Part II
Language and Text Orientations

Introduction: Gert Kadunz

For some twenty years (see Otte, this section), the theory of signs has been known and used as a valuable tool for planning lessons and for describing and interpreting students' activities as well. Among all the research questions arising in this area, the focus of all of the four chapters in this part is on investigating the relationship between language and mathematics learning. Each of these chapters presents its own view on this relationship. However, they all use semiotics as a tool for investigating mathematics learning from a wide perspective. In this respect, the texts of Priss, Kadunz and Otte can also be read as papers following ontological interests, while Morgan's deliberation also concentrates on the sociopolitical impact of language on education. Hence semiotics appears as a versatile tool, as a kind of Swiss knife.

In his considerations, Gert Kadunz discusses the question of the ontological status of mathematical objects. For this, he investigates the different uses of language within mathematics at school and mathematics at the university. The gap between these uses is rather wide as Kadunz explains, using the example of the "limit of a sequence" concept. Hence he asks whether the way in which this concept is applied using lenses of school mathematics could be wrong in the sense of university mathematics? What can we say about the relationships between the languages in these two realms? Is mathematics at university a more correct version of a kind of independent mathematics? One way to answer such a question is to discuss the problem of translation between languages. However, answers to this issue can be found among others within the oeuvres of Walter Benjamin and Martin Heidegger. Both philosophers claim that translation cannot be seen as the transmission of a meaning located behind the text we wish to translate. Kadunz argues that the relationship between mathematics in school and at university could be seen similarly, and therefore the assumption of an independently existing mathematics is neither useful nor necessary. In this respect, the author is in agreement with Ludwig Wittgenstein and his anti-Platonistic view of mathematics. Kadunz closes his deliberation with a bridge to Peirce and his semiotics by following Peirce's idea to identify "meaning as a translation of one sign into another sign system" (Jakobson 1985, p. 251, cf. Otte 2011, p. 314). This translation, which can be seen as a transformation of visible signs, too, leads to the conclusion that mathematics in school and mathematics at university are not two sides of the same coin. On the contrary, these two parts of mathematics can be seen—metaphorically speaking—as models for each other.

Candia Morgan's report provides a semiotic view on learning that does not concentrate on analysing single students' or teachers' activities but also offers views on mathematical learning within a wider context. Her approach is based on the social semiotics of Halliday (1978) and his suggestion that all modes of communication—language too—are functional and not representational. This functional approach includes the following:

- the field of discourse—the event being spoken about;
- the tenor—who the interlocutors are and what are their relationships to each other and to the event;
- and the mode of discourse—the role of the text itself within the event (Morgan this section).

Morgan presents two examples which demonstrate the strength of Halliday's social semiotics. First she concentrates on the learning of geometry. Through analysing the structure of a given text concerning a geometrical problem, Morgan is able to describe how this text functions in three different aspects: ideationally, interpersonally and textually.

Her second example uses social semiotics as a tool to investigate patterns within texts in a context larger than a classroom. With this example, Halliday's semiotics appears to be transformed into a kind of political semiotics. In her analysis, Morgan concentrates on texts in the "official fields of examinations and of school monitoring" (Morgan this section) to facilitate the role of such kinds of texts in the reader's development of a critical awareness of how mathematics is discussed in a wider context.

Michael Otte's paper appears like a flight over relevant statements of philosophers, starting in the seventeenth century with Descartes and ending in the twentieth century with Quine, Schlick and Chomsky. The aim of this journey lies in the author's wish to present a brief outline of a complementary principle between meaning and reference. What are the reasons why semiotics arouses only a little interest among mathematics educators and mathematician? We can read the answer between the author's lines. It is the misunderstanding of this "complementarity". To name only a few of Otte's examples, there is complementarity between epistemologically oriented semiotics (Peirce) and linguistically grounded semiotics (de Saussure). Further examples are the complementarity of function and metaphor or of mathematics as a language and as a system of visible signs. Semiotics in the sense of Peirce appears to be a valuable tool presenting a new view on the learning of mathematics, since this semiotics is a methodology suitable for investigating aspects of Otte's idea of complementarity.

In her deliberations, Uta Priss concentrates on the use of Peirce and some relevant parts of his semiotics (see also Ludlow, section 3, this volume) and investigates the influence of the use of everyday language on the construction and interpretation of mathematical concepts. Together with Peirce's semiotics, Priss uses "Formal Concept Analysis" (Ganter and Wille 1999) to back her claim that the associative character of everyday language could hinder students in building robust mathematical concepts. However, the notation of mathematical concepts is not always complete and unambiguous by itself. Hence, the use of everyday language to interpret such notations could cause further confusion. The searching for the meaning of a mathematical concept, as we like to do it with concepts of everyday language, should be avoided. "One should not ask what a definition means, but instead what it says" (Priss, this section). In this respect, we should not try to look behind mathematical concepts but just ask how to use them. Here we find an anti-Platonistic view on mathematics, which can be found in the other papers of this section, too.

References

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