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31. Two-level Semantics: Semantic Form and Conceptual Structure

Abstract

Semantic research of the last decades has been shaped by an increasing interest in conceptuality, that is, in emphasizing the conceptual nature of the meanings conveyed by natural language expressions. Among the multifaceted approaches emerging from this tendency, the article focuses on discussing a framework that has become known as »Two-level Semantics«. The central idea it pursues is to assume and justify two basically distinct, but closely interacting, levels of representation that spell out the meaning of linguistic expressions: Semantic Form (SF) and Conceptual Structure (CS). The distinction of SF vs. CS representations is substantiated by its role in accounting for related parallel distinctions including 'lexical vs. contextually specified meaning', 'grammar-based vs. concept-based restrictions', 'storage vs. processing' etc. The SF vs. CS distinction is discussed on the basis of semantic problems regarding polysemy, underspecification, coercion, and inferences.

1. Introduction

1.1. The turn to conceptuality

Looking back at the major trends of linguistic research in the 80's and 90's, we observe a remarkable inclination to tackle semantic issues by emphasizing the conceptual nature of the meanings conveyed by linguistic expressions. Several models and frameworks of linguistic semantics developed at that time marked off their specific view on meaning by programmatically labeling the structure they focus on as *conceptual* (cf. article 19 (Levin & Rappaport Hovav) *Lexical Conceptual Structure*; article 30 (Jackendoff) *Conceptual Semantics*; article 27 (Talmy) *Cognitive Semantics*) and by elevating *concepts, conceptualization*, and *Conceptual System* to key words of semantic theorizing. The approach presented in this article is another outcome of these efforts, which implies that it shows commonalities with as well as differences from the approaches mentioned above.

The semantic issues which have been under debate since that time are summarized in (1) by listing the major topics and the crucial questions they have given rise to:

(1) a. compositionality: How far do we get by holding to the Frege Principle?
b. lexicalism: What can provide a better account of the internal meaning structure of lexical items – semantic decomposition or meaning postulates?
c. meaning variation: How do we account for polysemy and underspecification?
d. cognitivism: How can we avoid "uninterpreted markerese" by drawing on semantic primes which are (i) compatible with our linguistic intuition, (ii) reconstructible elements of our conceptual knowledge, and which (iii) can be traced back to our perceptual abilities?
e. modularity: How can we spell out and test the claim that our linguistic behavior results from the interaction of largely autonomous mental systems and subsystems?
f. interpretations: What are the respective roles of word knowledge and world knowledge in specifying what is commonly dubbed "sentence meaning" vs. "utterance meaning" vs. "communicative sense"?

The answers to (1a–f) as provided by various frameworks differ to a certain extent, though on closer inspection they will presumably turn out not to be strictly incompatible. However, typical features of theoretical innovations in linguistics such as terminological rank growth, lack of concern in dealing with equivocations, and confinement to selections of data and/or problems that are supportive of a given approach have impeded detailed comparisons between the competing approaches so far, but see Taylor (1994, 1995), Geeraerts (2010). Space limitations prevent us from delving into this endeavor here. Instead, the article attempts to convey some of the motives and tenets of what has become known as *Two-level Semantics* (which, incidentally, is not a registered trademark created by the adherents of the approach, but a label it received from reviewers) and restricts reference to kindred views to that of *Conceptual Semantic*s expounded in Jackendoff (1996, 2002; article 30 of this volume).

1.2. Basic assumptions

Two-level Semantics is not at variance with the other frameworks in recognizing the conceptual nature of, and in pursuing a mentalistic approach to, linguistic meaning. The major difference between the former and the latter is hinted at in the subtitle, which presents the distinction of two levels of representation, i.e. *Semantic Form* (SF) vs. *Conceptual Structure* (CS), as the central issue this approach claims to deal with. The relations assumed to hold between SF and CS have in common that they induce certain asymmetries but they differ in the viewpoints that give rise to these distinctions. In the following, we briefly discuss a selection of features that have been proposed to distinguish SF representations from CS representations. To clarify the significance of these rather general claims, the goals and the problems connected with the assumptions will be commented on in more concrete terms.

(2) $SF \subset CS$
In substance, SF representations may be conceived of as those subsets of CS representations that are systematically connected to, and hence covered by, lexical items and their combinatorial potential to form more complex expressions.

Strictly speaking, SF and CS here stand for two sets of elements (inventories) which make up the respective representations. Due to the conditions specified in (3) and (4) below, SF representations and CS representations do not qualify as members of the same set – the former represent linguistic knowledge, the latter non-linguistic knowledge. The relationship expressed in (2) comprises two aspects. The uncontroversial one is the subset – set relation $SF \subset CS$ which follows from the widely held view that for every linguistic expression *e* in language *L* there is a CS representation *c* assignable to it via SF(e), but not vice versa. It is obviously not the case that for every actual or latent CS item *c* there is an expression *e* in *L* with an SF(e) which makes *c* communicable to other speakers of *L*. Thus, (2) presupposes the existence of non-lexicalized concepts.

The problematic aspect of (2) is this: The view that CS representations are mental structures that mediate between language and the world as construed by the human mind implies that the Conceptual System provides representations whose contents originate in heterogeneous cognitive subsystems and which therefore have to be homogenized to yield knowledge structures that can be accessed and processed on the conceptual level. The conditions based on which, say, perceptual features stemming from vision, touch, proprioception etc. are conceptualized to figure in CS representations are far from clear. We will call this the "homogenization problem" posed by CS representations.

(3) grammar-based vs. concept-based
SF representations account for the fact that the meanings of linguistic expressions come with grammatically determined kinds of packaging in terms of morphosyntactic categories and semantic types, while the elements of CS representations, due to their mental source and intermodal homogeneity, lack grammar-based wrappings.

The distinction in (3) is not challenged in principle but it is under debate whether or not the types of grammatical packaging in which the meanings of linguistic expressions are conveyed yield a sufficient condition to postulate SF as a representation level of its own. So, e.g., R. Jackendoff (article 30) does not absolutely exclude such a level in conceding "If it proves necessary to posit an additional level of »linguistic semantic structure« that is devoted specifically to features relevant for grammatical expression […], the addition of such an extra component would not at all change the content of Conceptual Structure, which is necessary to drive inference and the connection to perception". Basically, however, he sticks to the view "that in fact such an extra component is unnecessary" (Jackendoff, this volume, p. 695). Let's call this the "justification problem" posed by the assumption of SF representations.

(4) linguistic vs. non-linguistic origin
SF representations form an integral part of the information cluster represented by the lexical entries of a given language *L*, whereas CS representations are taken to belong to, or at least to be rooted in, the non-linguistic mental systems based on which linguistic expressions are interpreted and related to their denotations.

The distinction referred to in (4) by locating the roots of SF and CS representations in different though mutually accessible mental subsystems is the view taken by adherents of Two-level Semantics, cf. Bierwisch (1983, 1996, 1997, 2007); Bierwisch & Lang (1989a); Bierwisch & Schreuder (1992) for earlier works. Article 16 (Bierwisch) *Semantic features and primes* focuses on defining SF as an interface level whose basic elements, combinatorial rules, and well-formedness constraints directly reflect the conditions on which lexicon-based meanings of morpho-syntactically categorized, regularly combined linguistic expressions are composed and interpreted. While article 16 may well be taken as a state-of-the-art report on arguments in favor of assuming SF as a level of representation, much less attention is paid to CS representations that are supposed to connect the former with "the full range of mental structures representing the content to be expressed" (Bierwisch, this volume, p. 322).

So we face problems connected with the intermodal validity and the cross-modal origin of CS representations: (i) how to relate linguistically designated SF representations with conceptually homogenized CS representations? (ii) how to trace the latter back to their respective cognitive sources that are determined by crucially differing sensory modalities?

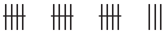
(5) storage vs. processing
SF representations are linguistic knowledge structures that are accessibly stored in long-term memory, whereas CS representations are activated and compiled in working memory, cf. article 108 (Kelter & Kaup) *Conceptual knowledge, categorization, and meaning*.

The distinction that (5) establishes by locating SF and CS representations in long-term memory and working memory, respectively, marks out what experimental psycholinguistics may contribute to clarifying the theoretically controversial interrelationship of SF and CS representations by drawing on evidence from language processing. The effects of taking (5) seriously can be expected to pay off in confirming or disconfirming the distinction of SF vs. CS but also in providing criteria for deciding what requirements the representations at issue have to meet.

The methodologically most relevant conclusion drawn by Kelter & Kaup (article 108) reads as follows: “researchers should acknowledge the fact that concepts and word meaning are different knowledge structures.” The claim in (5) suggests that if it is the SF of lexical items that is stored in long-term memory, the entries should be confined to representing what may be called “context-free lexical meanings”, whereas CS representations compiled and processed in working memory should take charge of what may be called “contextually specified (parts of) utterance meanings”. The difference between the two types of meaning representations indicates the virtual semantic underspecification of the former and the possible semantic enrichment of the latter. There is a series of recent experimental studies designed and carried out along these lines which – in combination with evidence from corpus data, linguistic diagnostics etc. – are highly relevant for the theoretical issues raised by SF vs. CS representations. Experiments reported by Stolterfoht, Gese & Maienborn (2010) and Kaup, Lüdtke & Maienborn (2010) succeeded in providing processing evidence that supports the distinction of, e.g., primary adjectives vs. adjectivized participles vs. verbal participles, that is, evidence for packaging categories relevant to SF representations. In addition, these studies reveal the processing costs of contextualizing semantically underspecified items, a result that supports the view that contextualizing the interpretation of a given linguistic expression *e* is realized by building up an enriched CS representation on the basis of SF (*e*).

