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CHILDREN MAKING SENSE OF PHYSICAL PHENOMENA



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For Noam, Jonatan and Daniel

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Annika Åkerblom

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1 Background

The epistemological role of language use

Introduction

This thesis concerns the activity of expressing ways of understanding in a structured dialogue, and how this activity can function in developing knowledge through language. It is an investigation of how children¹ of three different age groups express their way of seeing certain phenomena using verbal expressions; making sense of these phenomena, as well as exploring their own use of language.

Children in Swedish compulsory school were asked to express their understanding of physical phenomena in a framed dialogue, where the child was invited to investigate her/his own

¹ The children participating in the empirical investigation were respectively six, ten and fourteen years old. For the fourteen year olds, other words might conceivably be more appropriate than “children”. However, (except in article IV, concerning the two oldest age groups), the term “children” is used throughout, in order to avoid constructions like children/pupils etc.

use of language. The following questions were pursued in empirical investigations:

What expressions do the children use when expressing their understanding of a particular physical phenomenon in the world? *How do they use* these expressions, and *how do they reflect* over their function and meanings? Finally, in which ways, can use of language in a specific situation, and becoming aware of this use, be *related to learning*?

Aim

The present thesis was written in the frame of an interdisciplinary research project, financed by the Swedish Research Council, called *Language use and knowledge formation. Processes of interplay between content, meanings and expressions in learning and knowledge formation*. The overall aim of the project was to describe the interplay between language use and knowledge formation in different age groups, including pupils in elementary and secondary school. The results were also to be connected to previous research on language use in knowledge formation, concerning students in higher education (Svensson, Anderberg, Alvegård & Johansson, 2009). My special focus within the research group was language awareness, and concerns how children up to secondary school understand their own language use in relation to a particular content.

The overall aim of this thesis is to explore, analyse and describe how children aged 6, 10 and 14 used verbal language to express their understanding of certain physical phenomena in reflective dialogues. Four studies were conducted, which will be further presented in articles I-IV. Different aspects of language use were targeted in the studies, as the children made sense of the focused phenomena.

The first article is based on a study about how the children used the expressions 'air' (Swedish: 'luft') and 'attraction force' (Sw: 'dragningskraft'), and the various meanings they associated with these words. The variation in meanings which the children had given those expressions in the course of the dialogues was explored and analysed in article I. In article II, the focus was on how the six and ten year olds expressed awareness of their own language use. The third study concerned the children's responses in the reflective dialogues, as a variation in ways to approach content matter. Finally, the last investigation dealt with how the pupils of ten and fourteen dealt with the ambiguity of meaning when reflecting on the function of their use of expressions. Besides the overall aim to explore, analyse and describe ways of using verbal language in knowledge formation, an additional aim has been to consider aspects of language use that are critical for learning, and to discuss implications for pedagogical contexts.

Based on the results of the empirical studies, as well as a theoretical investigation of ideas relating to the function of language use, in a selection of writings by Wittgenstein, Vygotsky and Mead, the following overall questions will be discussed in the thesis.

- What characterises language use when the aim is to make sense of content matter?
- How can sense-making and awareness of language use be supported in pedagogical settings?

In the following part the theoretical framework used in the thesis will be presented, regarding the role of language in knowledge formation. Since the problem focused in the dialogues concern physical phenomena, the thesis relates to

science education more particularly. Previous research in science education about how children understand and use language about the world is therefore considered, followed by an outline of the theoretical and pedagogical problems investigated in this thesis.

The intentional-expressive approach

To examine the epistemological role of language a special intentional-expressive approach (Anderberg, 2000) was used, in order to examine how language functions in conceptualisation.

Use of language, especially in the context of learning, is in this thesis understood as having a relational, intentional and expressive character. The constitution of knowledge can from this angle be understood as a continuum, where creation of sense and the use of language for expressing understanding are viewed as dynamic activity.

The intentional-expressive approach aims to consider learning, involving the interplay between language use and understanding, from the learner's point of view. The active and creative role of the agent in learning is stressed. The learner is seen as active in approaching the world, acting as the author of the expressive and sense-making activities in which he/she is engaged.

When the relation between language use and understanding something is conceptualised from the learner's point of view²,

² Assuming the child's/learner's perspective should here be seen as a theoretical choice, and not as an ambition to perfectly understand the child's

s/he is the *agent of meaning*. But in the act of expressing there is also a relational aspect of response to the other. Sense is created, both in approaching an object, and directed to the other. Understanding is seen as an activity, where the children approach a problem using language. This specific function of language with respect to learning is in the present thesis referred to as the *epistemological role of language use*, and involves the question of how language functions to make sense of a specific content (Anderberg, Svensson, Alvegård & Johansson, 2008). “Epistemological” is a somewhat problematic notion, to the extent that it might imply a concern for the philosophical nature of knowledge or knowledge as something given. This is not the case here. Instead knowledge is seen as actively created in dialogue situations.

The epistemological role of language use is distinguished from the *communicative function* of language. For the communicative function, the overall aim is not so much conceptualisation in a learning situation, but rather to maintain a common ground and a communicative flow in the interaction between the speakers, as pointed out by Linell (2009). The notion of “communicative” could also be seen as problematic, since it can be understood in a number of ways. In one sense, all language interaction can be seen as communicative, but the notion of “communicative” is here used in a narrow sense, for

experience. Rather, the standpoint is that the learner is a conscious reflecting subject, and an active agent in the learning situation. Improving our knowledge concerning the learner’s experience is therefore of fundamental interest for educational development and research. For a discussion see Johansson, 2003.

aspects of language where the dominant aim of language use is social. Such interactional aspects will not be considered in the following, although the dialogues studied here naturally involve this dimension as well.

We could also distinguish a third function of language, a pedagogic function of language, that is, language use where the aim is support for knowledge formation. This function of language use will be discussed more in detail in chapter 5.

Language use is in the intentional-expressive approach seen as *intentional*, that is, fundamentally depending on the intentions of the speaker. Different functions are in the present thesis therefore seen as closely related to the aims of the language users. The context and situation are also relevant. In everyday communication, the open and ambiguous character of language use is seldom a problem. A related issue is the transparency of language. Language is not visible in the activity of speaking, unless it is deliberately focused through reflection (Merleau-Ponty, 1973). Bringing about such focus is highly relevant in learning situations, since important aspects of learning are connected to shifts of meaning when different expressions are used, and to the learner's own reflection over those shifts.

Different functions of language are here distinguished analytically/ theoretically to obtain a clearer picture of the conditions and dynamics of sense-making. While the analytical separation contributes to our understanding, the various functions are actually closely intertwined in situations where expressions come to mean something. The dialogues which constitute the empirical basis for this thesis take place in an interaction between a child and a researcher, as the researcher invites the child to examine her/his own language use. Dialogue is the framework of and a precondition for

expressing. Individual sense-making is thus situated in an inter-subjective situation.

Learning is in this thesis considered with a phenomenographic, relational sense that concerns changes in the way a learner approaches a phenomenon in the world (Marton, 1981; Svensson, 1979). The intentional-expressive research approach gives particular attention to the question of how a learner approaches a phenomenon *through use of verbal language*. Learning involves a change in the relation between expressions, and what the learner means with these expressions, as well as changes in how they relate to the content of the learner's conceptions. Language meaning is not understood as inherent to specific expressions, but as something which is constituted within the activity of making sense of content.

The theoretical starting point and approach adopted in the thesis has been briefly outlined above. However, it should be noted that the process of verbalising and expressing experiences drawn from the empirical material has led me to further develop and refine my theoretical approach to learning, as well as the way the relation between language and meaning are conceptualised. As the thesis progressed, those questions, and other key notions, such as understanding and awareness, have acquired a more specific meaning, based in material and results from the empirical studies

Limitations of the approach

It should be noted that speaking of the function of "language use" does not refer to language in general, in different situations or with different aims. The results of this investigation do not generalise to other aspects of language use. The investigation was limited to a specific situation, where particular aspects were focused and studied closely with the

aim to understand the epistemological role of language use for the individual learner.

The intentional-expressive approach delimits one function of language use, namely the epistemological role of language use. Elements of the expressing activity (conception, intended meaning and expression) are analytically separated to investigate the interplay of these elements from an agent perspective. The activity is situated in a dialogue situation, an interaction between two persons, but focus is on the child's response in the dialogue, and the activity of the researcher is seen as a background to the response - clearly affecting, but not determining the response. While delimiting the focus to the child's activity gives an opportunity to closely investigate how the child experiences his/her own language use, it also means that other aspects of the situation are not in focus. Certainly, a number of other sides to language use could have been studied in the dialogue, including aspects such as power/gender relations, emotional or discursive aspects, etc. In this thesis, the choice has been made to not to focus other aspects, in order to be able to explore the epistemological role more in detail.

Previous research

Research on language use in learning

The two dominant research traditions within research on language use in learning are the cognitive and socio-cultural traditions. These approaches form broad traditions, and there is a large variety of orientations within each of them. The aim here is not to do justice to those broad groups, but simply to outline certain important tendencies in how learning and

language meaning is seen, in order to clarify how the intentional-expressive approach differs from these.

One of the orientations with relevance to this study is research on *conceptual change*, developed within the cognitive tradition (Chi, Slotta & de Leeuw, 1994; diSessa & Sherin, 1998; Vosniadou, 1994). This direction was developed from the theories of Piaget. Learning is understood as an inner process of assimilating new content to already existing conceptual structures, and accommodating, as change of conceptual structures (Piaget, 1971). Language meaning is seen as related to systems of concepts. From this perspective, the main problem to address in learning scientific theories is the presence of alternative systems of concepts that are competing with them, and how to change from such alternative systems to scientific theories. The individual learner is here the basic unit of research.

Other dominant research directions emanate from the socio-cultural tradition, evolved from the ideas of Vygotsky (Lemke, 1990; Mercer, 2000; Wertsch, 1991). The thoughts of Vygotsky were interpreted and developed in a number of orientations, focusing different aspects of Vygotsky's work. The three main directions are *activity theory* (e.g. Leontjev, 1981; Engeström, 1987), where activities are seen as systems of human practices, and learning is considered to be a consequence of activity. The direction concerned with *semiotic mediation* (e.g. Säljö, 2000; Wertsch, 2002) focuses on verbal expressions as mediating tools, and learning is seen as appropriation of social languages or discourses. Another direction is *situated learning* (e.g. Lave and Wenger, 1987, 1991), where learning is understood as participation in communities of practice, and the primary interest is in social actions. Language is seen as a means to participate and act in social situations.

Learning is in those perspectives seen as a social and cultural process, in which language plays a critical role. In socio-cultural research on learning, there has been great interest in learning through interaction and the role of language as discursive practices in natural

settings (Lemke, 1990; Wertsch, 1991; Mercer, 2000; Dysthe, 2003). Language meaning is here seen as embedded in *discourses* or social languages and learning as a matter of appropriating or internalising the language of the discourse, for instance scientific language (Wertsch, 1998; Roth, 2008). The unit of analysis in this type of research on learning is not the individual learner, but the activity-system as a whole, consisting of interacting individuals, situations and activities, as well as subject content (Dysthe, 2003).

The present approach shares with socio-cultural theory a non-dualistic view on learning, which is seen as socially and discursively situated. However, here the main focus is how the individual learner constitutes and expresses her/his understanding, using (socially and culturally shared) language. Besides the situation as such, the intentional-expressive approach is interested in what the learner brings into the learning situation in the form of previous experiences, and how these are expressed in dialogue with another. Dialogic aspects have impact on how the speaker chooses to respond to the situation, but are not seen as determining the response.

The learner is seen as the agent of his/her own use of language. Contrary to most socio-cultural theories, the meanings given to words by the speaker are not seen as embedded in discourses. While cognitive theories see such meanings as embedded in systems of concepts, in the intentional-expressive approach, these are seen as individually constituted in relation to socially shared systems of meaning. The emphasis of an expressive intentional approach is on language as expressing³ (Wittgenstein, 1974), contrary to a view of

³ Vygotsky discussed language in a number of ways, sometimes as mediating (e.g. 1978), sometimes as a system of concepts (e.g. ch.5, 1987). But in his last writings, chapter 7 in *Thinking and Speech* he shows a qualitatively different view of language as *activity*. In the present thesis, Vygotsky's expressive view of language is used in the theoretical

language as mediating or appropriating (as in most socio-cultural research), or seeing language as representing (as in most cognitive research).

In conclusion, the most important difference between cognitive, socio-cultural and intentional-expressive views on language meaning is how the *context* in which expressions gain meanings is delimited. In cognitive research, the context in which language meaning is embedded is taken to be cognitive structure. In socio-cultural research, language meaning is also seen as embedded, but the context is the discourse/way of speaking. The context delimited in the intentional-expressive approach concerns how the situation makes sense for the learner, and language meaning is seen as constituted and actively chosen by the language user, from the range of verbal resources the speaker disposes of.

Previous research on how children understand and speak about the world

A considerable amount of research has been carried out with the aim of understanding what children know about the world. The ways in which their intuitive conceptions differ from scientifically accepted ideas have been observed and discussed in research on learning in science education (Driver & Easley, 1978; Osborne & Freyberg, 1985; for an overview, see Duit, 2007).

Piaget was a pioneer in describing how children think and reason about different phenomena (Piaget, 1971). Through interview studies, he saw that children's conceptions of various aspects of the

background (for a discussion of Vygotsky's language views, see Wertsch, 2000)

world often differed from what was scientifically accepted. Since Piaget, many studies have focused children's conceptions, discussing them as *misconceptions*, *alternative conceptions* or *alternative frameworks*. Most of these studies have been carried out in science and mathematics. The question of what role children's conceptions play in learning is a much discussed issue. Millar, Leach, & Osborne (2000) argue that although much is known about conceptions, "...there is little evidence that students understand science better as a result in practice that is based on research" (p. 7). Children's alternative conceptions of the world have shown to be particularly persistent, and do not easily change even if they undergo special teaching aiming at change (Helldén & Solomon, 2004). The result of a longitudinal study of personal ideas in student's thinking⁴ about ecological processes showed that several students seemed to have a core idea, a personal theme that reappeared through the years. When asked about where the ideas came from, they could often explain it, referring to childhood experiences (ibid.).

Science education and language use

When pupils study science at compulsory school, they are supposed to learn what can be regarded as a new language, and a different use of language than in their daily life, outside school. They meet theoretical terms that they often have no previous experience of. Other expressions used in science, like *force* or *energy*, are words that the pupils use in their everyday language, but with very different functions. In physics education, pupils are supposed to shift from the different possible meanings that expressions may be given in everyday language, to a more strictly defined disciplinary meaning (Alvegård, Anderberg & Svensson, 2010). The use of an expression can be seen as a relation between the pupil and the meaning of the

⁴ 24 students from the age of 8/9 to 15 years, and again at 19, with interviews carried out every 2 years (Helldén & Solomon, 2004)

expression (Vikström, 2005), and in science education children are supposed to create new relations to already known expressions, as well as learning new scientific terms. How expressions are used to express understanding of a subject matter is clearly a fundamental question for learning.

There is not much empirical research about science learning and scientific language with children in preschool ages (Thulin & Pramling, 2009), but some studies will be mentioned that point at the importance of considering scientific content matter in early years, as well as the issue of use of language. In a study about how preschool teachers and children address content matter in a science context, Thulin and Pramling (2009) showed that the teachers tended to use anthropomorphism. The teachers spoke in human terms about something non-human (in this case insects), in order to make their language connect with children's experiences and terms. This way of speaking was more common among the teachers, than among the children. The authors conclude the importance of making the teachers aware of the language they use, and question whether this kind of speaking actually supports learning about scientific content matter. In a pilot study with a group of six year old children (Åkerblom, 2008), the shape of the earth, critical aspects of gravity, and the movement of planets were pointed out with the help of models of planets and the children's acting. The activity, as well as scientific terms, was then discussed in reflective dialogues. Another study was conducted by Fleer (2009), examining how very young children develop conceptual understanding in science, drawing on Vygotsky's writings on everyday and scientific thinking. Fleer's conclusion was that support for children's understanding of science should include playful investigations of phenomena, as well as systematic exploration of scientific terms. These and other studies point at the fruitfulness of working with language use and understanding complex phenomena in preschool settings.

