

Semantic Form and Abductive Fixation of Parameters

1 Introduction

The present paper is concerned with the phenomenon that many linguistic expressions have a fixed set of readings which are extremely diverse but systematically related to one another. As pointed out by Nunberg (1979), such cases of multiple use can be roughly separated into two classes: First, the class of cases where we have no substantial reasons for assuming that one or another reading is prior, and, second, the class of cases where we have clear intuitions as to which readings are basic, and which are derived.

To take an example that has been often mentioned, the DP *the newspaper* offers apparently conflicting perspectives on the world as it can be used to refer to entities of different ontological sorts. Consider the occurrences of the DP in sentences (1a) - (1c).

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|-----|-----|--|------------------|
| (1) | (a) | The newspaper was on the table. | 'material thing' |
| | (b) | The newspaper was censored yesterday. | 'mental object' |
| | (c) | The newspaper was founded three years ago. | 'institution' |

In view of the restrictions imposed by the VPs on possible arguments it appears that, in (1a), *the newspaper* refers to a newspaper copy, i.e. a particular material thing, in (1b), to the content of a newspaper issue, i.e. a particular mental object, and, in (1c), to a newspaper company, i.e. a particular social institution. Obviously, the single readings of the DP are systematically related owing to the fact that the entities constituting the several domains of denotation are interconnected by specific relations. So a newspaper-as-material-thing is a transporter (or a representation) of a newspaper-as-mental-object, and a newspaper-as-institution has the purpose to produce newspapers-as-mental-objects. Note that there is no linguistic evidence that one of the readings is more basic than the others. Rather, the various interpretations of the noun *newspaper*, which underlie the three uses of the DP, seem to be principally of equal rank. By contrast, sentence (2) exemplifies a reading which is systematically connected to other readings in a different way.

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|-----|------------------------------|-----------|
| (2) | The newspaper was on strike. | 'persons' |
|-----|------------------------------|-----------|

Due to the range of application of the VP *be on strike* we have to assume that in (2) *the newspaper* refers to persons. However, this does not mean that there is a particular 'person' interpretation of the noun *newspaper*. Instead, the DP referring originally to a newspaper-as-institution receives a derived (actually, a metonymic) interpretation under which it denotes persons that work for or, more generally, are associated with the respective institution.

In accordance with the observations made before, I distinguish between two kinds of *systematic variation of meaning*. Variations of the first kind are founded on the fact that some linguistic expressions have a versatile meaning, i.e., they are equipped with the capability to specialize their meaning dependently on discourse and situation context of use and, by it, to

apply to entities of different domains. Unlike those, variations of the second kind, which include, in particular, metonymic interpretations, are based on the capability of some expressions to shift their meaning in contexts of use to a meaning under which they apply to entities of a 'new' domain. For designating the two kinds, I will use the terms *contextual specialization of meaning* and *contextual shift of meaning*, respectively.

In recent years several proposals have been made to treat systematic meaning variation within a framework of semantic representation. According to generative lexicon theory (e.g. Pustejovsky 1991, Pustejovsky 1995 and Copestake & Briscoe 1995), contextual specialization as well as contextual shift of meaning are ultimately determined by co-operation of qualia structure of individual lexical items with type coercion in semantic composition. In Dölling (1992) and Dölling (1995), I have suggested a number of autonomous semantic schemata by means of which, on the one hand, operations of sort-shifting and, on the other hand, operations of sort-specifying can be performed on lexical or phrasal expressions for meeting sortal restrictions. Similarly, in Nunberg (1995), semantic operations of predicate transfer are offered for shifting the meaning of expressions. As for contextual specialization of lexical meaning, Nunberg claims that it can be viewed as instantiating simply a specific kind of metonymy. In my opinion, the theories mentioned are challenged above all by two general problems: First, they do not provide an account which allows for the peculiarities of each kind of systematic meaning variation and, nevertheless, is basically uniform. Second, they mix up strictly linguistic knowledge and knowledge on the world or otherwise lack a formally justified mechanism by means of which non-linguistic world knowledge is accessible for interpretation.

In the paper, I will propose a unified approach to systematic meaning variation, which takes as its basis the assumption that the single readings emerge from interplay of semantic representation and world knowledge. In arguing for a level of structure which represents the underspecified meaning of linguistic expressions, I follow suggestions made by several workers in contemporary semantic research (e.g. Bierwisch 1983, Bierwisch & Lang 1989, Alshawi 1992, Hobbs et al. 1993, Allen 1995, Pinkal 1995, Poesio 1996). As it contains typically parameters that can be fixed by contribution of contextual factors to interpretation, the structure labelled *semantic form* owns a specific potential to vary the meaning of the respective expressions. What is crucial to my approach is that the potential of meaning variation is not confined to parameters included in primary semantic structures of lexical items. More specifically, it is assumed that additional parameters are introduced into semantic form by means of various general schemata which are obligatorily applied in building complex expressions. Taking into account that for understanding an utterance it has to be related to general and specific world knowledge, I suppose that the abductive interpretation model developed by Hobbs et al. (1993) is an adequate tool to determine its conceptual content. It is argued that in interpreting abductively the semantic form of an utterance we derive also a particular structure that is generated by replacing each parameter by an appropriate value and, thus, represents the context-dependent meaning of expressions occurring in the utterance. In this way, I will show that though contextual specialization and contextual shift of meaning have results that are clearly distinct both are realized by operations which are basically of the same type.

