changed since the days of Descartes, therefore the pineal gland is not up to date anymore. It is replaced by a more plausible hypothesis that the computational level can be mapped onto the physical level. At least computers work that way. The computations are realized physically.

It is easy to understand why it seems so attractive to get rid of semantics and concentrate on syntax when one tries to keep the discussion "in the head", in the Cartesian frame. It would indeed be very odd to claim that there is something green or blue or "tableness" in the physiological properties of the brain as such.

The relation between computation and causation is not so apparently strange.

Computers are designed to perform computational functions. For every routine function there is a physical device, e.g., an and-gate, which realizes the function. There is, in a digital computer, a one-to-one correspondence between computations and physical events. This is just self-clear in the case of digital computers. They are designed this way.

Fodor's language of thought (LOT) hypothesis (combined with the methodological solipsism) transfers this to the human brain. The language of

thought is mapped onto the physical features of the brain. But in the case of the human brain this is not self-clear. It is a hypothesis that guides us to look for certain kind of physiological properties.

Fodor's approach is a kind of top-down strategy taking the formal syntax as its starting point. Stephen Stich puts the point quite clearly. According to him

> "generalizations detailing causal relations among the hypothesized neurological states are to be specified indirectly via the formal relations among the syntactic objects to which the neurological state types are mapped" (Stich 1983, p. 151).

In other words, syntactic objects are required in the specification of the neurological states realizing cognitive processes. The starting point is the formally defined logical operation.[1]

However, as David Braddon-Mitchell and John Fitzpatrick put it, no one "programmed us by following a Language of Thought implementation manual" (Braddon-Mitchel and Fitzpatrick 1990, p. 23). Evolution worked the other way round. In order to understand the nature of the mapping relation one should know in virtue of what does such a mapping exist, what counts as syntactic structure (see ibid. pp. 11–12).

The evolutionary standpoint requires that the mapping relation is specified from the bottom, starting from the neurological states. But what makes us interpret some physical process as a computational operation? How do we choose between alternative computational functions? The realizing relation is not necessarily bidirectional. The one-to-one relation between logical and physical operations that seems to be so evident when looked at from the top (in the case of digital computers), is not so easy to see when one looks at it from the bottom (in the case of the human brain). Something more is needed to answer the question.

The approach based on the computer analogy is, after all, an attempt to sweep the aboutness problem under the carpet. If Braddon-Mitchell and Fitzpatrick are right, then the attempt fails already because we cannot have any syntax independent of a semantic content; semantics is needed before one can decide that the relations in question are syntactic relations (ibid. p. 14). The aboutness problem must be handled in one way or another.

Later on Fodor has distinguished between methodological solipsism and methodological individualism. The difference is that methodological individualism allows that relations to the world participate in the individuation of mental states. This means, in effect, that Fodor tries to develop a causal theory of mental content. His top-down analysis has led to a language of thought (Mentalese), and the problem is now to give a naturalized theory of meaning for these mental representations. Methodological solipsism is not given up, but because it is an empirical theory, it cannot be defended on *a priori* grounds. Methodological individualism is, according to Fodor, a way to do it. (See Fodor 1987, pp. 42–43.)

This move overcomes the Cartesian frame, causal relations to the world are taken into account. The problem of this approach is that mental representations are taken to be linguistic symbols, Mentalese is a *language* of thought.[2] Now what makes up a language? Let's take it simple, just for the argument's sake, and say that we need syntax and semantics in an individual's mind.[3] Causal relations take care about the syntactic relations, at least in computers, and causal relations take care about the relations of the symbols to the world, i.e., about the semantic relations as well.

In this simplified situation the instances of, say, horse should cause "horsy experiences". This may be accepted. It is easy to imagine that dogs have "horsy experiences", that they can tell horses from other objects. They can classify experience and in this sense have a concept of horse. But it is not easy to imagine how this "horsy experience" changes into a symbol which belongs to a language (with a syntactic structure). What *are* the syntactic properties of a "horsy experience"? Fodor has no story about that. Even if one could establish a causal relation from horses to "horsy experiences" (recall, however, the problems of a causal analysis of visual experience discussed in Chapter 7), there remains the problem (unsolved by Fodor) of how to cook up a language from these experiences. Any *naturalistic* view of language should tell how *nature* has produced the competence needed in the rudimentary forms of linguistic thought. The computer metaphor is not particularly convincing in this respect.

One of Fodor's motives is to show that only causal properties contribute to the processing of semantic content. But there is another, increasingly discussed alternative to relate computational and physical operations, namely the alternative of connectionism.[4]

According to Adrian Cussins, connectionism can solve the problem of embodied cognition (the problem of how physical systems think) on a different basis than LOT (the language of thought hypothesis; see Cussins 1990, p. 371). Cussins's approach is based on a non-conceptualist notion of content. A non-conceptualist content is given in terms of capacities to find one's way in the environment. Cussins maintains that no concepts are required of one's ability to find one's way (ibid. p. 395). This resembles our attempt to give a causal (and therefore non-conceptual) basis of cognition by the s-model. A basic difference between Cussins's approach and ours concerns the problem of conceptuality. Cussins takes for granted the conception of conceptuality in LOT, and tries to develop a notion of non-conceptualist content on this basis. This content is then related to physical (causal) systems.

In our approach the notion of conceptuality is taken under reconsideration (cf. the discussion of Marr's and Vaina's views about vision in Chapter 7). Causality is then related to syntactic structures and (reunderstood) conceptual contents. The s-model is a device for moving in the environment, and it produces a subcognitive structure that enables one to have a representation of the environment as objects, properties, and situations: the p-model. Therefore it is a conceptual content in Cussins's terminology (Cussins defines

conceptuality in terms of objects, properties, and situations; see ibid. p. 382). However, since the s-model is structured causally, and the p-model is achieved by adding a causal effect through sense-organs, these models cannot properly be called conceptual unless the notion of conceptuality is changed.

In other words, LOT connects its representational vehicles (i.e., syntactic structures) to physical level in the manner of digital computers, and Cussins relates connectionist representational vehicles to connectionist physical systems. We are, however, relating LOT's representational vehicles (structures in the l-model) to a physical system that resembles quite interestingly Cussins's representational vehicles, namely capacities to find one's way around the environment, and that system is the p-model – the object structure of which is achieved by the s-model.

Before we look closer at the relation between connectionism and our approach, we want to stress a methodological point: the need to overcome the Cartesian frame. The causal powers of the brain are not the only alternative to understand causality in a relevant way. The logical grid of language and thought, so to say, can be related not only to the neural net of the brain. The other alternative, the one we are examining, is to talk about the causal interaction between the thinking physical system (the body included) and its physical environment.

In a way connectionism drives one to this direction. Self-organizing connectionist networks are programmed (taught) by this kind of interaction. For instance, networks which are designed for recognizing physical objects, are programmed by showing them these objects. In other words, knowledge is self-organized under the control of received information (Kohonen 1989, p. 119). The thesis (stressed several times above) that external objects belong to the functional organization of mind, gets here the form: Interaction with the physical environment is essential in the process of the self-organization of knowledge.[5]

Also the discussion about the role of the units of the networks, especially the hidden ones, relates to this methodological point. Ramsey et al. point out that in a connectionist network "there is no distinct state or part of the network that serves to represent any particular proposition" (Ramsey, Stich and Garan 1990, p. 134). In other words, the connection from a propositional content to the network may well be untraceable. Indeed, there are indefinitely many connectionist networks that represent one and the same propositional content with no common features at the level of the network description (ibid. p. 136).

What's the moral? Definitely not that many connectionist models are "incompatible with the propositional modularity of folk psychology" (ibid. p. 127). Or better, this incompatibility holds only on the assumption that "the propositional modularity" must be found "in the head". This is, essentially, the assumption that the Cartesian frame is accepted. But there is no reason to do that, especially not from the connectionist point of view.[6]

The fact that some (or all) individual units, especially hidden ones, are difficult to specify in the sense that they "have no comfortable symbolic

interpretation" (ibid. p. 126), is a problem only for a top-down analysis that begins from symbolic operations and gets nowhere. This is just too bad for this kind of top-down analysis (and LOT).

The basic feature of the s-model is (in our bottom-up analysis) precisely the ability to model the world's object structure in the brain. In other words, it has a constituent structure. When Jerry Fodor and Zenon Pylyshyn discuss the relation between classical AI and connectionism, they claim that only classical theories (but not connectionist ones) can explain how mental representations "exhibit a combinatorial constituent structure and a combinatorial semantics" (Fodor & Pylyshyn 1988, p. 32). The causal connectedness that connectionist theories are able to provide does not succeed in this, they claim.[7] The point is that causality is, in these connectionist theories, understood in neural terms. There are nodes and connections in these networks (just like cells and their axons in the brain), but there is no explanation of how the relation between these networks and the properties of the environment is achieved. The s-model, however, is a model that cannot be understood in neural terms in this way. The causality of the s-model concerns the object structure of the rigid environment that is (causally) imprinted into a structure of the brain. And this makes all the difference. And this structure is, we suggest, a basis of the structured thought required by the linguistic cognition.

From our point of view (and we suggest that this angle is suitable for connectionism as well) there is no need for a network unit (or a brainstate) to be identified syntactically. *No* brainstate (network unit) is a cognitive state *as such*, i.e., described neurophysiologically (by activation values and connections). It is just a mess of neurons (or connections).

Kohonen criticizes the type of connectionism where network units are simply postulated to represent the environment, and the problem of the self-organization of knowledge is ignored (Kohonen 1989, p. 27). This is just an implicit way to express the methodological thesis that external objects belong to the functional organization of mind. Kohonen's way to solve the problem of the self-organization is, however, based on another dubious methodological assumption. The point is that Kohonen relies on *images* stored in the network. He looks for mappings from input signal patterns to projected images, and the mapping relation is based on *similarity* between patterns and images (see ibid. p. 129).[8]

It seems natural to look for similarity between retinal images and cortical (two-dimensional) layers, and no doubt nature has used all relations there are between the brain and the environment. The evidence from Marr (1982) and Julesz (1971) indicates, however, that this is not enough.[9] On the base of Marr's theory, it seems necessary that the subject already has a conceptual system picking up objects out of the visual field, and, therefore, it is not possible to transmit the object structure of the world into the network structure without some presumptions (like Marr's rigidity assumption). The pattern recognition tasks (with two-dimensional patterns) that are solved in Kohonen (1989), ignore this problem. And a glance at the pictures in Julesz (1971)

shows that the perception of depth (three-dimensionality) can be achieved without *any* signal patterns at the level of retinal images. Our suggestion is that the representation of the spatial relations of the environment is not based on vision, images and similarity, but on motor action and the subject's motor control system; in a word: on the s-model.

From this point of view the similarity between input signal patterns and image-like network states is not enough to explain (without presumptions concerning the conceptual capacities of the subject) how internal brainstates are *cognitive* states of mind, i.e., are *about* the external world.

What makes a brainstate (a network unit) a cognitive state?

The fact that the brainstate belongs to the functional organization of mind, that is, the fact that it participates in the inter*action* of the (thinking) physical system and its environment. In semiotic terms: the fact that it belongs to a semiotic triangle of perception and action.

If we accept the brain as a physical entity with its causal powers, why couldn't we accept the whole body in its environment?

One reason why this seems unacceptable, is the common doctrine of the theory-ladenness of sensations and the conceptual categorization of experience (together with the methodological stand shared by Kohonen and Kosslyn, for example). This seems to imply that we cannot reach the environment, external object, without already having concepts available. The basic problem of empiricism remains unsolved. But this does not matter, if we take into consideration only causal aspects of the interaction between the brain and the environment. The notion of the s-model is introduced precisely for this purpose.

Now we come to the interesting connection between our analysis and Cussins's approach.

The important difference between Cussins's approach and ours is that his representational vehicle (capacities to find one's way around the environment) is not analysable independent of perceptual processes that are already conceptually laden. At least Cussins makes no efforts to explicate how he takes perception to be non-conceptual. In his discussion about the distinction between conceptual and non-conceptual content he just makes no comments about the traditional problem of perception that has been examined by philosophers and psychologists from Kant to Marr (at least). And it remains quite unclear, how one is able to find one's way around the environment without experiencing it as objects, properties and situations (which is his definition of conceptual content, see Cussins 1990, p. 382).

Cussins has got the idea from Evans (1982). As Cussins puts it, the experiential (i.e., non-conceptual) content of perception is specified "in terms of certain fundamental skills which the organism possesses, '*the ability to keep track of an object in a visual array, ...* '" (Cussins 1990, p. 396, emphasis added). How is it possible to keep track of an object if one has not the object concept (as the non-conceptuality requires), and, therefore, cannot categorize one's experience. How can one decide that different sense impressions stem

from the same object if one cannot experience objects? It is not clear that we are dealing here with thoroughly non-conceptual content. (One thing is clear, though: the notion of conceptuality must be discussed further.)

One can, of course, just maintain that "it is completely clear to any conscious being that there exists *discrete objects* in the world" (emphasis in the original, Kohonen 1989, p. 27; he just *might* have mentioned the exception of some philosophers). But it is not quite clear in virtue of what does a conscious being have this firm belief. Many philosophers seem to be of the opinion that this is due to conceptual abilities.

Our notion of the s-model, however, is purported to a clearly non-conceptual causal analysis of motor interaction that creates the basis for the functional organization of the mind. This is another way to build relational structures into the neural network. The answer to the question "In virtue of what are these relational structures representations of the relational structures of the world?" is, of course, different.[10] The result is the same: The brain forms (by means of the s-model) discrete states that correspond to external objects (cf. Kohonen 1989, p. 27), relational structures, e.g., of the form (attribute, object, value) that correspond to statements like "The colour of the apple is red." (see ibid. p. 28).

Kohonen points out that abstract relational structures like semantic networks need not be really represented in memory; the fact that its existence may be confirmed is a pragmatic property (ibid. pp-28–29). From our point of view the same holds for neural network "images". The fact that their existence can be confirmed is, quite literally, a pragmatic property. "Spatial maps for attributes and features" (ibid. p. 239) are constructed by self-organization through action, and "the question of *how symbolic representations for concepts could be formed automatically*" (emphasis in the original, ibid. p. 239) is settled here as well. But this approach contains a suggested solution to the problem of the rigidity assumption.

Now we can ask in a new way: What makes the physiological state of the brain an intentional state that is, somehow, *about* something in the environment?

This question makes sense, as we have seen in the previous chapters, even if we have no language, neither syntax nor semantics. That what counts as causal in this approach, is the causally determined model of the rigid objects of the environment. This is not causality of the brain in isolation (the brain described as neural states). It is causality of the brain *qua* a causally determined model of the environment. We are not dealing with the causal powers of the brain but with the causal powers of the interaction of the body and the environment. The aboutness in question is the aboutness of motor intentionality.

The relation between the mind and the brain is to be considered as a relation between cognition and causality, but not in terms of computation and neural functions. The task is to find out, on one hand, how prelinguistic cognition (cognition based on the s-model and the p-model only) works as a ground of

linguistic thought, and, on the other hand, how is prelinguistic cognition related to the causal interaction of the body and the environment.

Our suggestion is based on external action as contrasted to perception and linguistic thought. The stress on action is not new, not even in cognitive science (see, e.g., Fetzer 1990, where the importance of Peirce's semiotics is also pointed out in this context). But the boundary between action, on one hand, and perception and linguistic thought, on the other hand, is not too clear.

Mark Johnson's theory of an embodied mind has the same problem, although it in other respects is interesting. The basic difference between Johnson's approach and ours is, that his embodied schemes of mental organization are – in spite of the fact that they are meaningful structures "at the level of our bodily movements through space, our manipulation of objects" – image schemes between abstract propositional structures and particular concrete images (Johnson 1987, p. 29). Manipulation is not, in Johnson's approach, distinguished from perceptual interaction. The notion of the s-model, on the contrary, not only tells that this schematic structure comes from purely causal interaction, but also turns the relation between mental imagery and operational structures of bodily movements upside down: Mental images (or image schemes) are spatial only in virtue of their relation to the systems controlling motor action. The talk about mental images, pictures, figurative representations, etc., is only metaphorical! Johnson's approach seems to be similar to that of Kosslyn's (which is discussed in Chapter 6), although Johnson stresses that his image schemes are "dynamic patterns rather than fixed and static images" (ibid. p. 29). From our point of view schemes of motor action can be, in principle, distinguished from schemes of perception and imagination.

The boundary between perception and action, on one hand, and linguistic thought, on the other hand, needs clarification. One source of confusion is the term 'propositional'. To the extent that the term is related to the structure of sentences, it is a linguistic term. But another characterization of a proposition is, that a proposition is that which may be said to be true or false. And that of which it is about (which makes it true or false), is the world carved up to objects, properties and relations. Confusion may arise if these aspects are thought to entail one another. This would mean that only a subject capable of linguistic cognition is able to experience the world as consisting of objects, properties, and relations.[11]

This particular point is denied in our approach. A subject having an s-model and a p-model only experiences the world as consisting of objects, properties, and relations, but it is not able to represent the object structure of the world with external signs. It has no linguistic cognition. Its cognitive states (of the p-model) are true or false. The p-model has a propositional structures in this sense, but these structures are not linguistic.

What comes to the relation between connectionism and syntactic theories like LOT, our view can be sketched as follows. Take a look at the Figure 1.1. From this point of view a digital computer can be viewed as a storage of

(formal) signs that perform logical operations on those signs. Digital computers do not simulate subjects' cognition, they simulate subjects' operations on signs (which they used to do with pencil and paper, for instance). Digital computers belong to the external part of the social organization of propositional thinking. Individual subjects do not think in the Cartesian frame.

We can, of course, think while sitting in a rocking chair, but that what takes place in the head is not that what digital computers do. We anticipate certain motor actions, namely actions that produce external signs (sound waves, marks on the paper or the computer screen, etc.). The external signs are a necessary part of the functional organization of mind, even if only anticipated.

Connectionist networks, on the other hand, do simulate individual (subjective) cognition. That's the point of view from which they were invented, in the first place. Connectionism is an attempt to simulate the neural networks of the brain. In other words, connectionist networks simulate the users (producers and interpreters) of signs.

So, this standpoint presents digital computers and connectionist networks as standing opposed to each other. A digital computer is an external storage of signs that is able to perform logical operations on those signs, and in this sense simulate that what individual human beings (especially logicians) would do with the signs (but this does not entail that the processes going on inside the digital computers would be similar to the processes in the brain). Connectionist networks are purported to simulate the internal processes of the users of signs. Logical operations are a part of both, but in opposite senses.