Learning to talk science

Critical examinations of Piaget's studies have led to a debate about the role of the child in the interviews and experiments, and about what the child actually knows and speaks about (e.g. Pramling, 2006; Donaldson, 1978; Hundeide, 1977). Those studies point at the importance of considering-situational and discursive factors as well.

In socio-cultural research on learning, there has been great interest in learning through communication (Lemke, 1990; Wertsch, 1991; Mercer, 2000; Dysthe, 2003). Hammer (1996) chooses not to regard the notions that pupils express as reflecting stable structures, but rather as an ongoing constructing of conceptions. Hamza and Wickman (2008) show that secondary school pupils' misconceptions in chemistry do not necessarily constitute obstacles for learning, but can be the basis for new thinking and new understanding, which is developed by discussions in groups.

However, although such studies suggest that communicative interaction leads to learning, it is not clear how this happens, and what aspects of the dialogue support understanding. When Dysthe (2003) discusses processes of interaction that support learning, she points out that not enough is known about those complex processes of interaction, or concerning which precise aspects actually lead to learning. These studies tend to emphasize the communicative function of language, rather than the epistemological role of language use that is in focus here.

Awareness of language use in learning

The importance of making pupils aware of the meaning of language was highlighted by Sutton (1998), both with regard to their own learning, and as a means to express scientific ideas and phenomena. Pramling (1986) showed that how preschool children understand themselves as learners is related to the way they go about approaching subject matter. Pramling Samuelsson and Asplund Carlsson (2003) emphasize the use of reflective dialogues about thinking and learning in preschool, in order to give children an opportunity to reflect on these matters.

Awareness of language use, and being conscious of how meanings of expressions shift, seems to be an important factor for how children develop understanding (Åkerblom, Anderberg, Alvegård & Svensson, in press). Rojas-Drummond and Mercer (2004) saw that in pupil-teacher dialogues where the pupils achieved better outcomes, the pupils were encouraged to make their own thought process explicit, and to reflect about what they were doing. The pupils were encouraged to take an active and vocal role in their education. Mortimer and Scott (2003) and Alexander (2006) have identified similar characteristics of productive teacher-pupil dialogue.

In “reciprocal” teaching dialogues, described by Palincsar and Brown (1984), children were encouraged to make sense of science texts. The teacher-pupil dialogue was designed to support pupils’ strategies in reading comprehension, through elaboration, questioning and clarification of the meaning of a text. The pupils were also encouraged to use the approach in dialogues between themselves. Brown and Palincsar (1989) claim that guided cooperative learning through structured dialogues resulted in significant achievements for individual children.

Barnes (1975) investigated how pupils used language in learning in classroom situations. Through expressing themselves about subject content, and getting opportunities to formulate what they knew, pupils were given the opportunity to adopt this content for their own purposes and understanding. In a study of groups of twelve year old pupils trying to solve problems together, and trying to make sense of a subject matter, Barnes identified different qualities of speech. One of those qualities he referred to as *exploratory talk*, characterised by many marks of insecurity, reformulations and changes of direction. In exploratory talk, hypotheses were tested, both against experience, and against the content of the subject matter discussed. Possibilities were held open, and hypotheses seen as changeable. Barnes called this approach an *open strategy*, and argued for its importance for active contributions to the learning process. However, an open strategy was not used by the pupils in all the interactions. Barnes also

described a different approach, which he calls a *closed strategy*. Here, the pupils were looking for clues, trying to find the “correct” words and statements, in a reproductive fashion.

Language use in knowledge formation

In socio-cultural research on learning, the social and cultural processes are considered critical (Palincsar, 1998). The communicative function of language is then emphasized (Lemke, 1990). But when communication is highlighted, other important aspects, such as agency of the learner or sense-making from the learner’s point of view, tend to be neglected. Merleau-Ponty (1973) points out that one of the effects of language in communication is that language form is not visible to the user while it is used.

When someone – an author or a friend – succeeds in expressing himself, the signs are immediately forgotten; all that remains is the meaning. The capacity of language remains in its capacity to pass unnoticed. (1973, p. 10)

Here, Merleau-Ponty draws attention to a problem with language as form: it is not visible and obvious in the activity of speaking, unless it is deliberately focused through reflection. This is relevant for research on learning, since important aspects of learning are connected to shifts of meaning when different expressions are used, and the learner’s own reflection over those shifts.

In this study, the epistemological role of language is emphasized, exploring how learners use language to express understanding of parts of the world. Neither the communicative function of language, nor language seen as “concepts” related to mental structures, are focused here. A theoretical alternative is instead proposed, where the agency of the individual learner is taken into consideration, as well as the character of the dialogue situation.

While language in communication is seldom visible to the user, language in knowledge formation may be objectified and spoken about by the user. Even though the children are able to communicate

well, using scientific terms in discursively adequate ways, they may not have a scientific understanding of the object that is focused. In this study, the notion of “conception” refers to something based on the child’s experience, verbalised in the interaction with a researcher, but which may not yet be explicit to the children.

Previous research on the epistemological role of language in learning

A series of empirical and theoretical studies have been conducted, focusing the role of language use in knowledge formation from the learner’s perspective (Anderberg, 2000; Anderberg et al. 2008; Anderberg, Alvegård, Svensson & Johansson, 2009; Svensson et al., 2009; Alvegård et al., 2010). The studies mainly concerned higher education, in areas like nursing and teaching (Anderberg, 1999, 2000, 2003), in a multilingual setting (Avery, 2009), and classical mechanics (Anderberg et al, 2008, 2009; Svensson et al., 2009; Alvegård et al., 2010). Those studies point to a large variety and ambiguity in the way expressions are used, as well as the meanings those expressions are given by the learner, related to a specific content.

Approaching a science problem

Many of the previous investigations about the epistemological role of language were conducted with engineering students in higher education, and focused on physical motion. The reason for choosing physical motion was originally that it was a well researched field of research on teaching and learning (Svensson et al. 2006), and that the disciplinary language of physics is strictly defined. Often this disciplinary language is treated as “knowledge”, in the sense that expression has a given form; e.g. notions like “force”, “gravity” etc. have a given meaning within a theoretical system (Alvegård, 2009). Language use in this context is therefore in several respects very different from how language normally functions in other contexts. The questions focused are at the same time commonly experienced phenomena, like the movement of a ball and the moon, which can be talked about in a number of ways.

The same problem was chosen for the different age groups of children participating in the present study. The children, especially the youngest, did not necessarily understand the questions as “science questions”. The objective–was not to assess whether they understood those questions more or less in accordance with a scientifically normative way⁵. Choosing this type of problem permitted to make comparisons between groups with more and less experience of a theoretical conception of the problem.

The problem

Following Vygotsky (1986) and Wittgenstein (1958), who both in different ways investigated the function of language in development of understanding, language use is distinguished by considerable complexity, dynamics and ambiguity. (Their contributions, as well as Mead’s, will be discussed more in detail in Chapter 2.) They discussed how the relation is open, between the content, what is talked about, the words used to express that content, and the meanings given those words. Instead, this relation depends largely upon the context⁶ and situation of the activity of expression. The open character of language use has great implications for when language is used in learning and teaching situations. In many cases, this characteristic creates problems for pupils attempting to understand an explanation, since expressions in use can assume a

⁵ However this question will be discussed when the results of the empirical study are related to science education.

⁶ The notion of “context” is here used in relation to how it makes sense to the language user.

number of different meanings, which are often implicit and vague to them. Although knowledge about the function of language use in knowledge formation (understanding) has significant implications for dynamic learning situations, there is not much research about how language is actually used in conceptualisation. Specifically, research is needed on how children experience their own language use in those situations. The empirical and theoretical studies using an intentional- expressive approach to the role of language in learning were mainly conducted in different areas of higher education (Anderberg, 2000; Anderberg et al., 2008, 2009; Svensson, et al., 2009; Alvegård et al., 2010). Until now, these studies had not concerned how children of different ages see their own use of language in the activity of speaking about something specific.

2 Theoretical framework

An intentional-expressive approach

Phenomenography

The theoretical framework on learning in this thesis was developed from the phenomenographic research tradition presented by Marton (1981), Marton et al. (1984), Marton and Booth (1997), and Svensson (1997). Of central interest for phenomenographic research on learning is how individuals experience the world and learn how to act in it. The dualistic separation between the subject and the world is rejected, since an individual only has access to the world through her/his experience (Marton, 1981). There is no ground for separating the experience from what is experienced; therefore the relation is treated as a whole. The most fundamental aspect of phenomenography is that experience is explained as an *internal* relationship, constituted between an individual and a phenomenon. Intentionality is another important notion. Since the relation between individual and world is seen as intentional, it must be understood according to the character of that specific relation (Svensson, 1997). In classical phenomenography, the object of research has often been the variation of different ways of experiencing a phenomenon (Marton, 1981). Individuals see different aspects and understand the world in different ways. Ways of experiencing parts of the world are referred to as *conceptions*. Conceptions are not to be seen as stable constructs, but rather as something that can change or develop, and which may be more or less explicitly expressed (Svensson, 1997). The ways an individual experiences the world are fundamental to the development of individual knowledge. One of the assumptions in this

perspective is that understanding how individuals experience learning provides the basis for improving teaching (Dahlin, 1999).

Research focus of the intentional-expressive approach

In the present thesis, conceptions *per se* are not the main focus, but rather the function of language use in the development of conceptions. The starting point in phenomenography was chosen from an interest in how individuals make sense of experience and how they reflect over their own approach to a specific content. A fundamental assumption about the function of language use in learning is that it is something between the learner and the surrounding world. The immediate context for learning is the activity itself (Svensson et al., 2009). Thus the focus of interest is not on cognition and assumptions about cognitive structures, nor on socio-cultural aspects and relations, even though those aspects are considered in the context of the relation between a subject and a part of the world.

Content focus: intentionality as 'aboutness'

The content-focus of phenomenographic research has been an important factor for the choice of this perspective as a theoretical starting point. Speaking or understanding is *about* something specific. In the material studied here, this was *the moon* or *how a ball falls*. In classical phenomenography, the variation of different ways of experiencing the same phenomenon has come to delimit the object. In order to see a variation, something must be considered "the same" in some respect, for a comparison to be made. An "object", in this sense, is a delimitation of the world in a certain way, to be able to speak about it or act on it. Delimiting objects in the world is something that we constantly do in everyday situations, as we speak to each other about what we understand as "the same thing". However, such delimitations are rarely reflected on. The object spoken about is neither given by reality, nor is it constructed by the subject independently. The delimitation takes place through the subject's relation to the world, in an activity, and when expressing something about the object in question.

In order to create situations where language use is productive and leads to development of knowledge, an explicit content focus has proved to be an important aspect (e.g. Malmbjær, 2008; Meira & Lerman, 2001, see also article III). How the part of the world is delimited is a matter of what aspects of the world are in focus and, what is considered “background”. What the children in the investigation actually had in mind at any particular point is impossible to know for sure, of course. Instead, what we are looking at is the question of *what the child is speaking about*, based on what the child says. Again, this does not mean that only a single interpretation can be made of the material. Any analysis will involve an interpretation by the researcher, based on what was said in the dialogue. This interpretation is subsequently discussed in the research team.

The methodological assumptions are, in other words, that what is explicitly said does provide relevant information about intentions and conceptualisation of the speaker. Clearly, there may be additional relevant information that is not visible in the discussion, but such aspects will not be investigated in this work. It is further assumed that the picture offered by the researcher’s interpretation is not implausible although, obviously, alternative interpretations can be made.

The theoretical standpoint adopted aims to investigate sense-making from the learner’s perspective. Of course, even though we aim at taking the perspective of the other, there is no way of being certain that “sameness” and “differences” are experienced in the same way. Nevertheless, despite some of the intrinsic uncertainties linked to this type of research, we maintain that the learner’s perspective is of central interest to studies of learning. Referring to Wittgenstein (1953) there are certain things that must be taken for granted, if we are to speak meaningfully concerning the world and fellow human beings. This includes that we share a common inter-subjective world, as humans, and that our experience - although individual, cultural and gender-based, in certain respects - is also similar enough for us to understand what we speak to each other about. This is not a matter

of “truth” and knowledge in an absolute or philosophical sense. Instead, varying and imperfect kinds of “understanding”, made up of constant readjustments and new approximations, appear more relevant to communication as it actually takes place. Hannah Arendt (1973) has given an elegant summary of the question, arguing that if people were not in some sense “the same” - that is, sharing similar human experience - they could not understand each other, but also, if they were not “different”, they would have nothing to say to each other.

A relational approach

The study of an internal relation, for instance the relation subject-world, or thinking-speaking, differs from studying either of the two aspects in isolation. The *relation* is seen as something in itself and as activity. However, viewing a relation in this way is not the same as to suppose identity of the two aspects which are parts of that relation. Vygotsky (1986) who was interested in the dialectic interaction of different aspects often speaks of relations, using the notion of “unity”. This should not be interpreted as “identity”, since unity is a living relation, the interaction of two aspects. These should be studied and analysed as distinct entities, but always in the context of each other (see p.211). Another important point regarding the study of interaction is that it needs to be studied as it goes on, which means that the interaction must be put into motion somehow, in order to be studied. This methodological issue was also a basic one for Vygotsky (1986), who put different aspects (e.g. both a tool and a task in experiment) into dialectical motion in order to study them. He used this approach theoretically, discussing relations between different notions, such as the relation between subject and socio-cultural context, or the interplay between learning/teaching and development.

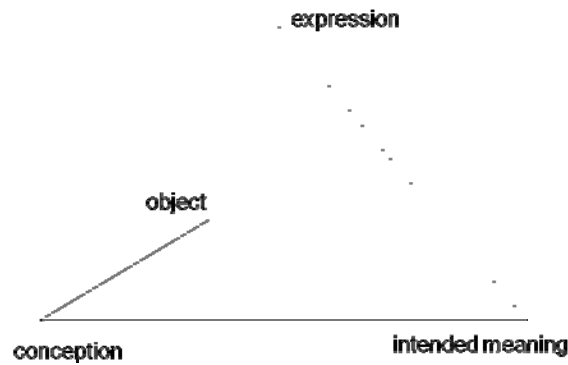
A basic research unit of phenomenography is the relation between the person who is experiencing and the phenomenon which is experienced (Marton & Booth, 1997). A relational contextual view on learning and understanding means that meaning is not given, but created in the situation at hand. The speaker as an agent is in the

foreground with respect to the meanings of the expressions which that speaker has used in that situation. The relations are seen as processes in time, and the temporal aspect of how meanings are used successively in the course of a conversation therefore needs to be considered. Based on the premises of this perspective, it would be impossible to draw general conclusions about language meanings as indicating discourses or socially determined ways to use language. Nor will language meaning be seen as abstract concepts within a cognitive structure. To sum up, the main point made here is that in expressing and developing understanding and knowledge, the use of language is an activity dependent on the situation, as well as on the speaker as an agent.

An intentional-expressive approach to the role of language in learning

The intentional-expressive approach was developed by Anderberg (2000; Anderberg et al., 2008), focusing the role of language in learning. This approach deals with how the relation between language use and knowledge formation is constituted from the learners' point of view. In learning situations, where the meaning of expressions changes or develops in the activity, or when similar meanings are expressed in different ways, a generalised structural or lexical description of language is not sufficient to explain and explore the changes that take place in the language use of an individual speaker. To include the individual learner, a language view drawn from the later Wittgenstein is used instead, where *language meaning is its actual use* (Wittgenstein, 1953). Learning involves a change in the internal relations between an expression, what is meant by that expression, and the content of the learner's conception of subject matter. Anderberg (1999) proposes a way to come closer to the individual's agency concerning the meanings of the expressions that individual used when describing his/her understanding of an object that had been referred to. Learners were asked, in highly structured dialogues, about how they understood the object in question, and what they meant with the expressions they had used.

The 'broken triangle' (see below) was developed to describe how the relation between language use and knowledge formation is constituted from the learner's point of view (Anderberg, Alvegård, Svensson, & Johansson, 2005; Anderberg et al. 2008). The model is based on both empirical and theoretical investigations on language use in learning. The triangle is not intended as a model of the phenomenon as such, nor are the parts to be considered as separated from each other. The triangle is rather to be seen as an illustration of aspects of sense-making activity⁷.