1.3. SF vs. CS – an illustration from everyday life

To round off the picture outlined so far, we illustrate the features listed in (2)–(5) in favor of the SF vs. CS distinction by an example we are well acquainted with, *viz.* the representations involved in handling numbers, number symbols, and numerals in everyday life. Note that each of the semiotic objects in (6)–(8) below represents in some way the numerical concept »18«. However, how numerical concepts between »10« and »20« are stored, activated, and operated on in our memory is poorly understood as yet, so the details regarding the claim in (5) must be left open. Suffice it to agree that »18« stands for the concept we make use of, say, in trying to mentally add up the sum to be paid for our purchases in the shopping trolley. With this proviso in mind, we now look at the representations of the concept »18« in (6)–(8) to find out their interrelations.

(6) a. 
b. ::: ::: :::

(7) a. *XVIII* a'. *IIXX* (rarely occurring alternative)
b. *18*

(8) a. *eighteen, achtzehn* (8 + 10) English, German
b. *dix-huit, shi ba* (10 + 8) French, Mandarin
c. *okto-kai-deka* ((8)-and-(10)) Greek
d. *diez y ocho* ((10)-and-(8)) Spanish
e. *vosem-na-dcat'* ((8)-on-(10)) Russian

f.	*duo-de-viginti*	((2)-of-(20))	Latin
g.	*ocht-deec*	(8 + (2 × 5))	Irish
h.	*deu-naw*	(2 × 9)	Welsh

(6) shows two iconic non-verbal representations of a quantity whose correlation with the concept »18« and/or with the numerals in (8) rests on the ability to count and the availability of numerals. The tallying systems in (6) are simple but inefficient for doing arithmetic and hence hardly suitable to serve as semantic representations of the numerals in (8).

(7) shows two symbolic non-verbal representations of »18«, generated by distinct writing systems for numbers. The Roman number symbols are partially iconic in that they encode addition by iterating up to three special symbols for *one*, *ten*, *hundred*, or *thousand*, partially symbolic due to placing the symbol of a small number in front of the symbol of a larger number, thus indicating subtraction, cf. (7a, a'). The lack of a symbol for *null* prevented the creation of a positional system, the lack of means to indicate multiplication or division impeded calculation. Both were obstacles to progress in mathematics. Thus, Roman number symbols may roughly render the lexical meaning of (8a–f) but not those of (8g–h) and all other variants involving multiplication or division.

The Indo-Arabic system of number symbols exemplified by *18* in (7b) is a positional system without labels based on exponents of *ten* ($10^0, 10^1, 10^2, \dots, 10^n$). As a representational system for numbers it is recursive and potentially infinite in yielding unambiguous and well-distinguished chains of symbols as output. Thus, knowing the system implies knowing that *18 ≠ 81* or that *17* and *19* are the direct predecessor and successor of *18*, respectively, even if we do not have pertinent number words at our disposal to name them. Moreover, it is this representation of numbers that we use when we do arithmetic with paper and pencil or by pressing the keys of an electronic calculator. Enriched with auxiliary symbols for arithmetical operations and for marking their scope of application, as well as furnished with conventions for writing equations etc., this notational system is a well-defined means to reduce the use of mathematical expressions to representations of their Conceptual Structures, that is, to the CS representations they denote, independent of any natural language in which these expressions may be read aloud or dictated. Let's call this enriched system of Indo-Arabic number symbols the "CS system of mathematical expressions". Now, what about the SF representations of numerals?

Though all number words in (8) denote the concept »18«, it is obvious that their lexical meanings differ in the way they are composed, cf. the second column in (8). As regards their combinatorial category, the number words in (8) are neither determinative nor copulative compounds, nor are they conjoined phrases. They are perhaps best categorized as juxtapositions with or without connectives, cf. (8c–f) and (8a–b, g–h), respectively. The unique feature of complex number words is that the relations between their numeral constituents are nothing but encoded fundamental arithmetic operations (addition and multiplication are preferred; division and subtraction are less frequent). Thus, the second column in (8) shows SF representations of the number words in the first column couched in terms of the CS system of mathematical expressions. The latter are construable as functor-argument structures with arithmetic operators ('+', '–', '×' etc.) as functors, quantity constants for digits as arguments, and parentheses (…) as boundaries marking lexical building blocks. Now let's see what all this tells us about the distinctions in (2)–(5) above.

The subset – set relation SF ⊂ CS mentioned in connection with (2) also holds for the number symbols in (7b). The CS system of mathematical expressions is capable of representing all partitions of *18* that draw on fundamental arithmetic operations. Based on this, the CS system at stake covers the internal structures of complex number words, cf. (8), as well as those of equations at the sentence level like $18 = 3 \times 6$; $18 = 2 \times 9$; $18 = 72 : 4$ etc.

By contrast, the subset of SF representations for numerals is restricted in two respects. First, not all admissible partitions of a complex number like *18* are designated as SF of a complex numeral lexicalized to denote »18«. The grammar of number words in *L* is interspersed with (certain types of) *L*-specific packing strategies, cf. Hurford (1975), Greenberg (1978). Second, since the ideal relationship between systems of number symbols and systems of numerals is a one-to-one correspondence, the non-ambiguity required of the output of numeral systems practically forbids creation or use of synonymous number names (except for the distinct numerals used for e.g. *1995* when speaking of years or of prices in €).

There is still another conclusion to be drawn from (6)–(8) in connection with (2). The CS system of mathematical expressions is a purposeful artifact created and developed to solve the "homogenization problem" raised by CS representations for the well-defined field of numbers and arithmetic operations on them. First, the mental operations of counting, adding, multiplying etc., which the system is designed to represent, have been abstracted from practical actions, *viz.* from lining up things, bundling up things, bundling up bundles of things etc. Second, the CS representations of mathematical expressions provided by the system are unambiguous, complete (that is, fully specified and containing neither gaps nor variables to be instantiated by elements from outside the system), and independent of the particular languages in which they may be verbalized.

The lexicon-based packaging and contents of the components of SF representations claimed in (3) and (4) are also corroborated by (6)–(8). The first point to note is the *L*-specific ways in which (i) numerals are categorized in morpho-syntactic terms and (ii) their lexical meanings are composed. The second point is this: Complex numerals differ from regular (determinative or copulative) compounds in that the relations between their constituents are construed as encodings of fundamental arithmetical operations, cf. (8a–h). This unique feature of the subgrammar of number words also yields a strong argument wrt. the "justification problem" posed by the assumption of lexicon-based SF representations.

The claims in (3) and (4) concerning the non-linguistic nature of CS representations are supported by the fact that e.g. *18* is an intermodally valid representation of the concept »18« as it covers both the perception-based iconic representations of »18« in (6) and the lexicon-based linguistic expressions denoting »18« in (8). Thus, the unique advantage of the CS system of mathematical expressions is founded on the representational intermodality and the conceptual homogeneity it has achieved in the history of mathematical thinking. No other science is more dependent on the representations of its subject than mathematics.

Revealing as this illustration may be, the insights it yields cannot simply be extended to the lexicon and grammar of a natural language *L* beyond the subgrammar of number words. The correlations between systems of number names and their SF representations in terms of the CS system of mathematical expressions form a special case which results from the creation of a non-linguistic semiotic artifact, *viz.* a system to represent number concepts under controlled laboratory conditions. The meanings, the combinatorial potential and hence the SF representations of lexical items outside the domain of numeric tools are far less strictly codified than those of numerals. Otherwise, the controversial issues listed in (1) would not emerge. The overwhelming majority of SF representations of lexical items have to account for ambiguity, polysemy, underspecification, context-dependency etc., that is, for phenomena which require the use of appropriate variables at the SF level to be instantiated by pieces of information available at the CS level.

1.4. Aims and limitations

Having outlined some perspectives and problems connected with the assumption of two separate but interacting levels of semantic representation, we conclude this introductory survey by some remarks on the weight one may attach to the pros and cons discussed so far.

First, regarding the justification problem raised by (3) there is a truism: the representations assigned to linguistic meaning depend on the meaning attributed to linguistic representations. In other words, in view of our limited knowledge of the principles based on which linguistic expressions and semantic interpretations are mutually assigned, we cannot get along without auxiliary terminology such as *tier*, *layer*, *plane*, *domain* etc. Thus, the term *level of representation* is just a heuristic aid that serves as a gathering place for distinctions considered to be necessary and worth systematizing. Any further assessment is premature.

Second, the crucial point is not the number of levels of linguistic structure formation we postulate but the validity of the arguments based on which such levels are substantiated. It is above all this guideline that characterizes the efforts subsumable under the label *Two-level Semantics.* There have been proposals to increase the number of levels, cf. Dölling (2001, 2003, 2005a); Schwarz (1992), as well as criticisms regarding the mapping operations assumed to apply between SF and CS, cf. Blutner (1995, 1998, 2004), Meyer (1994), Taylor (1994, 1995). Given the situation defined by the questions in (1), Two-level Semantics may be considered a series of attempts along the lines of (2)–(5) to achieve a more fine-grained picture of what we are used to calling "semantic interpretation". These attempts were, and still are, driven and guided by the following leitmotif:

(9) The semantic interpretation of a sentence *s* in isolation as well as of its utterance in use require to differentiate and interrelate those portions of its meaning that are lexicon-based and those possibly available portions of meaning that are context-based such that the latter may serve as specifications of the former.

Third, in view of the fact that lexical SF representations are discussed in detail by M. Bierwisch (article 16), we will pay more attention to compositionality issues (§3) and CS representations and the way they account both for the semantic issues pointed out in (1) and for the various problems raised in connection with the distinctions in (2)–(5) above (§4).