As suggested above, the causal functions (realizing the cognitive functions) are based on the functioning of the s-model, the structure of which is in the brain but is causally determined by the solid environment. The motor control system of the body contains this model as schemes or programs of motor action. The s-model as such is not an object of cognition, we are not conscious of it as an internal structure, but it models the object structure of the environment.

The relation between prelinguistic cognition and causal interaction between the body and the environment is, to some extent, examined in the previous chapters. The next three chapters are devoted to the other aspect: How is linguistic thought related to causality and prelinguistic cognition?

The s-model gives another perspective for the problem of computation and causality. The causal relations are not relations between neural states as such, but relations between the s-model states.

The fact that the s-model is a model of the body and the solid objects of the environment already breaks the framework of Fodor's methodological solipsism. The external objects, as they are modelled in the s-model, are included in the analysis. The relation between computation and causality is a relation between computation and manipulation of the rigid objects of the environment.

This brings us to historical and etymological considerations. The latin word *calculi* stands for pebbles that the Romans used in elementary calculations. To

calculate was to perform elementary arithmetical operations with external rigid objects.

Pebbles were used as signs, of course, but there is more to it. The relevant properties of external rigid objects are internalized (in causal interaction) by the s-model. A causal imprint of an external rigid object in the s-model is a basis for a permanent unit of internal calculation. The cognitive competence for computing is there in the functioning principles of the s-model. This competence is taken into use in conscious computing with external signs (fingers, pebbles, whatever). Internal computing consists of elementary arithmetical operations with internal units, but it is based on the manipulation of external rigid objects.

Logic can be compared with arithmetic as computing in the sense that both are sometimes considered to consist of "laws of thought". The problem is how to explain these laws on a naturalistic basis. Or better, how to explain the fact that human beings have, in the course of evolution, acquired the ability to think logically. We are not (here) trying to tell what logic and mathematics basically are, but we are concentrating to the psychological aspect of the question. We are asking what is required of a biological organism before it can learn to count.[12]

One trend in the present cognitive science has been to talk about the logical syntax of languages independently of the semantic relations. The concept of computing as internalized manipulation of rigid units takes the semantic aspect into the analysis in the very beginning. The s-model does not work without external objects which are modelled, without external objects that the states of the model are about. The *aboutness* of the s-model is different from the aboutness of perceptions, triadic states of mind.

By the same token the hindrance that the s-model as such is not an object of consciousness, is removed. When we perceive the external world, we are conscious of the s-model in the specific sense that the perceived object, when actually manipulated, leaves its imprint on the s-model.

The aboutness, or usability, of computation (cf. the next chapter) is based on motor intentionality (see above), as well as the aboutness of perceptions. In external action we compute perceived physical objects (physical objects as perceived, that is phenomenal objects, see Chapter 14). This usability remains hidden when computation is regarded as a purely formal operation. It becomes visible only when we ask for a genetic explanation of our ability to compute.

This approach to computation does not require that syntax is separated from semantics. Syntactic and semantic aspects of language are both based on the causal interaction between the subject and the natural environment.

This is not all there is to it, of course. Language is a social phenomena, and this aspect must be considered, too. Some problems relating to this side of the issue are discussed in terms of instrumental action (see Chapter 11), and the overall conception of language is, we believe, best achieved in characterizing language as a game and instrument (see Chapter 12).

But before turning to these issues we try to characterize our approach as a materialistic notion of mind.

To be a materialist in the philosophy of mind is to get on without any abstract immaterial entities, be they abstract syntactic objects, meanings, propositions, states of mind, or whatever.

Ontologically speaking there is no separate mind "in the head" or elsewhere. The Cartesian frame separating mind and brain from external world must be overcome. To have a mind (with the capacity of linguistic thought) is to have two motor control systems. One for manipulating external material objects and producing artifacts (for dealing with three-dimensional objects), and one for producing external signs.[13] We might speak about action and sign action. We return later to the issue of what it is to produce signs, but in regard to the ontology of mind it can be seen that producing, manipulating, and perceiving external signs is in no way different from producing, manipulating, and perceiving external material objects. After all, external signs are material entities. The difference is that usually signs do not leave imprints into the s-model.

Cognitive relations and processes are internalized external relations and processes. But still, as internal, the cognition requires external objects and signs as a part of the functional organization of mind. Mind is perhaps best characterized as a form of the interaction of the body and the environment – the physical environment, the social environment and the environment of external public signs included.

Mind and nature are constitutively intertwined, but it is not the mind that constitutes nature. The mind is itself constituted by the interaction of a living organism and its environment (which includes the social environment for human beings). This constitution is structured schematically, but the schemes of external action are the basic ones.

Notes

1 Syntactic objects fit in with our view on the assumption that they are taken to be three-dimensional rigid objects that are "mapped" to neurological states through motor action and the s-model. But this is not Stich's intention. He is aiming at a top-down analysis starting from formally defined logical relations. We return to the issue in the next chapter.

2 According to Fodor, mental representations are symbols because "only symbols have syntax", and the only theory of mind that is not known to be false, is the view that mind is a syntax-driven machine (Fodor 1987, p. 19–20). Unfortunately, this view is not known to be true, either. Anyway, the p-model can be interpreted as a system of signs that has a "syntax" in the sense of having a structure of objects, properties, and relations. The p-model is not a set of symbols, not a language, but it may well be the basis of the syntax of a natural language (see Chapters 10 and 12). How a Fodorian syntax-driven mind *gets* its syntax? There is no story about that.

3 That is, let's forget that language is a social phenomenon and let's ignore, for instance, the criticism of Hilary Putnam (1988).

4 By connectionism we do not mean a simple "switchboard" model (see Kohonen 1989, p. 238), but more generally theories of neural computing, Kohonen's approach included.

5 Kohonen concludes on this ground that "genuine neural computers should not be programmable at all" (Kohonen 1989, p. 268). Interaction is the only way to get the necessary structure into the neural network.

6 Note that the reconsideration of the notion of propositionality, to which our bottom-up analysis leads, affects also this issue. The structure of the environment as objects, properties, and relations, i.e., the propositional structure in one sense of the term, *is* "in the head" as a structure of the s-model.

7 This does not hold for the self-organizing networks analysed by Kohonen (1989). For some reason or other, Kohonen's work seems to be neglected in the discussion, in spite of the fact that he has been a pioneer in the field.

8 In other words, Kohonen shares Kosslyn's methodological assumptions, (cf. the discussion of Kosslyn's spatial medium above). Or in comparison to Vaina's analysis, it looks like Kohonen is concentrating on the 'what' system, not on the 'where' system (see Vaina 1990). The question is how far is it possible to develop the notion of the self-organization of knowledge on this ground only, without a full analysis of spatial self-organization and its relevance.

9 The analysis of the philosophical epistemology from Locke to Kant leads to the same conclusion.

10 From this point of view, the image-like features of internal network states are only secondary, even if useful in vision, for example.

11 Mark Johnson suggests that mental images or image schemes are propositional in the sense that they are continuous patterns of experience with "sufficient internal structure to permit inference" (Johnson 1987, p. 4). This is different from a proposition as a state of affairs in the world, "usually one holding between an entity and its predicates" (ibid. p. 3). From our point of view these two are related. Patterns of experience (structures of the models discussed in this study) permitting inferences are models of the spatial structure of the rigid environment.

12 In the next chapter we shall argue that this does not entail empiricism in the philosophy of mathematics in the same sense as it is traditionally understood.

13 This is, in effect, to say that we have two semantic systems, preverbal and verbal. And as already noted above, there is even some empirical evidence supporting this view, namely the suggestion that there is a stage of preverbal perceptual categorization and a stage of verbal semantics (see Vaina 1990, p. 75). Further, if we take notice of Hintikka's comments on Vaina, we end up with the suggestion that the semantic (or semiotic) relations of the p-model (the 'where' system) correspond to the perspectival framework of identification, and the l-model corresponds to the public framework of identification in Hintikka's system.

10. The origin of computational competence

Where does logic come from? From where do we get our ability to count and think logically? Why does it seem so certain that logic and arithmetic can (or must) be used in empirical investigation (at least if it is to be successful)? It must be stressed that we are here not interested about what logic and arithmetic are as formal systems, but mainly about the problem of how a biological organism can acquire the relevant cognitive capacities.

The Kantian answer to these questions is that logic is a characteristic of the universal human reason, and we are bound to have logically consistent experience of the world. But the thing in itself cannot be reached, and it is not the source of logic. The human reason puts the logic into experience.

If one wants to explain the nature of human cognition from an evolutionary point of view, this is not enough. Logic and arithmetic are in a sense *a priori* in regard to empirical experience, but the genesis of logical thinking needs explanation. In a materialistic conception the logical grid of human cognition, so to say, must have a basis in the pre-history of human cognition.

The problem can be viewed from different angles. We can distinguish between the logical form of a sentence and the principles of logical thinking. The notion of the s-model developed above and its status in our bottom-up analysis gives ground for the suggestion that these aspects make up the two sides of the coin. The logical form of a sentence is based on the structure of the world as objects, properties, and relations (represented in the brain in virtue of the s-model, as a result of causal interaction with the rigid environment). Principles of logical thought, so called laws of thought, are based on the same subcognitive structure, the s-model, but this time the s-model is viewed as basis for a system of correct inference or a system of counting, calculating, computing. From a formal point of view the coin in question, the s-model, has the structure of Boolean algebra. Counting is an arithmetical operation, and arithmetic is a Boolean algebra. On the other hand, sentential logic can be viewed as arithmetic of 0 and 1, i.e., a Boolean algebra.[1] This connection makes it possible and illuminating to discuss arithmetic and counting, even though the ultimate purpose is to understand from where we have got the ability to think logically.

The point is, then, that the s-model may well be the source of the cognitive capacities required 1) by our linguistic competence as an ability to form syntactically correct sentences, 2) by our logical competence as an ability to think correctly, and 3) by our computational competence to count. In a word, we discuss the hypothesis that the s-model is the source of our *computational competence*. The proposal cannot be discussed thoroughly enough, but the following considerations are supposed to give some support to it.

In the next two chapters we discuss more thoroughly the point from a linguistic point of view. This chapter deals with philosophy of logic and mathematics. The basic idea is that it is possible to combine a physicalistic

ontology with an aprioristic epistemology (with the notion of a biological *a priori*), and avoid the well-known difficulties of classical empiricism in this respect.

The nature of logic was one of the important problems of Ludwig Wittgenstein whose views, as interpreted by Jaakko and Merrill Hintikka,[2] seem to be interesting from the naturalistic standpoint selected in this study. Our appeal to Wittgenstein is not accidental. He seems to have had the same task: to get the logical form out of the extramental physical world (in *Tractatus*)[3] or make the rules of counting dependent of how the physical world behaves (in order to handle arithmetic as a language game). The main principle of a language game is that meaning is use. Arithmetic is used in counting, e.g., physical apples. Wittgenstein's question is: What features of the physical reality are relevant for the usability of arithmetic? What is the connection between the world and arithmetic? Naturalism in the philosophy of mathematics requires a physicalistic ontology. The views of Wittgenstein are, therefore, useful in our attempt to naturalize the theory of human cognition.

We are not trying to make an exegetic investigation of Wittgenstein, to find out what he really thought (if that is possible), but only to use some of his ideas in elaborating our conception of the role of action in human experience. Our aims are entirely systematic, and the interpretation of Jaakko and Merrill Hintikka is useful for these systematic aims.

According to this interpretation, Wittgenstein's background was in Russell's conception of objects of acquaintance (see Hintikka and Hintikka 1989, pp. 52–55). Russell had two kinds of objects of acquaintance, concrete objects and logical forms, 'Aristotelian' and 'Platonic' entities, as Hintikkas characterize them (ibid. p. 53).

In *Tractatus* Wittgenstein rejected the abstract logical forms as independent Platonic entities. But now he had to tell how the concrete objects can be the source of logical forms of thinking. The logical form of a sentence mirrors (not pictures, picturing is reserved to the sense in which sentences are isomorphic to possible states of affairs, see ibid. pp. 118–121) the form of reality. In other words, mirroring deals with the logical form of a sentence, and picturing deals with the sentence's property of being true or false. A well-mirrored sentence may be true or false (well- or ill-pictured), but the truth value of an ill-mirrored sentence cannot be decided.[4]

This idea of mirroring is a way to tell that the logical grid of cognition is got from the external world which is logical in itself. "Logic is not a body of doctrine, but a mirror-image of the world" (*Tractatus* 6.13). And logic is transcendental, Wittgenstein adds immediately.

This idea of the logical structure of the world leads Wittgenstein to Newtonian mechanics. Logic and mechanics are similar in the sense that they give the forms of possible descriptions of the world. Mechanics, like logic, gives us "the precise *way* in which it is possible to describe it" (the world), Wittgenstein writes in *Tractatus* (6.342).

We are dealing here with the laws of physics, but not *qua* causal connections. "The laws of physics, *with all their logical apparatus*, still speak, however indirectly, about the objects of the world" (6.3431, emphasis added). However, the belief in causal nexus is superstition (see 5.135, 5.135 and 5.1361).

The question we want to ask, strange though it may appear, is the following. What about if the invariances of nature, *qua* causal connections, were the source of as well the logical grid of cognition as the logical apparatus of mechanics?

C. S. Peirce noted the relation between logic and physics in terms of dynamics. "The laws of dynamics are very much like logical principles, if they are not precisely that. They only say how bodies will move after you have said what the forces are" (CP 1.348). There may very well be also a systematic connection between this view of dynamics and Peirce's terms 'dynamic (i.e., dyadic) relation' and 'dynamic object'.

In other words, the external real world, the dynamic world, is as it is, independently of what we think about it, and this independence concerns also logic. And what is more, the independent dynamic invariances of the external world also determine the logical grid of cognition.

This seems to be a mode of superstition rejected in *Tractatus*. However, Wittgenstein's later remarks give some ground not to condemn the view too hastily. After all, what else is there to get logic from, for an ontological materialist?

In *Tractatus* Wittgenstein puts logic and mathematics in the same position. "The logic of the world, which is shown in tautologies by the propositions of logic, is shown in equations by mathematics" (6.22). This leads to the notion of calculus. Hintikkas point out (1989, pp. 13–16) that Wittgenstein did not mean by the term just manipulation of symbols inside language. As noted already, the latin word 'calculi' stands for pebbles which the Romans used in elementary calculations, and it is this connection with action that is important in the view of Wittgenstein.

According to the interpretation of Hintikkas, this use of the term 'calculus' is a clue to the later term 'language game'. They quote (1989, p. 15) *Philosophical Grammar* (VIII, sec. 111) where the calculus of thought is connected with extramental reality. And this is the task of language games.

Hintikkas also point out (1989, p. 12) that Wittgenstein often spoke of obviously semantic rules as grammatical rules. That is, he spoke of rules of grammar that concern with a connection between language and reality.

Summing up these points from Wittgenstein we can now state how the situation looks like from our standpoint.

Language and mathematics have a common nucleus, rules of calculus, or to use a term in fashion, rules of computation. The laws of thought, as they are expressed in logic and mathematics, are computational rules. And computation is not only or even basically manipulation of abstract symbols, but based on manipulation of extramental reality.[5] This connection with extramental reality

gives the ground for holding to the conception, that the computational nucleus of cognition (the "laws of thought") is connected with extramental reality. This connection is different from the connection that semantics gives to language via language games. (The relation between these connections is discussed further in Chapter 12.)

In other words, keeping in mind the distinction between mirroring and picturing, we can say that the computational nucleus is mirrored from the extramental reality, and picturing is concerned with semantics, names, truth: a true sentence is a picture of a subsistent state of affairs (see Hintikka and Hintikka 1989, pp.118–121).

As to the logical form of sentences, a false but logically correct (ill-pictured but well-mirrored) sentence can be thought of, but a logically incorrect (ill-mirrored) sentence, if it is a sentence, cannot even be thought of. That is, "thought must have the logical form of reality if it is to be thought at all" (Wittgenstein 1979, CLI, p. 10).[6]

We leave picturing and semantic language games to later chapters and concentrate on the computational nucleus. How can it be connected to extramental reality, and what follows for its status if it is said to be mirrored from the physical world that is not logical in itself, that is, if we give up the claim that "logic pervades the world" (*Tractatus* 5.61)?

Let's start with the so called necessity of the laws of thought. David Hume differentiated between necessary and contingent propositions by stating that the contrary of every contingent fact is possible, while the contrary of a necessary proposition is not possible. Therefore, it is necessary that 2+2=4 because it is not possible that 2 plus 2 is, for instance, 5.

In *Remarks on the Foundations of Mathematics* (I, 37) Wittgenstein invites us to consider the possibility that when we put two apples on a table and then again two apples, there would be, surprisingly, five apples. Something must have gone wrong in putting apples, is the first idea occurring to mind. It must be impossible that two apples plus two apples would make five apples. But *what* makes it impossible?

Suppose that nature really worked that way. Wouldn't that be the end of the rules of computation? The proposition '2+2=4' follows from the definitions of arithmetic according to the rules of computation as necessarily and as certainly as before, but where's the use of this necessity and certainty. The result cannot be applied to counting apples. Then what is it certain about?

It is not enough to distinguish between definition and application, and to say that elementary computations just happen to apply to physical reality. We are interested to know, first, why does it seem so certain and necessary that 2+2=4 as a computational result, and, second, why does it seem so certain that it is applicable to apples, too.

It is worthwhile to start from David Hume, again. Hume distinguished between truths of reason and matters of fact on the ground that even if it seems highly improbable, even impossible, that causal chains in nature would suddenly change their course (the sun would not rise tomorrow, the billiard-

balls would start to behave surprisingly etc.), it is, anyhow, possible. But it is not possible that 2 plus 2 makes, e.g., 5.

The feeling of certainty about factual knowledge was explained by habit. We are accustomed to think that the sun will rise tomorrow, that is why it seems so certain. But it is not real certainty.

Truths of reason, e.g., arithmetical truths, are certain. But because Hume's empirical epistemology separated arithmetical truths from sense experience, this distinction of Hume's led to the uncomfortable result that arithmetic does not apply to the extramental world, at least we cannot know that it applies.

This kind of agnosticism was rejected not only by Kant, but also by J.S.Mill who stated that also arithmetic is derived from sense experience by inductive generalizations. Now it was possible to maintain that arithmetic applies to the extramental world. But this move leads to another, also quite uncomfortable, result that Hume's original distinction between logically necessary truths (of reason) and causally necessary truths (of matters of fact) is difficult to make.