The *object* is the “what” of the dialogue, and is therefore placed in the centre of the triangle. Talking or thinking is not seen in general terms, but is always *about* something specific. The *conception* refers to how an individual in a specific context understands a part of the

⁷ An alternative way to name the nodes could be (from the top) *saying*, *meaning (-making)* and *seeing-as/ understanding*, to emphasize the dynamic qualities of the ongoing activity.

world, delimited as the “object”. The *expression* in this figure refers to segments of the utterance, single words or longer expressions, used by the learner as parts of the explanation/description of the object. The expression is also the *language form*. The meaning, what is meant by an expression, is here not seen as something which is given beforehand or which could be defined in a dictionary. Rather, it is constituted in the dialogue, when an individual is asked what s/he means by a specific expression. This is the *intended meaning* in the figure. It is also important to specify that “meaning” here refers to the meaning of a word or other limited segment of speech. For meaning in a broader sense, like the meaning of a text or the meaning of a conception, the notion of *content* of a conception is used instead. The distinction made here is important, since meanings are used to express content, in the activity of making sense of something.

The broken part of the triangle signifies that there is no direct relation between an object (i.e. what we speak about) and an expression (the words used to express what we are saying). The lines in the figure represent *internal relations*, showing that the meaning given to a certain expression by an individual also relates to his/her conception of the object that is talked about. In the studies of this thesis, this “object” could be the movement of a ball thrown in the air, for instance. The relations are constituted in an activity, as the speaker clarifies how s/he speaks about the object and understands it. Thereby, these relations become focused as such, rather than implicitly underpinning the learner’s explanation.

Inter-subjectivity and awareness

The focus in the present thesis is how children use language to express their knowing. For this purpose, the issue of the inter-subjectivity of language needs to be taken into consideration. Phenomenography is traditionally concerned with individual-world relations: how individuals approach a certain aspect in the world. But as language use comes into focus, there is a double relation to consider. Expressions are used with a double intentionality: *aboutness* and *directedness*. We speak about something (the object),

but speaking also has a direction towards the other, unless we speak to ourselves. Expressing something presupposes the will to respond to the other, which is obviously important to consider in any didactic situation. The inter-subjective relation has not been extensively discussed within phenomenographic research. However Kroksmark (2007) claims that in phenomenography, the inter-subjective relation must be assumed to differ from the relation between a subject and a part of the world, since inter-subjectivity calls upon a *change* in the way an individual sees something, an important foundation for the pedagogical relation. In the meeting with the other, new possible meanings might become visible. In the relation between how different individuals approach a specific part of the world lies the pedagogical potential of offering alternative ways of understanding something.

Language is in itself inter-subjective, based on implicit agreements about its use. Wittgenstein even claimed that there was no such thing as private rules about the use of language. Language, he contends, is something learned, not invented (Wittgenstein, 1953).

In the following, some of the ideas of three important thinkers will be discussed, concerning a relational and dynamic conception of language use. The theoretical discussion clarifies how those ideas relate to an intentional-expressive approach. Certainly other thinkers could have been chosen, concerning language use and understanding; linguists such as Volosinov, Searle or Halliday, or philosophers, like Heidegger and Ricoeur. For the purposes of this study, however, the work of Wittgenstein, Vygotsky and Mead on these issues appeared particularly relevant.

Activity in interaction as a starting point for language use

The later Wittgenstein (1953), Vygotsky (1986), and Mead (1938, 1934, see also Cronk, 2001), all stood for a fundamental shift in

attention concerning human thought and activity. They reacted against a dualistic, consciousness-centred understanding of human subjectivity, and proposed in its place a holistic, relational and dynamic view. These thinkers share a focus on *activity* in specific situations, and used the actual situation as point of departure for their theoretical investigation. Despite these fundamental similarities in their overall approach, important differences can also be seen. Each thinker emphasized different aspects of thought and activity:

Wittgenstein was mainly interested in how language relates to the world, and how language functions in the activity of speaking about something specific. He also discusses how use of language is interrelated to ways of seeing, and understanding. Words may mean anything out of context, and can only be understood as something specific *in their actual use*. Wittgenstein philosophically investigated how words are actually used in different contexts. His main aim in these investigations was solving philosophical problems (Baker & Hacker, 1980).

Vygotsky discussed the moment of expressing as something was verbalised and spoke of *consciousness as movement*, in terms of activity. He also explored the relation between use of language and thinking. He saw as a major result that “word meanings” are dynamic and changing, and was interested in how and why. Among many other things, Vygotsky investigated how children gave meaning to objects. He studied children creating and investigating sense while playing and wanted to learn more about how children’s intentional meanings interplay with socially agreed meanings (as in scientific terms). He saw interplay between different ways of understanding and aspects of language use as leading to awareness and learning. To express and make sense of something was to him an activity quite different from finding the “right” words with given meanings (c.f. Wittgenstein, 1953). Rather he saw this process as intentional, creative and sometimes laborious activity, which could be supported in pedagogical situations to promote learning.

Mead explored reflection and awareness with a point of departure in the interaction between the subject and the social situation. He saw *awareness* as a function of language and inter-subjectivity, to be able to make oneself or one's own action something to speak *about*. Normally we are unaware about the precise meaning we give to the various expressions we use in daily speech. But we become aware of what we mean and how we see things when we meet conflicting tendencies (different ways of seeing "the same thing"). Mead claimed that experience becomes "aware" in the act of searching for a new way of seeing. Compared to Wittgenstein and Vygotsky, Mead does not focus on the use of expressions as verbal utterances, or how they are employed to "make sense" in specific contexts.

Almost a century has now passed since these ideas were first written. And the ideas discussed here changed and developed already during the lifetime of their authors. The writings must therefore be read and understood as a part of an ongoing dialogue situated in another time. The texts were written in different languages, and more importantly in very different contexts from where they are used here, to support and inspire some of the conclusions in this work. The intention in this section is certainly not an attempt to reach a historically accurate interpretation of a particular notion, nor to provide a comprehensive synthesis of the ideas of these thinkers. Rather it is here attempted to use some of their basic ideas in a new context, examining the significance for certain pedagogical situations, and to better understand the epistemological role of language use in learning.

Mead (1934, 1938) and Vygotsky (1986, 1987) had many similar ideas about reflection, consciousness, and its dynamic interrelationship with the social situation and use of language (Biesta, 1998). It is unclear whether Vygotsky actually was influenced by Mead, whom he never directly referred to in any of his writings. He might have known English (since he referred to writings by other American pragmatists, such as James and Dewey), in addition to German, French and the classical languages Latin, Greek and Hebrew (Kozulin, 1986; Strandberg, 2006).

Nevertheless, there is no doubt that both Mead and Vygotsky developed remarkably similar ideas (see for instance Kozulin, 1986; Valsiner & van der Veer, 2005; Edwards, 2007). It is interesting to note that they shared some sources of inspiration, among others in William James (with the classical description of the stream of thought as ongoing action), and the Gestalt theorists, both sources being important to Wittgenstein as well.

Expressivism

To some extent Vygotsky and the later Wittgenstein shared a similar view of language. This can be seen as an *expressive* conception of language, where language meaning and the function of language use is constituted in the activity of expressing.

The relations between the world, language, and mind have been discussed by philosophers since the time of Plato and Heracleitos. Ramírez (2002a) identifies two alternative thought traditions historically, with incompatible conceptions of language. In one of these conceptions, traceable back to Plato, language is viewed as the “naming” of objects that pre-exist within a given, ideal world. The function of language is instrumental, and language describes the world “as it is”, through well formulated sentences and unambiguous words. Here the noun is the central category (Ramírez, 2002a). The other conception of language, which is an *activity-oriented conception*, can notionally be traced to Heracleitos’ conception of the world and language as changing processes: activity. Wertsch (2000) refers to this way of seeing language as *expressivism*. Language is considered to be contextual and varying, rather than universal, ideal or absolute. Verbal expression is seen as ambiguous, open to interpretation, and used by individuals in the creation of meaning in expressing something

Speaking of “activity” as a basic category of language can be problematic. Ramírez (2002b) points out how central the ontological category of object-thing is in Western thought. An activity is difficult to think about without an active subject existing before the activity, initiating it. Immobility is seen as ground for movement, while the

subject may be considered the basis for activity. In certain languages, syntactical structures may even be forcing us to speak from an ontological perspective, where the noun and not the process is in the centre (Ramírez, 2002a). This way of seeing the world and language is encoded in the traditional analysis of many Western languages (such as English and Swedish), where the noun is used as the basic category. Such basic habits of thought might partly explain why Newtonian mechanics are considered difficult and anti-intuitive by learners. In Newtonian mechanics, movement doesn't need to be "explained" by a subject initiating activity (ibid.).

Wittgenstein's view of language use

The ideas of Wittgenstein are complex and have certainly been interpreted in many different directions, some of them conflicting (Anderberg, 1999). The direction presented here is related to the expressive view of language and to the aim of this thesis, building on what has been called the *Gestalt* dimension of Wittgenstein's ideas (Baker & Hacker, 1980).

Wittgenstein was initially a philosopher of language use (Kopytko, 2007). In his early work, *Tractatus logico-philosophicus* (Wittgenstein, 1961) first published in 1921, he described language as a "calculus", picturing the world according to explicit and systematic rules. Nouns were seen as mirroring corresponding objects, with absolute and logical meaning. He later abandoned this early idea of language, and replaced it with the idea of language as activity. In his later works, such as *Philosophical Investigations*, first published in 1953, language meaning is seen as constituted in its actual use, and not formulated beforehand or generalised (cf. Wittgenstein, 1953). His idea of "language-game" points at a view of language as dynamic, creative, ambiguous and open. Basically the aim of his later writings was to investigate the consequences of a different way of seeing language in solving philosophical problems.

Wittgenstein draws no conclusions based on his assumptions, and he does not bring forward any hypotheses relating to these ideas. The text of *Philosophical Investigations* is very concretely written in a sparse and simple style. Sometimes Wittgenstein uses the dialogue form, with questions and answers. The ideas that lie “between the lines”, and which are not explicitly stated, thereby gain special importance, and tend to make the text open to different possibilities of interpretation. In the first chapter of *Philosophical investigations* (Wittgenstein, 1953) Augustine’s⁸ picture of language is introduced. Wittgenstein believes that this picture lies behind many misconceptions about the function of language (Baker & Hacker, 1980).

*The view of language that Wittgenstein abandoned,
language as a system*

Within an Augustinian conception, the essence of language is the same as the essence of the world, and language is seen as a picture of the world. According to Augustine, the two fundamental functions of language are *naming* and *describing*. Every word has a meaning: the object for which a word stands. Ostensive definition (pointing at the object) is the fundamental way to explain the meaning of a word. Ostensive definition is the link between language and the world. With an Augustinian conception of language, to “mean” something with a word is to intend it to be understood in a certain way, which in turn depends on to what object it should be connected. It follows that there are correct and incorrect ways to use an expression. Understanding is seen as a form of “mental pointing” at the object spoken about. Teaching and learning language will consequently be seen as a matter of establishing correct relations between things and

⁸ Augustine was a Latin speaking philosopher and theologian living AD 354-430, and one of the most important figures in the development of Christianity (Russell, 1985)

words. The fundamental form of teaching is to point out objects and give them their proper names. Communication is seen as successful when both hearer and speaker pair the same words to the same things (Baker & Hacker, 1980).

The Augustinian picture was used by Wittgenstein to describe language as a system and calculus. He found it to be very important, since it contained one of the basic assumptions of philosophy of meaning at that time. Everyday understanding of language and meaning also run very much along the lines of an Augustinian conception (ibid.).

When they spoke about their own language use, some of the children in the empirical investigations of the present thesis expressed traces of a “pictorial” way of conceiving language meaning, similar to the views outlined above. For instance, Anton (age 10) states that a word “means what it is”, and that *gravity* means gravity (arts. III and IV). Anderberg (1999) shows in a theoretical overview about language meaning, that the assumption about “fixed” meaning is very dominant in philosophy historically.

Linell (2009) claims that the dominant perspective in traditional linguistics, is a systematic view of language as a code of expressions with fixed meanings. This view of language is strongly influenced by “the written language bias” (Linell, 2005). He believes that experiences from how written language functions and is structured constitute the base for theories about language in general. Viewing language like this would in the “broken triangle” (presented above) be represented with an unbroken line between object and expression, symbolising a direct relation between objects and their names.

The later Wittgenstein - language meaning can only be understood in its actual use

The ideas of the later Wittgenstein are quite different from the Augustinian reasoning above. The change in his thinking sometimes referred to as the pragmatism (Anderberg, 1999) or linguistic turn (Rorty, 1992). Towards 1940, Wittgenstein starts to focus on

concrete, everyday situations rather than seeing language function in an abstract system. Since the research interest of the present thesis concerns the function of language in use, rather than language systems, the thesis will draw on Wittgenstein's ideas after the linguistic turn for the theoretical base.

Wittgenstein described his new view on language meaning in his later writings, mainly *Philosophical Investigations* (1953), where he started out making a parody of the Augustinian view. Wittgenstein changed his ideas after having left philosophy for about a decade (1920-1930), spending these years living "in the world". During this period, he worked in different trades, among others as a school teacher. He now saw that his earlier thinking consisted of, "grave mistakes" (Wittgenstein, 1953, p.x), as he puts it himself. He started to criticise the basis for the logical-philosophical idea of a common logical form for language, thinking, and the world (von Wright, 1971).

One of the tasks of *Philosophical Investigations* was to show how Augustine's picture of language leads to errors and confusion. Wittgenstein's new discovery takes its starting point in how language is actually used. He observes that words don't refer to something fixed and unchangeable, but rather that the meanings of words are their function in every language situation. The use is intentional – having an internal relation to understanding the world. Since there is not a limit to what words may mean in use, the consequences for propositional logic are considerable (Wittgenstein, 1953).

Investigating the function of expressions in language games

But how then is it possible to understand or "mean" something with an expression, if its meaning is decided by its use in specific situations? Wittgenstein's answer is to investigate how words are actually used in different contexts. The function of language use cannot be understood beforehand, through order, rationality and clarity, says Wittgenstein (1953). The most important aspects of language are not visible to us, because of its simplicity and

commonality. Since we live inside language, it's impossible to see it from any other perspective.

Unlike his earlier conception of language as a generalised system, not considering human activity, the later Wittgenstein now argues that humans and human activity are a precondition for language. To imagine language is to imagine a form of life or action. In order to explain how it is possible for people to understand each other and speak meaningfully, the existence of forms of life cannot be questioned (Wittgenstein, 1953).

Human language, according to Wittgenstein, is something so complex and ambiguous, that instead of trying to extract what is general and systematic about it, he gives concrete examples of how language is used in different situations (Wittgenstein, 1953). He names his investigations "Sprachspiele" language-games. The notion of language-*game* "...is meant to bring into prominence the fact that speaking of language is part of an activity, or a form of life." (p.11e) Language-games are based on praxis following rules that have no rational basis, but rest on what is taken for granted and could not be formulated. The different kinds of language games are uncountable and changing. New language games appear and others disappear:

...-There are countless kinds: countless different kinds of use of what we call "symbols", "words", "sentences". And this multiplicity is not something fixed, given once and for all; but new types of language, new language-games, as we may say, come into existence, and others become obsolete and forgotten. (§23, p.11e)

The rules he talks about cannot be systematised, but must become known in the actual use of language. However, knowing what language-game a word belongs to is not enough, in order to know what the word means. Like just knowing in what tool-box it belongs, does not tell us how the word can be used. The only way to get to know the function of a word is to learn to practice it. Expressions

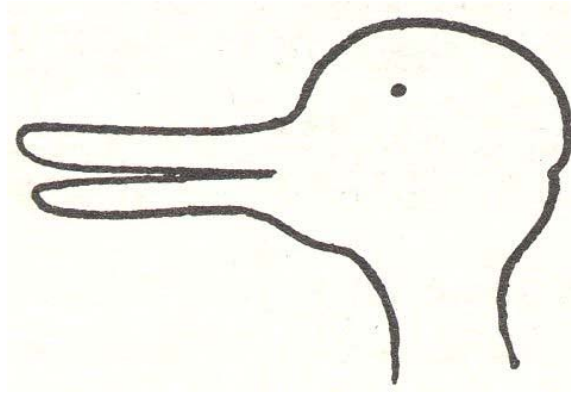
should, according to Wittgenstein, be seen as tools to investigate conceptual or philosophical problems.