2 Semantic form and conceptual knowledge

Before presenting some concrete proposals in exploring cases of systematic meaning variation, let me make a few general remarks on my approach. In what follows, I take for granted that interpretation of linguistic utterances is performed on several levels of mental representation. Starting from a more abstract meaning structure that is immediately linked with the expressions forming an utterance, the information conveyed by the utterance is elaborated step by step by using a variety of devices in the course of conceptual interpretation.

With respect to the basic level called *semantic form* *SF*, I assume that it is subject to a twofold characterization. On the one hand, SF represents the context-independent meaning of linguistic expressions and, therefore, can be considered a part of the system of natural language proper. As the principle of compositionality of meaning is decisive for this level of representation, the format of SF is that of a λ -typed logical language. Essentially, SF contains particular units that figure as parameters insofar as they each are supplied with an individual range of admissible values which can take the place of them. On the other hand, in view of the fact that SF is exclusively made up of conceptual units, it is not an autonomous level of meaning structure but an integral part of the conceptual representational system. More specifically, although, owing to its direct connection to morpho-syntactic and phonological structure of linguistic expressions, SF has some special features it is only a subkind of conceptual structure. Thus, the language of SF is a particular extension of the first-order logical language underlying the representation of conceptual world knowledge.¹

In addition, I distinguish between two potentials assigned to the SF of an expression α : the *potential of combination* of $SF(\alpha)$ and the *potential of variation* of $SF(\alpha)$. The first potential is given by the logical type of $SF(\alpha)$ and determines the possibilities of combining α with other expressions; the second one is identical with the set of possible readings of α , which are licensed by the parameters occurring in $SF(\alpha)$. Note that $SF(\alpha)$ exhibits flexibility owing to the fact that both potentials can be extended in semantic composition. As we will see, there are a number of specific operators that in dependence on the concrete appearance of SF can be used for this purpose

Obviously, such a conceptual approach to semantics has a lot of consequences. In particular, as the units occurring in SF are defined by conceptual conditions it is evident that SF cannot be independent of the system of conceptual world knowledge, i.e., the system being responsible for conceptualization of the world. In view of that, I suggest that we should distinguish between the meaning of an expression α and its sense. While the former is represented by $SF(\alpha)$ the latter

¹ It appears that although the term *semantic form* originates from the interpretation model that has been developed essentially in Bierwisch (1983) and Bierwisch & Lang (1989) and is labelled in the meantime frequently *two-level approach to meaning* it is used here in another way. Starting from the traditional hypothesis of strict modularity of mind, the two-level approach stands for the conviction that in the study of meaning one has to distinguish between two autonomous levels of representation of meaning: semantic form and conceptual structure. While the latter is taken to be a non-linguistic phenomenon of cognition the former is viewed as a linguistic structure which has to play the role of an interface between syntactic structure and conceptual structure. (For a more recent version of the approach, see Bierwisch 1996.) By way of contrast, I adopt basically a view of the architecture of mind that be called by Jackendoff (1997) *representational modularity*. Its overall idea is that the mind operates in terms of some finite family of representations and, accordingly, the distinction between modules is provided not by distinctions between faculties but between formats of representation. As semantic form has basically the format of conceptual structure, similarly to Jackendoff (1983, 1997), I suggest that there is no evidence for a special module of semantic form, distinct from conceptualization. (See also the criticism by Meyer 1994.)

can be viewed as the set of propositions that determine the place of $SF(\alpha)$ in the conceptual framework and, by it, the possible denotations of α . That means, the computation of $SF(\alpha)$ is a necessary step in understanding α , but only by relating $SF(\alpha)$ to the respective part of conceptual knowledge the occurrence of α can be really understood. Although this suggestion is admittedly vague and, therefore, needs to be made more precise I think that the intention lying behind the differentiation is clear.

To be more explicit, I will adopt the view that the domain of semantic knowledge consists of three components - the component of lexical base, of compositional derivation and of abductive interpretation. The architecture can be roughly described as follows:

(i) The component of *lexical base* comprises the basic semantic entries of lexical items as well as further semantic entries which can be derived from them by intralexical operations. Crucially, lexical entries do not contain encyclopedic or, more generally, world knowledge of any kind, i.e., in particular, they do not define any attributes of entities associated with the respective items. As a consequence, lexical semantic knowledge in a narrower sense is confined to language-specific knowledge on what SF is linked with the phonological form of items. Moreover, the organization of the lexical base is characterized by the fact that the number of ambiguous items is reduced in favour of lexical semantic entries that are radically underspecified.²

(ii) The component of *compositional derivation* is occupied with systematic production of the SF of complex expressions. Following the principle of semantic compositionality, the SF of a larger expression is derived from the SF of its parts and the way they are put together. However, unlike to the usual approach, it is not required that the computation of SF is performed strictly in parallel to the morpho-syntactic structure of the respective expression. Rather, by supposing a more flexible version of compositionality, I assume that under certain circumstances additional structure can be inserted during the SF derivation. More specifically, there are particular SF schemata which make it possible to transform a SF in a definite way. Accordingly, the following kinds of SF of an expression α can be distinguished:

- (3) (a) *basic semantic form* $SF_B(\alpha)$
 (b) *inflected semantic form* $SF_I(\alpha)$
 (c) *coerced semantic form* $SF_C(\alpha)$

While $SF_B(\alpha)$ designates the semantic form that is originally assigned to the lexical or complex expression α , $SF_I(\alpha)$ and $SF_C(\alpha)$ are derived semantic forms of α . In more detail, given that $SF_B(\alpha)$ meets certain conditions, $SF_I(\alpha)$ results from it by performing an obligatory operation called *SF inflection*. In comparison with $SF_B(\alpha)$, $SF_I(\alpha)$ displays more structure and, in particular, contains new parameters which have to be fixed. Thus, it has an extended potential

² This way, in pleading for a lexical base that satisfies the criteria of simplicity and generality, I adopt a minimalist attitude with respect to lexical meaning. In particular, I take the stand that versatility of meaning cannot be captured by considering such lexical items as polysemous albeit in a systematic way. Thus, I reject the supposition that the items in question each exhibit a range of interrelated lexical meanings which on their part are characterized encyclopedically in the lexicon. As the network model (e.g. Taylor 1995) results in a proliferation of lexical entries, it misses essential generalizations. Nor can I accept the weaker assumption that each versatile lexical item has only one semantic entry, but is nevertheless polysemous insofar as the entry licenses immediately the generation of several specific meanings of the item. As the generative lexicon theory (e.g. Pustejovsky 1995, Copestake & Briscoe 1995) includes certain pieces of world knowledge into the lexical entries, it likewise overexpands the lexicon. Instead, in agreement with Bierwisch (1983), my general claim is that the lexical items at issue are monosemous.

of variation. On the other hand, $SF_c(\alpha)$ is the result of a type-shifting operation called *SF coercion*. Unlike to SF inflection, operators of SF coercion are applied to $SF_B(\alpha)$ or $SF_I(\alpha)$ only if it is necessary to change the logical type of α for combining α with another expression. As a consequence, $SF_c(\alpha)$ is characterized by an extended potential of combination.³

(iii) The component of *abductive interpretation* has to produce the conceptual content CC of the utterance in question. More specifically, by interpreting abductively the SF of an utterance against conceptual knowledge not only its CC but also the CCs of expressions occurring in it are generated. Thus, given the SF of an expression α , we obtain a sequence of structures which increasingly specify the contribution of the respective occurrence of α to the CC of utterance. In a first step, the parameters enclosed in $SF(\alpha)$ are fixed by assignment of suitable values, resulting into a conceptual structure that represents the context-dependent meaning of the occurrence of α and is called its *parameter-fixed structure PFS*. Obviously, in determining $PFS(\alpha)$ we are challenged by the problem that one and the same SF parameter can be replaced by different concrete units. Suppose that I is a SF parameter and V_I is the set of units forming the range of the possible values of I . Then the set of possible PFSs of α $\Omega(\alpha)$ is defined by (4).

$$(4) \quad \Omega(\alpha) =_{\text{def}} \{PFS: PFS \text{ results from } SF(\alpha) \text{ by replacing of each } I \text{ in } SF(\alpha) \text{ by a member of } V_I\}.$$

As we will see, the question which member of $\Omega(\alpha)$ is selected to be the actual PFS has to be answered above all in dependence on the given base of general and specific world knowledge as well as the conditions of deduction.

3 The lexical potential of meaning variation

Let me now consider how the phenomena concerned with are treated in the framework outlined before. I will first explore what kind of the lexical semantic entries of nominal expressions are needed in order to permit systematic specializations of their meaning. To start with, let us recall that in traditional view common nouns are expressions that accomplish two related semantic functions, namely, to stand for a genus or kind as well as its single instances. Actually, by examining relevant cases, it appears that common nouns display an alternation between three readings - one under which it can be predicated of instances of a kind, one under which it can be predicated of subkinds of a kind and one under which it can be used to refer to the kind itself. Accordingly, I will distinguish between the 'instance' interpretation, the 'subkind' interpretation and the 'top-kind' interpretation of a common noun. To illustrate the differentiation, look at the noun *dog* and its use in sentences like (5a) - (5c).

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|-----|-----------------------------------|-------------------|
| (5) | (a) The dog frightened John. | 'instance of dog' |
| | (b) The dog is a domestic animal. | 'kind dog' |
| | (c) The Beagle is a dog. | 'subkind of dog' |

For conceptual reasons, in (5a), we take the definite DP *the dog* as an expression that refers to

³ Of course, with respect to my considerations on SF coercion, there is a strong connection to research into type-shiftings, done within the framework of flexible Montague semantics in the last fifteen years (see, e.g., Partee 1992).

a concrete dog. As a consequence, the respective occurrence of the noun *dog* denotes the set of instances of the kind dog. Unlike that, in (5b), it is more likely that *the dog* does not refer to a concrete dog but to the kind itself and, thus, the noun *dog* is used in its 'top-kind' interpretation. Further, as *the Beagle* is the proper name of a kind of dog, in (5c), the indefinite DP *a dog* is used as a predicate which denotes the set of subkinds of the kind dog. Correspondingly, the noun *dog* displays its 'subkind' (or taxonomic) interpretation.