Computational rules (rules of arithmetic and logic) do not look like being generalized out of sense experience. They have an air of necessity in themselves. Logical necessity seems to be more necessary than other kinds of necessity, as Wittgenstein remarked (1976, p. 196).

Where does this feeling of necessity come from?

Husserl found it easy to argue against Mill's view. "Only one thing is hard to understand: how such a doctrine could have seemed persuasive" (Husserl 1970, p. 112). Mill could not explain why the laws of logic seem to be more necessary than other kinds of laws.

Husserl's solution was based on "ideal form-species" (ibid. p. 180). Husserl is not alone with his Platonist approach. As R.J.Fogelin puts it, there is "something inherently compelling about the following reasoning:

> '5×5=25' expresses a true proposition. Thus, there must exist a domain of objects that it is true of. Furthermore, it expresses a necessary true proposition, hence these objects must be ideal, not empirical, objects" (Fogelin 1986, p. 153).

Others do not agree. John Bigelow, for instance, calls this linguistic magic, it is defining things into existence. When something is true then there must exist something that it is true of. (See Bigelow 1988, p. 7.)[7]

Platonism has also some problems in explaining why mathematics can be applied to the physical world. No wonder that David Hume ended up with agnosticism.

If we want, as we do, to explain the necessity of logic without "ideal form-species" or other kinds of abstract immaterial entities, we must find another suggestion.[8]

One alternative to Mill's type of psychologism[9] (for Mohanty's characterization of it, see Mohanty 1989, p. 2) is a computational theory of mind. But as Mohanty points out, this theory itself presupposes formal logic

and cannot, therefore, provide the foundation (ibid. p. 5). If Mohanty is right, then a computational theory of mind must look for some other foundation of computational rules.

What is left when Mill's psychologism (or empiricism) is ruled out?

Another alternative could be a kind of naturalistic psychology where meanings are considered to be causal consequences of the world's acting upon the mind. Mohanty (ibid. p. 7) argues, summarizing Fodor, that this kind of naturalism will not do, because it requires a description of the object in order to explain the causal connection between the subject and the object. And this, in its turn, requires that all the other sciences are completed.

However, this is sound only on the presumption that the subject needs the meaning in order to pick up the object in question. That there is "no access to the object *per se* save by means of such a *Sinn*" (Mohanty 1989, p. 7).[10]

This presumption is false. This kind of criticism may be effective in respect to Fodor's type of causal theory of meaning where external objects are supposed cause mental representations that are, by the same token, linguistic symbols (of Mentalese, cf. Chapter 9). It is hard, if not impossible, to develop a causal theory of language on the basis of methodological individualism. The notion of the s-model (which is not a theory of language), works on the basis of causal connections, on the basis of motor action independent of higher cognitive capacities. The imprinting of a rigid object into the s-model does not require any meanings. There is an access to the object without the full description of the object.[11] As a matter of fact, there is no need for any description. A subject capable of s-modelling only, which subject is perfectly possible in principle, does not have any descriptions of anything, it is not capable of describing. The ability of conceiving objects, in general, has a non-conceptual genesis.

J.N. Hattiangadi puts the point quite right on the basis of Jean Piaget. "We live in a mathematical world, and we are mathematical creatures in it" (Hattiangadi 1989, p. 380). Hattiangadi does not, however, elaborate this approach in detail.

Also John Bigelow (in Bigelow 1988) develops a physicalist philosophy of mathematics. The interesting aspect in his approach is a notion of arithmetic that can be called "pebble arithmetic" (recall the etymology of the word 'calculi'). The conception that mathematics is about rigid three-dimensional objects fits well in with our view. Arithmetic is true of three-dimensional rigid objects.

Unfortunately Bigelow does not present any epistemological considerations of his own, but contents to refer to Philip Kitcher's view.

According to Kitcher (1983) mathematical knowledge is based on sense experience, and the basic difference compared to Mill is the reference to the history of mathematical teaching and investigation. In our view this is not enough to count for the *apriority* of mathematics. This seems to be Kitcher's view, too, because he explicitly rejects apriorism (ibid., p. 7).

Penelope Maddy tries to combine empiricism (it is empiricism because, according to Maddy, "sets of medium-sized physical objects can be per-

ceived", Maddy 1990, p. 267) and a notion of mathematical intuition which notion (intuitively!) gives an air of apriority to the view. It is not clear, however, how a mathematical intuition based on an ability to *perceive* some sets can be *a priori*, that is *independent* of sense experience.

It cannot be denied that mathematics and logic, or computational rules, are *a priori*, that is, independent of and prior to sense experience. If it is denied, then the difference between logical necessity and other kinds of necessity seems to disappear. Even if one denies (like Quine, for instance) that the distinction between analytic and synthetic statements cannot ultimately be done, there is still the problem of how to count for the fact that we *do* feel that logical necessity is different from the necessity of regular causal chains. The notion of mathematical intuition is based on this feeling. A physicalist philosophy of mathematics should answer this epistemological question.

Psychologism and empiricism are not, in our view, enough for explaining the necessity of the laws of thought, the rules of computation. But the point we are trying to establish is that the notion of the s-model is not a psychological theory. Explaining computationality with it is not a mode of psychologism. Neither is it a mode of empiricism. It is a causal basis for cognition, for psychological processes. If thinking as a psychological process goes wrong, then the result is that action fails.

Where does the feeling of necessity come from? Not from acquaintance with abstract entities, not from psychological processes, but from causal necessity, from the causally determined subcognitive structure. But this is not based on *sense* experience. It is a kind of biological *a priori*, to use Konrad Lorenz' term.

The epistemological point that our notion of the s-model enables us to make, is similar to the criticism addressed to Piaget and others in the previous chapters: It is necessary to differentiate action completely and consistently from sense experience in order to maintain that action contains in itself an independent and important source of knowledge, that action widens genuinely the concept of experience. If this is done, then it is possible to develop a physicalistic philosophy of mathematics (epistemology included) that is compatible with apriorism.

Mathematical intuition, according to our approach, is not based on perception, but on the s-model which is, as apriority requires, independent of sense experience. We have the feeling of necessity, because the s-model is biologically fixed, and our everyday experience reinforces this rigidity with every move we make with external rigid objects.[12]

We can write "2+2=5" or utter "Two apples plus two apples makes sometimes five apples", we can dream about a world where the number of apples on the table is the same no matter how eagerly we eat them. One can even imagine that he is a beetle, fiction is possible, of course, but that is a different matter. We cannot imagine (intuit) that in the world out there the amount of food would sometimes really increase just like that.

The hardness of thinking that on the table there really are five apples after putting there two and two, is based on the s-model as the basis of pre-linguistic

imagination. The routines of motor action are based on the fact that, as far as we can remember, the solid material objects usually do not have the habit of disappearing and appearing again.

The hardness of thinking against the laws of computation is different from the system of computation as a formal system. We can very well consider that arithmetical theorems or logical conclusions are logical necessities. But this necessity concerns only these formal systems as such. There are definitions and rules that must be followed correctly. That what we intuit as logically necessary is, we try to argue, embedded in us by the evolution. The s-model is an organ just like any other organ, say the nose.[13] And there are, really, two kinds of habits. Biologically embodied habits of computational operations on the world (evolutionary experience), and psychological habits acquired on the ground of individual experience.

The uselessness of these formal systems in some cases does not mean anything to these systems as such. The logical necessity is as necessary as before. There just is no use for it. The only logical necessity that counts is the necessity that is usable, and *this feature* depends on how the physical world really behaves, independently of what we think about it.

Or better: Formal systems can or cannot be used. The apparently amazing fact that mathematics is highly applicable to the physical world is explained by the fact that the physical reality is the ultimate source of the axioms and rules of inference. N.D. Goodman maintains that mathematics simply is directly about the physical world (Goodman 1990). And the equally but only apparently amazing fact that mathematics is hard to use in social sciences (which fact has been claimed to indicate the immaturity of social sciences) is explained by the simple fact (or so we suggest) that the social reality behaves differently, and that during the short historical period of human society, the principles of the behaviour of the social reality have not been embedded in human cognition is firmly as the laws of the physical reality. And, after all, it is the environment of rigid three-dimensional objects where we still are acting in.

We all count the same way,[14] and this is due to the common physical world that puts us to act in the same way. This is a point that Kitcher puts quite all right: Arithmetic is true in virtue of "what *the world* will let us do *to it*" (Kitcher 1983, p. 108).

We count, in action, three-dimensional solid objects. The unit of computation is a solid object distinguishable in action from other solid objects. In action the units need not be similar, just distinguishable. Or better, similarity in respect to solidity just makes the units distinguishable in practice. Frege's requirement that distinquishability and identity must be united as contradictory features (Frege 1968, p. 58) does not count here. In respect to solidity the units are also identical. There is no contradiction.

This action determining the laws of computation is a part of a system connecting the computation in thought to the real physical world. This system might be called *a computational language game*. The connection goes, as is easy to guess, through the s-model.

In contrast to semantic language games, the computational game is related to the notion of mirroring (as opposed to picturing). It is through the s-model that the computational structure of the physical world (the structure of the world as rigid objects that are units of the action of computation) is mirrored in the head as a subcognitive structure, which is the basis of mental computation.

The computational game is connected to the world, and this is why one is tempted to speak about its connection as a semantic relation. But it is different from the semantic picturing-relation.

Computationality is connected to the world through usability. Its meaning is use, as in semantic games, but the use is private, in a sense. The computational system of cognition is connected to the world through *my* action, while the system of language in general, the semantic language game, is connected to the physical world through the action of my society. The family-resemblance of the uses of a word together constitute the objective meaning of the word.

The pictured objective meaning of a word is its use in a linguistic community, while the mirrored meaning of a computational sign is its use in my action. The mirroring relation is not a direct relation between language and reality but goes through the p-model. The computational (syntactic) structure of linguistic representations mirrors the object structure of the p-model, which structure, in its turn, is determined by the physical world through motor action and the s-model. The subjective meaning of a word is its interpretation with the p-model. (Note that this does not exclude internal relations inside the l-model as part of the subjective meaning.) These together make up the entire language, its syntax and semantics. The computational signs are used as public terms in language, but their connection to the world making up their usability goes through private action.[15]

The logical grid of language comes from the world of physical objects by mirroring through the s-model. It is common because we have a common evolutionary history. The subjective meanings of extralogical signs come from the world of phenomenal objects by ostension through the p-model. The objective reference of extralogical signs come from the world of physical objects, and is constituted by the family of subjective meanings. The subjective meanings are connected to each other by a family-resemblance based on the use of the signs in semantic language games. These games are not games in language but consist of language and action with which it is interwoven (see Hintikka and Hintikka 1989, pp. 217–220).

The logical (computational) grid of language is mirrored, as we have tried to argue, from the physical world. Does this mean that logical necessity is reduced to causal necessity? For an ontological materialist the causal necessity is all that there can be, and the nature of logical necessity must be explained on this ground. The point is that logical necessity is connected with the fact that the world is carved up into three-dimensional solid objects. Their behaviour as distinct units in causal connections can be distinguished from other causal effects.

First of all, to repeat, we are not dealing with psychologism (see note 9). Computational rules are not, according to our conception, generalizations drawn from perceptual experience, they are not psychological laws, rational principles of an ideal mind or anything of the kind.

The point can be expressed also in the Peircean terms of the previous chapters.

The logical grid is not based on triadic but dyadic experience. It is an index of the physical world. It consists of causal connections as indexed. And causal connections indexed in the s-model have the following features.

First, they are *general* in the sense that the s-model is a mode of existence of habits of action. Habits of action refer to future possible courses of events in a world consisting of an organism's behaviour in natural environment. Generality is continuous activity.

Second, they are *a priori* in the sense that the s-model is prior to triadic sense experience. The s-model gives the object structure of every possible experience, even when we don't experience rigid objects but think about (alleged) abstract objects, or use the terms as if they referred to something really existent. We prefer to call our view apriorism instead of quasi-empiricism, because quasi-empiricism has similar problems as classical empiricism in taking account of mathematical intuition and the feeling of necessity. And from our point of view it is not a perfectly happy formulation to say that arithmetic is in the same boat as, e.g., the physical sciences in that it is only well-corroborated and always conjectural (see Lakatos 1986, p. 34). It is most probable that no future physics will destroy the distinction between gases, liquids and solid objects. Arithmetic does not totter, it is literally founded on the bedrock. Computational rules would change only if rigid objects started to disappear and come occasionally back again, and we were bound to accommodate our behaviour and thinking to these new miraculous circumstances.

Third, they are *necessary* in the sense that the s-model is just as necessary as external causal connections. External causal necessity has been transferred into an internal causal necessity. As internal necessity it serves as a basis of our firm belief on logical necessity. Why should logical necessity have its source somewhere else?[16]

Fourth, they are *timeless* in the sense that the habits as anticipations of action in the s-model refer to possible future events in the external world. The appearance of eternality is based on the possible. But the basis of a habit of action is ruined if the rigid object taken as an object of motor action suddenly ceases to be a rigid object. And the tautology "if there is an apple on the table then there is an apple on the table" is meaningless if, while we are making the inference, the apple suddenly no more exists on the table (without anybody's taking it away). The habit becomes unusable just as the logical inference.

A tautology may not have truth-conditions, but it has conditions of usability. They are not conventional, they depend on the way the world

behaves. That is, if the physical world behaved differently in relevant aspects (which have to do with the stability of solid objects), then we would have a different logic, different rules of computation. As a matter of fact, it is possible to argue that rules of computation *are* different in a case where the world does behave differently, namely in the case of subatomic world. Quantum logic is different from classical logic (see Putnam 1969).

Logic is established on habits of practical computation. This amounts to a relation between causality and computation quite different from that of Fodor's. Computationality is here not computationality of a formal language of thought, the relation of which to the neurophysiology of the brain is open. And the habits in question cannot be compared to Humean or Peircean habits – they are embedded in our biological structure, they are based on the phylogenesis, not on the ontogenesis (as Piaget seems to be claiming).

Computationality is defined in terms of interaction between the subject and its environment – which move overcomes the Cartesian frame discussed above. To borrow from Putnam, the brain might as well be made of Swiss cheese as long as it performs the same functions of guiding motor action in rigid environment. The relevant neuronal properties are not defined as neuronal properties, but as a system controlling the interaction of the body and the external physical world. There is no room for solipsism, methodological or other, in this conception of computationality.

We have characterized the computational game as private. This is, however, only a genetic point. The competence of computing is individual's competence, even when hereditary properties are required. In another sense it is possible to consider the computational game as a part of the publicly observable language game of a natural language as a language game of counting (see Hintikka 1990a, pp.168–169). The connection between Hintikka's theory and our approach is quite obvious. Hintikka is developing a theory of language games as games of linguistic behaviour in its context, other publicly observable behaviour, we are dealing with the psychological and genetic aspect of linguistic competence by using the notion of language game. The language games of seeking and finding get quite a literal interpretation in our approach in terms of action and perception.

Hintikka's language games for quantifiers might be added to the picture, too. The ability of logical thought (counting and linguistic competence) is based on the properties of the s-model as a subcognitive structure. The comprehension of sentential logic can be based on these principles. Seeking and finding, however, requires more. Activities of seeking and trying to find (Hintikka 1973, p. 59) require perceptual capacities, the p-model. From our point of view, the relation between the s-model and the p-model corresponds to the relation between sentential logic and quantificational logic. The l-model (with which logic is consciously exercised as manipulation of external signs) gets the necessary cognitive capacities from the underlying systems and structures. This is not all there is to it, of course, but we cannot push the issue further here.

According to Kant arithmetic is a synthetic discipline because one must for proofs construct arithmetical concepts. Number 5, for instance, is constructed by producing: ///// (cf. Chapter 2). From our point of view, this ability to construct concepts by producing distinguishable units is based on (evolutionary) experience of external action. The resulting view is a combination of a physicalistic ontology and an aprioristic epistemology.

Notes

1 Fred Sommers treats traditional formal logic as algebra (Sommers 1984, pp. 164–206), but this goes beside our genetical point.

2 We are relying on the interpretation of Jaakko and Merrill Hintikka not as last word in Wittgenstein exegesis. It may fairly well be the best interpretation, but even if it were not, it would be useful for our purposes. It is on this interpretation that there seems to be a lesson to learn for a naturalistic philosophy of logic.

3 David Pears puts it this way: Wittgenstein had to explain "the towering structure" of logic using materials drawn entirely from this world, and the main task was to "show how sentences acquire their forms from the one and only world" (Pears 1987, p. 29). Any naturalistic theory of cognition, if it is to be convincing, has the same task, and therefore it is useful to start from Wittgenstein here, too.

4 The distinction between mirroring and picturing is important from our point of view. The idea that the logic of a language and the semantic content of the sentences of that language are both got from the extramental reality, but through different routes, so to say, is useful in our approach.

5 This is, as stated here, a genetical (evolutionary) point. We are asking how human beings have got the ability to compute, think logically.

6 Since we are not trying to interpret Wittgenstein any further but only use some of his ideas, we leave aside the problem of what can be thought and what cannot be thought and in what sense. It is worthwhile to note, however, that there is a difference between, for example, the sentences "It is raining and it is not raining" and "It is raining and it is not yellow". The former one is a logically contradictory sentence, but the contradiction is due to the fact that the two verbs are the same, that is, have the same *meaning*. With another verb it is logically correct ("It is raining and it is not shining"). The latter sentence, on the other hand, is not correct because the word 'yellow' is an adjective. One might pretty well imagine a situation where the former sentence can be meaningfully expressed, thought perhaps a little metaphorically. But it is difficult to imagine what the latter sentence might mean.

7 According to H.H.Field it is possible to explain the application of mathematics to physical reality without assuming mathematics to be true (Field 1980, p. vii). Our approach fits better in with that trend in the philosophy of mathematics that takes mathematics to be true of the physical reality.

8 Ilkka Niiniluoto points out (in Niiniluoto 1991, pp. 3–4) that platonism and

physicalism are not the only alternatives when one tries to defend the objectivity of mathematical truths. Popper's "poor man's platonism" enables one to be a realist and a constructivist at the same time. According to this view, mathematical objects are constructed as World 3 entities, abstract artifacts that are independent once created by humans. However, the problem of the abstract nature of these objects remains, be they manmade or not. How do we, literally speaking, produce abstract artifacts by "grasping" (ibid., p. 7)? How do these abstract entities interact *causally* with physical objects and human minds (ibid., p. 4)? When a mathematician invents a proof for a theorem and writes it down, what exactly happens *more* than that some physical signs are produced? (Does the proof of Fermat's famous theorem exist in World 3?) Where do the abstract and independent artifacts reside?