Wittgenstein (1953) uses the analogy of tools concerning words and sentences to point at the different functions they may have. The function of a word stands for what role it plays in a particular language-game, or in what way it is woven into activity (Baker & Hacker, 1980). Words may have the same form, but perform very different functions. It is the use of a word – not its form - that must be grasped, in order to understand the meaning.

Think of the tools in a tool-box: there is a hammer, pliers, a saw, a screw-driver, a rule, a glue-pot, glue, nails and screws. –The functions of words are as diverse as the functions of these objects. (And in both cases there are similarities). (p. 6e)

Wittgenstein connects playing and learning, saying that playing with the function of expressions is the only way to learn how to use specific expressions. The rules of a language-game cannot be formulated, but appear in playing. Therefore the rules are learnt in playing language-games, and when the child reflects over the activity of playing (Anderberg, 1999). Language-games are a way to investigate the meaning of expressions and learning to cope with the world. Meanings associated with particular words are not previously established, but instead actively created and verbalised.

Seeing-as: different ways to approach aspects of the world



(Wittgenstein, 1953, p.194)

Wittgenstein (1953) discussed what it means to understand something in different ways, using the metaphor of seeing. A way of seeing has to do with the aspects of a phenomenon that appear obvious to us. Seeing is not “interpretation” (an actively produced reflection of something), but an expression of a visual experience (or other sensuous experiences). Wittgenstein distinguishes between the continuous seeing of an aspect, and the “dawning” of an aspect. The latter was illustrated with the famous picture of the “duckrabbit”, which could be seen as either a duck or a rabbit, depending on what aspects of the picture are focused. A person might see the picture as a duck, but being advised of the possibility to see a rabbit, aspects of the rabbit might dawn on her/him. The person becomes aware of the possibility to see the same picture differently, and is able to change ways of seeing, although the lines in the picture stay the same. The dawning of a new way of seeing may cause perplexity. To be able to distinguish something in a certain way, for instance the “duckrabbit” as a duck or as a rabbit, presupposes experience of the phenomena called “duck” or “rabbit”. What the experiencing person sees first is probably the phenomenon s/he is most used to. What the seer distinguishes are not qualities in the experienced phenomenon itself. Rather, the seer organises perception into what is seen in the

foreground, and what becomes the background, as well as deciding how it relates to other phenomena.

Wittgenstein describes seeing something differently as a “grammatical movement”, the discovery of a new way of looking (cf. “view-turn”, Ahlberg, 2006). To do, so the seer must be able to imagine that there are other possibilities than the one at hand, and should be freed from what is taken for granted. Aspect-blindness is the opposite. It occurs when a person is incapable of seeing different ways of seeing. Learning comes to an end when a problem or an object cannot be seen differently.

Wittgenstein speaks of understanding as the implicit knowledge of the “meaning-rules” of language, which for him means the ability to do something with language. However the agreements about meaning are often tacit, vague and taken for granted. “Awareness” is to Wittgenstein what can be expressed in a meaningful way, something that can *both be said and thought* (1953). This sounds like a simple and obvious notion, but is more complex than it seems. For one, it implies that there is no identity between speaking and thinking. It also follows that there are things that can be said but not thought, like when Kristoffer (age 14) in one of the conversations in the empirical material says that he doesn’t know the meaning of *energy*, but says he still uses the word because he has to in science class.

Wittgenstein’s notion of awareness additionally suggests that there are things that can be experienced, but not (yet) verbalised. The activity of verbalising, expressing, is thus both an activity directed towards another person, and the creation of “awareness”, in the sense of listening to one’s own talk.

Vygotsky’s view of language use

Vygotsky’s thinking originated in the scientific discussions of the 1920s and 1930s, but his ideas were not known in the West until the

1960s, when the first English translations of his Russian texts became public (Kozulin, 1986, 1995). From the 1980s and on, he has had profound influence on both Russian and Western psychology and education (Kozulin, 1995). Vygotsky was contemporary with Wittgenstein (ten years younger), but died already in 1934 at the age of 37, leaving behind a large amount of unpublished manuscripts and other writings. But for political and ideological reasons, his texts were banned in the Soviet Union, and were not published until the 1950s.

Vygotsky's writings are rich in words and metaphors. Ideas are born and developed, reflected on, leading to new ideas. Themes appear and reappear from new perspectives. Vygotsky tries out different lines of thought, sometimes contradicting himself, developing his notions in a stream of thinking. Expressions used in previous texts gain new meanings, or meanings are progressively deepened as they are used in his texts. His multi-faceted writings clearly offer many possibilities for interpretation. Further problems of interpretation arise due to differences between Russian and English. The translations of Vygotsky's work have not always been close to his intentions (Veresov, 2005). The theories and notions that Vygotsky used have been much discussed and interpreted in many disparate directions, different researchers and schools focusing and developing various aspects of his ideas (for some angles on Vygotsky's thought see Kozulin, 1995; Veresov, 2005; Wertsch, 2008). Such discussions, while interesting in themselves, will not be further pursued here, since it is beyond the scope of this work.

Myshlenie I Rech' (1934), was translated as *Thought and Language* in 1962. A more accurate translation of the Russian title would be *Thinking and Speech*⁹, since Vygotsky referred to the ongoing

⁹ *Thinking and speech* was also the English title of Vygotsky's book when it was re-translated in 1987.

activity of thinking and speaking (Wertsch, 2008). He explored many aspects of language use, both in social interaction and the function of language use in thinking. Much of his research concerned children's intentional meanings. His main focus in the last chapter of the book was how thinking is embodied in speaking, and about the act of creating meaning with words.

Vygotsky made a distinction between language and speech, and referred to *language* as a system, while *speech* was linked to the activity, the moment of expressing, and to the creation of meaning. He mainly focused speech as an activity. Vygotsky rejected Cartesian and Augustinian dualism, in favour of Spinoza and Hegel, seeing mental and material phenomena as aspects of the same whole (Kozulin, 1986). He always put different aspects of a phenomenon at play in his texts, investigating the "living relation" between them. The different aspects of the phenomenon investigated are neither separate nor identical, but complementary elements of what he termed a "unity" (see Zinhenko, 2007, for a discussion on Vygotsky's view of the unity of thinking and speech). The relation between two aspects is to Vygotsky an activity, just as he sees the generalisation of concepts as an activity of thinking (1986).

Investigating how expressions and symbols are given meanings in activity

Vygotsky (1986) investigated the relation between speech and thinking through experiments, where children were stimulated to use language in creating meaning about objects. What he saw as a major result of the study was that what he termed "word meanings" (that is, the meanings associated with a particular word) are dynamic and changing. This is essentially the same result as Wittgenstein found in his more theoretical/ philosophical investigations.

Word meanings are dynamic rather than static formations. They change as the child develops; they change also with the various ways in which thought functions. (Vygotsky, 1986, p. 217)

To study the role of word meaning in verbal thought, Vygotsky considered it necessary to investigate the activity of creation of meaning in experiments with children, including both objects and signs. One of the ways the children constitute relations he calls “thinking in complexes”, adding that the mechanism of thinking in complexes is behind the development of language, and that thinking by means of complexes is widespread not only among children, but adults as well (Vygotsky, 1986).

Making sense of the world and testing meanings in play

Vygotsky (1933) wrote that in play, children develop a unique form of consciousness of meaning, creating imaginary worlds and roles to explore what something may mean. To use signs implies understanding something *through something else*: a stick may be a horse, a blanket a boat. Children’s symbolic play concerns the interplay between symbols and meanings. In play, children test how symbols can be used. Play is a form of activity where the meaning is separated from a particular association with certain objects. In this activity, meaning dominates over objects, in the sense that they can mean many things: a chair may in play be given the meaning of a house, a horse or a motorbike. Children are here the agents of meaning, trying to understand the world. The child needs tools to create an imaginary world, like the chair from the example before. Vygotsky (1933) called such a tool *pivot*, and claimed that the pivot helped children enter the imaginary world. The pivot must be functional for the specific game: a stick might do for a horse but a blanket wouldn’t work. It is possible to make a comparison with the use of expressions here: even though the relation between a certain expression and the meanings it can be given is open and dynamic, there are limits to what words may mean. The object is given a functional role tied to the specific game, but word meaning is not mechanically determined and fixed by the situation. To accept that a pivot or an expression can be “something else” than it seems, is the basis for symbolic thinking, and learning to use language (Strandberg, 2006).

Learning to use language to develop understanding

Vygotsky (1986) also discussed the interaction between spontaneous and reflected concepts¹⁰. When children express spontaneous concepts, they are not initially conscious of the functions of the expressions, but these relations are established in direct activities. An example from the empirical material of the present thesis could be that many children speak about the moon as *floating* or *hovering* in space, drawing the conclusion that it must be “held” or float in some kind of substance different from air, in order not to fall (conceptions that are consistent with their experiences). Spontaneous concepts, according to Vygotsky, are not reflected upon, and are instead drawn from children’s real (bodily) experiences with objects in the world. The children are normally not conscious of how they think in those cases. When they learn to use their own expressions it will help them to see the content differently (and realise that it is possible to see it in many ways). Learning of new ways of seeing is impossible and theoretically unfruitful, when children are given scientific terms with already established meanings (Vygotsky, 1986).

Like Wittgenstein, Vygotsky argues that it is impossible to verbally explain what expressions mean, and maintains that learning to use language involves playing with its functions, and reflecting on meanings in activity. Children have problems to develop scientific meanings without tension and activity. The new concepts (ways of experiencing) must be developed and created actively, as the child reflects over the activity. Vygotsky’s examples of contexts where children are expected to learn to use scientific concepts are taken from learning foreign languages, learning to read and write, or

¹⁰ The notion “concept” in the English translation of Vygotsky (Vygotsky, 1986) is in fact more in line with the phenomenographic use of the term “conception”, since it is something that is actively created, rather than a ready concept in a conceptual system.

studying algebra. Vygotsky observes that reflecting over his/her own language use allows the child to learn the function of the scientific terms. When children's experiences meet scientific terms which have been given specific and socially agreed fixed meanings, the children learn to see the world in a different way. However, in the case discussed by Vygotsky (1986), the successful meeting between the child's own experience and scientific concepts requires an active and creative elaboration of concepts.

Awareness of the ambiguity of word meanings

Vygotsky distinguishes the "sense" of a word from its "meaning"¹¹. Sense is to Vygotsky a notion that lies close to what is seen in the intentional-expressive approach as the individual intentional meaning of an expression. He describes sense as "...the sum of all the psychological events aroused in our consciousness by the word. It is a dynamic, fluid, complex whole, which has several zones of unequal stability." (pp. 244-245). The "meaning" of a word is, according to Vygotsky, only one of these zones: the socially agreed meaning of an expression in a certain context. "Meaning" is in other words one of the possibilities of "sense": the socialised discourse, realised in the living speech (Vygotsky, 1986). Veresov (2004) has argued that the same distinction is made by Vygotsky (1934), describing children's role play as movement between the field of "sense" (which is the intentional meaning of something) and the field of "meaning" (the socially agreed meaning) So in the case of the chair, which is used as an example by Vygotsky, the "meaning" is a piece of furniture to sit on, and the "sense" (from the child's point of view) is horse, motorbike or house. According to Vygotsky (Veresov, 2004), a

¹¹ Vygotsky uses "meaning" in at least two different ways: mostly for intentional "word meaning" (here "sense"), but in this specific part of his reasoning the term is employed to signify socially agreed word meaning, for instance, the meaning of scientific terms.

contradiction occurs when the child understands that objects in play can be symbols for many meanings, and that there is a tension between the “meaning” and “sense” of the symbols, just as in the language situation, described earlier as tension between everyday conceptions and scientific conceptions .

A relational conception of learning

According to John-Steiner (2007), Vygotsky distinguishes between communicative language, and language used for conceptualisation. He describes two different aspects of language: the function of understanding, and the function of communication, translated as “inner dialogue” and “outer dialogue”¹². Outer dialogue refers to the collective and social aspect of language used in interplay between individuals, while the inner dialogue involves the interplay between the individual “sense”, and language expressing something verbally. “Word meaning” is created in dialogue, and progressively developed and changed in the dialectic process involving thinking and speech (Vygotsky, 1986). The relation between thought and word is described as an ongoing activity. Vygotsky writes that thought is completed in the word. However, “completed” should not be seen as something finished and static but as an ongoing process, like a braid or weave. Thought is woven into the word.

Vygotsky sees learning in terms of the interplay which occurs, as the individual develops ways to use language for seeing something in new ways, and understands it through expressing thoughts verbally. But the learning activity is at the same time situated in an interaction with another (or others). Vygotsky (1986) mentions consciousness or awareness as an important aspect of learning to use language. It is a deliberate activity of consciousness-raising. To become consciously

¹² The notions “inner” and “outer” point to a dualistic conception of consciousness which Vygotsky was critical to, and should not be interpreted this way. Better words would maybe be “silent” and “spoken”.

aware of something means that the object of awareness is differentiated from consciousness in general. Becoming consciously aware can also be seen as generalisation, or delimitation, turning the content of thought into “something” that can be spoken about.

To become consciously aware of an operation, it must be transferred from the plane of action to the plane of language; it must be recreated in imagination such that it can be expressed in words. (Vygotsky, 1986, p. 183)

Mead’s view on activity and awareness

Like Wittgenstein and Vygotsky, Mead’s writings have been interpreted in a number of ways (see for instance Gillespie, 2005; Biesta, 1998). Mead was several generations older than the two thinkers we have discussed so far. He was born in 1863, and his most important writings were written between 1900 and 1929 (Biesta, 1998). In principle, Mead could have been a source of inspiration for both Wittgenstein and Vygotsky, but in fact it is unlikely that either of them was familiar with his ideas. One of the reasons is that Mead never published a book during his lifetime. Instead he spread his ideas in lectures and articles. After his death, lecture notes by his students and unpublished papers were collected and published. As a result, his writings were often interpreted and coloured by the ideas of the editors (Biesta, 1998).

Here, I will focus on some of the basic ideas elaborated by Mead, especially concerning how he saw awareness and the intersubjectivity of language. Mead did not construe “awareness” as an inherent psychological quality, but rather as a phase within a temporal act, which is in line with how the notion of awareness is used in article II.

Like Vygotsky and Wittgenstein, Mead developed a relational view on interaction, that is, to understand interaction, he believed that relations between the parts should be studied. For him, the very

activity going on was the main focus (Mead, 1938). Mead shared with Dewey, as well as the other pragmatists, this point of departure in the actual activity. Just like Vygotsky and Wittgenstein, he reacted against the consciousness-centred understanding of subjectivity that dominated psychology at the time (Biesta, 1998). Emphasizing complex activity led Mead to investigate and develop theories about the relationships and interplay as parts of dynamic social interaction. In his view, the activity of an individual cannot be understood apart from the situation it occurs in.

To Mead, the act (activity) was central, and especially the social act (Gillespie, 2005). It was from the standpoint of the social act that it became possible to assume the attitude of others, and also for symbols to become significant.

It is through the ability to be the other at the same time that he is himself that the symbol becomes significant. (Mead, 1922, p.161).

Like Vygotsky, Mead discussed the notion of “awareness” as a form of differentiating, turning the content of thought into an “object”, something possible to picture and speak about. To become aware of oneself requires a change of seeing, to be able to see oneself both as “I” and “me”.

...; for in order to become aware of himself as such he must, to repeat, become an object to himself, or enter his own experience as an object, and only by social means – only by taking the attitude of others toward himself – is he able to become an object to himself. (Mead, 1934, p. 226)

Mead saw reality as “a field of situations”, while the act was viewed as the relation between an individual and his environment. Through the act, the relation between the individual and the world is defined and developed. This relational way of explaining experience as what Svensson (1997) has called an “internal relationship” constituted between an individual and a phenomenon, is also fundamental in

phenomenography. Social acts involve others, and the social act is a dynamic whole, where the individual is situated and where individual acts are given meaning. Mead thought, like Wittgenstein, that language must be understood in the specific situation at hand, adding that the situation is inter-subjective, and that expressing something presupposes at least two persons.