Given the three possible interpretations of a common noun, the question arises whether one of them is primary and the others are systematically derived from it, i.e., whether we are dealt with cases of systematic meaning shift. According to the standard approach, common nouns express basically predicates over ordinary individuals. Consequently, as for its 'subkind' and 'top-kind' readings, it is assumed that these uses are secondary somehow. By way of contrast, Krifka (1995) argues that the lexical semantic entry of a common noun is identical with a primitive term denoting a kind, i.e. common nouns have originally a 'top-kind' interpretation. Further, the assumption is that under the 'subkind' and 'instance' readings a common noun expresses predicates derived immediately from its basic meaning. Following Krifka's approach, in several papers (e.g. Dölling 1992, 1995), I have made use of specific shifting operations for receiving the respective predicates.

Contrary to my previous view, now I think that none of the three interpretations which a common noun can have is really primary.⁴ Instead, I suggest that they each are equally available to our mind, i.e., the various readings result from contextual specialization of the lexical meaning assigned to the common noun. Thus, the approach pursued here can be outlined as follows: Common nouns have semantic entries in the form of a complex one-ary predicate that is underspecified in some respect and, therefore, allows certain differentiations. More specifically, by fixing of parameters included in it the predicate can be transformed into a predicate which denotes either the singleton of a kind, the set of subkinds of this kind or the set of its instances.

Suppose that each lexical item is made up of three constituents - phonological form, morpho-syntactic features and semantic form. Then, ignoring some complexities, the basic lexical entry of the common noun *dog* can be viewed as (6).

(6) $/dog/; N; \lambda x. x K_n \text{ dog}$

Let me mention that the SF of *dog* contains a term representing the concept 'dog'. It identifies the natural kind dog, and, in this way, determines the specific content of the noun concerned with. Unlike that, predicate K_n (with $n \geq 1$) is a SF parameter that is a part of the lexical meaning of each common noun. As the set of possible values of parameter K_n contains the predicate \triangleright ("instance of") and the predicate \leq ("subkind of"), there are two possible parameter-fixed structures PFS being derivable from the basic SF by contextual specialization. Accordingly, the SF included in (6) can be specialized, on the one hand, to predicate (7a) which denotes the set of instances of dog and, on the other hand, to predicate (7b) which denotes the set of subkinds of the kind dog.

⁴ Note that the account is in agreement with the view taken by Nunberg (1979). According to Nunberg, we have no evidence that either the 'type' interpretation or the 'token' interpretation of an lexical item is primary. He points out that, for instance, in sentence (i) the noun *tree* may be construed equally as referring to either tree-types or tree-tokens.

(i) There are three trees on that island.

- (7) (a) $\lambda x. x \triangleright \text{dog}$
 (b) $\lambda x. x \leq \text{dog}$

With respect to the occurrence of *dog* in sentences (5a) - (5c), we may assume that in (5a) the lexical item *dog* has the PFS given in (7a), and in (5b) and (5c) it has the PFS given in (7b). However, whereas (7b) is obviously sufficient for representing the contextual meaning of *dog* in (5c), it seems to fail in regard of the occurrence of the noun in (5b). Strictly speaking, the PFS (7b) does not reflect the fact that in (5b) *dog* is used to refer to the very kind dog, not to some proper subkind of it. Thus, we have to realize that the 'top-kind' reading of a common noun is not simply a matter of contextual specialization of its basic lexical entry. Rather, on condition that SF parameter K_n is fixed by \leq , such a reading can be got only by qualifying additionally the respective 'subkind' reading. For this purpose, I suggest that there is a particular predicate TOP which brings it about that a set comprising the subkinds of a kind is restricted to the unit set of this kind. By this means, the PFS that represents the 'top-kind' interpretation is (8).

- (8) $\lambda x. \text{TOP}(x) \ \& \ x \leq \text{dog}$

As we will see immediately, TOP is a possible value of further SF parameters which are introduced by intralexical operations performed on the basic lexical entries of common nouns.

Note that the basic lexical entry of a common noun is not only semantically underspecified with respect to its 'instance', 'subkind' and 'top-kind' interpretation. In addition, I assume that normally such an entry does not contain any explicit features which permit to classify a noun as being count or mass.⁵ In particular, the lexical entry of a noun like *dog* does not have a feature displaying it as being singular, i.e., contrary to the standard view, the base form of the noun is not identical with its singular form. Accordingly, a SF like such occurring in (6) is also underspecified insofar as it can be applied to both 'ordinary' individuals and pluralities of them. Actually, the respective contextual differentiations can be made only if a particular number morpheme is attached to the common noun and, thereby, one of its derived lexical entries is produced.

Let me suppose that in English there are two number morphemes: a singular/mass morpheme being phonologically empty and a specific plural morpheme - the suffix *-s*. Consider their lexical entries given in (9a) and (9b).