We are not claiming that these questions cannot be answered in a way or another, but they need not be answered if a physicalistic stand is selected – as is our purpose.

9 Psychologism, in so far as it entails that the principles of logic and arithmetic are based on psychological laws which are different from and independent of physical laws, does not fit in with our naturalistic approach. For different form of psychologism see Notturno & Brill 1989.

10 This point is neglected by Penelope Maddy who, by referring to Hebb, raises up the possibility that the child acquires neurologically the concept of "a space-occupying and sense-stimulating *something*" (see Maddy 1990, p. 268, and Hebb 1980, p. 109). This is bound to remain obscure until one has explicated the notion of conceptuality and its relation to neural processes (which is our concern in the last chapter).

11 A restricted description of the object as an s-object is enough in the standard case of external rigid objects. For the notion of s-object see Chapter 14.

12 This point shows also why J.R. Brown is just wrong in claiming that from the fact that we have mathematical intuitions, we can conclude that there are abstract objects (Brown 1990, p. 107).

13 The use of Chomskian phrases is not accidental. Chomsky's innate ideas seem to be quite compatible with the naturalistic approach argued for in this study. It might be of some interest to note that Chomsky has noticed some similarity between vision and linguistic competence. He refers to theories of visual processing using a principle that Chomsky calls a rigidity principle (Chomsky 1984, pp. 14–15). No doubt Marr is a case in point. Chomsky thinks that the principles in these two faculties are entirely distinct (ibid. p. 16). However, the notion of the s-model suggests a way in which they might be one and the same, after all. Every organism adapted to a solid environment would probably have the same principle, Martians included (see ibid. p. 21).

14 The laws of logic are determined by a consensus of action, as Wittgenstein noted (Wittgenstein 1976, pp. 183–184).

15 Another aspect is, of course, the usability of computational systems like mathematics in physical sciences, engineering etc., but this goes beyond our aims. We are interested in individual cognition and its origins.

16 A Platonist is not in so much a better position in explaining necessity, after all. If the necessity of '2+2=4' is explained by stating that some Platonic abstract objects are necessarily so-and-so, then: 1) How do we know it? 2) Why are they necessarily so-and-so?

As to the first question, we are in a circle if we answer by referring to mathematical intuition (according to Platonism it is, after all, just an ability to "grasp" Platonic objects). And as to the second question, it is perfectly possible that entities in the Platonic universe are different from what we now think them to be. Anyway, a Platonist must admit that if the entities were different in the Platonic universe, then we would have a different logic. So what's the big deal in being a Platonist? Where is the difference between assuming that a) we would have a different logic if the three-dimensional solid objects behaved differently, and b) we would have a different logic if some Platonic entities behaved differently? Answer: We have some empirical (scientific and common) knowledge about three-dimensional solid objects, but not about Platonic objects!

11. Instrumental action and language

Words have meanings, and the language game approach is based on the general idea that the meaning of a word is its use. We understand the meaning of a word if we can use the word. Our bottom-up analysis entails also the following the problem: How is the ability to take words as meaningful entities acquired, in the first place?

One way to face the problem is, as suggested by several writers, to compare the use of words to the use of tools, material instruments. The purpose of this chapter is to apply the semiotic concepts (developed above) to instrumental action and analyse how the semiotic relation inherent in the structure of action (as described by the p-model) becomes conceivable, and how this implicit relation turns to a semiotic structure of conventional signs, words of natural language. From this point of view, the ability to understand conventional signs is learned on the basis of tool use.

The starting point is the structure of action and perception as described by the p-model. The physical object is perceived as a phenomenal object. It is the same real object, but discussed from different standpoints. That is, we have two descriptions of one and the same object, one in physical terms (the only property required is solidity, cf. Chapter 14), and one in phenomenal terms (phenomenal colours, etc.). The object as physical is the object as it is independently of what we think of it, of how we perceive it. This point of view can be called the physical standpoint. On the other hand, the object as phenomenal is the object described in phenomenal terms that *do* depend on our capacities to perceive and think. This is the phenomenal (but neither phenomenological nor phenomenalistic[1]) standpoint.

Peirce tried to widen the concept of experience with a notion of action. As noted above, Peirce's dynamic object is a concept with which he took the naturalistic standpoint into his philosophical view. But he could not, of course, avoid the conclusion that the dynamic object cannot be *perceived* but as a percept, as an immediate object, which, in its turn, is achievable only by means of a propositional perceptual fact. The last point is his way of telling that experience is, in perception, conceptually organized.

Since we are trying to explain the very possibility of propositional thinking in naturalistic terms, we cannot take the conceptual organization of perception as a starting point. That is why we defined above the non-linguistic meaning-giving act in terms of a causally analysed habit.[2]

A subject not capable of linguistic cognition perceives the phenomenal object as standing for the physical object, which is the object of motor action. A banana is seen as phenomenal, then one takes and eats it up. But it is the banana as physical that is eaten. There is an elementary meaning function (a sign function) between these two standpoints to the one and the same real object. The real object as perceived is a sign of itself as an object of motor action.

Such a subject does not need a complete description of the phenomenal object in order to perceive it as meaningful. It needs a description (or rather a depiction) which is enough for controlling motor action. In other words, it must experience the world as consisting of three-dimensional solid objects. And this is precisely what the notion of s-model explains in naturalistic causal terms. The rigidity assumption is added to the phenomenal experience by virtue of motor action. In addition, it is useful, for example, to see the difference between edible bananas and non-edible ones on the ground of certain crucial perceptual properties, yellowness in this case. This is achieved with the notion of the p-model and an evolutionary approach, again in naturalistic terms. The semiotic triangle of perception illustrates the situation.

The elementary sign-function inherent in non-linguistically meaningful perception is changed when the object perceived is used as an instrument, a physical tool. A tool is objectively connected with other things.[3] As a phenomenal object it refers not only to itself as a physical object – in which case the reference relation is hidden. (To repeat, this is due to the fact that the physical object cannot be perceived but as a phenomenal object which means that the other part of the reference relation is inconceivable. One cannot perceive that what is, by definition, unperceivable. The reference relation as a meaningful relation cannot be conceived, it remains hidden.)

Fortunately, this implicit semiotic relation is not needed here. The objective relation embodied in a tool as its defining property makes the tool to refer to the object of instrumental action as a physical object. For instance, a hammer (as tool) refers to nails (as objects of instrumental action), it classifies objects to those that can be hammered and to those that cannot be hammered (or are not suitable for the purpose).

The instrument widens the causal interaction between subject and object. The tool is between the body and the physical environment.[4] And there are two ways to look at the situation.

A material tool is, on one hand, a further part of the body with which one experiences the world differently. Don Ihde calls this an embodiment relation (see Ihde 1979, p. 13). One *perceives* the world differently through instrumental action. As Ihde points out, a tool reduces the number of perceived properties (one cannot *see* with the dentist's probe), but it amplifies the ones that are perceived (by probing the dentist gets to know properties he/she cannot feel with the finger).

The embodiment relation (in which a tool is taken to be an extension of the body) does not help us in digging up the reference relation. It remains hidden in the object of the instrumental action (in the same way as it is hidden in the tool). This is because the tool is here only an aid of perception.

However, when a tool is considered not as a part of the body but as an external real object, the reference relation embodied in the tool comes into sight. The tool's objective reference relation (as a physical object) to the physical object of instrumental action[5] can be seen and conceived, because they are both perceived as phenomenal objects. The tool as a phenomenal object refers to the object of instrumental action as a phenomenal object. Both parts of the reference relation are phenomenal objects and, therefore, within the scope of (prelinguistic) consciousness. Ihde calls this relation a hermeneutic relation. The term fits in well with our approach, too. The subject begins to understand the objective connections in nature by conceiving the role of tools in changing the external conditions of action.

In the hermeneutic relation one phenomenal object (the tool) is a sign of another phenomenal object. The tool functions as a sign.[6]

When the sign-function gets independent of its embodiment in a material tool, we have pictorial signs (icons) and conventional signs (symbols, words) at hand. They are physical entities as pictures or written (uttered) words, but the instrumental connection is lost. But the ability to take conventional signs as meaningful entities (i.e., the ability to use them) is learned from the use of tools, and the ability to take tools as meaningful entities stems from the semiotic relation already inherent in the structure of prelinguistic action (described by the p-model).

Peirce defined icons as signs that refer in virtue of some internal property (for example, a picture of a banana and a real banana have the same figure, they are figuratively similar from some perspective). But the only connection with action is the fact that a hand moving along the figure of a real banana, and a hand drawing a picture of a banana, move in a similar way. An icon is not a tool in instrumental action, it functions through perception.

In conventional signs even this is lost. A word does not function as a sign in virtue of its physical features (its being a spot of ink on a paper). The physical features are needed only for distinguishing it from other words. Its sign-function is based on other kind of facts. The meaning of conventional signs is

not a physical, but a social feature. As Dewey put it, the real fact behind the word and the meaning of it is "social usage" (Dewey 1916, p. 186). Meaning is use, but in the case of conventional signs the objective (physical) basis of use is lost.[7]

The mediation of a tool is objective in nature. What is possible to do with a tool to an object, depends on the physical features of the tool and the object. A tool (a hammer, for instance) refers objectively to its object (nails) and the working process (hammering).

This objective reference relation is a meaningful relation not only to the acting agent itself, but for other potential actors and co-actors as well. A tool is a public sign. With a tool the subject can affect not only his behaviour but the behaviour of others as well, especially in cases where co-operation is necessary. A tool as a sign is a medium of communication.

When the sign-function gets independent of the sign's being a material tool it looses the (physically) objective nature of the tool's reference relation. But it is objective in another sense. Social usage is no less real than a physical event, as Dewey already pointed out (Dewey 1916, pp. 186–187). Nature and society are both objective from an individual's point of view. But according to Vygotsky, the sign is internally oriented. By using signs we do not change external objects. We cannot hammer with the word 'hammer'.

Vygotsky distinguishes between external mediation of tool as tool and internal mediation of tool (and sign) as sign. The connection between them is, according to Vygotsky, that in phylogenesis[8] as well as in ontogenesis the mastering of nature and the mastering of behaviour are mutually linked (Vygotsky 1978, p. 55). But he is not quite explicit in telling how these forms of mediation are really linked to each other.

In ontogenesis the child constructs its mind by internalization, which is defined as internal reconstruction of an external operation (ibid. p. 56). But this internalization begins at the level where signs are already used in a social community. In his notebooks he puts the point more definitely: It is a general law of all higher psychological functions that they are internalized social functions (Vygotsky 1986, pp. 53–54).

The perspective of ontogenesis does not tell where the sign-function of signs comes from. Vygotsky only states here an analogy between tools and signs. According to Wertsch (1985, p. 28), Vygotsky held that the use of tools provides the ground for socially organized labor, but the specific semiotic analysis of how gestures, etc. can be considered as meaningful (semiotic) entities is left open.

It is possible to interpret the situation so that also the sign-function of a tool, the use of a tool as a sign, is to be derived from the social use of signs as signs. Gestures and sounds become meaningful when they are used as means of communication. Meaning is also genetically based on social usages. This is how Dewey saw it:

> "As to be a tool, or to be used as means for consequences, is to have and to endow with meaning, language, being the tool of tools, is the cherishing mother of all significance. For the other instrumentalities and agencies, ... can originate and develop only in social groups made possible by language" (Dewey 1958, p. 186).

But this position does not tell us where language comes from. Social groups are made possible by language, the use of tools as signs is made possible by language. *Where* does language, or better, the meaning-function of language, come from?

According to Vygotsky, social groups are made possible by the use of tools. This is a necessary but not sufficient condition for the emergence of language. But how did humans learn to take signs as signs, interpret, understand physical entities as signs?

Martin Heidegger saw the problem. "Only he who already understands, can listen" (Heidegger 1986, p. 164). Heidegger not only realized the problem, but also suggested a solution to it.[9] According to him perceiving (*Anschauung*) and thinking are derivates of *das Verstehen* (ibid. p. 147). And *das Verstehen* is a constitutive element of man's being in the world. Man's being in the world, in its turn, is based on his instrumental relation to the world. This instrumental relation contains the solution also in a semiotic analysis.

It is not necessary to work through the heavy terminology of Heidegger's *Sein und Zeit* in order to make use of some of its important points relevant to our study.[10] The reason why Heidegger's work interests us is just the fact that he tries to put a mode of understanding (a mode that is inherent in instrumental actic n) beneath perceiving and thinking.

Man's being and essential features cannot, according to Heidegger, be understood from the point of view of a dichotomy between subject and object. Instead, we must find a primordial unity of them. That is found in the concept of instrument (*das Zeug*).

The instrument is essentially for a purpose (ibid. p. 68). It is a thing with which a subject can do something to an object. It requires that subject and object are united in instrumental action. The concept of instrument looses its sense if either subject or object is excluded. Without the object it is just another organ of the body, and without the subject it is a part of the environment. An instrument fulfills its essence only in use. That's why it expresses (in action) the primordial unity of subject and object.

Now what has understanding (*das Verstehen*) to do with this primordial unity?

The instrument not only unites the subject and the object in the sense that the instrument itself and through it the object are ready for use and manipulation (they are *Zuhanden*). It also contains a semiotic relation in itself. It has a purposive (*Um-zu*) structure that contains a reference relation of something to something (ibid. p. 68). An instrument refers, first of all, to the work produced. The work produced has, in its turn, the same way of existence as the instrument.

The product's character as an instrument contains a reference relation, too. It refers to the materials out of which it is made. The nature becomes *Zuhanden* as products of nature. (Ibid. p. 70.)

The working instrument and the produced work contain a further reference relation. They are ready for use for other human beings as well. They refer to the society of potential users of instruments and products, they belong to the public world (ibid. pp. 70–71).

The instrument's objective reference relation and its character as a public entity make it possible to analyse the nature of a sign as a special kind of instrument.

Signs (*Zeichen*) are instruments (*Zeuge*) whose instrumental character consists in showing (*Zeigen*, ibid. p. 77). And showing is one mode of referring.

The important point is that referring as showing is based on the structure of the being of instrument, on the usability of instrument (ibid. p. 78). The primordial understanding is inherent in man's instrumental relation to world. The ability to take signs as signs, i.e., as referring to something else, is based on this primordial relation to world.

It is not the case that words are there already and we just give them meanings. On the contrary, the totality of meanings changes to a language, words grows up to meanings which exist already (ibid. p. 161).

The primordial mode of understanding (which is required before one can listen to anything) is the understanding of the use of instruments and the understanding of the reference relations contained in instrumental action. And this understanding is private, it is based on an individual's becoming aware of the semiotic relation that is present in the structure of instrumental action.

With the concepts of our semiotic approach the lesson to learn can be expressed as follows (see Figure 11.1).

Even a non-instrumental relation to world contains a semiotic structure in the sense that a phenomenal object refers to itself as a physical object. But this semiotic relation remains absolutely outside the reach of the subject's consciousness (animal consciousness, one could say), because the other part of the relation cannot, by definition, be perceived. The physical object cannot be perceived but as phenomenal.

Instrumental action takes two (or more) phenomenal objects as elements of a reference relation. The tool as an instrument is a phenomenal object that refers to the object of instrumental action as a phenomenal object. From which it follows that the objective reference relation (due to physical properties of the tool and the object) can be conceived as a meaningful relation between two phenomenal objects.

The instrumental relation as conceived is intellectually significant because the relation is both an objective relation in the world, and at the same time it allows for conscious experimentation. From this (theoretical) point of view the primordial mode of thinking is external experimentation. The tool and the object of instrumental action belong to the functional organization of the

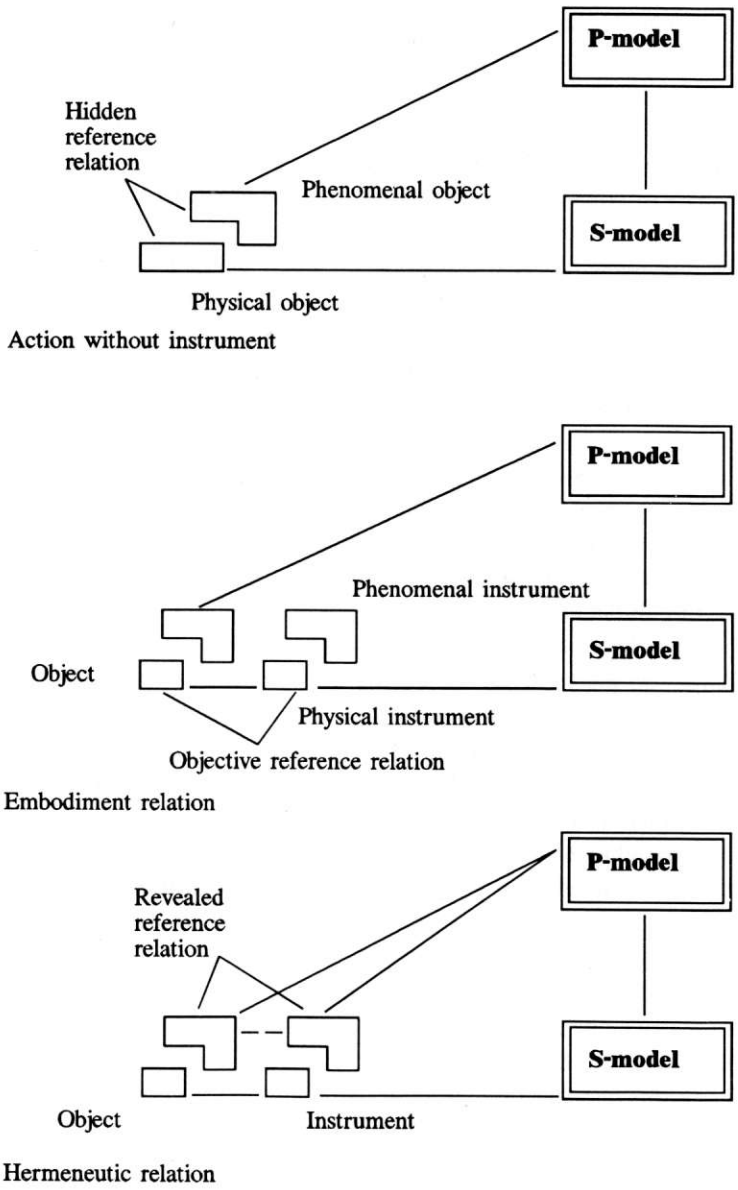


FIGURE 11.1. The birth of symbol function based on instrument's objective reference relation.

primitive mind. And the common habit of tool use is based on the objective properties of the tools and the objects. There a certain jobs that can be done with a stone axe or a spear (and certain jobs that cannot), and this is learned in a primitive society. The habit of instrumental action is the first social habit where there also is an external semiotic entity, the tool, connected with that habit.