Conflicting tendencies

Mead holds that a person actively orients towards a part of the environment, and that the meaning¹³ is created in that relation (Biesta, 1998). “Meaning” is to Mead not something in the object itself, but resides in our reaction, our “attitude” to it. As long as action with respect to “objects” is not interrupted, we will not be aware of the meaning we give to these objects. Like Dewey (1910), Mead claims that reflection, leading to change in the attitude to something, starts with the presence of a conflict between different lines of activity, and is concerned with the solving of a problem. In the phase of the act when a subject is no longer satisfied with the meaning connected to the attitude he/she has towards something, s/he becomes “aware”, in search of new meanings.

New and different meanings lie in different tendencies to act (which is a temporal whole of the individual approaching the world). To illustrate my understanding of Mead on how awareness arises in the act of searching for new meanings, I will use an example from one of the dialogues (see p.10 article III). Here Agnes (age 10) explains her conception of why the moon does not fall down onto the earth. The problem in this example is the movement of the moon, and she tests different meanings in her explanation. At first she says that the moon

¹³ Mead here uses the notion “meaning” in a broader sense than the meaning associated with a particular word or expression. Instead, he is talking about a certain way of approaching aspects of the world, comparable to the content of a conception in phenomenography.

is “stuck in space”. In the dialogue she experiences a problem with the conception of the moon as “stuck” and changes to use the expression ‘hovering’ instead. However, she is not satisfied with this either. Again she tries different expressions, “moving” and “around earth”, so far expressing the movement of the moon with four different expressions. A bit later in the dialogue she uses yet another expression, the word “spinning” around earth which she says she prefers, because it works with the way she conceptualises the movement of the moon. Drawing on Mead (1912), (Cronk, 2005) we could say that in this sequence she becomes “aware” in the act of searching for new expressions and experiencing different possible meanings in relation to different ways to conceptualise the movement of the moon. Mead (1934) thinks that tendencies to express different meanings create awareness of possible meanings. He also considers that it is in the moment that something is expressed, addressed to another, that what is said is embodied - in other words that it does not exist beforehand. What is expressed cannot be generalised, but belongs to that specific moment (cf. *the immediate context*, Svensson et al. 2009). Awareness of different meanings makes it possible to compare and select the expressions that are meaningful, as in Agnes’ case. Mead also claims that a problem can be consciously solved only when we turn our attention to different tendencies to act (different conceptions).

Consciousness of meaning

To Mead, the notion of “meaning” refers to how a person approaches a specific object, her/his attitude towards it. “Consciousness of meaning” implies the ability to make a distinction between “the thing” and what “it means”. As an example of this distinction, we can use the child playing with a stick, being aware of the stick as a thing (stick) on the one hand, and on the other, seeing the object as whatever meaning it is given in the child’s play: horse, motorbike, sword etc. This is not saying that the “thing” would be something universally determined as such in an objective sense, since also “being a stick” is a meaning attributed to the object. The important point is awareness that there might be different ways to approach an

object and that the thing has become a symbol. Mead (1934) emphasizes the inter-subjective aspects of playing and how it leads to awareness of the self. To Mead, *play* is, besides *game* and *language*, social interactions taking place via shared symbols. In language, these symbols are expressions, but in play they also consist of roles or objects used as symbols. In play, the child can take the role of another and act *as though* she *were* the other. The child becomes conscious of himself taking the attitude of the other in play. The idea of oneself as an object arises out of experiences of “being as if another”.

The ability to make the distinction between a thing and what it means can also apply to language use, as a child distinguishes the sound or written form of an utterance from the meaning that is given that expression. But the meaning of a word is not always obvious to the speaker. When the act becomes habitual, the response is automatic, and consciousness does not arise. Mead separates immediate response from reflected response. When a response is immediate, the agent her/himself is not able to make the distinction between the thing and what it means, (cf. Merleau Ponty, 1973, art II). Awareness only appears as the agent is able to direct attention to his/her own attitude.

Mead's language view

To Mead, language is communication through significant symbols. We understand each other as we give the symbols the same function. A significant symbol is a (usually vocal) gesture that calls out the same response in the other as it was intended (Cronk, 2010). According to Gillespie (2005), Mead does not mean that the sign must have the same meaning for those interacting, but that persons communicating can assume both their own attitude and the attitude of the other. This involves considering more than one meaning:

It is through the ability to be the other at the same time that he is himself that the symbol becomes significant. (Mead, 1922, p.161).

What must be in common to constitute communication is the object that speaking is about.

Theoretical themes

Ambiguity of language meaning

With a starting point in the dynamic situation of speaking and interacting, Wittgenstein, Vygotsky and Mead all attempt to describe or show aspects of the situation, while investigating diverse relations within it. Vygotsky and Wittgenstein observed and described the complexity and dynamics of language in use. All three thinkers presented new perspectives which contrasted with the contemporary ideas about language and thinking, insisting that language can be understood only if seen as ongoing human activity (Wertsch, 2008). Meaning is not a pre-defined essence inherently bound to objects or expressions, but is instead viewed as something open and actively created in speaking.

Wittgenstein's discovery took its starting point in how language is actually used. His conclusion was that the relationship between language and thought could not be formulated on a general level, but only experienced in its use. Wittgenstein felt that his discovery was overwhelming. The consequences are that there is no limit to what words might mean – a conclusion that has great implications for logic (Wittgenstein, 1953). Wittgenstein attempted to show that in order to be understood, language must have a certain dynamic and contextual character. Meaning is actively created and “internally” related to how understanding develops.

The function of expressions

The function of words and their place as tools for human interaction is a topic for the three theorists. The tool function of language supposes a functional aspect, in other words, that language *does* something. The function of something (be it an expression, or an object in play) is what makes it meaningful in a certain situation.

Vygotsky describes human language as the functional use of signs; language is the tool for thinking. He also describes how children use concepts as tools, and that the functions of these tools change as the meaning of the concepts changes. The tool and the result come to existence together.

The meaning of words is contextual, and inseparably connected with life and the creation of a common world, for Wittgenstein. The meaningful word constitutes a living unity of sound and meaning, with an “outer” side as the sign/expression, and an “inner” side as the intentional meaning (Vygotsky). Language is like a living organism that dies if separated. The meaningful word is an activity of language. The signs would be without life without the organic process of understanding (Wittgenstein). The three thinkers share a view of learning, where knowledge is not localised in the individual, but seen as part of a creative and dynamic constitution, in which language plays an important role.

Vygotsky (1933), Mead (1934) and Wittgenstein (1953) all discuss play as a method to investigate the relation between signs, roles, and the meanings given to them by the players. They understood play as an activity with certain characteristics related to understanding. While Wittgenstein spoke of games and play in a metaphorical sense, Vygotsky (1934) was more specific, going into how children use symbols in play.

Awareness of language use

One of the conditions required to see the complexity of language in use is awareness of one’s own use of language. This occurred to Wittgenstein himself, as he realised that language in everyday life was something completely different than in his earlier description of language as a logical abstract system. Vygotsky described how awareness is created in the paradox, when something unexpected is experienced.

This interpretation of Vygotsky’s zone of proximal development appears more in line with his intentions and use of terms in Russian,

according to one of the specialists on his work, Veresov (2004). Vygotsky uses examples from the stage, and refers to the experience of a contradiction or paradox in this context. An emotionally experienced drama brings change in the thinking of the child, s/he becomes different. Change in a relation between the learner and the world is, in other words, caused by a dramatic event. Vygotsky's reasoning on this point is close to the intentional-expressive approach: learning involves a change in the relation between expressions and what is meant by these expressions, as well as in how they relate to the content of the learner's conception. Here, Vygotsky maintains that learning involves seeing differently, as two aspects meet. A relation to the social surrounding by the child is a certain form of attitude, actively approaching reality, and interacting with the social surrounding (Veresov, 2004). What is expressed is already a generalisation, an act of thinking. Learning involves the ability to create individual sense of phenomena, through the use of language. In turn, using language requires awareness of how individual meanings are given to specific expressions. When meanings are given to particular words, delimitation is made. This, in turn, opens the possibility for testing. It becomes possible to test and try out different meanings – elaborate with different ways of understanding.

Wittgenstein, Mead and Vygotsky seen in the light of an intentional-expressive approach

Using dynamic metaphors, such as floating, living organism, processes, change, games and play¹⁴ Wittgenstein, Vygotsky and Mead expressed a view of language and interaction as activity.

¹⁴ For a discussion about Vygotsky's metaphors, see John-Steiner (2007).

Individuals approach the world and each other using language. Sense is something actively and intentionally created, and not given by the inherent meaning of objects, which are simply pointed at with words. Sense-making is situated in time and place, and the meaning associated with specific words or expressions can only be understood in the ongoing activity itself.

All three thinkers discussed here have been interested in interaction – starting in a concrete, complex situation, where the situation is viewed as a whole. With a holistic approach, investigating and understanding complex relations (how different aspects of a situation interact) was the aim for all three. However, they focused on different relations within the situation of interaction with language, and used quite different vocabulary to discuss their ideas. Wittgenstein’s main concern was how expressions are related to meanings and understanding. Vygotsky focused how thinking and speaking are connected, “plaited” into each other, investigating the very activity of expressing something. Finally, Mead examined language in the inter-subjective relation, seeing awareness as a function of reflection, which starts in the relation to the other.

How would their different focuses look in the light of the broken triangle? This triangle is used within the intentional-expressive approach to illustrate the interplay of aspects of sense-making activity (see p. 33).



Starting out with Wittgenstein, the triangle can be said to exemplify a language-game. As object spoken about, we use the picture of the “duckrabbit” from p. 46, above. The “conception” corresponds to what Wittgenstein would call “seeing as”. Vygotsky would call a similar notion “thinking” or “inner language”, while Mead would speak of “attitude”. Let’s say in this case that the person experiencing the picture sees it as a rabbit. In the top of the triangle is an expression used to express something about the object, using in this example the verbal expression “rabbit”. The “intended meaning” is what the speaker means with the word rabbit (e.g. small mammal with large ears), expressing her conception, which is the way s/he understands the phenomenon “rabbit” in a broader sense, including experiences of rabbits. Finally, expressing is both about the object (“duckrabbit”) and directed to another person, for instance as a response to the question “What is that?” or “How do you mean?”

Wittgenstein often starts his investigations from particular expressions, to explore how they were used to mean something in different situations. As a result of his investigations, he became aware of the gap between the object (a part of the world) and use of language. If he formerly saw the relation as closed and unambiguous (as in Augustine’s picture of language), he afterwards came to see its open and ambiguous character. There is no simple relation between expressions and objects in the world, and words may mean anything, he maintains.

If this was an overwhelming insight for Wittgenstein, Vygotsky, on the other hand, was not worried about the open and dynamic character of language. He saw it as a condition for learning, rather than a philosophical problem. Vygotsky discussed many aspects of language use, often related to learning, but the aspect focused here is how he saw the *activity* of expressing something. In the broken triangle, this can be visualised as a movement from an implicit conception of something, gradually conceptualised, given sense, and then expressed with a word. “Word meaning” (i.e. the meaning associated with a particular word) he saw as something “between” thinking and speaking, similar to the “intentional meaning” in the

figure above, which expresses the conception, and which has a part/whole relation to it. The movement goes back and forth in the triangle, as expressions are given meaning, or as expressions are chosen to express something.

Mead was not explicit about the relation between conceptions, expressions and meanings in the way Wittgenstein was. Instead, Mead focused the inter-subjective situation of expressing, an aspect that lies in the context of the triangle, as a prerequisite for expressing. He discussed change of meanings and attitudes, and reasoned about awareness. Mead did not understand awareness as an inherent quality, but as a phase within a temporal act, constituted in the situation. Awareness of something is a way to approach it through language. To be aware of the expressing activity requires an inter-subjective situation, where attitudes may come to expression.

3 Method

Data Collection

Data was collected in a dialogue structure, developed within the intentional-expressive approach (Anderberg, 1999, 2000, 2003). The questions of the dialogue structure were intended to make the children express their understanding of a problem, and then reflect on a number of key expressions they had used when speaking about their conception of the problem. Thus focus alternated throughout the dialogue, between the conception of a problem, and reflection on how the conceptions were expressed.

Participants

Dialogues were conducted with 18 six year olds (11 girls and 7 boys)¹⁵ from preschool classes, 22 ten year olds (13 girls and 9 boys) from 4th grade, and 25 fourteen year olds (11 girls and 14 boys) from 8th grade of Swedish compulsory school. The dialogues were conducted individually with the researcher, and lasted between 20 and 40 minutes each. The age groups were chosen with four years apart, to gain a developmental picture of how children in different age groups relate meaning to expressions, and understand themselves as language users. The participants of each age group came from two

¹⁵ Gender or any possible differences in language use due to gender were not considered or focused in the analysis. The only reason that it is mentioned is to show that the groups were not homogenous.

different classes: two preschool classes and two fourth grades, all at the same school, while the eight graders came from two other schools.

The recorded material was then transcribed verbatim, according to transcription level III (Linell, 1994), which is a thorough documentation of what was said, rather than a transcription in a linguistic sense. The dialogues were carried out and transcribed in Swedish, and the analysis was made on the Swedish transcripts. Examples from the empirical material used in the English texts were translated from Swedish to English by a translator familiar with the research aim. The translation of the dialogue excerpts aimed at reflecting the Swedish wording as faithfully as possible, rather than providing a more idiomatic English equivalent.

Ethical considerations

The ethical guidelines of the Swedish Research Council have been followed. The parents gave their written consent, allowing their child to participate in one-to one dialogue with a researcher, which was digitally recorded. The researcher presented herself to the classes involved and explained the aim of the dialogues. The children themselves were asked if they wanted to participate and also gave their consent. They were informed that participation was entirely voluntary, and if they chose to participate they could at any time interrupt the dialogue. The material was handled to maintain anonymity. All the children were given pseudonyms as the dialogues were transcribed, and only the age and gender of the child was recorded.

Dialogue structure

In the dialogue setting, the child was asked the two questions: *What happens when you throw a ball obliquely up in the air?* and *Why doesn't the moon fall down?* The problems were chosen to match previous investigations about the epistemological role of language, also focusing on physical motion (e.g. Svensson et al., 2009). The phenomena focused on additionally present the advantage of being

commonly experienced phenomena (the movement of a ball and the moon), which can be talked about in a number of ways. This choice therefore allowed comparisons between groups with more and less experience of a theoretical conception of the problem.

All dialogues followed the same basic structure: The two questions were presented to the child and s/he decided which one to start with. The dialogue started with one of the questions. The child was then invited to elaborate on her/his conception of the problem - that is, a possible way to understand the problem. Follow up questions were asked, and the child was requested to clarify details. To exemplify how a dialogue might look, a child might, for instance, have chosen to start to elaborate on why the moon doesn't fall down. The child says that the moon "floats" since there is no "air" in space (a common conception, known from research on alternative conceptions, e.g. Kavanagh & Snider, 2007). This is then seen as a conception of the problem, a possible explanation to why the moon appears to float. Expressions which—were central in the pupil's explanation/ description were then chosen by the interviewer, and focused in the following sequence of the dialogue, in order to stimulate reflection. Key expressions were in other words not chosen beforehand, but selected by the interviewer during the dialogue. Normally, content-words were selected which played important roles in the child's description/explanation of the problem. In the example above, expressions such as 'air' and 'float' would be selected. The child was invited to explore and identify what s/he meant with these expressions, and why that particular expression was used, rather than another.

The function of the expressions was explored, as the child was invited to look for synonyms, related expressions, and identify which meanings had been given to these words when speaking about the problem. The initial question was then repeated, to see how the conception had developed and to maintain the focus of the dialogue. Aronsson and Hundeide (2002) note that repeated questions may make the child to believe that the first answer was "wrong", and induce him/her to try a different answer, to satisfy the interviewer. In

the dialogue structure used here, the question was framed to make the child summarise what had presently been said – that is, find a way of expressing “the same thing”, rather than offering different answers. At the end of the dialogue, the children were given the opportunity to reflect on the dialogue situation as a whole. The aim of each dialogue was not to “uncover” conceptions in a phenomenographic sense, but to invite the child to speak about something specific, conceptualising it during the activity of the interplay of the dialogue. There was an element of change and development during the activity, as thinking about a problem was verbally expressed. Although the interviewer had a passive role in the interaction, not bringing in alternative ways of viewing the problem herself, some of the children¹⁶ spontaneously referred to the dialogue as a learning situation.