Fourth, Two-level Semantics shares several objectives with the framework presented in article 30 (Jackendoff) *Conceptual Semantics* but prefers different solutions. There is agreement on the guiding role of compositionality and the need for decomposition. Jackendoff's requirement that "Utterance meanings must serve as a formal basis for inference" (Jackendoff, this volume, p. 691) is accepted as contextualized inferencing at the CS level but in addition there are built-in inferences at the SF level. The two-level framework acknowledges the import of categorization and contextualization but places emphasis on the grammatical nature of SF as indicated in (3) and (4) above. On this view, the principles governing SF representations concern not only the internal meaning structure and the grammatical packaging of lexical items but also general conditions on the lexical system of *L*, e.g. grammatical categories, lexicalization patterns, options to be chosen as the basis of agreement etc. By way of illustration, note the following.

The English collective noun (i) *married couple* has two equivalents in German: (ii) *Ehepaar*, which is also a collective noun, and (iii) *Eheleute*, which, though based on a plural only noun, behaves like a regular individual plural and has no direct counterpart in English; cf. Dölling (1994), Lang (1994). Now, while all three are absolutely alike at the CS level in denoting a set of two individuals as HUSBAND AND WIFE, they differ at the SF level in the way they are sensitive to number agreement and selectional restrictions, cf. (10–13):

(10) a. Die Eheleute hassen [3P.Pl] einander/sich gegenseitig.
b. Das Ehepaar hasst [3P.Sg] *einander/*sich gegenseitig.
c. Das Ehepaar *ist/*sind [3P.Sg/Pl] beide Linkshänder.
d. Die Eheleute sind [3P.Pl] beide Linkshänder.

(11) a. The married couple hate [3P.Pl] each other/are [3P.Pl] both left-handers.
b. Each one of the married couple hates [3P.Sg] the other.

(12) a. The married couple is [3P.Sg] waiting for their visa.
b. The married couple are [3P.Pl] waiting for their visas.

(13) a. Das Ehepaar$_i$ wartet [3P.Sg] auf sein$_i$/*ihr$_i$ Visum.
b. Die Eheleute$_i$ warten [3P.Pl] auf ihre$_i$ Visa.

The antecedent of reciprocals like *einander* or *each other* must denote a set of two (or more) elements. In both languages, the antecedent is usually a plural NP or an *and*-coordination of NPs; with collective nouns, however, there are language-particular constraints. In German, agreement features for person, number, and gender are assigned on the basis of some morpho-syntactic correspondence between antecedent and target. A singular collective noun as subject requires a verb in the singular and excludes reciprocals like *einander* as complement, cf. (10b,c; 13a), whereas plural NPs or *and*-coordinated NPs as subjects usually come with plural verbs and allow for reciprocals as complements, cf. (10a,d; 13b). In British English, however, *committee*-type singular nouns as subjects may spread agreement features on a morpho-syntactic or on a semantic basis, cf. (11a,b; 12a,b). Cases of singular agreement like (12a) are conceptualized as referring to a single entity, cases of plural override like (12b) are conceptualized as referring to the individual members of the set. What is an option in English is an obligatory lexical choice in German. As lexical items, English singular collective nouns are unspecified for inducing morpho-syntactic or semantic agreement and for co-occurring with reciprocals, German singular collective nouns, however, are basically unavailable for plural agreement and/or reciprocals since number agreement in German strictly operates on morpho-syntactic matching. In sum, although having the same SF, the collective nouns *married couple* and *Ehepaar* differ in their impact on sentence formation.

Moreover, since SF forms a constitutive part of *L* as a natural language, it is subject to a series of pragmatic-based felicity conditions on communication. None of these aspects of SF as a linguistic level applies to CS representations.

The article attempts to show that the distinction of SF vs. CS representations may turn out to be a useful heuristic means in dealing with the issues listed in (1) as well as a promising research strategy to connect semantic theorizing with empirical methods of analyzing semantic processing along the lines of (5). Guided by the leitmotif in (9), §2 deals with some unsolved problems of polysemy. §3 explores the SF vs. CS distinction from the angle of compositionality, and in §4 we turn to contextualization by discussing case studies of variables in SF representations and their instantiation at the CS level. In doing so, we also examine how inferences are accounted for by SF and CS representations, respectively.

2. Polysemy problems

2.1. Institution nouns

Meaning multiplicity on the lexical level comprises three basic types: homonymy, polysemy, and indeterminacy (or vagueness). Bierwisch (1983), in a way the birth certificate of the SF vs. CS distinction, draws on institution nouns such as *school*, *university, museum, parliament* etc. to illustrate systematic polysemy, that is, a lexical item with one meaning representation acquiring further representations that differ from the first in predictable ways based on conceptual relations. (14a–d) below shows some of the readings that *school* may assume. The readings are numbered and the concepts they represent are added in *ITALICIZED CAPS*. NORMAL CAPS in (15) show the invariant SF representation for the lexeme *school*, which may be contextually specified at the CS level by applying certain functions to (15) that eventually yield the utterance meanings of (14a–d) as represented in (16a–d).

(14) a. The school made a major donation. $\text{school}_1 \subset$ *INSTITUTION*
b. The school has a flat roof. $\text{school}_2 \subset$ *BUILDING*
c. He enjoys school very much. $\text{school}_3 \subset$ *PROCESS*
d. The school took a staff outing. $\text{school}_4 \subset$ *PERSONNEL*

(15) SF(*school*) = λX [PURPOSE X W]
with W = PROCESSES_OF_LEARNING_AND_TEACHING

(16) a. λX [*INSTITUTION* X & SF (*school*)]
b. λX [*BUILDING* X & SF (*school*)]
c. λX [*PROCESS* X & SF (*school*)]
d. λX [*PERSONNEL* X & SF (*school*)]

Taken together, (14)–(16) show a way of (i) keeping the lexical meaning of the lexeme *school* constant and avoiding problematic ambiguity assumptions and (ii) still accounting for the range of semantic variation the lexeme *school* may cover at the CS level. The conceptual interpretations of *school* in (16) are determined by selectional restrictions, cf. (14a–d), and come with distinctive grammatical features: so e.g. *school* in the *PROCESS* reading has no regular plural and in German the prepositions in *Max geht auf die/in die/zur Goethe-Schule* clearly select the *INSTITUTION, BUILDING* and *PROCESS* reading, respectively. So far, so good. Methodologically, however, the analysis of these institution nouns poses some problems.

First of all, we do not have reliable principles yet to find the SF of a polysemous lexeme, which makes it difficult to motivate a collection of templates that would account for the specifications in (16). Moreover, it is unclear (i) whether the members of the concept family associated with the noun *school* all draw on the abstract SF the same way (as suggested by (15–16)) or (ii) whether some of the concepts are more closely interconnected than others. Finally, it is unclear what conceptual (sub-)system is taken to serve as the source for the specifications in (16). To show the importance of these issues and their impact on the SF vs. CS distinction some brief comments might be in order.

The SF proposed in (15) takes *school* as a sort of artifact by drawing on the feature PURPOSE X W, which is not implausible as it inheres in all artifact-denoting nouns. However, (15) ignores the social relevance attributed to the purpose W = PROCESSES_OF_LEARNING_ AND_TEACHING or to the purposes W', W" of other institution nouns. Actually, what makes a created X into an INSTITUTION is its social importance evidenced by the fact that some PURPOSE W^i has been institutionalized by founding or keeping X. Therefore, instead of reducing the role of this feature common to all institution nouns to that of yielding a concept at the CS level, cf. *INSTITUTION* in (16a), the lexical semantics of these nouns should make use of it as an invariant component at the SF level. Heuristically, the starting point for construing the SF of *school* and the CS specifications in (16) might be the lexical meaning of *institution*, which is something like 'a legal entity that organizes purposeful events to be performed and/or received by authorized groups of persons in specific locations' such that it (i) also covers abstract instances like *the institution of marriage* and (ii) provides the basis for (16a–d) as metonymy-based conceptual shifts. The learned word *institution*, no doubt an element of the adult lexicon, has a lexical meaning that is sufficiently abstract to allow for each and every of the conceptual specifications of *school* in (16); its conceptual basis is a sort of world knowledge that rests on what may be called "created advanced level concepts", which in turn define a widely unexplored domain of the conceptual system.

In contrast, the conceptual subsystem of spatial orientation is a domain we know a bit more about, as it crucially draws on human perception and thus on "natural basic level concepts". So it is not a surprise that a number of pioneering works in the realm of conceptual structure deal with spatial issues. Since these studies provide better illustrations of the SF vs. CS distinction, we will focus on them in the next sections.

Another problem with this approach to systematic polysemy is the fact that, despite their ontological and/or categorial differences, the conceptual specifications of the SF (*school*) in (16a–d) are not absolutely incompatible but may occur in certain combinations, cf. the gradual acceptability of the examples in (17):

(17) a. The school which has a flat roof made a major donation.
b. ?? The school, which has a flat roof, made a major donation.
c. ?? The school, which has a flat roof, went out for a staff outing.
d. The school has a flat roof and *it/the school went out for a staff outing.

Whereas the *INSTITUTION* and the *BUILDING* readings are somewhat compatible, the *BUILDING* and the *PERSONNEL* readings are not; as regards the (type of) reading of the antecedent, anaphoric pronouns are less tolerant than relative pronouns or repeated DPs. The data in (17) show that the conceptual specifications of SF (*school*) differ in ways that are poorly understood as yet; cf. Asher (2007) for some discussion. The semantics of institution nouns, for a while the signature tune of Two-level Semantics, elicited a certain amount of discussion and criticism, cf. Herzog & Rollinger (1991), Bierwisch & Bosch (1995). The problems expounded in these volumes are still unsolved but they sharpened our view of the intricacies of the SF vs. CS distinction.

2.2. Locative prepositions

In many languages the core inventory of adpositions encode spatial relations to localize some x (called *theme*, *figure* or *located object*) wrt. the place occupied by some y (called *relatum*, *ground* or *reference object*), where x and y may pairwise range over objects, substances, and events. Regarding the conceptual basis of these relations, locative prepositions in English and related languages are usually subdivided into topological (*in, at, on*), directional (*into, onto*), dimensional (*above, under, behind*), and path-defining (*along, around*) prepositions. The semantic problems posed by these lexical items can be best illustrated with *in*, which supposedly draws on spatial containment, pure and simple, and which is therefore taken to be the prime example of a topological preposition.