- (9) (a) $/\emptyset/; +\text{sg}/+\text{m}, [\text{N}_-]; \lambda P \lambda x. T_n(x) \ \& \ P(x)$
 (b) $/s/; +\text{pl}, [\text{N}_-]; \lambda P \lambda x. U_n(x) \ \& \ P(x)$

In regard of (9a) and (9b), the following should be mentioned. First, whereas '[N₋]' indicates that both morphemes are subcategorized as taking (the base form of) a noun, '+pl' and '+sg/+m' indicate what feature - the plural or the singular/mass feature - is absorbed by the noun if the morpheme in question is combined with it. Second, the alternative '+sg/+m' displayed by (9a) makes clear that by allowing of singular as well as mass readings the null morpheme is indeterminate relative to the singular/mass distinction. Third, as (9a) and (9b) contain SF parameters T_n and U_n , respectively, it appears that the SFs of the morphemes can be also contextually specialized. Thus, for example, T_n can be fixed by assignment of the predicates

⁵ See Pelletier & Schubert (1989) for an analogous approach to the count/mass alternation of common nouns.

For exploring the source of specific versatility of *newspaper*, we have to look at the conceptual unit 'newspaper' which is part of the SF given by (12) and identifies a certain kind. More specifically, in view of the various readings which the noun *newspaper* can have, the concept identifies the kind which is realized by each newspaper-as-mental-object, newspaper-as-material-thing and newspaper-as-institution. Further, as the respective instances of newspaper are members of disjoint ontological sorts, it is evident that the kind in question cannot be a natural kind. Rather, it is hybrid owing to the fact that its immediate subkinds are subordinated to three disjoint ontological categories. Strictly speaking, as represented by axioms (13a) - (13g), newspaper is a specific combination of newspaper₁, newspaper₂ and newspaper₃ which are subkinds of the categories of mental object, material thing and institution, respectively.

- (13) (a) newspaper = [newspaper₁ ∇ newspaper₂] ∇ newspaper₃
 (b) newspaper₁ ≤ ment.object
 (c) newspaper₂ ≤ mat.thing
 (d) newspaper₃ ≤ institution
 (e) $\forall x[x \leq \text{ment.object} \ \& \ x \leq \text{newspaper} \rightarrow x \leq \text{newspaper}_1]$
 (f) $\forall x[x \leq \text{mat.thing} \ \& \ x \leq \text{newspaper} \rightarrow x \leq \text{newspaper}_2]$
 (g) $\forall x[x \leq \text{institution} \ \& \ x \leq \text{newspaper} \rightarrow x \leq \text{newspaper}_3]$,
 where ment.object, mat.thing and institution represent the ontological categories of mental object, material thing and institution, respectively.

With respect to the operation ∇ by means of which kinds such as newspaper can be introduced, I suppose that there are certain constraints for applying it. In particular, the components of a hybrid kind are subject to the requirement that their specimens are linked by relations which are characteristic of the respective ontological sorts.⁸ So, in regard of the kind concerned with, its subkinds newspaper₁, newspaper₂ and newspaper₃ meet axioms (14a) - (14d).

- (14) (a) $\forall x[x \triangleright \text{newspaper}_1 \rightarrow \exists y[y \triangleright \text{newspaper}_2 \ \& \ y \text{ TRANSP } x]]$
 (b) $\forall x[x \triangleright \text{newspaper}_2 \rightarrow \exists y[y \triangleright \text{newspaper}_1 \ \& \ x \text{ TRANSP } y]]$
 (c) $\forall x[x \triangleright \text{newspaper}_1 \rightarrow \blacklozenge \exists y[y \triangleright \text{newspaper}_3 \ \& \ x \text{ PRODUCT } y]]$
 (d) $\forall x[x \triangleright \text{newspaper}_3 \rightarrow \exists y[y \triangleright \text{newspaper}_1 \ \& \ y \text{ PRODUCT } x]]$,
 where TRANSP and PRODUCT are the predicates 'transporter of' and 'product of', respectively.

According to axioms (14a) and (14b), the transporter relation establishes cohesion between instances of newspaper₁ and newspaper₂ and, thus, makes it possible that the two kinds are combined. Further, the combination of newspaper₁ ∇ newspaper₂ with newspaper₃ is allowed by axioms (14c) and (14d). While (14d) ensures that each instance of newspaper₃ is the producer of an instance of newspaper₁, axiom (14c) only says that for instances of newspaper₁ there is normally an instance of newspaper₃ which is the producer of it. Because, in this manner, the transporter relation between instances of newspaper₁ and newspaper₂ seems to be decisive the connection between newspaper₁ and newspaper₂ can be viewed as being stronger than that between each of them and newspaper₃. In (13a), the latter is indicated by brackets.⁹

⁸ As a consequence, proposition $\forall xyz[x = y \vee z \rightarrow y \leq x \ \& \ z \leq x]$ is true but, unlike to sum operation, not its converse.

⁹ That means, in contrast to sum operation, ∇ is non-associative.

As the kind concepts 'newspaper₁', 'newspaper₂' and 'newspaper₃' are determined by propositions (13b) - (13g) and (14a) - (14d), they can be considered as constituting a structure called frequently a *concept family*. It is just the existence of such a family of concepts what gives rise to the fact that the contextually-specialized meanings of a lexical item are systematically related to one another.