Data Analysis

Contextual analysis

The analysis was performed using qualitative *contextual analysis*, as described by Svensson (2005). The methodology is both analytic and contextual in a specific sense – involving the analytic delimitation of a phenomenon/ research object and its parts, as well as being “contextual” in delimiting how the parts depend on their contexts (Svensson & Dumas, 2010). The starting point of analysis was to delimit the object of research, as the children’s experience of the function of their own language use in expressing conceptions. The aim of the analysis concerned grouping similarities and differences of the interplay between conception, expressions and intended meanings.

¹⁶ See article IV for details.

The transcribed dialogues constituted the material for analysis. The analysis started with repeated readings of the transcribed material. In the first phase of the analysis, each dialogue transcript was dealt with as a whole - the global impression of each transcript was in focus. In the next phase of analysis, all the transcripts were divided in sequences, where the children reflected on selected expressions. The broken triangle (see pp.) was used as an analytical tool. *Expressions*, *intended meanings* (that is, what the child said s/he meant with a certain expression) and *conceptions* of the phenomenon talked about were delimited in the sequence (several meanings and conceptions could be expressed within the same sequence). The *expressions* were the verbal utterances which the children reflected over in the sequence, and *intended meanings*, what the children said they meant by certain expressions. The distinctions that they made concerning how they understood the problem, were delimited as *conceptions* (interpreted with the whole script as background). A conception was expressed, using intended meanings as tools. Finding out what a child means with a certain expression in a particular context is a way to come closer to what conception the child aimed at expressing. Conceptions were not categorised here, but simply seen as a part of the interplay of language in expressing content. The emphasis was on the child's reflection, concerning the function of expressions in the conceptions.

An analysis of the interplay in each sequence was then conducted. The child's activity during the reflective sequences was compared to other sequences and grouped, based on similarities and differences. Analyses were conducted, with different focus in each of the four studies (see articles I-IV). In study I, the analysis emphasized the relation between expressions and what the children said they meant with these expressions. The children's common use of the expressions 'air' and 'force of gravity' were selected for a closer analysis of the intended meanings of these expressions. In study II, the focus of analysis was how children in two age groups experienced their own language use and expressed awareness of it. The analysis of study III concerned the variation of ways of

approaching the situation, while study IV emphasized the ten and fourteen year old pupils' manner of handling the ambiguity which words could have.

Some reflections on the method used

Interviews

Conversation can be said to be the base for human interaction, and a great deal of our knowledge about the world around us comes from dialogues with other people. This is because other people have had other opportunities to know the world than we have, but also because they will have dealt with their experience from another perspective.

The qualitative research interview attempts to understand the world from the subjects' point of view (Kvale & Brinkmann, 2009, p. 1).

Knowledge is created in an interplay, which can be seen as an exchange of viewpoints between two persons focusing on and speaking about the same topic.

The word "interview" literally points at something that is constructed between two persons engaged in conversation. But the research interview differs from conversation in general in several ways. First of all, it is a professional conversation with specific goals and aims. The purpose of a phenomenographic research interview is to understand aspects of the world and experiences in it, from the subjects' own perspectives. Although the structure looks like an ordinary conversation, there is a specific approach and technique of questioning involved. Kvale (1997) contrasts the modes of interaction in a research interview with those of philosophical dialogues and therapeutic interviews. In a philosophical dialogue, going back to Socrates in the writings of Plato, the participants are

formally on an equal level. The aim is to detect the true nature of knowledge and uncover the logic of the participants' questions and answers. It is not a question of understanding individual thinking, but to look for truth, that both parties can agree on. Knowledge, in Plato's sense, is something objectively true, hidden within the immortal soul of man. Therapeutic interviews aim at personal change, not by logic argumentation, but through interaction in a therapeutic situation. The change sought after is not intellectual, but emotional and personal. Therapeutic interviews have been a source of inspiration for the development of qualitative research interviews (Kvale, 1997). Kvale points out that the research interview in itself sometimes leads to changed understanding, as a phenomenon is focused and ideas are verbalised.

Knowledge may be seen as constructed, and constituted through interplay between partners of the dialogue. The knowledge that is created is constructed with language. It is contextual and relational, which means that it cannot be understood, except as part of the situation and in relation to the questions asked. The medium of the interview is language, and language is both the tool and the object of interpretation.

The mode of understanding in the qualitative research interview described by Kvale (1997; Kvale & Brinkmann, 2009) is inspired by phenomenological method, with phenomenology as a term that:

(...) points to an interest in understanding social phenomena from the actors' own perspectives and describing the world as experienced by the subjects, with the assumption that the important reality is what people perceive it to be. (Kvale and Brinkmann, 2009, p. 26)

How the situation is understood affects the way the interview is accomplished. One position could be that the interview serves to collect information from the interviewee. According to that standpoint, the interview itself is assumed to only have a marginal impact on the nature of the information which is retrieved. We could,

for instance, interview children with the objective of finding out what they know about gravity. The assumption would, in that case, be that the knowledge is already there (cf. the discussion of Piaget's interviews, below).

On the other hand, when meaning and knowledge are seen as something that is constituted in *interaction* within the interview focus for the interviewer is to create a situation where such knowledge can be constituted. In the interview, power relations influence the situation, and must be taken into consideration by the interviewer. Even though knowledge is, in principle, seen as something that is created in interaction between two equals, the relation in a research interview is not symmetric. The interviewer defines and controls the situation. S/he decides what to talk about and what is to be regarded as topics, by choosing to follow up some answers and leaving others. The more asymmetric the relationship is, the less scope is given for the interviewee to participate in creating knowledge. In feminist research (e.g. Davies & Esseveld, 1987) the unequal relationship is considered a problem. Oakley (1981) advocates an interview situation as a sharing of information, where the interviewer opens up and expresses her own view as well.

The phenomenographic research interview

In phenomenographic research on learning, knowledge is seen as relational and constituted in the encounter between an individual and parts of the world.

Phenomenology and phenomenography share the same basic epistemological understanding and object of research; human experience and awareness. But while the aim of phenomenology is to uncover the "essence" of a phenomenon, phenomenography aims at describing variation in ways of experiencing phenomena (Marton & Booth, 1997). Phenomenography has, to a large extent, focused on how "internal relations" (Svensson, 1984) are constituted by the individual as an agent, in different kinds of learning situations.

The method often used in phenomenography is the phenomenographic research interview (Marton & Booth, 1997; Theman, 1983). An important aim of the interviews has been to stimulate the interviewee's own reflections over his/her experiences. Theman (ibid.) describes the phenomenographic interview as different levels of communication. Apart from the level of content, there is also a social level. The social level constitutes the framework in which the level of content is examined. On the social level, the relation between the interviewer and interviewee is in focus, and the situation is similar to communicative situations in daily life (Marton & Booth, 1997). Another level constitutes a reflective level, where it is possible to scrutinise what is seen as obvious, and question what was said, by breaking the continuity of the social level. This is made by certain types of questions that bring the interviewee back to the content focus. The reflective level can be seen as a meta level, since the questions asked stimulate self reflection for the interviewee (Anderberg et al., 2005).

The phenomenographic interview is characterised by an open method of questioning and a deep interest for the answers. This means that the task of the interviewer is also to approach contents that are not visible to the interviewee (Kroksmark, 2007). In this sense, the situation is *new*. According to Kroksmark the phenomenographic interview should be connected to the moment when the interviewee meets content matter in a new way, and in a concrete situation. Meaning depends on the intention, and this is why the context of the situation, as well as what it means to those involved, are cornerstones of phenomenographic method.

Interviewing children

The dialogues of the empirical investigation described here were carried out with children and young people between six and fourteen. Which special demands does this place on the interviewer speaking to children, compared to adults? Traditionally, young children have been considered unreliable sources of information (von Brömssen, 2003). What might be created in conversations with children depends

on the interviewer, as well as on the child. In interviewing children, the unequal relationship between adult and child is particularly important to consider, as well as the child's wish to appear to know what is demanded of her, and satisfy the adult with his/her answers. Certainly, children are capable of expressing themselves about their understanding of the world and their use of language, but the language resources available to them may differ from adults, and between different ages.

Piaget (1973) introduced and used interviews to understand children's thinking. He was interested in systematically describing the world from the child's perspective. One of the questions he wanted to find the answer to was:

What conceptions of the world does the child naturally form at the different stages of development?
(Piaget, 1973, p.13)

Piaget pointed at the need to try to understand children's answers in relation to the situation of the child itself, and to use their own language when forming his questions, both in form and content:

(...) by the spontaneous questions actually asked by children of the same age or younger. (p.17)

Piaget was interested in the structure of thought behind an answer and wanted to know:

To what extent does he distinguish the external world from an internal or subjective world and what limits does he draw between his self and objective reality?
(p. 13)

To Piaget, there was an objective reality external to the child, and he saw the child's thinking as ruled by internal schemata that decide the possibilities for the child to think about the external world. The relation between what we have here called the "intentional meanings" used by the children and their conceptions (in a

phenomenographic sense) was not discussed by Piaget, since he did not separate these aspects analytically.

The position of the child in the interview situation of Piaget's work has been questioned, as well as what the child actually knows, understands and speaks about. Donaldson (1978) showed that redesigning some of Piaget's experiments, slightly changing the situation, had great impact on what the child was able to achieve. She also claimed that many of the questions the children were asked were illogical from the child's point of view and misleading. Reanalyses of Piaget's interview protocols (e.g. Pramling, 2006; Aronsson & Hundeide, 2002) show that children's answers should not be interpreted as "reflections of their spontaneous thinking", but that discursive aspects of the interaction with the researcher are also important in order to understand what the children mean. Another critical issue is in which manner the questions made sense to the children.

Pramling (2006) shows that children use language non-literally, using meta-communicative markers (as if, like, etc.) in a communicatively competent way. Schoultz, Säljö and Wyndhamn (2001) are generally critical to the constructivist idea that children's answers in interviews mirror underlying mental models. By modifying a situation where children are asked about the shape of the earth and bringing in a terrestrial globe, different results emerged than in situations where children were asked the same questions without a globe (Vosniadou & Brewer, 1992). Schoultz et al. (2001) claim, that situational factors decide how children are able to reason about astronomical phenomena in a meaningful way. Additionally, Halldén, Haglund and Strömdahl (2007) argue that expressions used by children in an interview situation can be seen as "cultural tools" used to realise discursive practice, depending on what the children want to achieve.

However in the dialogues carried out in the present study, the child's way of reasoning is analysed from a first person perspective. The children are asked about what they mean. Compared to other studies,

where the analysis is carried out from a “third person perspective” (Johansson & Svensson, 2006), the children’s own statements concerning intentional meanings are the point of departure for the analysis.

Reflective dialogues as learning situations

The phenomenographic child interview was developed by Pramling (1983), inspired by Piaget’s method, but differing in its aim. Rather than being interested in what lies behind an answer, the content of a child’s answer is here in focus. The starting point is that there is no “correct” answer to find. Pramling Samuelsson and Asplund Carlsson (2003) discuss metacognitive dialogues with children, and claim that dialogues as well as pedagogic activities are communicative¹⁷ situations. They saw how these dialogues could be used both to find out about how children think about different phenomena, and as a way to create a learning situation. Meta-communication is seen as something that is made possible in communication. Children may see aspects of the world in a certain way that are not always explicit to them, and act or speak accordingly. What the child speaks about should thus be interpreted as expressions of her/his view of something, and about how s/he understands the situation. To take the child’s perspective is aiming at understanding what s/he means, on his/her conditions (ibid.). Meta-communicative dialogues are not dialogues in a general sense. Instead, the aim of the researcher (or teacher) is here to invite children to think, reflect and express their thoughts. This is a way to come closer to the first person perspective (agency).

¹⁷ The notion “communicative” is here used regarding verbal interaction, in a broader sense than in the case of maintaining common ground, as opposed to reflection over content (see. p. 14).

Theman (1979) noticed in phenomenographic interviews with adults that his respondents sometimes expressed confusion, and changed their ways of understanding.

As one of our aims in the dialogue is to bring our partner into a partly un-reflected arc of her/his body of knowledge, there will necessarily be a situation in which he/she will be rather uncertain and insecure. (Theman, 1979, p.7)

Since what is said in the interview is examined closer, or the same question is asked again, issues taken for granted are questioned. This means a break in the continuity of the conversation. Such a break is considered to create a reflective level of the dialogue, where new awareness is created.

In also reflecting back to the respondent what has just been said, this elaborating can be further developed with the help of the interviewer and the qualitative interview can be given the character of a learning dialogue. (Anderberg, 1999, p.32)

This might create a situation where the respondent sees the dialogue as a learning situation, like Erland (10) from the empirical study, who says, speaking about the interview situation:

“...I found out things that I didn’t even know that I knew...”

The aspect of changed understanding in the dialogue is important when the aim of research is to study learning. The respondents sometimes, like Erland above, express awareness of learning and understanding, related to a concrete situation in which he experiences something new. Another important aspect of the conversation is how a space of opportunity is opened up in the meeting between researcher and child. The researcher has to create a space, where the child feels like responding, and wants to express her/his sense of knowledge about content matter. It is also critical that it is possible to show uncertainty. For this to be the case, the child must feel free to express any thought without being judged or assessed.

In intentional expressive dialogues, the child's answers are interpretations of expressions of conceptions, within a communicative situation. The aim of those dialogues is to invite the child to reflect on their use of language about an object pointed out to them by the researcher, and in that way come closer to the interplay of saying and experiences in terms of agency.

4 Summary of the articles

The four articles are closely related, building on the same empirical material. Different aspects and parts are analysed in each article, however, depending on the aim of the various studies. The overall aim of the present thesis was to investigate how children in different age groups understood the interplay between their conception and the function of the language they used, in framed dialogues about physical motion. In the articles, the empirical material was approached in different ways. The articles form a sequence, where each study presents new questions, and angles that follow from the results of the preceding investigation.

Article I is based on an investigation about meanings that the children gave certain words in their explanations, and describes the ambiguity of meanings. The investigation focuses two expressions frequently used by the children in the dialogues. Based on the results, the question arose whether since the same expressions are used with such a variety of meanings, even by the same speaker – the children are aware of this variation? And are they aware of other aspects of how they use language in conceptualisation?

Article II is an investigation of how the six year olds and the ten year olds reflect on the interplay between various components in their sense-making, and to which extent they express awareness of it. It should be emphasized that “awareness” is here not understood as an inherent quality, but as experience expressed in language in a meaningful way. Of particular interest was to study awareness of the interplay of language use and understanding, as a variation of language awareness in the six year olds. This age group was assumed to be particularly sensitive about the form of language, since they

were in the phase of learning to read and write. The ten year olds were chosen for comparison.

In Article III, the character of the dialogue situation as a whole was closely investigated, with regard to the interplay created between various components in the sense-making process. The global impression was here in focus. As the dialogues progressed in different ways, a closer analysis was made of the variety of ways in which the children made sense of the phenomenon, in response to the interviewer. The manners in which these ways differed or resembled each other were also analysed. The characteristics were described in qualitatively different categories, representing four approaches to the problem.

Following the result of study III, showing differences in the ways ten year olds and the fourteen year olds approached the same problem; the fourth study is a closer investigation of how the ambiguity of meaning was handled. How did pupils in the two age groups reflect over their own language use and the meanings they associated with words they had used in their explanations? Micro-process analysis was undertaken, in order to study in greater detail how the interplay between expressions and meanings worked. The study investigated the ways the children explored the function of meaning, reflecting on their own language use when they expressed understanding.

Below is a summary of the results of the studies described in the four articles. Both theoretical perspectives and methodology are discussed elsewhere, and will not be repeated in this summary.

Article I: Hur elever i grundskolan använder orden luft och dragningskraft för att uttrycka sin förståelse av fysikaliska fenomen. [How pupils in elementary school use the words air and attraction force to express their understanding of physical phenomena.]