To illustrate how SF (*in*) is integrated into a lexical entry with information on Phonetic Form (PF), Grammatical Features (GF), Argument Structure (AS) etc., we take German *in* as a telling example: It renders English *in* vs. *into* with distinct cases which in turn correspond to the values of the feature [± Dir(ectional)] subcategorizing the internal argument y, and to further syntactic distinctions. The entry in (18) is taken from Bierwisch (1988: 37), examples are added in (19). The interdependence of the values for the case feature [± Obl(ique)] and for the category feature [± Dir] is indicated by means of the meta-variable $\alpha \in \{+,-\}$ and by the conventions (i) $-\alpha$ inverts the value of α and (ii) ($_{\alpha}$W) means that W is present if $\alpha = +$ and absent if $\alpha = -$.

(18) Lexical entry of the German preposition *in*:

$$\overbrace{\text{/in/;}}^{\text{PF}} \qquad \overbrace{[-\text{V},-\text{N}, \alpha\ \text{Dir}];}^{\text{GF}} \qquad \overbrace{\underset{\substack{|\\ [-\ \alpha\ \text{Obl}]}}{\lambda y}\quad \lambda \underline{x}}^{\text{AS}} \qquad \overbrace{[(_{\alpha}\text{FIN})\ [\text{LOC}\ x] \subset [\text{LOC}\ y]]}^{\text{SF}}$$

(19) a. Die Straße/Fahrt führt in die Stadt. [+ Dir, – Obl] = Acc, “x is a path ending in y”

The street/journey leads into the city.

$$\text{/in/;} \qquad [-\text{V},-\text{N}, +\ \text{Dir}]; \qquad \underset{\substack{|\\ [-\ \text{Obl}]}}{\lambda y}\ \lambda \underline{x}\ \ [(\text{FIN})\ [\text{LOC}\ x] \subset [\text{LOC}\ y]]$$

b. Die Straße/Fahrt ist in der Stadt. [– Dir, + Obl] = Dat, “x is located in y”
The street/journey is in the city.

/in/; [–V,–N, −Dir]; $\lambda y\ \lambda \underset{\underset{[+\text{Obl}]}{|}}{\underline{x}}$ $[[\text{LOC } x] \subset [\text{LOC } y]]$

Now let’s take a closer look at the components of SF. The variables x and y represent entities ranging over the domains of objects, substances, or events. LOC is a SF functor-constant of category N/N such that LOC x assigns x the place it occupies in the domain it is an element of. The SF constant FIN yields the final part of [LOC x], thereby transforming the external argument of *in* into a path. The SF-constant ⊂ “specifies a particular relation between places, in the case of *in* simply (improper) inclusion” (Bierwisch 1988: 34). Confining our review to objects, the SF of *in* assigned to (19b) might thus be paraphrased as “the place occupied by the street x is (improperly) included in the place occupied by the city y” (op. cit.).

While it is widely accepted that the semantics of locative *in* should be based on spatial inclusion, the relativizing attribute “(improper)” in the explication of the SF-constant ⊂ quoted above is indicative of a hidden controversial issue. In fact, much ink has been spilled on the problem of how to determine the lexical meaning of *in* by keeping to the spatial inclusion approach. The discussion was ignited by groups of data that seem to challenge the [[LOC x] ⊂ [LOC y]] analysis of the preposition *in* in some way.

(20) a. The amount of *oxygen in the air* is diminishing.
b. The *balloons in the air* quickly escaped.
c. The *air in the balloons* quickly escaped.

(21) a. The *water in the vase* should be replaced.
b. The *flowers in the vase* are wilted.
c. The *cracks in the vase* cannot be repaired.
d. I did not notice the *splinter in his hand*.

Whereas the approach under review might capture the examples in (20) by letting x and y range over substances (a) or objects and substances (b, c), the differences of (20a vs. b) and of (20b vs. c) in the interpretation of LOC and ⊂ remain out of its reach. Obviously, (20a–c) differ in the way the place is assigned to x and to y by LOC, but are alike in clearly requiring that ⊂ has to be interpreted as proper inclusion. The examples in (21) show that the place assigned to the relatum by the functor LOC is not confined to the material boundaries of the object y but may vary to some extent. In (21a–c) the interpretation of *in the vase* involves function-based enrichment, e.g. by means of gestalt-psychological laws of closure, to account for the containment relation between x and y, which is proper in (21a), partial in (21b), and privative in (21c). The PP in (21d) is ambiguous, i.e. unspecified wrt. “x being materially included in y (as a foreign body)” or “x being functionally included in a cupped y (to prevent x from getting lost)”.

The discussion of such data produced a series of theoretical revisions of the semantic analysis of topological prepositions. Wunderlich & Herweg (1991) propose (22) as a general schema for the SF of locative prepositions thereby abandoning the problematic functor ⊂ and revising the functor LOC:

(22) λy λx (LOC (x, PREP*(y))),

> where LOC localizes the object x in the region determined by the preposition *p* and PREP* is a variable ranging over *p*-based regions.

Bierwisch (1996: 69) replaces SF (*in*) in (18) with λy λx [x [LOC [INT y]]] commenting "*x* LOC *p* identifies the condition that the location of *x* be (improperly) included in *p*" and "INT *y* identifies a location determined by the boundaries of *y*, that is, the interior of *y*". Although this proposal avoids some of the problems with the functor ⊂, the puzzling effect of "(improperly) included" remains and so does the definition of INT y as yielding "the interior of x".

Herweg (1989) advocates an abstract SF (*in*) which draws on proper spatial inclusion such that the examples in (21) are semantically marked due to violating the "Presupposition of Argument Homogeneity". The resulting truth value gap triggers certain function-based accommodations at the CS level that account for the interpretations of (21a–d).

Hottenroth (1991), in a detailed analysis of French *dans*, rejects the idea that SF (*dans*) might draw on imprecise region-creating constants like INT *y*. Instead, SF (*dans*) should encode the conditions on the relatum in prototypical uses of *dans*. The standard reference region of *dans* is a three-dimensional empty closed container (bottle, bag, box etc.). If the relatum of *dans* does not meet one or more of these characteristics, the reference region is conceptually adapted by means of certain processing principles (laws of closure, mental demarcation of unbounded y, conceptual switching from 3D to 2D etc.).

In view of data like those in (21), Carstensen (2001) proposes to do away with the region account altogether and to replace it with a perception-based account of prepositions that draws on the conceptual representation of changes of focused spatial attention.

To sum up, the brief survey of developments in the semantic analysis of prepositions may also be taken as proof of the heuristic productivity emanating from the SF vs. CS distinction. Among polysemous verbs, the verb *to open* has gained much attention, cf. Bierwisch (article 16). Based on a French-German comparison, Schwarze & Schepping (1995) discuss what type of polysemy is to be accounted for at which of the two levels. Functional categories (determiners, complementizers, connectives etc.), whose lexical meanings lack any support in perception and are hence purely operative, have seldom been analyzed in terms of the SF vs. CS distinction so far; but cf. Lang (2004) for an analysis that accounts for the abstract meanings of *and*, *but* etc. and their contextual specification by inferences drawn from the structural context, the discourse context, and/or from world knowledge. Clearly, the 'poorer' the lexical meaning of such a synsemantic lexical item, the more will its semantic contribution need to be enriched by means of contextualization.

3. Compositionality and beyond: Semantic underspecification and coercion

Two-level Semantics was first mainly concerned with polysemy problems of the kind illustrated in the previous section. Emphasis was laid on developing an adequate theory of lexical semantics that would be able to deal properly and on systematic grounds with the distinction of *word* knowledge and *world* knowledge. A major tenet of Two-level Semantics as a lexicon-based theory of natural language meaning is that the *internal* decompositional structure of lexical items determines their *external* combinatorial properties, that is, their external syntactic behavior. This is why compositionality issues are of eminent interest to Two-level Semantics; cf. (1a).

There is wide agreement among semanticists that, given the combinatorial nature of linguistic meaning, some version of the principle of compositionality – as formulated, e.g., in (23) – must certainly hold. But in view of the complexity and richness of natural language meaning, there is also consensus that compositional semantics is faced with a series of challenges and problems; see article 6 (Pagin & Westerståhl) Compositionality.

(23) Principle of compositionality:
The meaning of a complex expression is a function of the meanings of its parts and the way they are syntactically combined.

Rather than weakening the principle of compositionality or abandoning it altogether, Two-level Semantics seeks to cope with the compositionality challenge by confining compositionality to the level of Semantic Form. That is, SF is understood as comprising exactly those parts of natural language meaning that are (i) context-independent and (ii) compositional, in the sense that they are built in parallel with syntactic structure. This leaves space to integrate non-compositional aspects of meaning constitution at the level of Conceptual Structure. In particular, the mapping of SF-representations onto CS-representations may include non-local contextual information and thereby qualify as non-compositional. Of course, the operations at the CS level as well as the SF – CS mapping operations are also combinatorial and can therefore be said to be compositional in a broader sense. Yet their combinatorics is not bound to mirror the syntactic structure of the given linguistic expression and thus does not qualify as compositional in a strict sense. This substantiates the assumption of two distinct levels of meaning representation as discussed in §1. Thus, Two-level Semantics' account of the richness and flexibility of natural language meaning constitution consists in assuming a division of labor between a rather abstract, context-independent and strictly compositionally determined SF and a contextually enriched CS that also includes non-compositionally derived meaning components. Various solutions have been proposed for implementing this general view of the SF vs. CS distinction. These differ mainly in (a) the syntactic fine-tuning of the compositional operations and the abstractness of the corresponding SF-representations, and in (b) the way of handling non-compositional meaning aspects in terms of, e.g., coercion operations. These issues will be discussed in turn.