In figure 1, the relationships described before are illustrated. In addition, it is also taken into account that for each newspaper-as-institution there are one or more persons that are associated with it. That means, the following axiom holds:

- (15) $\forall x[x \triangleright \text{newspaper}_3 \rightarrow \exists y[y \triangleright \text{person} \ \& \ y \text{ ASSOC } x]]$,
 where person represents the ontological category of person and ASSOC is the predicate 'associated with'.

However, as mentioned on occasion of sentence (2), the existence of this relation between persons and newspapers does not give reasons for assuming a further reading of the common noun *newspaper*. Instead, axiom (15) is the basis of a metonymic interpretation of DPs whose nominal head is *newspaper*.

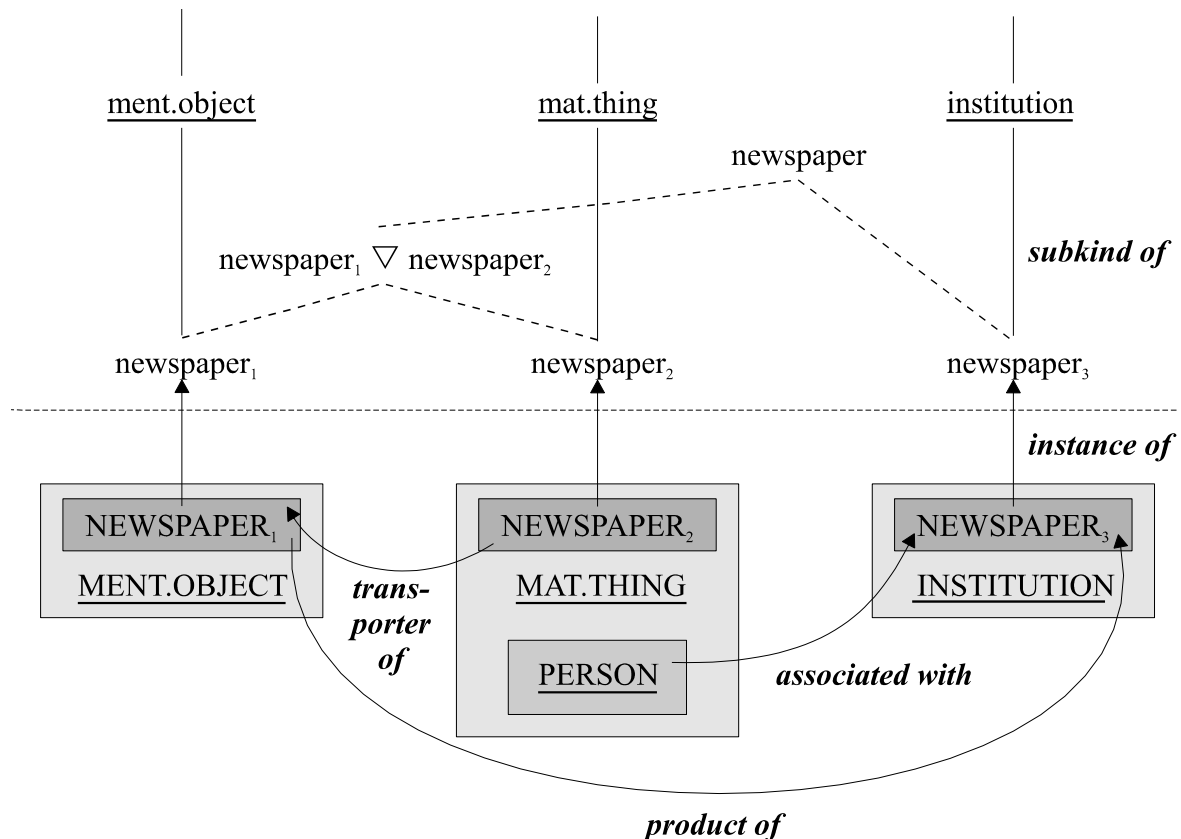


Figure 1

To sum up, I have dealt with the question where specific cases of versatility of common nouns result from. As pointed out, the lexical SF of such a noun contains a kind concept for which

there is a family of concepts subsumed immediately under it. Thus, the respective kind concept is underspecified due to the fact that the members of the concept family are defined by more specific conditions on their instances. However, nothing has been said about how the SF of a versatile noun can be modified in order to obtain representations of the corresponding contextually-specialized meanings, i.e., how the respective PFSs can be realized. Actually, the situation is such that for accomplishing this task the SF being available by the lexical base entry of a noun is too poor much. A way out of this problem could be that the SF is changed in such a way that further SF parameters are at hand. In the next section, I will make a proposal how this can be done.

4 Inflected semantic forms and possible parameter-fixed structures

Up to now, we have only looked at SFs that are assigned to original lexical items or to items resulting from them by means of intralexical number operations. Thus, the potential of meaning variation of a common noun has been taken into account only inasmuch as it is represented by the SF of its base entry or the entries of its morphologically derived number forms. But, as we will see, nominals are among those expressions which in the process of semantic composition are subject to obligatory operations labelled in section 2 as SF inflection. That means, in respect to any nominal expression we have to distinguish between its basic semantic form SF_B and its inflected semantic form SF_I . As the latter contains new SF parameters, it permits to derive further parameter-fixed structures PFS. Thus, SF_I represents an extended potential to vary the meaning of the expression in question.