The intellectual function of the relation between the phenomenal tool and the phenomenal object (which relation is primordially conceived by an individual) changes to a communicative function at the moment when these public (phenomenal) objects begin to mediate the behaviour, not only of one (experimenting) subject, but the behaviour of a social group, especially in a task requiring co-operation.

The immediate instrumental relation to world becomes intellectually mediated when the tool is understood as a sign. But this ability to interpret tools as signs is based on the reference relation objectively contained in the tool itself. The tool as a sign is not completely conventional.

When the sign-function becomes independent, i.e., when signs are no more used as material tools, the signs become conventional. But this does not prevent them from functioning as a special kind of tools, namely as tools which have an object, one's own brain (see Vygotsky 1986, p. 56). As Vygotsky notes this is a very peculiar kind of object. The point he wants to make is that with conventional signs we influence on the brain (of ourselves and the others).

Analogously to the case of tools, the primitive mind thinks by producing signs (e.g., by showing tools, in the beginning) in the external world and by autostimulating itself (and stimulating others) in this way. This means that external physical entities (tools and signs) belong to the functional organization of mind in thinking. External signs build up new connections between different parts of the brain, and the organization of the mind is qualitatively changed. A genuinely human mode of thinking begins to emerge.[11] The higher psychological functions are, according to Vygotsky, internalized social functions which are expressed in instrumental operations. After the psychological functions are internalized,[12] it is no more apparent that external objects belong to the functional organization of mind. The possibility of the Cartesian framework is opened (but this framework is false, anyway).

As we have interpreted the case, the basic semiotic relation is inherent in the instrumental relation of a single individual to the world. This is enough for the instrument's intellectual function as a sign (for an individual). And this is the source of the communicative function as well. One must understand in order to listen to anything.

One must understand in order to take a sign as a sign. The meaning of a word – ultimately a social habit – is understood in virtue of the fact that one is able to understand the meaning of an instrument as a sign.

The problem which still remains is this: From where comes the ability to understand an instrument as a sign?

If we are to explain the genesis of symbol-function on a naturalistic evolutionary basis, then we have to tell how the ability to conceive the tool as a sign is achieved without reference to language or social habits as a residence of meanings.

The semiotic analysis of prelinguistic cognition, cognition based on the p-model only, reveals how this is possible.

From the genetic point of view: Manipulation of external rigid objects brings the physical object within the reach of an individual subject, but the semiotic relation between phenomenal and physical remains hidden. The hiddenness does not, however, mean that there is no reference relation. In other words, the reference relation (the semiotic relation) is an integral part of the structure of prelinguistic cognition (as characterized by the notion of the p-model). The relation is there, the problem is how to conceive it.

Instrumental action reveals the semiotic relation both individually and publicly. (As Heidegger noted, the instrument is ready for others to use as well.) Here we are interested about the individual's point of view. Let's say that p-action is action of a subject who is only capable of p-modelling.

In p-action an individual is perceiving a phenomenal object but acting on a physical object.[13] When a tool is added to this, the instrumental relation has two aspects: it is both an embodiment relation and a hermeneutic relation, to use the terms of Ihde.

From the viewpoint of the embodiment relation, the individual learns to integrate the tool into its structure of action. It now perceives the object as a phenomenal object and uses the tool as a physical object when it acts on the physical object (that is not perceived as physical but as phenomenal). From this point of view, there is no difference in the individual's relation to the world compared to the situation where it uses its own limbs only, except that the individual understands some properties of nature when he/she knows how to use the tool.

The situation changes when viewed from the other angle. In the hermeneutic relation the tool is separated from the individual's own body and is perceived as a phenomenal object. The tool is, hence, both perceived as phenomenal and used as physical. That is, the physical relation between the tool and the object can now be perceived as a relation between two phenomenal *objects*, because in the hermeneutic relation the tool is an object of environment distinguished from the subject. And it is the individual who grasps this hermeneutic relation between two phenomenal objects.

In semiotic terms we have now two states of the p-model which are interpreted through the same habit of action. The perceptions of both the tool and the object as phenomenal (two different states of the p-model) are interpreted by the same habit of action using the tool on the object as physical. These two p-model states are just bound to be related to each other.

This mutual relationship between the two p-model states is internal. This is, from the semiotic point of view, the origin of the internalization of external relationships, the origin of the cognition based on the conscious use of signs. As the conscious understanding of tools as signs becomes more systematic, the p-model representations of tools (and other signs) achieve independency (an easy guess: through lateralization) and form an selfsubsistent system which we have called the l-model.

Ostension is, from this point of view, a degenerate mode of instrumental action (see Figure 11.2). The instrument is not present, but the gesture stands

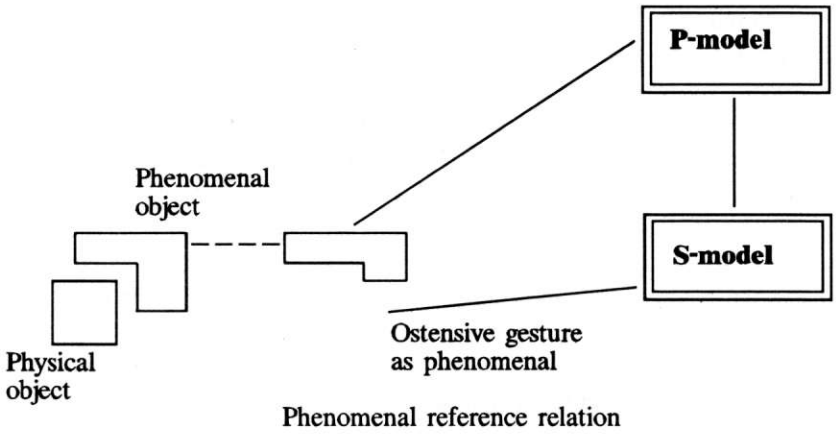


FIGURE 11.2. Ostension as a degenerate mode of instrumental relation.

for the objective reference relation which was embodied in the instrument. We have, say, the hand as phenomenal (in the place of the tool as perceived) and the phenomenal object, but the objective physical relation between the tool and the object as physical is gone.

When the instrumental relation is bereft of its objective basis, there are only words, gestures, and phenomenal objects, and with them the ability of conceiving the semiotic relation. This means that words, gestures, etc. can be understood only by those who already have grasped the hermeneutic relation in virtue of their own individual instrumental action (or those who are lucky have the ability to understand by virtue of evolution, by virtue of the fact that the hermeneutic relation has become an internal relation as a part of our biological inheritance, cf. Chapter 13).

With this degeneration we loose the physical object, and ostension is not objective in the same sense. The ineffability of semantics amounts, from our point of view, to the impossibility to grasp subjectively the two elements of the semantic relation: the social habit and the physical object. The social habit is not reached because signs are conventional (there is no tool with which one could learn the habit), and the average use of conventional signs in a linguistic community is something that cannot be directly known by anybody (even lexicographers have difficulties with it). The physical object, on the other hand, is not perceivable, strictly speaking. We do not see the light waves as physical, we see phenomenal colours.

The genetic basis of the ineffability of semantics, seen from this phenomenal point of view, is precisely the fact that ostension has been separated from the objective instrumental relation realized in material tools.

The physical object has slipped outside the reach of the individual subject. It *was* reached through instrumental motor action, but even then the object was physical, not phenomenal, strictly speaking. It was not within the reach of individual consciousness by perception. And conventional signs refer to physical objects through a language game which is a social enterprise.

Also the other end of the semantic relation, the social habit, has slipped away. The instrument's common (but not necessarily cooperative) social usage is established on its objective reference relation. When the social usage of instrument is established as a social habit, then the practice of having social habits is ready for use also in the case of completely conventional signs. The manner of establishing social habits as a residence of meanings is learned in the collective use of instruments. But when the collective use is no more the use of material tools, but the use of conventional signs, the objective basis of that what is common in the collective use is lost. The only objectivity that remains is the objectivity of the social habits in regard to the individual. The objectivity embodied in the material tool has disappeared. An individual cannot reach this objectivity (as he/she *could* reach it by using personally the material tool).

Both ends of the semantic relation are unreachable. No wonder that one is tempted to talk about the ineffability of semantics.

Notes

1 The distinction between the physical standpoint and the phenomenal standpoint is made inside the naturalistic standpoint which is bracketed away in Husserl's phenonemology. It is possible to distinguish between physical colours and phenomenal (perceived) colours in a naturalistic theory of action and perception. The phenomenal*istic* standpoint, in its turn, would make this distinction empty because the physical aspect is not available at all.

2 This approach can be compared to that of John Dewey, whose conception of tools we shall discuss below. Dewey defined "practical meaning" as the future responses which an object commits us to (Dewey 1916, p. 309, see also Hickman 1990, p. 56).

3 As John Dewey put it, a tool "possesses an objective relation as its own defining property. Its perception as well as its actual use takes the mind to other things" (Dewey 1958, pp. 122–123).

4 Also Dewey took the body to be continuous with the rest of nature and compared bodily motor skills to tools (see Hickman 1990, p. 44).

5 The reference relation is objective precisely because it is determined by the physical properties of the tool and the object. A hammer can be used for hammering because of its physical properties (it is objectively difficult to hammer with a pen, say), and nails are physically fitted to be hammered (unlike pens).

6 This analysis differs from Umberto Eco's approach (see Eco 1979, pp. 22–23) in that here the tool is a sign of the object of action, while Eco takes one tool (a stone, say) to be a sign of another tool suitable for the same purpose (another stone). One token stands for another token, and is gradually taken to stand for a type. Therefore the *name* of the tool is the first sign in this analysis. (Wittgenstein, too, stresses the role of the names of tools when he compares tool use and word use in language games, see Wittgenstein 1975, I 15, pp. 22–23.) The unsolved problem

here is, however, the question of where does the ability to take anything as a meaningful entity come from. Eco's analysis *presupposes* this understanding. As Heidegger noted, one must understand before one can listen (as contrasted to mere hearing, see the discussion below in this chapter). Another difference is that in our analysis the first signs are not names but general concepts in the sense that a hammer, for example, refers to anything that can be hammered. To take a hammer as a sign entails an understanding of a concept 'suitable for hammering'. The problem is: Where does this ability to understand general (practical) concepts stem from?

7 In spite of this, the character of language is instrumental (Dewey 1958, p. 128). Its "instrumental use is always a means of concerted action for an end" (ibid. p. 184). Tools and words have both an instrumental function in human action.

L. S. Vygotsky made the same point (he also referred to Dewey, see Vygotsky 1981, p. 53). According to him "the basic analogy between sign and tool rests on the mediating function that characterizes each of them" (ibid. p. 54). The use of signs and the use of tools are forms of mediated activity. The subject affects behaviour through signs and tools, but the tool mediates the working process, it comes between the subject and the object. The tool is externally oriented, it must lead to changes in object (ibid. p. 55).

8 The role of tools in the phylogenesis is stressed, for example, by Parker and Gibson (1979).

9 G. H. Mead underestimated the problem. "Of course, one may hear without listening", he wrote (Mead 1967, p. 139), but according to him it is "absurd to look at the mind simply from the standpoint of the individual human organism"; and "[o]ut of language emerges the field of mind" (ibid. p. 133). It is, however, the individual that just has to understand, and Heidegger had a solution for this, in spite of the fact that he stressed the social origin of mind as well (see Heidegger 1986, pp. 126–130).

10 It should be understandable that we are not trying an exegetic approach here, either. That would most probably be an endless job. Heidegger is, however, worth mentioning because he is combining the use of instrument with an individual's ability to understand, contrary to Dewey and Vygotsky who both see the mind as emerging from language. From our point of view, human mind and language both emerge from tool use, and it is, originally, the individual who has to understand, take the tool as a sign.

11 According to Vygotsky, this qualitative change can be traced also in the development of children, see Vygotsky 1981.

12 Internalized relations are structured relations between the p-model and the l-model, in our terms.

13 We are, of course, discussing the case where the object of motor action is a three-dimensional rigid object in the natural environment.

12. Language as game and instrument

The notion of language game has been useful because it enables one to combine a physicalistic ontology with an irreducibly social conception of language. The principle that meaning is use is purported to characterize the connection between language and extramental reality.

Combining the suggestions of the previous chapters we get the following general description of the situation.

An individual has a subjective viewpoint on the language and its use. He/she gives the word a subjective meaning, that is, interprets the sign with other signs (I-model states) and the beliefs concerning the state of the environmental context (p-model states).[1]

This is not enough, of course. Words refer ultimately to the physical reality.[2] The physical world is not within the reach of perception, therefore we need the notion of language game that takes care of this connection to the physical world.

The individual origin of the basic semiotic relation does not imply a non-social notion of language. The instrumental relation gives only a semiotic basis for individual (subjective) understanding of signs as signs. As Heidegger's terminology already indicates, the semiotic relation can be based on showing a relation between two phenomenal objects, phenomenal instrument and its phenomenal object. This is the subjective meaning as revealed by the hermeneutic instrumental relation.

Subjective meaning is not enough for language, but a notion of language is incomplete without this aspect. Language presupposes also a relation between a sign as understood by an individual subject and a phenomenal object perceived by the same individual.

According to Jaakko and Merrill Hintikka, Wittgenstein presented in *Tractatus* a phenomenological notion of language. The meaning of a word is, in this case, shown by ostension.

One can point to a green object and say "green", and this way show by ostension what he means with the word "green". The other one may learn to use the word "green" correctly, but there is no guarantee that he in fact experiences the same phenomenal greenness. The identity of the phenomenal worlds of different individuals cannot be taken for granted, even if the similar biological structure gives some ground to suspect that this is the case.

Ostensive relation between subjective meanings and phenomenal objects is not enough in characterizing language. The meaning of a word must be in some sense intersubjective and objective, in the sense that it cannot be reduced to subjective meanings.

Subjective meanings of a word must, therefore, be somehow united, linked to each other. The notion of language game is intended to take care of this. Language game relates the common language to the common world.

Common usage (social habit) links together the different tokens of uttering (writing) of a word. The word's objective meaning is based on a family

resemblance of these tokens in context. Tokens of word use are related to each other due to similarities in the context, environmental conditions, and the behaviour of word users. For example, people may have fairly different subjective interpretations for the word 'gavagai', but if the utterance "Pass me the gavagai" results to expected action, then it can be assumed that there is resemblance enough for guaranteeing the common object for the term. To the extent that word users are solid biological organisms acting on solid objects, we can assume that the word refers to a solid three-dimensional object. The reason is that this kind of organisms might have the s-model working as a basis of their linguistic competence. If (assumed just for the argument's sake) the neighbour referred with the word to a rabbit slice, then the utterance "Pass me the gavagai" would probably (assuming *some* mutual understanding) result to some unexpected behaviour with a knife, and I would have a slice of rabbit in my hands. If the word 'gavagai' meant only, say, morning rabbit, then the sentence uttered in the evening would result to an unexpected time lag in the behaviour (suggesting that one might make use of a bit of methodological discussion with astronomical data). Inter*action* is more informative than mere observing.

The common object is the physical object that different observers perceive as different phenomenal objects, or better, from different phenomenal points of view. Ostension does not give the same phenomenal object of different observers, but it gives the same physical object that is perceived differently (as different phenomenal objects) by these observes. The object is the same for them as a three-dimensional solid object, as an object of motor action, although there is no *direct* subjective evidence on the ground of perceptual experience alone that it is the same physical object. (Common sense and some philosophical considerations are useful here, see Chapter 14.)

We are speaking only of words referring to certain objects of natural environment, and this case does not cover all of the varieties of language use. But it serves the present purpose, which is to indicate a specific problem.

The problem is that neither the common usage nor the common object is, as such, within the reach of word users. All they can personally attain are the subjective meaning and the phenomenal object. But language as a social phenomenon is a physical system that refers to physical objects by virtue of a language game (understood as a game played with a language but not with*in* language).

In *Tractatus* Wittgenstein tried to find a way out of the ineffability of semantics by ostension. In language game this is hopeless. One cannot point to average social usage or to physical objects, strictly speaking.

But in external motor action one is manipulating external physical objects. If ostension is changed to motor action, then the physical object is, in fact, within the reach of different word users.

The ineffability of semantic relations does not mean that they do not exist. And the impossibility to grasp directly what semantics is about does not mean, from our point of view, that the semantic relations cannot be discussed.

Language is to be considered as a combination of a physical and a phenomenal system. As external public action a language game is a physical system and consists of relations between the linguistic expressions as physical tokens and other external behaviour in the context of natural and social environment. A language is, therefore, a social, interindividual system. But, on the other hand, it does not function as a language without some subjects interpreting it as a system of meaningful signs. And this subjective understanding takes place within the phenomenal world of an individual.

A physical instrument contains an objective reference relation to the object of instrumental action, and this objective reference is revealed in instrumental action as a relation between the instrument and its object. This phenomenal relation is perceived, and as completely phenomenal it is within the reach of individual consciousness. When the semiotic function of the instrument is transferred into the semiotic function of a word, there is still an objective reference relation between the word and the object, but the objectivity of this relation is no more based on the physical properties of the sign, as is the case when the sign is also a material instrument. The objectivity of the relation between words and objects is based on the common social usage of the word – which feature is a transformation of the common social usage of material instruments.

As already noted in the previous chapter, an instrument's common social usage is established on its objective reference relation. When the social usage of the instrument is established as a social habit, then the practice of having social habits is ready for use also in the case of conventional signs. Social habits are established as a potential residence of meanings in virtue of the collective use of instruments.

This notion of language game has in fact two aspects. These aspects are distinguished in the Wittgenstein interpretation of Hintikkas as the distinction between picturing and mirroring – picturing dealing with the true/false distinction and mirroring dealing with logical correctness.

As suggested in the previous chapters, this distinction can be characterized also by using different notions of language game. In addition to the traditional language game (which we have called the semantic language game because it takes care of the semantic aspect), there is a game dealing with the syntactic aspect, the computational game.