3.1. Combinatory meaning variation

Assumptions concerning the spell-out of the specific mechanisms of compositionality are generally guided by parsimony. That is, the fewer semantic operations warranting compositionality are postulated, the better. On this view, it would be attractive to have a single semantic operation, presumably functional application, figuring as the semantic counterpart to syntactic binary branching. An illustration is given in (24):

Given the lexical entries for the locative preposition *in* and the proper noun *Berlin* in (24a) and (24b) respectively, functional application of the preposition to its internal argument yields (24c) as the compositional result corresponding to the semantics of the PP.

(24) a. in: $\lambda y\, \lambda x\, (\textsc{loc}\, (x, \textsc{in}^*(y)))$
b. Berlin: berlin
c. $[_{PP}$ in $[_{DP}$ Berlin$]]$: $\lambda y\, \lambda x\, (\textsc{loc}\, (x, \textsc{in}^*(y)))\, (\text{berlin})$
$\equiv \lambda x\, (\textsc{loc}\, (x, \textsc{in}^*(\text{berlin})))$

Functional application is suitable for syntactic head-complement relationships as it reveals a correspondence between the syntactic head-non-head relationship and the semantic functor-argument relationship. In (24c), for instance, the preposition *in* is both the syntactic head of the PP and the semantic functor, which takes the DP as its argument. Syntactic adjuncts, on the other hand, cannot be properly accounted for by functional application as they lack a comparable syntax-semantics correspondence. In syntactic head-adjunct configurations the semantic functor, if any, is not the syntactic head but the non-head; for an overview of the different solutions that have been put forth to cope with this syntax-semantics imbalance see article 54 (Maienborn & Schäfer) *Adverbs and adverbials*. Different scholars working in different formal frameworks have suggested remarkably convergent solutions, according to which the relevant semantic operation applying to syntactic head-adjunct configurations is predicate conjunction. This might be formulated, for instance, in terms of a modification template MOD as given in (25); cf., e.g. Higginbotham's (1985) notion of *θ-identification*, Bierwisch's (1997) *adjunction schema*, Wunderlich's (1997b) *argument sharing*, or the composition rule of *predicate modification* in Heim & Kratzer (1998).

(25) Modification template MOD:
MOD: $\lambda Q\, \lambda P\, \lambda x\, (P(x)\ \&\ Q(x))$

The template MOD takes a modifier and an expression to be modified (= modifyee) and turns it into a conjunction of predicates. More specifically, an (intersective) modifier adds a predicate that is linked up to the referential argument of the expression to be modified. In (26) and (27) illustrations are given for nominal modification and verbal modification, respectively. In (26), the semantic contribution of the modifier is added as an additional predicate of the noun's referential argument. In (27), the modifier provides an additional predicate of the verb's eventuality argument.

(26) a. house: $\lambda z\, (\textsc{house}\, (z))$
b. $[_{PP}$ in Berlin$]$: $\lambda u\, (\textsc{loc}\, (u, \textsc{in}^*(\text{berlin})))$
c. $[_{NP}\, [_{NP}$ house$]\, [_{PP}$ in Berlin$]]$:
$\lambda Q\, \lambda P\, \lambda x\, (P(x)\ \&\ Q(x))\, (\lambda z\, (\textsc{house}\, (z)))\, (\lambda u\, (\textsc{loc}\, (u, \textsc{in}^*(\text{berlin}))))$
$\equiv \lambda x\, (\textsc{house}\, (x)\ \&\ \textsc{loc}\, (x, \textsc{in}^*(\text{berlin})))$

(27) a. sleep: $\lambda z\, \lambda e\, (\textsc{sleep}\, (e)\ \&\ \textsc{agent}\, (e, z))$
b. $[_{PP}$ in Berlin$]$: $\lambda u\, (\textsc{loc}\, (u, \textsc{in}^*(\text{berlin})))$
c. $[_{VP}\, [_{VP}$ sleep$]\, [_{PP}$ in Berlin$]]$:

$$\lambda Q\, \lambda P\, \lambda x\, (P(x) \,\&\, Q(x))(\lambda z\, \lambda e\, (\textsc{sleep}\,(e) \,\&\, \textsc{agent}\,(e,z)))(\lambda u\, (\textsc{loc}\,(u, \textsc{in}^*(\text{berlin}))))$$
$$\equiv \lambda z\, \lambda e\, (\textsc{sleep}\,(e) \,\&\, \textsc{agent}\,(e, z) \,\&\, \textsc{loc}\,(e, \textsc{in}^*(\text{berlin})))$$

The semantic template MOD thus provides the compositional semantic counterpart to syntactic head-adjunct configurations. There are good reasons to assume that, besides functional application, some version of MOD is required when it comes to spelling out the basic mechanisms of compositionality.

The template MOD in (25) captures a very fundamental insight about the compositional contribution of intersective modifiers. Nevertheless, scholars working within the Two-level Semantics paradigm have emphasized that a modification analysis along the lines of MOD fails to cover the whole range of intersective modification; cf., e.g., Maienborn (2001, 2003) for locative adverbials, Dölling (2003) for adverbial modifiers in general, Bücking (2009, 2010) for nominal modifiers. Modifiers appear to be more flexible in choosing their compositional target, both in the verbal domain and in the nominal domain. Besides supplying an additional predicate of the modifyee's referential argument, as in (26) and (27), modifiers may also relate less directly to their host argument. Some illustrations are given in (28)–(30). (For the sake of simplicity the data are presented in English.)

(28) a. The cook prepared the chicken in a Marihuana sauce. (cf. Maienborn 2003)
b. The bank robbers escaped on bicycles.
c. Paul tickled Maria on her neck.

(29) a. Anna dressed Max's hair unobtrusively. (cf. Dölling 2003: 530)
b. Ede reached the summit in two days. (cf. Dölling 2003: 516)

(30) a. the fast processing of the data (cf. Bücking 2009: 94)
b. the preparation of the chicken in a pepper sauce (cf. Bücking 2009: 102)
c. Georg's querying of the men (cf. Bücking 2010: 51)

The locative modifiers in (28) differ from the general MOD pattern as illustrated in (27) in that they do not locate the whole event but only one of its integral parts. For instance, in (28b) it's not the escape that is located on bicycles but – according to the preferred reading – the agent of this event, viz. the bank robbers. In the case of (28c), the linguistic structure does not even tell us what is located on Maria's neck. It could be Paul's hand but also, e.g., a feather he used for tickling Maria. Maienborn (2001, 2003) calls these modifiers "event internal modifiers" and sets them apart from "event external modifiers" such as in (27), which serve to holistically locate the verb's eventuality argument.

Similar observations are made by Dölling (2003) wrt. cases like (29). Sentence (29a) is ambiguous. It might be interpreted as expressing that Anna performed the event of dressing Max's hair in an unobtrusive manner. This is what the application of MOD would result in. But (29a) has another reading, according to which it is not the event of hair dressing that is unobtrusive but Max's resulting hair-style. Once again, the modifier's contribution does not apply directly to the verb's eventuality argument but to some referent related to it. The same holds true for (29b), where the temporal adverbial cannot relate to the punctual event of Ede reaching the summit but only to its preparatory phase.

Finally, Bücking (2009, 2010) discusses a series of cases in the nominal domain which also show a less direct relationship between the modifier and its host argument than the one established by MOD; cf. (25). The modifier *fast* in (30a), for instance, may be interpreted event-externally, expressing that the overall duration of the processing was short. But (30a) also has an event-internal interpretation, according to which the subevents of processing the data were performed in a fast manner (whereas the whole processing might have taken a long time). In a similar vein, Georg need not necessarily be the agent of the querying in (30c). Bücking argues that the prenominal genitive establishes a more indirect relationship to the nominal referent, such that a more abstract control relation between Georg and the query would suffice; cf. the one provided by the context in (31).

(31) Georg wanted to know how mens' buying behavior is influenced by the weather. He therefore instructed his research assistants to interview men under varying weather conditions. Georg's querying of the men is still considered a milestone in consumer research.

(cf. Bücking 2010: 51)

The conclusion to be drawn from these and similar studies is that modifiers show a remarkable flexibility in relating to their compositionally determined host argument, thus giving rise to a wide spectrum of meaning variations.

Is there a way to treat this observation compositionally? The proposals developed by Bücking, Dölling and Maienborn basically amount to liberalizing MOD such that it may license the particular kind of semantic underspecification observed above. That is, besides linking the semantic contribution of the modifier directly to the verb's or noun's referential argument, as in (25), there should be a less direct variant that could be spelled out as in (32).

(32) Modification template MOD':
MOD': $\lambda Q\ \lambda P\ \lambda x\ (P(x)\ \&\ R\ (x, v)\ \&\ Q(v))$

MOD' introduces a free variable v that is linked to the modifyee's referential argument x by means of a relational variable R. Both v and R are so-called *SF-parameters*, i.e. free variables that remain underspecified at the level of SF and will only be instantiated at the level of CS. Applying MOD' to a sentence such as (28c), repeated as (33), yields the following SF:

(33) Paul tickled Maria on her neck.
SF: ∃e (TICKLE (e) & AGENT (e, paul) & PATIENT (e, maria) & R (e, v) & LOC (v, ON*(maria's neck))

According to the SF in (33), an entity v which is involved in the tickling event is located on Maria's neck. This is as far as the compositional semantics of event-internal modifiers takes us. The identification of v and its exact role in e can only be spelled out at the CS level by taking into account contextually available world knowledge. This would include, e.g., knowledge about the spatial configuration required for tickling, viz. contact, as well as knowledge about suitable and/or plausible instruments employed for tickling. A potential conceptual spell-out is given in (34); cf. Maienborn (2003: 490ff) for details.