(written in Swedish)

Annika Åkerblom

Result

The results show that there is no stable and unambiguous relation between expressions and intended meanings when the pupils express their conceptions of physical phenomena. The most noticeable observation is that expressions were given different meanings by different individuals. These meanings sometimes even constituted opposites. There was also variation in how meanings were given to the same expression within the same dialogue. The great variety of meanings given to the expressions *air* and *attraction force*, which were commonly used in the dialogues, were grouped in themes of meaning. Three of the themes were found for both *air* and *attraction force*: the themes *carrying*, *stabilising* and *delimiting*, and in a fourth theme, *air has attraction force*, *air* and *attraction force* were seen as closely connected.

Discussion

The themes were similar to previously described “misconceptions” (e.g. Kavanagh & Snider, 2007) about *air* and *attraction force*, where *air* and *attraction force* are seen as related, especially the notion that objects are weightless where there is no *air*. While expressions and ways to use expressions change with age, conceptions did not change to the same extent. Regardless of age, the pupils expressed similar conceptions, but they used different words. The six year olds used *air* with similar meanings to those the older pupils attributed to the expression *attraction force*.

In the discussion of the results it is stressed that if the right conditions are created in learning situations, pupils in preschool and the early years of elementary school are capable of understanding abstract scientific ideas. One important point, however, is not to take for granted that expressions are given the same meanings in different contexts, and by different individuals. The interplay between expressions and meanings needs to be taken into consideration. The variation in meanings given to the same expression can be used to create awareness and collaborative learning, provided this variation is made explicit and reflected upon. When awareness of the interplay

between expressions and meanings is created, the dynamic and ambiguous character of language use can be used as a tool for sense-making, instead of constituting an obstacle to learning.

Article II: Awareness of language use in conceptualisation: A study of children's understanding of movement and gravity

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(Accepted for publication in Scandinavian Journal of Educational Research)

Results

The different qualities were grouped into four descriptive categories and subcategories of awareness, with respect to the interplay between conceptions, expressions and intended meanings. The first category of awareness concerned the relation between language form and language meaning. Remaining categories concerned the learners' awareness of how language functions in the activity of expressing their conceptions. The categories cover a range of variation, from what is commonly described as linguistic awareness, to awareness of the function of language use in understanding. Common to all the described categories of awareness is that different features of language use were visible to the children. Language and the use of language were not transparent and taken for granted, but instead became the focus of awareness which was expressed and discussed explicitly by the children.

The first category, *Awareness of the relation between language form and language meaning*, corresponds to the relation between expression and intended meaning. It is not just language that is visible, but the contrast between meaning and form. According to Vygotsky, to acquire a conscious language, children must differentiate the two sides and become aware of their different characteristics.

The second category, *Awareness of the nature of understanding* is related to how an object is understood. This category has traditionally been the main interest for phenomenographic research on learning. *Focus on the act of understanding* stresses how an object of knowledge is experienced (the conception), while *focus on perspective and context* concerns how to deal with an object of knowledge. In this category, understanding and objects of knowing are seen as something that has contextual and dynamic features.

In the third category, *Awareness of the expressive function of language for new word meaning*, language is used to develop new meaning. This process is distinguished by testing and change of expressions and meanings. In the last main category, *Awareness of the function of language use in understanding*, something is expressed about the process described in the third category. The expressive function of language has become visible and thus, expressible. When the function of language use is reflected on, some more general notions concerning the actual function of language in understanding are expressed. The last category can be seen as a further development of language awareness, where not just awareness of what language is (form/meaning), is expressed, but also thoughts concerning how language functions in expressing understanding.

Discussion

The discussion considers the ways in which the children responded to the invitation to reflect over the function of their own use of language in expressing conceptions. In the phenomenographic perspective, learning is described as a change in ways of experiencing something, and accordingly, instances of change in ways of experiencing found in the dialogues can be seen as instances of learning. By reflecting on the language used to express a thought, the children became aware of new aspects of their own thinking.

Language awareness involves the ability to shift focus of conscious attention between issues of meaning, on the one hand, and the

specific verbal form that is given to an idea, on the other. This allows the child to distance from language and to reflect on it.

A widened definition of language awareness is proposed in this study, where awareness of the close relationship between language use and knowledge formation is taken into consideration. The close relationship between language awareness and thinking is something that has been acknowledged and discussed by other researchers. The various categories of awareness described in this article are all seen as connected, together defining language awareness from a content-focused phenomenographic perspective, considering the function of language use in understanding. To use language in learning and thinking, several aspects of language need to be considered, other than simply the ability to reproduce specific verbal forms and terminology that are usual in a particular discipline. Awareness of how meaning and form relate to each other in dynamic processes may be crucial for the ability to reflect on the act of learning and thinking. A widened definition of language awareness points to the important role of language use in knowledge formation, and the need to work with language awareness in learning situations. Language must be considered as a central dimension of learning, and explicitly reflected upon, in order for children to understand their own learning activity. This relation certainly merits to be examined further and discussed with respect to its implications for didactic situations.

*Article III: Making sense of physical phenomena:
Language use in approaching objects of knowledge*

Annika Åkerblom

Results

In the children's responses to the dialogue situation, four different categories of interplay were distinguished between conceptions, expressions and intended meanings.–The activities of the children were seen as ways to approach a part of the world, which was constituted in the dialogue, but also seen as a response in the dialogic situation as a whole. Critical aspects concerning the responses were

identified and described. The findings were grouped as *exploring approach*, *tentative approach*, *associative approach* and *conscious approach*. When an *exploring approach* was used, a shared object of attention was created between the pupil and researcher. The speech sequences of the pupils were longer and richer in expressions, compared to other dialogues. The exploring approach was interpreted as an experience-based conception, since the pupils often referred to their own experiences in relation to the problem discussed. The approach was characterised by figuring, simultaneity of focuses and changes of conception. This type of response in the dialogue was found among 6 of the six year olds, 9 of the ten year olds and 9 of the fourteen year olds. The dialogues placed in the category *tentative approach* were qualitatively different from the exploring approach. They were distinguished by more marks of insecurity. Although there was an agreement about what was talked about in the dialogue, the object appeared as vague and unspecified to the children. The speech sequences were shorter, containing fewer exemplifications. The children often referred to memory or lack of memory in these dialogues, and in some cases gave expressions as explanations. Language was often discussed in a general way, and the children claimed having difficulties finding words. Dialogues of this kind were found among 6 of the six year olds, 7 of the ten year olds and 16 of the fourteen year olds. The dialogues placed in the category *associative approach* were distinguished by responses to the prompts in the dialogue situation, where the intended focus of the conversation differed between the interviewer and the children. Even though the phenomenon of movement of different kinds of objects (ball, moon) was discussed in a very broad sense, the researcher aimed for an answer in the form of an explanation/description of aspects that related to movement. But in the dialogues placed in this category, the children spoke about a different object altogether, and a mutual agreement about intended object was not reached. Instead of speaking about physical movement, the children associated to episodes with a ball and the moon. When asked about the meanings of expressions they had used, they did not seem to be able to make

sense of the questions, and instead associated to other expressions that do not directly relate to the physical phenomenon the researcher had in mind. Dialogues of this kind were found among 6 of the six year olds, and one of the ten year olds. On the other hand, dialogues placed in the category *conscious approach* were distinguished by all the features that characterise exploring approach, but in addition the pupils assumed a reflective approach when it came to awareness about their own use of language in the dialogue. The five dialogues were distinguished by greater activity and comparatively long speech sequences. The children often commented on their own activity and thoughts during the dialogue, speaking about how they used language in relation to the phenomenon. In several instances they spoke of the reflective dialogue as a learning situation. At the end of the dialogue, when general questions are asked about language use and thinking, all the children whose dialogue was placed in this category referred to what had occurred during the dialogue. Conscious approach responses were found among 5 of the ten year olds, but in no other age group.

Discussion

The categories of the present investigation can be seen as associated to three different ways of “knowing”, in the sense that what the children aim to achieve and how they understand the situation have an effect on the way language is used. The categories exploring approach and conscious approach involve *knowing as conceptualising an object of knowledge*, in other words; ways of making sense of the object. The category tentative approach was linked to *knowing as remembering*, whereas the category associating responsive approach was linked to *knowing as telling/ inventing*. The ways of knowing varied between the age groups. Knowing as remembering was the most common way of knowing (16 of 25 dialogues) among the pupils in secondary school (fourteen year olds).

This way of knowing might be associated with efforts to reproduce a given set of expressions that have precisely defined meanings within

the school subject associated to the question. The difference between the fourteen year olds and the ten year olds may be related to the fact that the children have had physics as a school subject at secondary school. Could it be that the way the school subject physics is conceptualised restricts the possibilities to think and talk about it in more than one way, namely knowing as remembering? That would partly explain the striking difference in the character of the dialogues between ten year olds and fourteen year olds. Unlike the older children, among the ten year olds, the most frequent approach was “knowing as conceptualising an object of knowledge” (14 of 22 dialogues). Another difference was that conscious dialogues were found only among the ten year olds, suggesting that a condition for awareness of one’s own learning process is that the object of knowing is something that can be related to individual experiences.

Just a third of the six year olds express knowing as approaching an object of knowledge, which means that a larger share of dialogues represent *knowing as remembering* or *knowing as telling/inventing*. But this result should not be interpreted as an indication that preschool children are not able to use language in a productive way in understanding complex phenomena. Rather, the language focus of the dialogue design was not adjusted to this age group. Even though preschool children are competent language users, they normally do not adopt a reflective approach to language, having difficulties separating language form (expression) from meaning. If language form is not visible for them as “something”, they cannot conceptualise or speak “about” it. Nevertheless, many studies show that science education in preschool settings is a fruitful topic. Reflective dialogues about thinking and learning can be used, in order to give the children an opportunity to reflect on their own learning.

The results of the present study imply that becoming aware of language use in expressing understanding is a tool for reflecting over the some of the foundations for interpreting the world. But to use and develop reflective dialogues as support for learning science, additional aspects need to be considered. One critical aspect would

be to challenge both the content of conceptions expressed and language use in a more conscious way. To make explicit the diversity of conceptions and use of language of a group of children would be a way to actually challenge the pupils' approach to making sense. Depending on the aim of teaching, the diversity of conceptions among the children should also be mirrored against scientifically normative conceptions and agreements on language use. To develop intentional-expressive dialogues with a didactic intention would therefore be a promising topic for further research.

*Article IV: The epistemological role of language meaning:
handling ambiguity in meaning when expressing object
oriented understanding*

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(Accepted for publication in Cambridge Journal of Education)

Results

Two main categories display important characteristics concerning how each child reflected on the meanings s/he used to explain his/her understanding of the problem: *inventory of meaning* and *exploring function of meaning*. In the first category, handling the use of expression and meaning was seen in relation to other expressions, and not to the focused problem. Even though many connections between expressions and meanings were made, the children were uncertain about how to use them concerning the problem. In spite of this uncertainty, they did not pursue reflection when experiencing ambiguity of the meanings given the expressions they had used. Dialogues placed in the second category, *exploring function of meaning*, explored in more consistent manner expressions and meanings related to the child's attempts to conceptualise the problem. In these dialogues there was low acceptance of ambiguity of experienced meaning. The pupils dealt with ambiguity by exploring different ways to express themselves, but remained close to the problem focused. The two categories were not equally represented in the two age groups. *Inventory of meaning* was most

common in the dialogues with the fourteen year olds (16 of 25 dialogues), while *exploring function of meaning* was most common among the ten year olds (14 of 22 dialogues).

Discussion

This difference between the two age groups reflects the difficulties experienced by the fourteen year olds in exploring what they actually meant

with the expressions they had used when describing their conception of the problem. This was not the case with the ten year old children, who appeared to experience less difficulties testing different possibilities, until they found expressions they were satisfied with. The results suggest that exploring and testing led the pupils to certain clarifications, thereby increasing the degree of precision and consistency in their understanding of the problem. The expressions and the meanings that the pupils had given the expressions in their initial explanation were examined and tested, both in relation to other expressions and to their personal understanding of the problem. This can be contrasted with the dialogues where the pupils simply responded with inventories of possible meanings the expressions could have, without relating these to the problem, and which did not lead to this kind of clarification. In Category 1, the expressions and meanings examined were mainly related to other expressions, while the relation to their conception of the problem was not explored. In other words, the potential for language to play an epistemological role is not fully exploited, when learners elaborate on language use or concepts per se, without simultaneously relating these to their personal understanding of a problem.

Variation of the epistemological role of language use in a dialogue setting

The four articles concern different aspects of the *activity of expressing understanding with words* and describe a variation in this

activity. The variation in the activity of making sense shows how children relate themselves to an expressive function of language use. The articles emphasize different parts of the interplay between language use and knowledge formation. These elements, as well as the ways in which the articles relate to each other will be illustrated below with the “broken triangle”.



Article I, *How pupils in elementary school use the words air and attraction force to express their understanding of physical phenomena*, mainly concerns the right line in the triangle. This corresponds to the relation between two selected expressions (‘air’ and ‘attraction force’, used by the children in their explanations/descriptions), on the one hand, and the meanings the children gave these expressions, on the other. The expressions were used with a number of different meanings, even within the same dialogue. While expressions and ways to use expressions changed with age, the way the children understood the problem did not change to the same extent. Regardless of age, the pupils expressed similar conceptions, while using different words.

Article II, *Awareness of language use in conceptualisation: A study of children’s understanding of movement and gravity*, is based on a study that focuses manifestations of awareness about language use in the transcripts. The “object” that the children focused was their own language use in the activity of speaking about something. What they expressed awareness about is in one category the relation between the form and meaning of words (also discussed in article I), where the right line of the triangle can be seen as the *object*. The other

categories concerned awareness of how language functions in the activity of conceptualising. Being aware of the function of meaning in conceptualisation seemed to involve the ability to change conception, that is, the manner in which the children saw the function of their own language use, had an impact on how they used language as a tool to make sense of something.

In article III, *Making sense of physical phenomena: Language use in approaching objects of knowledge*, the activity of expressing something, may be illustrated as a movement. The movement is both an *approach* to the object that is spoken about, and a *response* towards the other person. The results show a variation in the ways to approach the content through language. Four categories were distinguished. The most important difference between the categories lies in the object of the dialogue, that is, what was focused and spoken about. In the categories *explorative approach* and *conscious approach*, the children delimited the phenomenon “as something” they attempted to make sense of. Strategies included picturing, using examples, as well as their own experiences of the phenomenon in their explanations. Conceptualisation may be illustrated as a movement of the interplay, including all the nodes of the triangle. The last category also included awareness of language use. In the two other categories, the aim did not seem to concern conceptualisation in the same way. Those children did not refer to their own experience, nor did they explore different possible meanings relating to the problem. In the triangle, those categories mainly concern expressions and meanings as such (illustrated by the right part of the triangle) while how they relate to the object is not obvious.

Article IV: *The epistemological role of language meaning: handling ambiguity in meaning when expressing object oriented understanding*, concerns a further elaboration on how the older children in the study (ten and fourteen year olds) handled ambiguity of meaning. Two qualitatively different manners of handling ambiguity were discerned: *exploring function of meaning* and *inventory of meaning*. These were different ways the children

constituted relations between what was expressed (expression), meant (intended meaning) and understood (conception). In both categories, they discussed expressions and various meanings, reflecting over other possible meanings. Illustrated with the triangle, this concerns the relation to the right: *expression-intended meaning* (see above). In the first category, the children also tested the usefulness of meanings against their conception of the phenomenon in focus for the dialogue. This activity then concerns the base line in the triangle: *intended meaning-conception*. The first category was interpreted as the children being simultaneously aware of their own use of language in speaking about an object *and* at the same time maintaining a focus on the object per se. This category coincided with what was termed *explorative* and *conscious* approach in article III. In the category called *inventory of meaning*, the children did not focus their personal understanding of the problem, which meant that they were not able to choose meanings that could work to express it. This category coincided with the *tentative approach* described in article III.

The articles jointly show several important features relating to the role of language in knowledge formation, which we have here called the epistemological role of language.

5 Discussion

Making sense

The pedagogical point of departure of this thesis concerns children's learning and how language can be used to create knowledge. A vital notion about learning is to express understanding of something in a meaningful way. In this thesis, this activity is referred to as "making sense". Another notion which is central to learning is when the children become aware of their own use of language, as they focus on *how* they express something, besides *what* they are speaking about. Making sense concerns both the *how* and the *what* of expressing.