These are not different games but rather different aspects of the same system, at least not until computing has received an independent expression in the form of arithmetic. The justification for the notion of a computational game is our suggestion that the s-model provides the computational basis of cognition, and our everyday practice as motor action in solid environment is, in this sense, a way to enforce continuously the functional principles of the s-model.

We are not claiming (although it may seem to be the case) that in a natural language there is an explicitly distinguishable logical nucleus, so to say.[3] We are rather looking for the genetic source of the ability to construct logically correct sentences in a natural language.

The semantic game is related to language as a social system. As a form of collective sign use, language is an irreducibly social phenomenon, but the community of sign users consists of individuals interpreting the signs. Although individual sign users can reach neither the average use of (social habits of using) signs nor the ultimate objective referent of signs (physical objects in the elementary case we are discussing), the language game takes care of the semantic relation between these two. And the only access that individual subjects have to this relation is their subjective interpretation of the perceived signs and the perceived world. The subjective judgement concerning the relation between significant combinations of signs and perceived states of the world is about the truth of the combinations of signs. In other words, this is picturing, a unity of individual subjectivity and social (average) objectivity.

The route of mirroring is different. The computational game is, in a sense, private. It deals with the possibilities of motor manipulation of external rigid objects. Meaning is use also in the case of computational signs, but the use is not social, in this case, at least not when we discuss natural language and individual cognition. Logic and arithmetic as formal systems are another matter. As formal systems they are not treated as a computational basis of individual cognition.

In spite of the fact that the computational game is private, it affects on the structure of language precisely in the same sense as Chomsky's innate nucleus. According to the analysis of this study, the principles of the universal grammar (or some basic features of them) might be reducible to the functioning principles of the s-model and the p-model. In other words, the criteria of logical correctness are private, they are embedded in our biologically fixed organ of the s-model, so to say. The s-model is based upon evolutionary experience and continuously enforced by everyday practice.[4]

Under a physicalist interpretation this notion of language game explains also quite naturally how also the syntactic aspect is *about* the world, although an introspective view on natural language does not show it. This aspect is not about the phenomenal world, but about the rigid physical world that is "behind" the phenomenal world. The s-model does not belong to the sphere of consciousness, but rather to the unconscious part of the mind. However, the s-model is *about* the external physical world in the sense that its functional principles are principles of acting on external solid objects. The s-model is adapted to the objective physical features of these external objects.

This much about language as game. What about language as instrument?

From the semiotic point of view signs must be interpreted, words must have interpretants. Johnson-Laird (in 1983) claims that syllogisms are understood by constructing a mental model on the basis of the information contained in the propositions. He presents some evidence from psychological experiments. Our approach requires that interpretation of linguistic expressions are ultimately interpreted in terms of the p-model. The interpretant of a sentence is a p-model state, although not necessarily at every instant. A person trained in linguistic

(or mathematical) thinking may work on the basis of the l-model only, and completely abstract terms are also possible, of course. But in our genetic approach we are concerned with words which are ultimately interpreted in terms of the p-model. The point is that according to our view, the use of language is learned and the necessary basic structures are acquired in this context.

From this point of view language is an instrument of thinking. To understand language, to think with language, is to establish a relation between the l-model and the p-model, and this relation constitutes the subjective meaning of words and sentences.[5]

This interpretation of language with the p-model is private. It is the individual that does the thinking.

Language contains not only semantic relations but syntax as well. Therefore, these both aspects have to be considered here.

Let's start with the syntactic aspect. The possibility we are trying examine is the following. The logic of our linguistic thought is the logic of three-dimensional solid objects. The problem is how the principles of the behaviour of solid objects are transformed into the principles of linguistic thought. This point concerns the relation of the l-model to the p-model, or better to the s-model which gives the p-model its structure.[6]

Some apes have been taught sign languages, but critics have emphasized that they have not acquired grammatical, syntactic relations. Chomsky has criticized Washoe (one of those learned creatures) for not indicating any understanding or existence of syntactic relations. This amounts to saying, in our approach, that Washoe has not internalized the syntactic relations of the language that has been taught to it, it has no internal mechanism relating the system of signs structurally to the p-model it presumably has. But computational capacity (the computational basis of syntactic relations) is not what the apes are missing, what is missing is the conscious use of it as a structure of the l-model, as a structure of a language. From our point of view, those apes don't have a structured relation between these two models, or they do not have a structured l-model at all.

What is it to have a structured relation between these models?

Following Johnson-Laird's suggestion, according to which to understand a language is to build a mental model on the ground of the information that the sentences contain, we get the following.

The basic principles of internal model design are such that the model must have a spatial structure of three-dimensional solid objects. Of course, to repeat, language is not about solid objects only.

There is, in the model, a representation of the agent (the grammatical subject). And since the p-model is based on habits of action, the agent is naturally related to a mode of action (the grammatical verb). If the verb is transitive the model must have an object of action (the grammatical object). In addition there are properties and relations among these (and possibly other) entities.

This is, of course, very sketchy, but it will serve our illustrative purposes. We shall only try to make a couple of general remarks in favour to our approach.

A spatial mental model is one possible answer to the question: What are the basic criteria of grammaticalness? From this standpoint a grammatical sentence is such that it is possible to build a spatial mental model on the ground of the information contained in it. For instance, on the ground of the sentence[7]

Is John the man who is tall?

we can understand that it deals with one rigid object named John. The object has the property of being a man, and we are questioned whether this John is the same entity as another object, the man about whom we know that he is tall. But the sentence

Is John is the man who tall?

is indeterminate. After the part 'Is John' we expect to find something to which we can relate the fellow called John, another entity or perhaps some property. But there is the verb 'is' which is impossible to connect to John who already has the attribute of existence (in the model) by virtue of the first 'is'. A verb in another form, e.g., 'running', would do, but not just 'is'. We are not able to relate the doings (or beings), properties and relations discussed in the sentence in a way enabling a spatial mental model, therefore the sentence is ungrammatical.

In other words, the structure-dependency of the allowed transformations of a sentence is based on the spatial structure of the model built on the ground of that sentence. The transformation of a sentence must not break the structure of the model built on the ground of it (or make the model unconstructable). The deep structure of a sentence is based on the spatial structure of the model that is to be constructed on the basis of it. This is not all there is to it, of course, grammaticalness is a complex notion.

If we relate this to the discussion of the logical syntax of language (above) we can compare grammaticalness to Wittgensteinian limits of thought.

The computational game (based on external computation of rigid objects, e.g., *calculi*) transfers the "logic" of external physical objects into internal habits of action (the s-model). This logic expresses the limits of thought as well as the limits of grammaticalness.

We can say "two plus two is five", but we cannot think (in terms of an internal spatial model that would lead to *successful* action) about a situation where we put two apples on the table, and again two apples, and get, surprisingly, five apples, or rather, that the external world would really behave this way. This is not how three-dimensional solid objects behave, according to our evolutionary experience, as well as according to our everyday experience (which continuously affirms us about this). We can say "Is John is the man

who tall?", but we cannot really imagine in terms of a spatial model (guiding external action successfully) what this really amounts to.[8]

The limits of language are the limits of thought, but only to the extent they express the principles of the behaviour of three-dimensional solid objects.This is to be distinguished from other senses in which language seems to raise barriers to thinking.

To begin with, a string of words may be such that it is not possible to determine the spatial structure of the model that one tries to construct on the basis of the string. The string is not *computationally correct.*

In this case it is not possible to construct the model even if the meanings of the words are ignored, that is, even if we allow the meanings vary inside the same syntactic category and form, replace a verb with another verb, a noun with another noun, etc.

For example, we cannot make sense about

The ball is on runs.

except by changing the last word to a noun:

The ball is on the box.

Some transformations lead to the same kind of situation:

Is John is the man who tall?

These computationally incorrect strings are not even *contradictory* in the same sense as this one:

The ball rolls and doesn't roll.

This sentence can be changed to a coherent one by changing the meaning of one verb:

The ball rolls and doesn't stop.

And the case is similar also with the sentences:

The ball is square.

and

The ball is round.

Here we can construct the basic spatial structure of the model that has the same spatial structure as the models of the corrected sentences. That is, the fact that

the sentences do not make sense is *not* due to the difference in computational correctness. They are computationally correct in the sense defined above.

In other words, the sentence

The ball rolls and doesn't roll.

enables us to imagine an object to which 'the ball' refers and to which we attach two properties. This is one way in which objects and properties can in some cases (although not here) relate to each other.

But this does not hold for the above case:

Is John is the man who tall?

because the second 'is' cuts off the model constructing once and for all. We cannot even begin to consider whether this sentence is logically true, logically false (contradictory) or contingent. This question is decided within the limits of computationality. Only computationally correct sentences can be decided to be true or false, and a logical contradiction is false, of course.[9]

The general point that grammaticalness depends on factual presumptions in certain cases is not new (see, e.g., Lycan 1984, pp. 110 ff.). The same holds for the claim that there is a kind of isomorphism between the structure of the world and the syntactic structure of sentences. This isomorphism is also called iconicity in language. (See, e.g., Givón 1990, pp. 966 ff.)

The point we are trying to make concerns the epistemology of the phenomenon. The linguists who talk about iconicity, seem to think that the *perceived* structure of the situation is reflected into that structure of language by means of sense perception. The notion of the s-model suggests a different way to explain this isomorphism.

The notion of computational correctness gives also some ground for the talk about the limits of language as the limits of thought. It makes sense to distinguish between objects and properties in this regard. We can imagine an object that is blue and not blue (e.g., green) at the same time, simply assuming that it is only partly blue. We can make sense of the claim that the water in the sea is both healthy and unhealthy at the same time, namely by distinguishing the standpoint of fishes and that of humans, for example. But we cannot imagine that an apple is and is not in a certain place at the same time.

Wittgenstein's example of two plus two making surprisingly five is a case in point. Even if we admit the distinction between the definition of arithmetic as a formal system and its application to physical objects (as we should do), it makes, however, sense to maintain that solid physical objects make up a typical case to which arithmetic should be applicable. If it were not, then we would feel tempted to search for a magician or some other explanation.

This temptation can be explained, we argue, by the notion of computationality in terms of possible operations on solid objects and in terms of our evolutionary notion of the s-model.

The logical grid of linguistic thought is mirrored from the external physical world through the s-model (internalizing the behavioral principles of solid objects) to the p-model, and through the principles relating the l-model (linguistic representations) to the p-model. There is, in the external world, a structure of objects, properties and relations that is what it is independently of what we think about it, and this structure is mirrored to our cognition as a logical (or conceptual) structure. It is not necessary to maintain that this explanation exhausts the issue. A basic structure is sufficient (it is, after all, possible to distinguish between different levels of grammaticality, see note 9).

This computational game is played with external motor action. It is internalized as habits of action. These internalized habits concern the relation between an individual subject and its physical environment. That is why they are private like subjective meanings (relations between subjective interpretations of signs and the world as phenomenal). But even if they are private, they are not within the reach of ostension. The internalized habits of motor action are not objects of triadic experience, they are not phenomenal objects. Meaning is private use in a computational game, while it is public (social) use in a semantic language game.

This makes it also understandable how the features of the logical grid can be biologically fixed. Chomsky has criticized Piaget's account of sensorimotor constructions, for example on the basis that the child's experience cannot be rich enough for this. The sensorimotor constructions are not, however, necessarily based on ontogenesis only. The hand is a biological organ specialized in manipulating solid objects. Why could there not be brain structures for the same purpose. In other words, the s-model may well be (indeed, it would be astonishing if it were not) based on biologically determined structures. After all, there have most probably been three-dimensional solid objects to be manipulated during the whole course of evolution. And since the nose of a human being is different from an ape's nose, why couldn't the principles concerning the structuring of the p-model according to representations of linguistic signs be a part of our biological inheritance. (An easy guess is that this has something to do with the development of lateralization, i.e., the division of labor between the hemispheres.)

Language can be an instrument in another sense, too.

One of Vygotsky's principles is that tools are signs and signs are tools. Signs are tools of a peculiar kind. Their "object" is, ultimately, one's own brain. We affect on the brain (of ourselves and the other's) with signs. In other words, signs as external physical entities belong to the functional organization of mind. And what is essential, signs change qualitatively the functional organization of the mind.

This principle can be applied to the social history of human mind: Psychological processes and relations are internalized social processes and relations. During the social history man has constructed his own mind so that now we are born with equipments ("innate ideas", if you like) that newborns

did not have at the time when human society began to develop and that are, in a way, both social and biological in nature. (We return to this genetic point in the next chapter.)

The system of instrumental motor action is based on the p-model which concerns the relation between an individual and the environment. It is non-individualistic only in the sense that evolution presupposes biological genera. The systems of mediated action are non-individualistic in a further sense: they presuppose a community of tool and word users, a community enabling the formation of social habits.

There are two systems of mediated instrumental action. The system of instrumental motor action, based on the p-model, is the system of perceiving and acting with instruments on the external natural environment. The second system is a system of producing and perceiving external signs, the l-model, or better, it is a system of language as game and instrument.

Notes

1 The nature of metaphors is naturally explained in this approach. According to Lakoff and Johnson, many concepts are partially defined in terms of physical and structural metaphors, in terms of concrete experiences (Lakoff & Johnson 1981, pp. 323–324). In our terms, they are partially defined in terms of the p-model. Just like from Michael Arbib's scheme-theoretic point of view, "there is a sense in which all language is *metaphorical*" (emphasis in the original, Arbib 1988, p. 236). The importance of metaphors in understanding natural language is stressed in linguistic theories that are presented as an alternative to the dominant trends in linguistics. Langacker's cognitive grammar, for instance, is offered "as an alternative to the generative tradition" (Langacker 1987, p. 4). From our point of view it is interesting to note that spatial metaphors play a significant role here (ibid. p. 197), Langacker even initially called his framework space grammar (ibid. p. vi). The notion of the s-model is one way to handle this aspect, too.

2 Not every word, of course. We have a genetic viewpoint, we are trying to find out how the ability to use language is, possibly, acquired, and it seems quite reasonable to assume that language is acquired in the context of instrumental action which has the physical environment as its object.

3 As noted earlier, it can be argued that syntax and semantics cannot be distinguished in the way the computational theory of mind of the methodological solipsism requires. From our point of view this amounts to saying that the semantic game and the computational game are only aspects of one and the same game. That is, computationality as a basis of a natural language may not have (or probably does not have) exactly the same features as computationality as an independent formal system (logic or arithmetics). Rather, the computationality of a natural language and the computationality of formal systems have the same genetic basis. And if the notion of the s-model is acceptable, then there is a kind of

implicit logical nucleus in language, and its connection to the physical world is private (through individual motor action).

4 This fits in quite well with the Chomskian notion of innate ideas. Chomsky claims that Piaget and Luria have presented purely methodological arguments in insisting that the origin of grammatical principles must be sought from man's relations to reality and the social history; they have not told us how, "even in the most vague and hypothetical way" (Chomsky 1980, p. 210). The notion of the s-model may be "most vague and hypothetical", but certainly it is not purely methodological. It is a theory of the basic features of linguistic intuition (cf. Chomsky 1975, p. 6) suggesting that linguistic intuition has the same source as mathematical intuition: the s-model which gives the physical world's structure as objects, properties and relations. This subcognitive structure is inherited, like the structure of the nose, and offers a bottom for model constructing (the p-model) on the basis of linguistic information. And in Chapter 13 we shall see that the reference to the history of society is not at all "beside the point" (Chomsky 1980, p. 211), on the contrary. Why should it be impossible that social factors have influenced on the biological structure of human beings? Since Engels, at least, it has been argued that the hand is a product of labor, use of tools. Why not some prerequisites of word use?

5 We return to this issue from a genetic standpoint in the next chapter.

6 It might be of some interest to note that in the literature there are suggestions emphasizing the role of event structures in linguistic representations (see Pustejovsky 1991). The connection to the s-model is quite obvious. It gives a natural basis for representing event structures of the physical environment.

7 Some of the following examples are from Cook (1988).

8 One can, of course, "imagine" a situation where two apples intrude into each other or write books where one turns to a beetle, but if one really started to behave as if this were true, one would most probably be classified lunatic. In other words, we can distinguish between imagination in fiction, poetry, etc., where it is possible (and even refreshing) to violate the laws of the external real world, and imagination in terms of an internal spatial model where the laws of the real world must not be violated if one intends to act successfully.

9 It is possible to distinguish between levels or degrees of grammaticalness (see, e.g., Chomsky 1975, pp. 129 ff., and Lycan 1984, pp. 123 ff.), and the suggestion which follow from the notion of the s-model is that computational correctness might be the most basic level.

Human cognition is conceptual. We use concepts, and this must be explained in a way or another. But what are concepts? The preceeding discussion has already shown that our naturalistic approach requires a reconsideration of the notion of conceptuality. On the other hand, this approach requires some qualifications concerning the subject who is supposed to use these concepts, the human mind.

A constructive way to approach these problems which are related to each other, is, in our view, an evolutionary approach. This strategy gives some clues to the analysis of the structure of mind. The general approach of our study may, therefore, be called an genetic bottom-up analysis.

It makes sense to claim that there is some inherited innate nucleus in human cognition that separates man from the animals. This stand does not, however, imply that the inherited nucleus can be described in biological terms only. On the contrary, the origin of this inherited nucleus may well be social and historical. L.S.Vygotsky's general thesis about the genesis of human mind – namely the thesis that psychological processes are internalized social processes – combined with our three different models helps to distinguish between different layers in this inherited cognitive structure.

The mind does not necessarily reside between the ears or behind the eyes. From a genetic point of view it is irreducibly historical and social in nature. The methodological point that external objects belong to the functional organization of mind can be widened to hold for external signs and social entities (institutions, habits, etc.) as well. This means, in particular, that the mind is not reducible to brainstates. It emerges over and above them, but there is no need for Cartesian minds, however.

Neither do we need self-subsistent immaterial entities in our ontology. Meanings of words, contents of theories, etc. are ideal and objective in relation to individual experience, but their ideal existence is the existence of ideal forms of action, social habits. Their objectivity is the objectivity of history and culture in an individual's perspective. External physical signs, books, machines, etc. represent possible habits of action, that is what their objectivity amounts to. There is only one world we live in.

That what is referred to with the word "concept" can be analysed to consist of different elements. The ability to experience the world as objects can be explained causally by the notion of the s-model. The world as experienced by the s-model only can be called the world of s-objects.

Perceptual qualities are attached to these solid (and other perceived) objects by the p-model which works on the basis of the s-model and the causal relations through the sense-organs. Resulting objects can be called f-objects (phenomenal objects).