(34) Paul tickled Maria on her neck.
SF: ∃e (TICKLE (e) & AGENT (e, paul) & PATIENT (e, maria) & R (e, v) & LOC (v, ON*(maria's neck))
CS: ∃ex (TICKLE (e) & AGENT (e, paul) & PATIENT (e, maria) & INSTR (e, x) & FEATHER (x) & LOC (x, ON*(maria's neck))

This conceptual spell-out provides a plausible utterance meaning for sentence (34). It goes beyond the compositionally determined meaning by exploiting our conceptual knowledge that tickling is performed with some instrument which needs to have spatial contact to the object being tickled. Consequently, the SF-parameter R can be identified as the instrument relation, and the parameter v may be instantiated, e.g., by a feather. Although not manifest at the linguistic surface, such conceptually inferred units are plausible potential instantiations of the compositionally introduced SF-parameter v. (Dölling and Maienborn use abduction as a formal means of deriving a contextually specified CS from a semantically underspecified SF; cf. Hobbs et al. (1993). We will come back to the SF-CS mapping in §4.)

Different proposals have been developed for implementing the notion of a more liberal and flexible combinatorics, such as MOD', into the compositional machinery. Maienborn (2001, 2003) argues that MOD' is only licensed in particular structural environments: Event-internal modifiers have a base adjunction site in close proximity to the verb, whereas event-external adjuncts adjoin at VP-level. These distinct structural positions provide the key to a compositional account. Maienborn thus formulates a more fine-tuned syntax-semantics interface condition that subsumes MOD and MOD' under a single compositional rule MOD*.

(35) Modification template MOD*:
MOD*: λQ λP λx (P(x) & R (x, v) & Q(v))

Condition on the application of MOD*: If MOD* is applied in a structural environment of categorial type X, then R = PART-OF, otherwise (i.e. in an XP-environment) R is the identity function.

If MOD* is applied in an XP-environment, then R is instantiated as identity, i.e. v is identified with the referential argument of the modified expression, thus yielding the standard variant MOD. If applied in an X-environment, R is instantiated as the PART-OF relation, which pairs entities with their integral constituents. Thus, in Maienborn's account the observed meaning variability is traced back to a grammatically constrained semantic indeterminacy that is characteristic of modification.

Dölling (2003) takes a different track by assuming that the SF-parameter R is not rooted in modification but is of a more general nature. Specifically, he suggests that R is introduced compositionally whenever a one-place predicate enters the composition. By this move, the SF of a complex expression is systematically extended by a series of SF-parameters, which guarantee that the application of any one-place predicate to its argument is systematically shifted to the conceptual level. On Dölling's account, the SF of a complex linguistic expression is maximally abstract and underspecified, with SF-parameters delineating possible (though not necessarily actual) sites of meaning variation.

Differences aside, the studies of Dölling, Maienborn and other scholars working in the Two-level Semantics paradigm emphasize that potential sources for semantic indeterminacy are not only to be found in the lexicon but may also emerge in the course of composition, and they strive to model this combinatory meaning variation in terms of a rigid account of lexical and compositional semantics.

A key role in linking linguistic and extra-linguistic knowledge is taken by so-called *SF-parameters.* These are free variables that are installed under well-defined conditions at SF and are designed to be instantiated at the level of CS. SF-parameters are a means of triggering and controlling the conceptual enrichment of a grammatically determined meaning representation. They delineate precisely those gaps within the Semantic Form that call for conceptual specification and they impose sortal restrictions on possible conceptual fillers. SF-parameters can thus be seen as well-defined windows through which compositional semantics allows linguistic expressions to access and constrain conceptual structures.

3.2. Non-compositional meaning adjustments

Conceptual specification of a compositionally determined, underspecified, abstract meaning skeleton, as illustrated in the previous section, is the core notion that characterizes the Two-level Semantics perspective on the semantics-pragmatics interface. Its focus is on the conceptual exploitation of a linguistic expression's *regular* meaning potential. A second focus typically pursued within Two-level Semantics concerns the possibilities of a conceptual solution of combinatory conflicts arising in the course of composition. These are combinatory adjustment operations by which a strictly speaking ill-formed linguistic expression gets an admissible yet *irregular* interpretation. In the literature such non-compositional rescue operations are generally discussed under the label of "coercion". An example is given in (36).

(36) The alarm clock stood intentionally on the table.

The sentence in (36) does not offer a regular integration for the subject-oriented adverbial *intentionally*, i.e, the subject NP *the alarm clock* does not fulfill the adverbial's selectional restriction for an intentional subject. Hence, a compositional clash results, and the sentence is ungrammatical. Nevertheless, although deviant, there seems to be a way to rescue the sentence so that it becomes acceptable and interpretable. In the case of (36), a possible repair strategy would be to introduce an actor who is responsible for the fact that the alarm clock stands on the table. This move would provide a suitable anchor for the adverbial's semantic contribution. Thus, we understand (36) as saying that someone put the alarm clock on the table on purpose. That is, in case of a combinatorial clash, there seems to be a certain leeway for non-compositional adjustments of the compositionally derived meaning. The defective part is "coerced" into the right format.

Coercion phenomena are a topic of intensive research in current semantics. Up to now the primary focus has been on the widely ramified notion of aspectual coercion (e.g. Moens & Steedman 1988; Pulman 1997; de Swart 1998; Dölling 2003, 2010; Egg 2005) and on cases of so-called "complement coercion" as in *Peter began the book* (e.g. Pustejovsky 1995; Egg 2003; Asher 2007); see article 25 (de Swart) *Mismatches and coercion* for an overview. The framework of Two-level Semantics is particularly suited to investigate these borderline cases at the semantics-pragmatics interface because of its comparatively strong assumptions and predictions about this interface in terms of SF- and CS-representations, and about the kind of knowledge available at each level. To give an example, one issue emphasized by Dölling (2010) is that it is not only grammatical conflicts that trigger coercion operations (as predominantly assumed in the literature), but that such operations may also be employed for solving conflicts or expectations that arise from world knowledge. If we take for instance a variant of sentence (36) such as (37), there is no immediate need for a non-compositional rescue operation anymore. The subject NP *the children* fulfills the adverbial's selectional restriction for an intentional subject, hence, the sentence can be interpreted strictly compositionally with the children as intentional subjects. Nevertheless sentence (37) still has a second reading – viz. the only possible reading for (36) – according to which someone else, e.g. their teacher, put the children on the table on purpose.

(37) The children stood intentionally on the table. (2 readings)

Dölling (2010) draws the conclusion that rather than being borderline cases with somehow irregular interpretations, so-called coercion phenomena are just another instance of semantic underspecification; cf. §3.1. Thus, he would propose to derive an abstract, underspecified SF for both (36) and (37), and to defer its specification to the level of CS. On the other hand, the following data are problematic for a radical underspecification account such as Dölling's.

(38) *The alarm clock stood voluntarily on the table.

(39) The children stood voluntarily on the table. (1 reading)

Sentence (38) is ungrammatical. There is no way of rescuing it along the lines of (36). Although from a conceptual perspective it would make equally good sense to interpret (38) as expressing that someone put the alarm clock voluntarily on the table, there is no such rescue option available. Apparently the linguistic system prevents such a resort. In the same vein, sentence (39) only has one reading, according to which it is the children's will to stand on the table but not that of another person. These observations suggest that the additional readings available for (36) and (37) are not fully regular interpretations but coerced ones. They show the need for scrutinizing on a much broader empirical basis the conspiracy of grammatical, conceptual and pragmatic factors that license and constrain the coercion phenomena; see also the different viewpoints on this issue put forward by Dölling (2005b), Rothstein (2005) and Maienborn (2005a,b). A comparatively new kind of evidence that might help clarify matters is provided by psycholinguistic studies; see Pylkkänen & McElree (2006) for a state of the art report on coercion.

The short discussion of (36)–(39) gives a slight impression of the wide range of options currently tested in sharpening our understanding of the semantics-pragmatics interface and the implications they have for our assumptions about compositionality. The matter of how much grammar gets into meaning constitution and what else may join it to establish a full-fledged utterance meaning of natural language expressions is still far from being settled.

4. More on SF variables and their instantiation at the CS level

As pointed out in section 2.1, it was mainly the conceptual subsystem of spatial cognition that has stimulated pioneering investigations within Two-level Semantics. Therefore, it may be appropriate to report some of the analyses proposed in the realm of dimensional designation of spatial objects, cf. Bierwisch & Lang (1989a); Bierwisch (1996, 1997); Bierwisch & Schreuder (1992); Lang (1990, 1994, 2001); Lang, Carstensen & Simmons (1991). It is the complex interaction of two major grammatical modules, *viz*. gradation/comparison and dimension assignment, which make facts and insights in this field especially rewarding to semanticists. In order to discover the full range of relevant data, the basic assumption of Two-level Semantics (quoted at the outset of section 3), i.e. that the internal componential structure of lexical items determines their external combinatorial properties, has been converted into a heuristic guideline: Eliciting the combinatorics of dimension assignment (DA) terms for spatial objects by means of tasks like naming object extents or guessing objects by their dimensions etc. will reveal both the lexical meaning of each DA term and the structural pattern determining the lexical field which the DA term is an element of.

4.1. Variables in SF representations of spatial dimension terms

In Bierwisch & Lang (1989a), SF representations of German and English dimensional adjectives are taken to be complex 3-place predicates. Their general format is shown in (40); the variables in (40) are distinguished by the type of operators that bind them.

(40) $\lambda c\ \lambda x\ [\textsc{quant}\ [\ \textsc{dim}\ x\ ] = [\ v \pm c\ ]]$

First, there are variables in argument places that are subject to λ-abstraction, λ-conversion and other binding operations: (i) an object x that is assigned a dimension d, with $d \in \{\textsc{dim}\}$ and DIM being a metavariable on dimension assignment parameters, cf. (42) below; (ii) a difference value c which is added to (+), or subtracted from (–), the comparison value v.