I assume three operators of SF inflection, which are used in the course of my investigation. Suppose that S_n is a parameter of ontological sorts and R_n is a parameter of characteristic relations between members of two disjoint ontological sorts. Then, provided that the SF of an expression meets certain conditions, one of the following operators is applied to it:

- (16) **sort1**: $\lambda P \lambda x. \exists y [S_n(x) \ \& \ x R_n y \ \& \ P(y)]$
 sort2: $\lambda P \lambda x. \exists y [S_n(y) \ \& \ y R_n x \ \& \ P(y)]$
 sort3: $\lambda \rho \lambda P. \rho(\lambda x. \exists y [S_n(y) \ \& \ y R_n x \ \& \ P(y)])$

Before we can formulate rules determining the application of these inflectional operators, the notion of *referential argument position* has to be defined.

- (17) Assuming that $SF(\alpha)$ is a structure $\lambda x_m \dots \lambda x_1. \phi[x_1]$, where $m \geq 1$, ϕ is a formula and x_1 is a free variable in ϕ . Then x_1 is said to be a *referential argument position* of $SF(\alpha)$ if $S_n(x_1)$ or $x_1 R_n k$ is a subformula of ϕ .

The rules of application of **sort1** - **sort3** are formulated as follows:

- (R1) If $SF_B(\alpha)$ is of type $\langle e, t \rangle$ and has a referential argument position, then it is transformed into $SF_I(\alpha)$ such that $SF_I(\alpha) = \mathbf{sort1}(SF_B(\alpha))$.
 (R2) If $SF_B(\alpha)$ is of type $\langle e, t \rangle$ and has no referential argument position, then it is transformed into $SF_I(\alpha)$ such that $SF_I(\alpha) = \mathbf{sort2}(SF_B(\alpha))$.

- (R3) If $SF_B(\alpha)$ is of type $\langle\langle e, t \rangle, t\rangle$, then it is transformed into $SF_I(\alpha)$ such that $SF_I(\alpha) = \mathit{sort3}(SF_B(\alpha))$.

I emphasize that performing operations of SF inflection has to be recognized as a prerequisite for using the respective expressions in semantic composition. That means, an expression whose SF satisfies the condition of one of the rules (R1) - (R3) may be combined with another one only if its SF is transformed correspondingly in advance. In this manner, operators *sort1* - *sort3* are not optional supplements to but intrinsic parts of the SF of expressions in question. While operations of SF coercion, i.e., operations resulting from type conflicts, are determined basically by conditions of syntactic combination operations of SF inflection are motivated by requirements of interpretation against conceptual knowledge. Unlike the former, the latter do not extend the potential of combination by shifting the logical type of the expressions. Rather, by changing the internal structure of SFs the operations expand the faculty of those expressions to convey information. Of course, this could be seen as a departure from or weakening of semantic compositionality. However, as the context-independent character of SF is preserved, SF inflection is in the same way as SF coercion entirely in agreement with the principle of compositionality of meaning.

Again, the set of possible PFSs $\Omega(\alpha)$ that are derivable from the SF_I of an expression α is limited by the set of values which can be substituted for the SF parameters occurring in it. Values used for fixing parameters S_n and R_n are given in (18a) - (18e) and in (19a) - (19d), respectively.

- (18) (a) $\lambda x. \underline{ENT}(x)$ (b) $\lambda x. x \triangleright \underline{ment.object}$
 (c) $\lambda x. x \triangleright \underline{mat.thing}$ (d) $\lambda x. x \triangleright \underline{institution}$
 (e) $\lambda x. x \triangleright \underline{person}$,
 where ENT is a predicate that denotes the set of entities.

- (19) (a) $\lambda xy. x = y$ (b) $\lambda xy. x \text{ TRANSP } y$
 (c) $\lambda xy. x \text{ PRODUCT } y$ (d) $\lambda xy. x \text{ ASSOC } y$

I underline that both lists are anything but complete. Actually, each of the predicates that denote an ontological sort is a member of V_S , and each of the predicates that denote a characteristic relation between entities of disjoint ontological sorts is a member of V_R . Moreover, it is important to note that predicates (18a) and (19a) are used as values by default, i.e., the parameters S_n and R_n are fixed by ENT and $=$, respectively, if there are no arguments opposed to it.

Let me now explore how operators of SF inflection can be used for forming SF_I s from corresponding SF_B s and, furthermore, what PFSs are derivable from the respective SF_I s in the end. To begin with, look at the basic lexical entry of *newspaper* once more.

- (20) */newspaper/*; N; $\lambda x. x K_n \text{ newspaper}$

In analogy to (7a) and (7b), the SF occurring in (20) could be specialized to PFSs (21a) and (21b).