Language (the l-model) enables us to speak and think about theoretical (not empirical) objects, t-objects. With the help of f-objects we learn to use external

signs also as referring to t-objects we don't perceive, but this does not imply that the t-objects should all be self-subsistent. It is possible to use words like "centaur" and "number" even if such objects were not real self-subsistent entities. This analysis of the conceptual structure of experience completes our sketch for a naturalistic theory of human cognition.

13. Evolution and the structure of mind

The approach sketched above suggests that there are two major structures in mind, the p-model and the l-model. This general principle is not uncommon. We have already mentioned Philip Johnson-Laird's notion of mental model. He suggests that verbal tasks are solved by constructing a spatial mental model on the ground of the information contained in the given linguistic representations. The solution is then worked out with the help of the model, and the answer is again recoded in linguistic representations. There is an interplay between linguistic and spatial modes of representation.[1]

An obvious question from an evolutionary point of view is: How is this kind of division of labor historically achieved?

A combination of Vygotsky's general thesis and our semiotic analysis of the models of mind gives ground for a couple of remarks in this respect.

A general point, to begin with, is that we have to distinguish between three viewpoints: those of natural evolution, history of human society, and developmental psychology.

Natural evolution is supposed to have provided the starting point of our analysis: an organism which belongs to a biological species and originates the social history of mankind. We do not need much information of this organism for our general purposes. The assumptions are that the organism's action is analysable in terms of the p-model, and that it can learn to use objects of environment as instruments.

It seems quite obvious that this being is biologically different from contemporary human beings, at least this is the conclusion to which the debate between Piaget and Chomsky leads. Some biological prerequisites are necessary for the acquisition of a natural language.

An obvious explanation for this is the following. The social and cultural environment has influenced on the biological structure of the human species, in spite of the relatively short period of the social history.

In our terms this amounts to saying that during the social history, human beings have achieved some hereditary facilities for constructing the l-model and relating it to the p-model.[2]

These facilities as such are not enough. The child needs both the natural and social environment in order to learn to use these models, and this is the viewpoint of developmental psychology.

A complete theory of the genesis of human mind is, of course, a goal not attainable here. We shall only present some general points, the purpose of which is to suggest how it is, in principle, possible to combine a materialistic ontology with an irreducibly social notion of human mind.

Immediate experience of phenomenal objects is grounded on the p-model, only. According to our above analysis this kind of immediate non-linguistic experience may well be characteristic of developed animals. They experience the physical environment as objects, properties and relations, and react on perceived properties and objects. Perception and action are directly connected.

In immediate perception there is a reference (a semiotic) relation between the phenomenal object and the physical object (see Figure 11.1), but this relation is hidden, not conceivable for the subject.

The situation changes when action is mediated by an instrument. As noted in previous chapters, a material tool as an instrument has an objective reference relation to its object (a hammer refers to nails, not to fishes, say). Now both parts of this relation are (also) phenomenal objects, which means that the relation is now cognizable. The instrument stands for the object to the subject. And this reference relation can be conceived by the subject. The semiotic triad has been formed.

The objective intrinsic features of a material instrument which relate it to its objects, are not *perceived* features. They reveal themselves only in action (even if these features could be perceived, the objective relation of an instrument to its objects is not revealed *in virtue* of perception).

On the other hand, instruments can be used in different ways, one just might use a hammer for scratching one's ear. In order to understand what the other is communicating by showing a tool, one must know what the other intends to do with it, and there is no mutual understanding if they have not used the tool for the same purpose, if the common habit of using the tool has not been established. Therefore, the social habit of the particular use is also necessary. The choice of the particular use (or a couple of them) is conventional in the sense that the particular use is not strictly determined by the physical properties of the tool alone. It depends also on what practices have been established in the community of tool users.

The social habit of the particular use is the residence of the communicative meaning of the tool as a sign. The communicative meaning of the tool (when showed) is understood in virtue of the common acquaintance of the concrete use of the tool.

Now we can conclude that a material instrument has two aspects at the same time. The first aspect is that they function partly as conventional signs. They are not, as noted, completely conventional because there are restrictions in the use of instruments. There are jobs one cannot do with a hammer, for example. The second aspect is, therefore, the causal relation between subject and object, and it is in virtue of this second aspect that the reference relation is objective.

The first aspect of the instrumental relation (the sign-function) is crucial for the emergence of human mind. The instruments stands not only for the object

of motor action, but also for the relation between the subject and the object. This sign function makes it possible for the subject to conceive his/her own relation to reality. It also enables one to take oneself as an object. The consciousness of the subject-object relation and of the subject as an object is mediated consciousness.

The origin of human mind is, according to our analysis, explained by the revelation of the hidden semiotic relation that is implicit in motor action controlled by immediate perception. And this revelation is based on the use of material instruments. Contrary to Vygotsky, instrumental motor action is not only a basis of social groups the habits of which (or forms of action) in general give birth to meanings. Instrumental motor action is itself a meaning relation, and the common (i.e., social) habits of tool use turn this private meaning relation to a social (public) meaning relation.

The point of difference is, in other words, in explaining the individual subject's ability to understand. It is not, in our view, given by the society, the social habits as the residence of meanings. Understanding arises from an individual's instrumental relation to the world.

The individual subject's ability to understand is based on the semiotic structure of action described by the p-model only. The subjects *takes* (in action) the phenomenal object as a sign of the physical object. The subject cannot, at thsi stage, conceive this relation as a semiotic (symbol) relation. The instrument breaks the fusion of perception and action. And it is the individual that conceives the instrument's objective reference relation as a relation between two phenomenal objects. There is no need for society here. We do not need, at this stage, any cooperation that material tools possibly require. What is needed is that several individuals know what an instrument can be used for.[3] But this is just the beginning.

When a social meaning relation has been established on the ground of the common use of material instruments (and using the material instruments as a means of communication, not only action), there opens up a new possibility. Social habits as a residence of meanings give the basis for completely conventional signs. The sign function of material instruments is now independent of the second aspect, the causal relation between the instrument and the object of motor action. The second aspect is no more necessary for the instrument to function as a sign, therefore the word may take the place of it.

In other words, a subject having only one p-model gets into trouble when it begins to have two kinds of phenomenal objects. One kind of them (objects of instrumental action) remains as an integral part of its action structure. But the other group (instruments) has the new feature that these phenomenal objects as instruments are not enough for action. One must find the object, too. Instruments begin to mediate action as signs.

The need for manipulating two kinds of phenomenal objects differently forces the subject (the species) to develop a new p-model working on different principles, namely principles of relating signs to other signs and to perceived

objects of action. In other words, this new p-model is that what we have called the l-model – when it has developed enough. In other words, when completely conventional signs have taken the place of instruments as signs and taken the form of a natural language. Now we are dealing with word meanings.

The only basis of word meaning are social habits, but that *is* now enough. We have reached the situation illustrated in Figure 1.1.

For the structure of mind this means that there are two systems of action, one for dealing with external rigid objects with or without material instruments, and one for producing and perceiving signs. In our terminology they are controlled by the p-model and the l-model, respectively. Both are, actually, systems of external motor action, called occasionally s-action and sign action in the previous chapters.

The difference between them is that in sign action the sign is not really the object of this action (in spite of the fact that signs *are* external physical objects). The "object" of sign action, as noted by Vygotsky and accepted here, is the brain, one's own or anyone's. Of course, signs do have the objects to which they refer. Signs have two types of objects. This latter aspect (concerning the brain as an object of signs) is needed only in the analysis of the structure of mind.

The system controlling s-action is spatial in the sense that motor action guided by it proceeds in the world of three-dimensional solid objects, and the solidity of these objects is a highly relevant feature in regard to successful behaviour. But as noted earlier, this stand does not require that there are isomorphic spatial structures in the brain separately considered.

The other system controlling sign action is not spatial in the same sense. Genetically earlier signs (voices, gestures, utterances) are not even solid objects. Written words are physical objects, perhaps even rigid in some cases, but this is not crucial. The only relevant feature in the physical nature of signs that effects the system controlling sign action (the l-model) is the fact that they are typically produced and perceived in a serial order. The seriality of the l-model amounts to the serial process needed in producing and perceiving signs.

What is more important is the fact that the relations among signs are not determined by their physical nature. They are (partly) determined by meanings. Meanings are, in our view, basically social habits of sign use (this is what the notion of language game is good for). This aspect of the structure of the l-model can be characterized with the notion of a semantic network.

But the fact that the l-model, as suggested, is a system of action and perception rather than a matrix of memory places having connections to each other, leads us closer to a connectionist framework, as noted earlier.

We have claimed above that external objects belong to the functional organization of a mind operating on a p-model. Analogically, signs as external objects or events, as well as the producers of these signs, belong to the functional organization of a mind (human mind) operating with the l-model.

And conversely: minds and social practice belong to the functional organization of signs.

Now this is where the analysis usually stops. Minds, signs and social habits make up a system where meanings are defined as internal relations. And there is an unbreakable hermeneutic circle and no privileged connection from language to reality.

This is quite right to a certain extent. Sensations *are* theory-loaded, they do not give any unproblematic basis for some independent language of empirical terms. Sensations are private. Neither does a language game, a system of social habits, give any privileged connections.

However, if signs are ultimately interpreted by habits of motor action (s-action), then the external objects as physical (not phenomenal) objects belong to the functional organization of mind, even of the human mind reorganized by linguistic representations. Three-dimensional solid objects perceived as phenomenal in common experience are privileged as potential objects of natural languages because (in the case of thing-words) the phenomenal object (to which a word user referres with the subjectively understood word) *is* the physical object. And this physical object as physical is the same for others as well (cf. Chapter 14).

Finally, the logical syntax that determines partly the connections between signs is, if the analysis presented above is on a right track, in its turn determined by the physical laws (the "logic") of solid physical objects.

This amounts to saying that physical reality, external signs, brainstates (as parts of the systems of motor action control), and social habits of word use all belong to the functional organization of the human mind. There is no way of locating the mind between the ears. There are no contents or intentional states "in the head", if the head is cut off from the other elements of the functional system of mind.

The ontology of mind, therefore, consists of physical objects and events, some of which are interpreted as signs, some are brains, bodies, and bodily behaviour. We have a persistent feeling that the mind resides behind the eyes and between the ears, and this feeling is justified in the sense that each sign user has, in a sense, a private phenomenal world in which he acts and in terms of which he personally interprets the signs. But there is no mind without the interplay of external and internal functional elements.

Genetically speaking, the emergence of the human mind is based on external instrumental action, tool use. External objects have been a necessary part of the functional organization of mind in this sense as well. But when internalized this functional organization has transformed from an external relation between the brain (the p-model) and the external object into an internal relation between the two systems: the p-model and the l-model. The functional role of external objects has been transferred to states of the p-model. We think by relating l-model states and p-model states to each other and, at a higher developmental level, l-model states to other l-model states (which is linguistic thought, from our point of view). But the way of relating linguistic thought to experience goes through the p-model.

Evolutionary theories often relate ontogenesis to phylo- and sociogenesis. The development of child repeats in an altered form the development of the human race and society. This metaphor is of some use here as well.

According to Vygotsky, there is a crucial stage in the development of child when "the use of auxiliary signs breaks up the fusion of the sensory field and the motor system and thus makes new kinds of behavior possible" (Vygotsky 1978, p. 35). The whole psychological process is restructured by the system of signs. This holds for perception, memory and thinking.

From our point of view this is especially interesting when applied to word meanings. Vygotsky claims that "the connections underlying words are fundamentally different in the young child and in the adult" (ibid., p. 50). Children's words are related to a series of examples, and word meaning is based on remembering these examples. To think means to recall. But for the adolescent, to recall means to think, that is, at this level the memory is "logicalized" (Vygotsky's term, see ibid., p. 51). Indeed, the whole structure of mind is logicalized.

In our terms, the l-model takes the rule from the p-model. Mind is reorganized. An adult categorizes perceptions with the l-model, that is, organizes them under linguistic representations.

But since the p-model does not disappear, and since the l-model gets constructed on the basis provided by the p-model, the basic spatial structure of the experienced phenomenal world does not change. The spatial system of action control is in a privileged position because we are, still, spatially behaving animals, biological organisms.

The radical change Vygotsky speaks about can in our terms be described as follows.

The first stage of sign use and understanding is the stage of relating signs (independently of each other) to phenomenal experience. In other words, each l-model state has connections only to past (memorized) and present p-model states. But there are no connections between the l-model states except through the p-model. Syntactic and semantic relations between signs are loose or they do not exist at all.[4]

A more developed language would require direct connections between the l-model states. It is perfectly possible that our ability to acquire linguistic relations is based on some biologically determined structure or functional system in the brain. But this does not entail any commitments to any innate ideas interpreted as spiritual or immaterial entities.

This claim about some hereditary properties becomes even more plausible if this system can be described as a modification of the p-model. This is the case if the hemispheres have been two relatively independent p-models, one of which gets specialized in sign action (and thinking), and the other in external motor action. This ability to get specialized would then be the functional property which requires some biological basis in the brain.

This kind of evolutionary approach enables us to sketch a naturalistic conception of language.

The logical syntax of language is based on the "logic" (i.e., the principles of behavior) of three-dimensional solid objects. Every animal acting in a natural environment is bound to adapt its behaviour to these conditions. But no animal (except human beings) can conceive its action as logical.

But because we as humans still act in the environment of rigid objects, the system guiding this motor action is, not only deeply embedded to our biological structure, but also continuously enforced by everyday practice.

The p-model alone is not enough for conscious thinking about this "logic" of rigid objects, it controls action immediately. But the p-model enables one to experience the world as objects, properties and relations. This structure *is* there as experienced world of action.

If the phenomenal world is there already as objects, properties, and relations, then the system of the representations of external signs (the l-model) is just bound to get organized according to this structure, that is, as nouns, verbs, adjectives, etc.

In other words, if the phenomenal world's structure is propositional already (in virtue of the s-model, of course), then what else is there for the language as a basis of organization. At least, nothing else is needed in order to explain the propositional structure of a natural language. The logical form of a sentence, or better the computational structure as a basis of it, is already given by the phenomenal world.

The objective and common nature of this structure is not based upon experience as phenomenal (it would not be enough). It is based on the fact that solid three-dimensional objects are the same both as phenomenal and as physical. And this is the context where the use of language is learned and which gives language its basic structure. Later the use is generalized to cover also other cases.

Because this propositional structure of the phenomenal world (its structure as objects, properties, and relations) is ultimately based on motor action and the s-model, it is most natural that this structure is a part of our biological *a priori*, so to say.

So this is how far we can, in principle, get from the simple assumption that there are three-dimensional rigid objects, including the subject's body. And there is no need to postulate any Cartesian mind related somehow to the body in order to explain our ability to use language as an instrument of thinking.

The Cartesian way of talking about the issue is just misleading, as if the problem could be discussed as a relation between the mind and the body. The solution to the Cartesian riddle, we suggest, can be given only by rejecting the Cartesian frame, that is, by stating that external objects, signs and signs users (the society) belong as an inseparable part to the functional organization of human mind.

Notes

1 Lateralization, that is, the division of labor between the hemispheres, is worth pointing out here. According to John Eccles's characterization, the dominant hemisphere is, among other things, verbal, arithmetical, and computer-like, while the minor hemisphere is almost non-verbal, geometrical, and spatial (Eccles 1989, p. 208). From our point of view, this kind of evidence reflects the division of labor between the hemispheres in the sense that one of them takes care of sign production (or sign action, the l-model), and the genetically earlier functions (the p-model) are left to the other. However, it might not be advisable to stress too heavily the independence of these functions (and terms like 'computer-like'). The most important methodological point following from our analysis is the need to break the Cartesian framework which is often on the background of this kind of characterizations.

2 These hereditary facilities may include also the ability to point. Chimpanzees do not point if they are not trained to (Premack 1988, p. 47). This is quite natural if ostension is a degenerate mode of instrumental action, as our analysis entails.

3 This knowledge is required of an individual, because if it does not know the use of an instrument (if it has not conceived the reference relation between an instrument as phenomenal and its natural object as phenomenal), then it cannot take the instrument as sign in communication, either. As Heidegger noted, listening is to be distinguished from mere hearing.

4 By the way, apes' ability to use signs has also been criticized on the ground that the languages involved are too simple (see Cook 1988, pp. 73–74), and this is what one would expect from our point of view. Apes do not have the hereditary facilities that humans use in constructing the l-model.

14. The conceptual structure of experience

Concepts are prior to experience, they give experience its categorical structure. Experience is conceptually categorized. This is a commonplace in contemporary philosophy.[1]

There is a difference between maintaining that experience is conceptually categorized (and we don't know about the real world) and claiming that the world itself, the reality, is conceptually categorized. Both alternatives take, however, concepts as a starting point.

But what *are* concepts? The arguments for the conceptual categorization assume that we have a priviledged access to concepts, that concepts are in some absolute sense internal, prior to the empirical experience of the external world.

One may, of course, take concepts to be abstract immaterial entities somehow accessible to the mind. It is, however, difficult to take this

assumption to be less metaphysical than the assumption that there are external material objects distinguishable from each other. However, there is no need to push the issue further.

Since we are trying to approach this question on a naturalistic basis, we shall try another approach. If we have to choose between external material entities and abstract immaterial entities, we shall choose material ones, be this choice called metaphysical or not. We shall only examine what can be developed out of a simple (perhaps metaphysical) assumption that there are solid three-dimensional objects perceived by everyone as familiar phenomenal objects of everyday experience.

The problem of our approach is how to avoid naive empiricism, how to take account of the theory-ladenness of sensations, the fact that cognitive structures (that are often called conceptual) play an active role in experience and are prior to sense experience. This feature of experience must somehow be combined with the assumption that there are solid three-dimensional objects to which we refer by words like 'stone', 'tree', 'table', 'human body', etc. The only property required of these objects is that they are distinguishable from each other as solid objects.

In order to go through with this analysis it is, we argue, necessary to reconsider the notion of conceptuality. What is it that we refer to, when we talk about concepts and conceptuality?

Lucia Vaina (1987) distinguishes between two conceptual processes on the basis of Marr's computational theory of vision. The rigidity assumption discussed by Marr is explained by assuming an early conceptual operation independent of the so called verbal-semantic phase. In other words, we categorize the perceived world into rigid three-dimensional objects before and independently of linguistic categorization.

What is this kind of conceptuality? Why should we call this a conceptual operation? If the notion of the s-model makes any sense, this kind of conceptuality is analysable in causal terms. The object structure of the world (assuming that there are solid three-dimensional objects) produces causally a subcognitive structure that takes care, or so we suggest, about the rigidity assumption in the visual system. There is, in principle, a way to experience (independently of visual perception) the world as consisting of solid objects.