Second, the variable v is a free variable which – depending on the respective structural context within the clause – may assume one of the following values: (iii) “0” if c contains a Measure Phrase or “norm of the class which x belongs to” if DIM is an AP in the positive without complement or “content of the comparative phrase” if DIM is part of a comparative construction. The admissible specifications of the comparison value v are subject to some general conditions which are motivated by CS but have been formulated as conditions on well-formed SF representations; for details justifying that solution, cf. Bierwisch & Lang (1989b).

The operator QUANT is an SF functor constant which selects the type of scale induced by DIM and triggers existential quantification of the value c in accordance with the Unspecified Argument Rule, (cf. Lang 1985; Bierwisch 1989: 76) such that the SF of, e.g., *The pole is long* comes out as in (41), where DEF.pole’ abbreviates the meaning of the subject *the pole*:

(41) $\exists c\ [[\text{QUANT MAX DEF.pole'}] = [\text{Norm}_{\text{pole}} + c]]$

This much on SF variables coming with dimension terms and on their instantiation in structural contexts that are provided by the morphosyntax of the sentence at issue. After a brief look at the elements instantiating the metavariable DIM, we will discuss a type of SF variable that is rooted in the lexical field structure of DA terms.

Conceived as a basic module of cognition, dimension assignment to spatial objects involves entities and operations at three levels. The perceptual level provides the sensory input from vision and other senses; the conceptual level serves as a filter system reducing perceptual distinctions to the level that our everyday knowledge of space needs, and the semantic level accounts for the ways in which conceptually approved features are encoded in categorized lexemes and arranged in lexical fields.

DA basically draws on Dimension Assignment Parameters (DAP) that are provided by two frames of reference, which determine the dimensional designation of spatial objects:

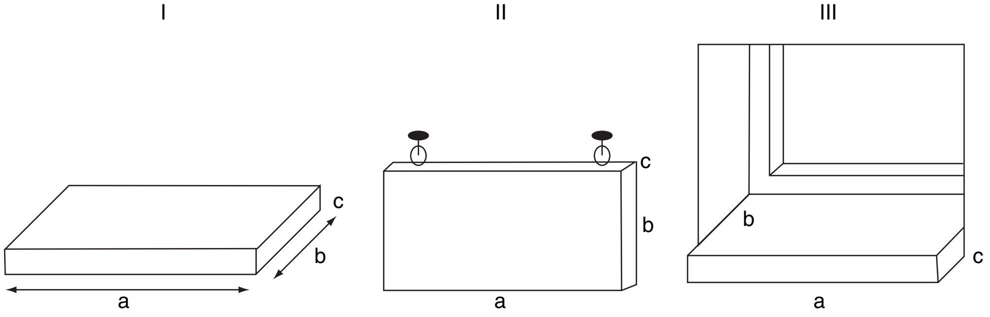
(42) a. The *Inherent Proportion Schema* (IPS) yields proportion-based gestalt features by identifying the object's extents as MAXimal, MINimal, and ACROSS axis, respectively.
b. The *Primary Perceptual Space* (PPS) yields contextually determined position features of spatial objects by identifying the object's extents as aligned with the VERTical axis, with the OBSERVER axis, and/or with an ACROSS axis in between.

The DAP in SMALL CAPS listed in (42) occur in two representational formats that reflect the SF vs. CS distinction. In SF representations, the DAP figure as functor constants of category N/N in the SF of L-particular dimension terms that instantiate {DIM} within the general schema in (40). In CS representations, elements of the DAP inventory figure as conceptual features in so-called *Object Schemata* (cf. 4.2 below) that contain the conceptually defining as well as the contextually specified spatial features of the object at issue.

Lang (2001) shows that the lexical field of spatial dimension terms in a language L is determined by the share it has in IPS and PPS, respectively. While reference to the vertical is ubiquitous, the lexical coverage of DA terms amounts to the following typology: *proportion-based languages* (Mandarin, Russian) adhere to IPS, *observer-based ones* (Korean, Japanese) adhere to PPS, and *mixed-type ones* (English, German) draw on an overlap between IPS and PPS. The semantic effects of this typology are *inter alia* reflected by the respective ACROSS terms: In P-based and in O-based languages, they are lexically distinct and referentially unambiguous, in mixed-type languages like English they lack both of these properties.

Note the referential ambiguity of the English ACROSS term *wide* in (44.1) and its contextualized interpretations in (44.2 – 4) when referring to a board sized 100 × 30 × 3 cm in the spatial settings I–III shown in (43):

(43)



a = long, b = wide   a = wide, b = high   a = wide, b = deep

(44) 1. The board is *wide* enough, but too thin. [I: *wide* = b; II & III: w*ide* = a]
2. The board is *long* and *wide* enough, but too thin. [*wide* = b as in setting I]
3. The board is *high* and *wide* enough, but too thin. [*wide* = a as in setting II]
4. The board is *deep* and *wide* enough, but too thin. [*wide* = a as in setting III]

As regards the manner of DA, note the following pairwise differences: (43 I) and (44.2) refer to the board as such by confining its DA to P-based gestalt properties, whereas (43 II, III) and (44.2, 3) account for the board's increasing integration into the surrounding spatial context. This in turn entails that (44.2) can be applied to setting II or III as well, but (44.4 and 3) may not be applied to setting II and I, respectively. Now let us look at the relationship between object extents and DA terms.

Whereas the coupling of extent c and the term *thin* (or its antonym *thick*) is constant in I–III, the ACROSS term *wide* can refer to a or to b. The choice is determined by the situational context, cf. (43 I–III), and/or the linguistic context available, cf. (44.1–4). In short, the English ACROSS term *wide* selects an object extent d that is orthogonal to an object extent d', with d' ∈ {max, vert, obs}. The set includes those dimensions from IPS (max) and from PPS (vert, obs) that are independently assignable to object extents. The inherent relativity of *wide* requires its SF to contain – in addition to the schema in (4) – an ∃-bound variable d' to be instantiated in the situational and/or the linguistic context:

(45) $\lambda c\ [\lambda x\ [\exists d'\ [[\textsc{quant across} \perp d'\ x\ ] = [\ v \pm c\ ]]]],$
with $d' \in \{max, vert, obs\}$

Without contextual clues about d', *wide* is ambiguous or unspecified between referring to extent a or to extent b, cf. (44.1). In the spatial settings in (43 I–III), the relevant extent d' is visible, in the sentences (44.2–4) d' is linguistically accessible. The intermodal equivalence of visual and verbal contexts wrt. selecting the constant that replaces d' provides a strong argument for the view that the specification of the object extent which *wide* refers to takes place at the CS level. It is CS representations that provide the visual and/or linguistic information based on which the selectional restriction "d' ∈ {max, vert, obs}" in (45) can be operative, cf. (43) and (44).

However, the restriction on d' is not just an idiosyncratic feature of the lexical item *wide/small* but a condition on DA terms in L following from its typological make-up as a P/O-mixed-type language. Correspondingly, P-based languages restrict ACROSS terms to IPS requiring "d' ∈ {max}", and O-based languages to PPS by requiring "d' ∈ {obs}", cf. Lang (2001) for details.

Now, having located the source of the referential ambiguity of *wide – small* at the SF level and identified CS as the level where the ambiguity is resolved, provided that suitable context information is available, we want to know how the spatial settings shown in (43) and verbally described in (44) can be homogenized at the level of CS representations.

4.2. Object Schemata as CS representations

A suitable way of representing concepts of spatial objects is by means of a matrix with 3 rows and up to 3 columns, called *Object Schema* (OS), cf. Lang (1989, 1990); Lang, Carstensen & Simmons (1991). An OS contains entries which represent spatial properties of objects in three tiers.

The 1st row represents an object's (i) dimensionality by variables for object axes, i.e. a, a b, or a b c, ordered by their relative salience such that within the general OS for buildings the entry vert in a vs. b vs. c differentiates the OS of a sky-scraper from that of an apartment house or of a bungalow; (ii) boundedness by <…> to set apart undimensionable objects (sky, weather) or objects named by mass nouns (air, water); (iii) integration of axes by (…) to distinguish a disk < (a b) c > from a pole < a (b c) > and a ball < (a b c) >.

The 2nd row lists the object's gestalt and position properties by *primary entries* like max, min, vert, obs, which stand either for (i) axial concepts induced by DA terms whose SF contains MAX, MIN, VERT, OBS or for (ii) concepts activated by non-linguistic, i.e. visual or tactile, input on the object at issue. Empty cells with Ø in the 2nd row mark object extents that may be designated by several distinct DAP depending on the position properties attributed to the object at hand.

The 3rd row (separated by a horizontal line) displays the results of contextualizing the entries in the 2nd row and hence the contextually specified DA of the object at issue. The mapping between DAP as SF functor constants in SMALL CAPS and their counterparts in OS as CS entries in lower case letters involves two operations defined as follows:

(46) a. Identification: P ⇒ p,
with P ∈ { MAX, MIN, ACROSS, VERT, OBS …},
p ∈ { max, min, across, vert, obs …} and p is a 3rd row entry in OS
b. Specification: Q ⇒ p,
with Q ∈ { VERT, OBS, ACROSS, … },
p ∈ { max, Ø, vert, ….} and p is licensed as a landing site for Q in OS

(47) below shows the distinct OS serving as CS representations of the board in the settings in (43) as well as of the utterance meanings of the sentences in (44). To elucidate (i) the intermodal equivalence of the context information available from (43) or (44) and (ii) how it is reflected in the corresponding OS, the setting numbers and

the pertinent DA terms for a and b have been added in (47). The respective extent chosen as d' to anchor across in the OS at issue and/or to interpret *wide* in (44.2–4) is in boldface.