The children's responses in the dialogues were associated to three ways of knowing,: *knowing as conceptualisation*, where the aim concerned making sense, as well as *knowing as telling/ inventing*, and *knowing as remembering*. In the latter categories, the aims did not primarily concern making sense of the content matter.

Making sense is related to conceptualisation. In almost half (30 of 64) the dialogues, children from all age groups used language to conceptualise content matter. Knowing as conceptualising content matter was most common among the ten year olds. In the reflective dialogues, they attempted to figure out and elaborate ideas concerning the phenomenon. Some of them developed new ways of understanding the content matter. The five children who reflected on how they used language to express their understanding of the focused object were all ten year olds.

Telling/inventing was a common way of knowing among the preschool children, but diminished with age. Although the dialogues concerned abstract phenomena, there was also a group of six year olds that had developed complex ways to approach the content matter¹⁸. One of the reasons why many of the other of the six year olds understood and answered the questions within a narrative framework (Heath, 1983), could be that telling stories is a way of speaking and knowing which is often supported in preschool settings. Thulin & Pramling (2009) describe how preschool teachers use anthropomorphic speech (speaking in human terms about something non-human) with the children, in order to make their language connect to what they perceive to be appropriate children's language and experience. Also Fler (2009) and Thulin (2006) saw that preschool teachers often supported a narrative way of speaking, evading the content matter.

The youngest children spoke of balls that were thrown, and about the moon, in a variety of ways. This contrasts to the oldest children, who recognised the content of the two questions as "science content", spontaneously referring to science class. *Knowing as remembering* increased among the oldest children, who never used a narrative strategy. Many of the fourteen year olds tried to recall what they had learnt, as well as searching for the established meanings of the expressions. This meant that they mainly saw the dialogue as a request for "correct" scientific terms, which they attempted to reproduce. The oldest children were less willing to question their own language use. Also, they did not try to connect their explanations to their own experiences. Due (2008) describes the dominant way of speaking in school physics as "rational",

¹⁸ Children's play at this age shows the need for concrete objects to focus on, in order to make sense about something specific. Had the dialogues included interaction with objects, they would probably have come out differently (see also Fler, 2009).

“mathematical” and “logical”, contending that the language of physics is characterised by clarity and unambiguous meanings. The world depicted is an “objective” world, described without considering who describes it. This approach was in line with the manner in which a large proportion of the fourteen year olds attempted to use language. But although they clearly were trying to reproduce “scientific talk”, the fourteen year olds’ conceptualisation of physical motion was hardly more “scientific” than the younger children.

Those findings suggest at least two things:

- Children of all ages can develop the ability to express understanding of something in a meaningful way and become aware of the function of their own language use.
- The pedagogic setting and the prevailing discourse in the setting is decisive for how children decide what ways of knowing and using language are meaningful.

This, in turn, points to possibilities to support and invite children to make sense of content matter in pedagogical settings.

Making sense as learning activity

In this particular work, learning is understood as a change in the relation between a learner and a part of the world. In a special dialogue setting, the researcher invited the child to speak about a specific object, and explore his/her language use relating to this object. The relation between the learner and the part of the world was described as an approach, constituted through the use of language. In order to delimit and study the children’s approach, some fixed points were created: *expressions used* (referring to linguistic units, utterances, the form of language), *intended meanings* (what the speaker says s/he means with a certain expression), and *conceptions* (how a learner sees the part of the world that s/he is speaking about). The fixed points were interpreted as aspects of the function of language use, and the ways these aspects related to each other was

investigated. The inter-subjectivity of the dialogue situation was also understood as a precondition for expressing and change.

The assumption made is that knowing more about the variation of ways in which children approach content matter in language may have implications for how to support children in their processes of making sense in the classroom.

Although the activity focused did not take place in a science class, some general conclusions about the epistemological role of language in science education are drawn.

Making sense may also be described as a learning activity; an activity where learning takes place. In some cases, the children themselves spontaneously spoke of the situation as “learning”, or said that they came to understand differently. In the other cases the activity could be described as a change in how a child relates to a part of the world, which is also an aspect of learning. When it is expressed the relation changes. What was previously implicit becomes explicit.

An overall aim in this thesis was to explore, analyse and describe ways of using verbal language in knowledge formation. Additionally, aspects of the function of language use that were critical for learning were considered, as well as implications for pedagogical contexts.

In the introduction to this thesis, two questions were formulated, which will be further discussed in this section. The questions concern expression as activity, and are closely related to the aim of this thesis. The first question was: what characterises the function of language use in knowledge creation? If language use has a special character and role, in situations where children are invited to conceptualise and verbalise a specific content, how do they themselves understand this activity when they reflect over it? And since this is a thesis in Education, concerning the pedagogic relation of learning, through the use of language, and teaching as support to use language to make sense, the other question concerns how to support sense-making in pedagogical settings.

Some characteristics of the function of language use in knowledge creation

What kind of knowledge about the function of language use is needed to draw conclusions about how to support children and help them make sense? The survey of Wittgenstein, Vygotsky and Mead in Chapter 2 provides a variation of ways of understanding the activity of making sense. Their insights about how language is used in expressing allow us to draw some conclusions about certain of the aspects these thinkers considered to be central. Their different starting points and focuses capture the complexity of what language use in knowledge creation might be. The critical aspects they point at are visible in the empirical investigation as well. Those aspects can be summarised as

- the open and ambiguous character of the function of language in use
- awareness of language use created in dialogue
- “playing” with language, as means to learn about and with it

Ambiguity - an open relation between expressions and the content matter

Wittgenstein's (1953) conclusion was that the relationship between language and thought could not be formulated at a general level, but only be experienced in its use. In order to be understood, language must have a certain dynamic and contextual character. This also means that meaning is actively created as language is being used. Words do not refer to something fixed and unchangeable. Vygotsky drew similar conclusions, claiming that his most important discovery was that the meanings given to words are dynamic and changing (1986, p.217). He was interested in what the ambiguous and open character of language in use might mean for learning, and how the activity of verbalising something was actually constituted. Like

Vygotsky, Mead (1934, 1938) saw language meaning as created by speakers in the moment of speaking. The meanings and roles of objects and words change and develop in dialogue.

The results of the empirical investigations also point to a very open relation between expressions, meanings and understanding. For instance, the children used the same expressions in many different ways, giving the expressions ('air', 'attraction force') a number of meanings. Even the same child would on some occasions use the same expression with different meanings. Another finding is that it is rather the intentional meanings that the children use to conceptualise something, while the particular wording they choose to express their understanding varies, and also depends on what expressions they have access to. This was pointed out by Vygotsky (1986), who stressed that once a child has conceptualised something, finding an expression is a lesser problem. The six year olds tended to use the expression 'air' in a similar manner to the way that the older participants used 'attraction force'. Inversely, the use of different expressions did not necessarily mean that they explained the phenomena differently (see art. I).

The role of awareness

To see something differently is what Wittgenstein (1953) describes as a "grammatical movement": the discovery of a new way of looking (cf. "view-turn", Ahlberg, 2006). To do so, the seer must be able to imagine that there are other possibilities than the one at hand, and be freed from what is taken for certain. Wittgenstein speaks of understanding as the implicit knowledge of the "meaning-rules" of language, which allows the children to do something with language. However, the agreements about meaning are often tacit, vague, and taken for granted. Awareness is to Wittgenstein what can be expressed in a meaningful way, something that can both be thought and said (1953). When Vygotsky (1986) mentions awareness, it is as an important aspect of understanding the function of language. To become consciously aware of something, for Vygotsky, means that the object of awareness is differentiated and seen as "something" that

can be spoken about. Vygotsky saw the moment of expressing as movement. Instead of considering awareness as an inherent quality, he regarded it as something that becomes obvious in dialogue. Mead (1954, 1958), like Vygotsky, discussed the notion of “awareness” as differentiating, turning the content of thought into an “object”, something possible to picture and speak about. To become aware requires a change of seeing, expressed in words. For Mead, consciousness of meaning implies the ability to make a distinction between “the thing” and what “it means”. All three thinkers see the inter-subjectivity of the situation, where words come to mean something, as a condition for the speakers expressing, as well as listening to their own speech.

Some of the children in the study were surprised about their own use of language, as they were invited to reflect over specific expressions. Although some of the six year olds had difficulties reflecting over language and their own language use most of them spontaneously focused on language as *something* to reflect on and speak about, seeming to be especially sensitive to the relation between expressions and meanings. Some of the ten year olds spoke about how they used language to conceptualise physical motion, spontaneously referring to the dialogue as “learning”.

Besides being aware of the function of language use in expressing conceptions, the delimitation of what was spoken about appears to be something very critical in all age groups. To be able to relate to something means *to see something as something*. Awareness appears as the child is able to direct attention to his/her own conception, and is closely connected to the activity of expressing, as the child hears her/his own words in dialogue with another.

“Playing” with language

Vygotsky, Mead and Wittgenstein all discuss “play” as a method to investigate the relation between signs, roles, and the meanings given to them by the “players”. They understood play as an activity with

certain features related to making sense, involving elaboration with different ways of speaking and knowing.

To use signs implies understanding something *through something else*. A stick may be a horse or a blanket may be a boat. Both Vygotsky and Mead see children's play as working with the interplay between symbols and meanings. Wittgenstein's notion of Sprachspiele (1953) points in two directions: playing with words and getting to know the rules of the game. Playing is to him closely connected with learning – the only way to learn how to use words is to play with their function. The rules cannot be formulated, but appear in playing. "Knowing" is to be able to elaborate something with words.

All three thinkers connect playing with awareness, and argue that playful activity with words around a content leads to awareness. The notion of "play" points at dynamic and creative activity. The character of this activity is also to be *meaningful* for the players involved. The setting and conditions need to be agreed on, and the players have to know what playing is about. In the empirical investigations, for the children to experience what was spoken about as "something" that could be pictured, made analogies or examples about, appeared to be a condition for sense-making. To have a sense about what they were speaking about made it possible to test how well different meanings associated with words fitted their conception. They could explore the function of the use of those meanings, and ultimately, make an active reflected choice concerning what expressions they wanted to use. Another aspect of playfulness is creation of sense as something unsure and unfinished, as opposed to the establishment and verbatim reproduction of given truths.

Simultaneity of different focuses, or rather the ability to move between "seeing something as something" and focusing words used to talk about this "something", also appeared critical. When the children merely focused on language and language meaning, without

clearly delimiting the object, discussing various expressions did not lead to developments in conceptualisation.

To support sense-making in pedagogical settings

Some conditions

In order to make sense of content matter and to reflect over the function of language use, some conditions appeared to be more critical than others. Drawing on the results of the investigation, some implication for pedagogical practice in general, and in relation to science education in particular, will be suggested in the following.

First: The most important condition is to give children of different ages access to a variety of speaking situations, where they can express themselves verbally in meaningful ways. They need to be the agents of their own language use, in relation to specific content which can be related to their personal experience. This concerns children in preschool settings, as well as pupils in senior level science classes.

Awareness of the epistemological role of language

Many of the children who participated in the study were themselves surprised about their use of language in the dialogue, like Gunnar (age 10) who claimed that he “... used so terribly many words[...]*I found a new word that can describe it every minute it feels like...*”(Art.II, p.19). The surprise Gunnar expressed is in line with Wittgenstein’s insights that the agreements about meaning are often tacit, vague and taken for granted. The variety of meanings the children gave to specific expressions point to the need to invite children to reflect on the function of their own (as well as other’s) language use, in order to become aware of possible variation in meaning.

Coming to be aware of the epistemological role of language is not a process that only starts when the child is “mature” enough. The preschool child certainly seems to be sensitive to the possibility of making language into an object to speak and think about. The preschool child is also clearly able to distinguish language form from language meaning. This sensitivity can be observed in the way young children spontaneously use their play to elaborate with symbols and meanings. Language awareness involves the ability to shift focus of awareness between meanings of language, and the different forms of language, something that allows the child to distance from language, and to reflect on it. If awareness of the epistemological role of language is seen as an aspect of language awareness, it follows that the methods used in preschool to enhance language awareness (like collaborative play with language forms and meaning), could be used with older children around specific content.

Awareness of the “object”

Knowledge of how language is used should be discussed in relation to learning and teaching a specific content - supporting children and pupils to actively approach an object of knowledge. What does it take, for instance, to understand complex, scientific phenomena? A result of the empirical investigation is that it is critical that the children can conceive the object as “something”. To support making sense of content matter, the children must understand what the situation is about, and what they are supposed to make sense about. In preschool, the content focus is often implicit (Thulin, 2006; Pramling Samuelsson, & Asplund Carlsson, 2003). But the result of the present study shows that given the opportunity to reflect on their own conceptions and function of language use, the six year olds are able develop quite complex understanding of physical phenomena. The similarities between how physical motion is conceptualised by children of all age groups suggest that the children have not been given opportunities to conceptualise scientific phenomena, besides their own early experiences about these phenomena (cf. Helldén &

Solomon, 2009). Fler (2009) concludes that support for understanding science in preschool should include playful investigations of phenomena, as well as systematic exploration of scientific terms.

The question of “content matter” is not unproblematic. In the present investigation, the children’s conceptions were not classified as more or less “scientifically normative”. Instead, it was assumed that being able to conceive the object (and understand that it could be seen in a number of ways), combined with reflection on the role of language in that activity, was more critical for learning, than seeing the object in one specific way. But in order to draw conclusions for science education, the “scientific” way of understanding the phenomena should be considered as well, and this particular way of seeing the world needs to be compared to other possible conceptions. Children do not experience physical motion in a Newtonian way; unless it is pointed out to them the same aspects need to be considered for children of all ages, although the level of complexity differs.

Invitation to language games

The notion of “playing” points at a number of conditions for making sense: that the activity is dynamic and creative, as well as being meaningful for the players involved. The setting and conditions need to be agreed on, and the players should know what the game is about. Even if the notion of “playful” points to something that is open-ended and holds many possibilities, it does not mean that the activity lacks aim. On the contrary, a critical aspect of playing with language to make sense is the explicit content focus. Accordingly, the teacher needs to enact pedagogic situations where knowledge can come to movement in language, and invite children to make sense of specific content. This performs other functions than playing with the sounds and rhythm of words, but is equally necessary.

Wittgenstein saw playing as closely connected with learning – the only way to learn how to use words is to play with their function. To reflect over the function of language use and content the way it was done in the specific dialogue situation seems to be productive. The

children had an opportunity to become aware of aspects of knowledge creation and of language use. Playing involves seeing many possibilities, and collaborative reflection can be way to become aware of the variety of conceptions of content matter among a group of children.

The pedagogic role of language use

In this particular work, the language activity of children around a specific content matter was emphasized. Hopefully, it has shed some light on one dimension of the complex pedagogic relation that Svensson speaks of as support for knowledge (2009), namely how children actually use language to make sense and reflect over their understanding. Certainly much remains to be explored. For one, the empirical material used for these studies still holds many possibilities. Also, new questions are brought to the fore. We might ask if all the six year olds came to their right as competent learners, since they were limited to using verbal language in these studies. Maybe the result would come out differently, if the children had been afforded other resources, including visual or concrete objects to focus on. Another question concerns the researcher's use of language. The inter-subjective relation between the researcher and child has been mentioned throughout this work as a condition for expressing and making sense, thus a condition for the research itself. In order to explore conditions for making sense, this situation was created by the researcher. This makes it comparable to a teaching situation, or rather a form of support for sense-making. The activity of the researcher was not specially analysed in the study from this angle. The researcher had a passively supportive role, pointing alternately at a specific content matter, and alternately at the child's own language use in expressing that content, asking about the meaning and function of specific expressions. But it is quite clear that alternating between language use and content provided support for sense-making and awareness of the function of language use, for many of the children.

A topic for further research is to investigate language used in support for children's sense-making, concerning the teacher's awareness and use of language. This role of language is distinct, yet closely connected to the epistemological role. When the aim is to use language to support the learner's approach to an object of knowledge, it could be named *the pedagogic role of language use*. A topic for further research would be to investigate conditions for the pedagogic role of language use by teachers. This concerns what teachers speak about as well as how they express it in actual classroom situations as words come to mean something to children.

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