Our approach to these issues can be characterized with the help of Eino Kaila's conception of experience. According to Kaila (1979), we can experience the world in three ways: as perceptual objects (p-objects), as physical objects of everyday world (f-objects) or objects of physical science, theoretical objects.

An example of Kaila's p-object is a mirror image. It looks like a real f-object that can be touched and manipulated, but it is not. Another example of Kaila refers to the phenomenon that when you push your eye with a finger, you may see things as double. You may see two computers on the table, but there really is only one.

According to Kaila animals and babies experience the world as p-objects (see Kaila 1979, pp. 273–275). As to babies Kaila refers to Piaget's experiments concerning the development of the scheme of permanent object. Babies have to learn, on the basis of sensorimotor experience, that different perceptions (which they originally take to be different p-objects) really are perceptions of one and the same f-object. Animals, on the other hand, seem to take mirror images as real f-objects, as is indicated by Kaila's example of a dog seeking objects behind the mirror.

The transition from p-objects to f-objects is characterized by increasing conceptualization, and this conceptualization involves, among other things, increasing invariance (ibid., p. 276). Adults experience the world as more invariant f-objects because of conceptual categorization of experience. Animals and small children experience the world as p-objects because they don't experience the world from the adults' higher conceptual standpoint.

Physical science is, of course, conceptually more developed, and uses higher invariances of scientific laws. Therefore objects defined by the science of physics are even more invariant.

Kaila's view is that conceptuality and invariance belong together. The origin of concepts and conceptuality is, however, an open question.

Our suggestion is that the invariance of solid three-dimensional objects is the basis on which cognitive operations called conceptual are based. The notion of conceptuality must then be developed on the basis of this assumption.

This concerns only the first part of Vaina's division of conceptuality. That is, according to our analysis, the rigidity assumption (which Vaina explains by some kind of conceptuality) is based on motor experience of invariant rigid objects.The s-model is, in principle, independent of any power of perception. The objects determining the structure of the s-model are not perceptual (phenomenal) objects. The categorization of the phenomenal world is based on the s-model which is internal and (biologically) *a priori* in regard to sense experience, but externally determined through motor action. The s-model categorizes the phenomenal world into invariant objects, but this invariance is not of conceptual (but causal) origin. It is the invariance of rigid objects projected into these very same objects, but now as perceived phenomenal objects.

In other words, we project this invariance from inside and *a priori*, only this internality and apriority is explained in naturalistic terms. The fact that this projection takes place in sense experience separates us from naive empiricism. According to Kaila, for example, naive realism says that perceptual things are not dependent on ourselves (Kaila 1979, p. 263). That what we perceive does depend on us, it depends on internal conditions. The internal condition called the rigidity assumption is, however, produced causally by external conditions.

Once again, if we have to choose between invariance of concepts and invariance of external material objects, we choose the latter option and try to explain conceptuality (or Vaina's first aspect of it) on this ground.

Developed animals, it follows, do not experience the world as Kaila's p-objects. The fact that they make mistakes with mirrors, expresses the fact that they take even mirror images as solid objects of action and don't have evolutionary experience of mirrors. They take p-objects as f-objects (not everything, f-objects included, as p-objects). The fact that they mistake p-objects as f-objects (a dog, say, takes a mirror image as a real sausage) only indicates that they have not revealed the hidden semiotic relation between the phenomenal object and the physical object, which relation, when conceived, would make it possible to take a mirror image as a sign, not as an immediate object of action.

What comes to Vaina's second part of conceptuality, the verbal-semantic phase, we refer to the previous discussion about semiotics of instruments and language games. The categorization of phenomenal experience and the ability to use conventional signs is all the conceptuality we need.

The object structure of the s-model and the linguistic representations (the l-model) are both internal and *a priori* in regard to perceptual (i.e., phenomenal) experience. There are no obstructions to the so called theory-ladenness of sensations.

This stand entails a closer relation between causal and conceptual necessity. David Hume's criterion in distinguishing between necessary relations of ideas and matters of fact was simple: for every fact the negation of that fact is possible, but some relations between ideas are necessarily true. Logic is one part of this necessarily true knowledge, but if it is based on the behaviour of solid objects this criterion of Hume does not work.

Hume claimed that causal chains may well proceed differently, it is not necessary that the sun rises tomorrow. This holds for the solid objects as well. Is it necessary that two solid objects cannot occupy the same place at the same time? This is, one might say, in contradiction with the concept of solidity. The point is, however, that external objects do not behave the way they do because of our pre-existent concept of solidity. On the contrary, our concept of solidity is based on the fact that some external real objects just do not (as far as we know) occupy the same place at the same time. It is perfectly thinkable that this may some day happen. What about if next friday, when you take two apples and try to put them in the same place, they suddenly began to intrude into each other? There you are, then, with one apple on the table. This is not extremely probable, be it admitted, but the point is that this is a physical fact, not a logical necessity.

We are so accustomed to act in the space occupied by solid objects that we just cannot imagine a world which would really behave like this. But is this so different a possibility from the possible fact that the sun just might not rise tomorrow?

Both are in contradiction with what we have experienced in the physical world this far, but the difference is that the solidity of three-dimensional objects is closely connected with our cognitive capacity of counting, computing. If apples behaved in the way just described, then our signs and rules for computing would not apply. They could not be used in counting

apples, and since their meaning is their use, they would be meaningless for us, or at least they would not have the meaning they now have in our everyday practice.

Logical or conceptual necessity (of computationality) is at the same boat with causal necessity (of the sun's rising tomorrow), from this point of view. The difference is that the rigidity is embedded into our inherited cognitive facilities of the computational nucleus (the s-model), while other kinds of regularities are not. Our mathematical and grammatical intuition is based on the mind-independent rigidity of some external objects.

Hume's (and his followers') distinction is here replaced by the Wittgensteinian distinction between mirroring and picturing. The computational nucleus of thought is mirrored from the physical world, and computationally correct sentences are rightly or wrongly pictured. Mirroring concerns computational correctness and picturing the property of sentences that they are true or false. But both aspects are based on the way things are in the real physical world which is out there for us to experience and to which our thought is adapted.

This reality can be viewed from three standpoints. Inspired by Kaila we shall speak about three types of objects illustrating these standpoints: rigid objects of motor action (s-objects), perceived phenomenal objects (f-objects) and theoretical objects (t-objects). Notice that Kaila's p-objects do not have a place in this series of objects. It is preferable not to speak about objects at all in the case of mirror images, for example. The light coming from a mirror just causes a perceptual process, and that's all there is to it.[2]

Every individual perceives the world from his own point of view and faces the reality as it is manifest to him. Perceived f-objects are referred to by empirical signs as interpreted by the individual. They consist the subjective meaning of empirical signs. (See Figure 1.1.)

But even the objective meaning of every empirical sign is not within the reach of individual experience. The objective meaning of any conventional sign is given by a semantic language game based on social habits.

Theoretical signs have no subjective meaning in terms of phenomenal predicates (perceived properties). Everyone who has some knowledge of words like 'electron', understands them subjectively, but this subjective meaning is not given in terms of personal sense experience. We do not see what electrons are like. Therefore we say that electrons are theoretical objects.

This quite familiar distinction is not modified when we add a third standpoint: solid three-dimensional s-objects. They are, on one hand, unavoidable elements of everyone's personal experience, real boundary conditions of motor action. A solid object cannot, so our experience tells us, be at the same place at the same time with another solid object. We cannot walk through the wall. The annoying point is that they cannot be perceived but as f-objects. This means that the s-objects are, on the other hand, theoretical objects. They can be conceived only in non-empirical (non-phenomenal) terms, just like electrons.

The subjectively experienced phenomenal world (the world of f-objects) and the theoretically conceivable physical world (the world as defined by the science of physics, the world of t-objects) have a common element, the s-objects. The s-objects belong implicitly to the phenomenal world of f-objects - recall that the s-objects and solid f-objects really are the same real objects regarded as objects of action and objects of perception, respectively. On the other hand, s-objects belong to the world of theoretical objects in the sense that solidity is a term in the science of physics. The distinction between gases, liquids, and solids is a scientific distinction, and most probably the future research concerning the ultimate structure of matter, quarks, etc., will not remove this distinction. Therefore, some theoretical objects (namely solid three-dimensional objects) are also s-objects. In other words, we get s-objects by giving a restricted description of some t-objects.

The s-objects are a kind of crossing point of three epistemological points of view: practical, phenomenal, and theoretical.

From the practical point of view, the s-objects are objects of motor action. They are imprinted into the s-model by means of motor action. The only way to get the s-objects into an individual's consciousness as something different from the f-objects is to use Peirce's pragmatic maxim. A good explanation of the fact that we cannot walk through the wall is the hypothesis that there exists a solid object quite independently of its being perceived (as an f-object). That's the relevant "practical bearing" in this case. The conscious experience is about the results of planned action, not about the external world of s-objects directly.

From the phenomenal point of view, the s-objects are perceived as phenomenal objects with phenomenal qualities. A phenomenal quality is a relation, really. Colours, for example, require both some physical properties of the object and some biological properties of the subject. Relevant restrictions of the s-objects as physical objects must, of course, be removed.

From the theoretical point of view, s-objects are physical objects characterized by the science of physics, or to be more exact, a restricted description of some physical objects gives us the s-objects.

The reason for introducing this distinction is the need to argue for our original assumption to start from three-dimensional rigid objects. There are no absolute postulates that would justify themselves independently of anything else. It is the philosophical stand as a whole that counts. The argument in favour the present approach is simply that it fits in with common sense experience and the present scientific world view. Solid objects are not odd entities in these views, and to the extent that our conceptual capacities can be explained by developing the relevant notions on this basis, this approach is plausible.

Ideal objects as self-subsistent immaterial entities do not fit in with our approach. However, the problem of the ideal must somehow be solved. There are several senses in which ideal is real and objective.

Consider numbers. Frege (1968, p. 58) had a difficulty in ascribing to units of counting two contradictory qualities, distinguishability and identity. A part

of his solution to the riddle was that the distinguishability concerns the things numbered, and the identity is identity in respect to some concept under which the things are subsumed (ibid., pp. 66–67). The weakness of this solution, from our point of view, is the fact that it starts from concepts. Our task is to try to solve these problems on the basis of a materialistic ontology.[3]

We can, however, abandon the identity requirement (if it requires something else than the distinguishability of solid objects in action, in which case the solidity is the basis of identity as well) and, by the same token, the requirement that all numbers are self-subsistent objects (see ibid., p. 67). Numerals, in our approach, do not stand for immaterial self-subsistent entities but for distinguishable physical objects (or aggregates of them). In individual experience this reference relation goes through acts of counting. We can count solid objects in virtue of their distinguishability quite independently of what names or labels they are categorized under.

The meanings of numerals are habits. Meaning is use, and computational rules express these habits of counting. To be short, this is a kind of combination of Bigelow's pebble arithmetics and our epistemological view (cf. Chapter 10).

The ideality and objectivity of these meanings as habits (but not as abstract immaterial entities) can be characterized with E.V. Ilyenkov's conception of ideality which is based on Hegel's and Marx's views. According to Ilyenkov (1977, p. 89), the ideal can be understood as the corporeally embodied form of the activity of social man. Ideality is the form of social human activity represented in the thing (ibid., p. 86, see also Ilyenkov 1974, pp. 201 ff.).[4]

These forms of action are ideal in the sense that they are not material, they are not reducible to material objects or subjects or individual acts. A form of action in a computational game of counting is an established habit represented by a computational rule. And these ideal forms of action can be, of course, instantiated by acts where we do not count solid objects. But the habit of counting is learned with solid objects (the computational nucleus of cognition is based on evolutionary experience of solid objects). When these acts of counting have become represented by numerals (signs like '2' or '//' or two fingers) the lesson learned can be generalized to all possible acts of counting.

As Ilyenkov points out, ideal forms of action are objective. They are not "in the head", they are forms of social practice. But their objectivity is not only the objectivity of social reality. They are objective also in the sense that the form of material objects shapes the form of action, also here and now. In the case of counting, the existence of individual solid objects in the environment is an objective basis for computational acts.

We have again a choice, be it called metaphysical or not, between the solid objects and supposed self-subsistent immaterial objects in a mathematical (platonic) reality, and we choose the former ones.[5]

Further, about ideal forms of action cannot be said, where exactly they exist (Ilyenkov 1977, p. 90). But the "bodiless substance" is social practice (of solid organisms in the environment of more or less solid objects). That what is ideal,

Ilyenkov writes (ibid., p. 98), exists only through the transformation of the form of activity into the form of a thing, and the form of a thing into the form of activity.

What does this all amount to?

The general idea has been to explain on a naturalistic basis how the human cognition might acquire the abilities required by conceptual functions and operations.

Assuming solid physical objects we get a causal explanation of how a model of rigid objects (the s-model) can be formed and function in an organism. This is, in principle, enough for the categorization of the object structure of perceptions, explained by Lucia Vaina with (some kind of) concepts.

This categorization of perceptions, in its turn, is enough for the implicit semiotic structure of motor action controlled by perceptions. This implicit semiotics contains a possibility of conceiving meanings and referential relations.

The semiotic structure of action, although it is functioning, cannot be conceived until both parts of the semiotic relation come visible, which takes place in virtue of the use of material instruments. The instrument is the first genuine external sign, the source of completely conventional signs, written words. This presupposes that the ways to use instruments are established as social meanings of these instruments as signs.

The conceptual nature of language can, in principle, be explained without any self-subsistent immaterial entities. From an ontological point of view, we need only external solid objects, external signs as physical entities, living organisms, and a social practice as a residence of meanings (the habits of instrument and sign use). The conceptual structure of experience is based on causal interaction which is partly semiotic and social in nature.

We have seen that there are different jobs that are given to concepts or conceptuality. Following the order of our bottom-up analysis we may sum up what this amounts to.

First, the categorization of experience into solid objects (Marr and Vaina). The s-model takes care of this on the ground of motor action.

Second, the categorization of phenomenal objects under perceived properties, say colours. There is the problem of the phenomenal description and the physical description of colours. The phenomenal red is in a sense private, while the physical red is described in terms of a body's capacity to reflect light waves. We do not *see* the atomic structure of a body and how it reflects certain wave-lengths of light. Phenomenal properties are, rather, relations that depend on the subject as well.

The notion of biological *a priori* takes care about this aspect. Colours are relations between the physical properties of the object and the biological properties of the subject. We need an eye capable of distinguishing between different wave-lengths of light. The perceived difference between light waves can then be attached to objects of experience as phenomenal properties, because the object structure is available already.

The causal effect from objects to the eye is by itself not enough for explaining visual experience, but this is possible, we suggest, if the structuring effect of the s-model is added to this. The result is that the phenomenal objects are categorized under phenomenal properties, and this is explained by a double causation: Through motor action and through the sense organs.

The s-model gives also the spatial relations between solid objects which relations turn to spatial relations of phenomenal objects.

Third, the ability to use external physical signs as representations of the phenomenal objects, properties, and relations is also explainable in naturalistic terms. Instrumental action gives an individual the ability to take signs as signs, and the biological species gives us a potential community needed for social habits as forms of action.

Fourth, the basis of the logical structure of sentences (possible combinations of external physical signs) is given to the individuals by the propositional structure of the phenomenal experience. But this is ultimately due to motor action and the s-model which makes it intersubjective (every subject has it) and objective.

The structure of experience may be called conceptual, provided that the notion of conceptuality is analysed in naturalistic terms. Or we might call the view emergent materialism which takes account of the irreducibly social nature of human thought. Emergence is here just another word for the methodological principle stressed several times above: External objects (signs and other sign users included) belong to the functional organization of mind. That is how the mind emerges over and above the brain.

The result of the above analysis may also be characterized with the help of C.S. Peirce's Pragmatic Maxim which goes as follows. "Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object" (CP 5.402).

What are these effects?

We have, among other beliefs, some beliefs about the spatial structure of the environment, and we act accordingly. If these beliefs prove to be wrong, then we collide with some hard facts (in dyadic action), and are immediately ready to change our beliefs. It must be noted here that the experience is not directly about external objects in themselves, the experience is about the results of planned motor action, it is about what plans of action can be successfully completed and what plans cannot. This is the content of the pragmatic maxim.

But there is more to it than external hard facts as unpleasant and sudden surprises. There is an internal subcognitive structure as a basis of our object conception. Our conception of the object has an internal structure as a spatial model of the environment. The practical effects of the object give shape, quite literally, to our conception of the object. The phenomenal properties are then attached to this object which can now be perceived as a phenomenal object out there, in spite of the fact that everything phenomenal does depend on internal conditions, in sense or another.

Notes

1 See, e.g., Putnam (1981). He defends a view called internal realism which takes concepts as a starting point. This view is opposed to so called metaphysical realism according to which there is some privileged and non-conceptual way to have access to reality.

2 Mirror images are not real objects. They are fakes caused by the fact that the light coming from a mirror is sufficiently similar to the light coming from real objects. This is good evidence for the thesis that phenomenal objects (f-objects) are semiotic entities, they stand for physical objects (t-objects or s-objects), and as noted before, Umberto Eco's criterion for a semiotic entity is its ability to lie. And that is what mirror images do (in more than one sense, by the way). Hallucinations are fakes caused by internal factors, without external causes.

3 Note that there is no problem, from our point of view, in using concepts in defining arithmetics after the notion of concept is naturalized in the way we are trying to sketch. The whole point is in explaining the apriority and instrospective necessity of formal relations without reference to independent immaterial entities.

4 Marx W.Wartofsky's notion of models as modes of action seems to be suitable for similar purposes (see Wartofsky 1979).

5 This counts for Popper's World 3 as well, if it is taken to consist of abstract entities, as his reference to Fregean objective contents of thought seems to imply (see Popper 1979, p. 106). However, Popper's thought experiments make sense if we interpret the World 3 as depending on the world of artifacts, the part of the World 1 that is modified by man. Books, machines, etc. allow of such possibilities of action that the natural environment does not (reading, working, etc.). World 3 in this interpretation is ideal in the Ilyenkovian sense that artifacts as such are not enough for the forms of action. The other component of this relation, the subject, is also needed. There are two senses of objectivity to be distinguished here, namely the objectivity of artifacts as physical entities which belong to World 1 (objectivity in regard to the whole mankind), and the objectivity of ideal forms of action existing only in social practice (objectivity in regard to individual human beings).

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