(47)		I			II			III	
	< a	b	c >	< a	b	c >	< a	b	c >
	max	Ø	min	max	Ø	min	max	Ø	min
	max	across	min	across	**vert**	min	across	**obs**	min
	a = **long**, b = wide			a = wide, b = **high**			a = wide, b = **deep**		

The OS in (47) as CS representations of (43) and (44) capture all semantic aspects of DA discussed so far but they deserve some further remarks. First, (47-I) results from **primary identification** à la (46a) indicated by matching entries in the 2nd and 3rd row, while (47-II and III) are instances of **contextual specification** as defined in (46b). Second, the typological characteristics of a P/O-mixed-type language are met as d' for *wide* may be taken from IPS as in (47 I) or from PPS as in (47 II and III). Third, the rows of an OS, which contain the defining spatial properties and possibly also some contextual specifications, can be taken as a heuristic cue for designing the SF representations of object names that lexically reflect the varying degree of integration into spatial contexts we observe in (43–44), e.g. *board* (freely movable) < *notice-board* (hanging) < *windowsill* (bottom part of a window) – in this respect OS may be seen as an attempt to capture what Bierwisch (article 16 in this volume) calls "dossiers". Fourth, Lang, Carstensen & Simmons (1991) presents a Prolog system of DA using OS enriched by sidedness features, and Lang (2001) proposes a detailed catalogue of types of spatial objects with their OS accounting for primary entries and for contextually induced orientation or perspectivization. Fifth, despite their close interaction by means of the operations in (46), DAP as elements of SF representations and OS entries as CS elements are subject to different constraints, which is another reason to keep them distinct. The entries in an OS are subject to *conditions of conceptual compatibility* that inter alia define the set of admissible complex OS entries listed as vertically arranged pairs in (48):

(48)	max	max	max	Ø	Ø	Ø
	across	vert	obs	across	vert	obs

An important generalization is that (48) holds independently of the way in which the complex entry happens to come about. So, the combination of max and vert in the same column may result from primary identification in the 2nd row, cf. *The pole is 2m tall*, where the SF of *tall* contains MAX & VERT x as a conjunction of DAP, or from contextual specification, cf. *The pole is 2m high*, where vert is added in the 3rd row. The semantic structure of DA terms is therefore constrained by compatibility conditions at the CS level but within this scope it is cross-linguistically open to different lexicalization patterns and to variation of what is covered by the SF of single DA terms.

Finally, whereas OS may contain one or more Ø or entries that have a share in both IPS and PPS (as does e.g. across), the DA of spatial objects by linguistic means is subject to the following **uniqueness constraint**:

(49) In an instance of naming distinct axial extents a, b, c of some object x by enumerating DA terms, each DAP and each extent may occur only once.

Reminiscent of the Θ-criterion, (49) excludes e.g. (i) **The board is long and wide enough, but too small* or (ii) **The pole is 2m long and 2m high/tall* as ill-formed. Though disguised by distinct lexical labels, *wide* and *small* in (i) are conflicting occurrences of the DAP ACROSS, whereas *long* and *high/tall* in (ii) compete for one and the same extent a. The uniqueness constraint in (49) exemplifies one of the pragmatic felicity conditions on linguistic communication; cf. §1.4 above. Structurally, (49) follows from the homogeneity condition on the conjuncts in coordinate structures; theoretically, (49) is an outcome of the Gricean Maxim of Manner, especially of the sub-maxim “Avoid ambiguity!”.

4.3. Inferences

The distinction of SF vs. CS representations, hitherto exemplified by DAP as SF constants for dimension terms and by OS as a CS format for spatial objects, respectively, is also relevant to the way inferences in the realm of spatial cognition are semantically accounted for. The SF vs. CS distinction outlined by (2)–(5) in §1.2 reappears in a division of labor between (i) inferences that draw on permanent lexical knowledge made available in SF format and (ii) inferences that are performed on contextually specified CS representations. We will illustrate this correlation by means of three groups of data.

4.3.1. Lexical antonymy

While hyponymy and synonymy are non-typical lexical relations among DA terms, various facets of antonymy seem to be indispensable to them; cf. Lang 1995. The SF of DA terms, cf. (40) and (45), is componential as it results from decomposing the meaning of lexical items into suitable building blocks, that is, into SF components which are interrelated by meaning postulates and which therefore allow for purely lexicon-based inferences. There are two sorts: (i) schema-forming SF components (e.g. BECOME and CAUSE, cf. Bierwisch 2005, 2010; Wunderlich 1997a); and (ii) schema-filling SF components (e.g. the elements of {DIM} in (42) and (46) or operative elements like ‘∃’, ‘±’ or ‘=’ in (45)).

Two DA terms are *lexical antonyms* if (i) they share the same DAP in forming polar opposites, (ii) assign contrary values to d, (iii) allow for converse comparatives etc. Inferences that draw on lexical antonymy show up in entailments between sentences, cf. (50), and are codified as lexical knowledge postulates at the SF level, cf. (51). We neglect details concerning ‘=’, abbreviate SF (*the board*) by B, and take N(orm value) and K(ey value) to instantiate the comparison value v in (50a) and

(50b), respectively. For the whole range of entailments and SF postulates based on DA terms see Bierwisch (1989).

(50) a. The board is short → The board is not long.
b. The board is not long enough ↔ The board is too short

(51) a. $\exists c\ [[\ \textsc{quant max}\ B] = [N - c\ ]] \Rightarrow\ \sim [\exists c\ [[\exists c\ [[\ \textsc{quant max}\ B] = [N + c\ ]]]$
b. $\sim [\exists c\ [[\ \textsc{quant max}\ B] = [K + c\ ]]] \Leftrightarrow \exists c\ [[\ \textsc{quant max}\ B] = [K - c\ ]]$

4.3.2. Contextually induced dimensional designation

Valid inferences like those in (52) are accounted for, and invalid ones like those in (53) are avoided, by drawing on the information provided by, or else lacking in, contextually specified OS.

(52) a. The board is 1m wide and 0.3 m high → The board is 1m long and 0.3m wide
b. The pole is 2m tall/2m high → The pole is 2m long

(53) a. The wall is wide and high enough ↛ The wall is long and wide enough
b. The tower is 10 m tall/high ↛ *The tower is 10 m long.

The valid inferences result from the operation of *de-specification*, which is simply the reverse of the operation of contextual specification defined in (46b):

(54) *De-specification:*
a. For any OS for x with a vertical entry < p, q >, there is an OS' with < p, p >.
b. For any OS for x with a vertical entry < Ø, q >, there is an OS' with < Ø, across >.

The inferences in (53a, b) are ruled out as invalid because the OS under review do not contain the type of entries needed for (54) to apply.

4.3.3. Commensurability of object extents

Note that the DA terms *long*, *wide* and/or *thick* are not hyponyms to *big* despite the fact that *big* may refer to the [v + c] of one, two or all three extents of a 3D object, depending on the OS of the objects at issue. When objects differing in dimensionality are compared by using the DA term *big*, the dimensions it covers are determined by the common share of the OS involved, cf. (55):

(55) a. My car is too big for the parking space. (too long and/or too wide)
b. My car is too big for the garage door. (too wide and/or too high)

So it is above all the two mapping operations between SF and CS representations as defined in (46a, b) and exemplified by DAP and OS that account for the whole range of seemingly complicated facts about DA to spatial objects.

5. Summary and outlook

In this article we have reported on some pros and cons related to distinguishing SF and CS representations and illustrated them by data and facts from a selection of semantic phenomena. Now we briefly outline the state of the art in more general terms and take a look at the desiderata that define the agenda for future research.

The current situation can be summarized in three statements: (i) the SF vs. CS distinction brings in clear-cut advantages as shown by the examples in §§ 2–4; (ii) we still lack reliable heuristic strategies for identifying the appropriate SF of a lexical item; (iii) it is difficult to define the scope of variation a given SF can cover at CS level.

What we urgently need is independent evidence for the basic assumption underlying the distinction: SF representations and CS representations differ in nature as they are subject to completely different principles of organization. By correlating the SF vs. CS distinction with distinctions relevant to other levels of linguistic structure formation, cf. (2)–(5) in section 1, the article has taken some steps in that direction. One of them is to clarify the differences between SF and CS that derive from their linguistic vs. non-linguistic origin; cf. (4).

The *linguistic basis of the SF-representations* of DA terms, for instance, is manifested (i) in the DAP constants' interrelation by postulates underlying lexical relations, (ii) in participating in certain lexicalization patterns (e.g. proportion-based vs. observer-based), (iii) in being subject to the uniqueness constraint in (49), which is indicative of the semioticity of the system it applies to, whereas the Conceptual System CS is not a semiotic one. Pursuing this line of research, phenomena specific to natural languages like idiosyncracies, designation gaps, collocations, connotations, folk etymologies etc. should be scrutinized for their possible impact on establishing SF as a linguistically determined level of representation.

The *non-linguistic basis of CS-representations*, e.g. OS involved in DA, is manifested (i) in the fact that OS entries are exclusively subject to perception-based compatibility conditions; (ii) in their function to integrate input from the spatial environment regardless of the channel it comes in; (iii) in their property to allow for valid inferences to be drawn on entries that are induced as contextual specifications. To deepen our understanding of CS-representations, presumptions like the following deserve to be investigated on a broader spectrum and in more detail: (i) CS representations may be underspecified in certain respects, cf. the role of 'Ø' in OS, but as they are not semiotic entities they are not ambiguous; (ii) the compatibility conditions defining admissible OS suggest that the following relation may hold wrt. the well-formedness of representations: sortal restrictions $\subset$ selectional restrictions; (iii) CS representations have to be contingent since contradictory entries cause the system of inferences to break down; contradictions at SF level trigger accommodation activities.

As the agenda above suggests, a better understanding of the interplay of linguistic and non-linguistic aspects of meaning constitution along the lines developed here is particularly to be expected from interdisciplinary research combining methods and insights from linguistics, psycholinguistics, neurolinguistics and cognitive psychology.

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