- (21) (a) $\lambda x. x \triangleright \text{newspaper}$
 (b) $\lambda x. x \leq \text{newspaper}$

However, it is obvious that *newspaper* owns originally a semantic entry which is of type $\langle e, t \rangle$ and has a referential argument position. Consequently, the structure $\lambda x. x K_n \text{ newspaper}$ has to be viewed as a basic SF and, therefore, is subject to rule (R1). Thus, $SF_B(\text{newspaper})$ is transformed by applying of *sort1* into $SF_1(\text{newspaper})$ which is a part of derived lexical entry (22).

$$(22) \quad /newspaper/; N; SF_1: \lambda x. \exists y[S_n(x) \ \& \ x R_n y \ \& \ y K_n \text{ newspaper}]$$

As the new SF contains additionally parameters S_n and R_n , it may be assumed that, in comparison with (20), entry (22) has an extended potential of meaning variation.

For demonstrating that $SF_1(\text{newspaper})$ allows the derivation of further PFSs, consider (23a) - (23h). Here, for each possible contextual specialization I give, first, the PFS that is immediately generated by replacing of SF parameters S_n , R_n and K_n by admissible values and, second, one or more of its variants that result from it by equivalent replacement on the basis of axioms (13b) - (13g).

$$\begin{aligned}
 (23) \quad (a) \quad & \lambda x. \exists y[\underline{\text{ENT}}(x) \ \& \ x = y \ \& \ y \triangleright \text{newspaper}] \\
 & = \lambda x. \underline{\text{ENT}}(x) \ \& \ x \triangleright \text{newspaper} \\
 & = \lambda x. x \triangleright \text{newspaper} & \quad (= (21a)) \\
 (b) \quad & \lambda x. \exists y[x \triangleright \underline{\text{ment.object}} \ \& \ x = y \ \& \ y \triangleright \text{newspaper}] \\
 & = \lambda x. x \triangleright \underline{\text{ment.object}} \ \& \ x \triangleright \text{newspaper} \\
 & = \lambda x. x \triangleright \text{newspaper}_1 \\
 (c) \quad & \lambda x. \exists y[x \triangleright \underline{\text{mat.thing}} \ \& \ x = y \ \& \ y \triangleright \text{newspaper}] \\
 & = \lambda x. x \triangleright \underline{\text{mat.thing}} \ \& \ x \triangleright \text{newspaper} \\
 & = \lambda x. x \triangleright \text{newspaper}_2 \\
 (d) \quad & \lambda x. \exists y[x \triangleright \underline{\text{institution}} \ \& \ x = y \ \& \ y \triangleright \text{newspaper}] \\
 & = \lambda x. x \triangleright \underline{\text{institution}} \ \& \ x \triangleright \text{newspaper} \\
 & = \lambda x. x \triangleright \text{newspaper}_3 \\
 (e) \quad & \lambda x. \exists y[\underline{\text{ENT}}(x) \ \& \ x = y \ \& \ y \leq \text{newspaper}] \\
 & = \lambda x. \underline{\text{ENT}}(x) \ \& \ x \leq \text{newspaper} \\
 & = \lambda x. x \leq \text{newspaper} & \quad (= (21b)) \\
 (f) \quad & \lambda x. \exists y[x \leq \underline{\text{ment.object}} \ \& \ x = y \ \& \ y \leq \text{newspaper}] \\
 & = \lambda x. x \leq \underline{\text{ment.object}} \ \& \ x \leq \text{newspaper} \\
 & = \lambda x. x \leq \text{newspaper}_1 \\
 (g) \quad & \lambda x. \exists y[x \leq \underline{\text{mat.thing}} \ \& \ x = y \ \& \ y \leq \text{newspaper}] \\
 & = \lambda x. x \leq \underline{\text{mat.thing}} \ \& \ x \leq \text{newspaper} \\
 & = \lambda x. x \leq \text{newspaper}_2 \\
 (h) \quad & \lambda x. \exists y[x \leq \underline{\text{institution}} \ \& \ x = y \ \& \ y \leq \text{newspaper}] \\
 & = \lambda x. x \leq \underline{\text{institution}} \ \& \ x \leq \text{newspaper} \\
 & = \lambda x. x \leq \text{newspaper}_3
 \end{aligned}$$

In this manner, the lexical meaning of *newspaper* can not only be contextually specialized to 'instance' and 'kind' readings where the 'mental-object'/'material-thing'/'institution' distinction is left out of account (see (23a) and (23e)). Rather, the operation of SF inflection makes it possible that *newspaper* is used also in a 'mental-object', 'material-thing' or 'institution' reading as well as in a 'kind-of-mental-object', 'kind-of-material-thing' or 'kind-of-institution' reading.

Two remarks are in order here. First, note that assuming an inflected SF for a common noun does not mean that the respective item has to be viewed as being lexically ambiguous. Instead,

because SF_1 is only secondary in comparison with SF_B the number of lexical meanings of a noun such as *newspaper* is not really enlarged by it. In addition, observe that a SF_1 is underspecified in the same way as SF_B , i.e., by extending the potential of meaning variation nothing is changed with respect to the character of SF. Second, a merit of being equipped with a general schema such as *sortI* is that we do not need operators which are only specific to meaning specializations of single nouns. So, the tools proposed can be utilized equally in the case of other meaning variations, provided that appropriate conceptual conditions are given. Actually, in my opinion, approaches that postulate for each contextual variant a particular device of derivation miss an essential generalization.

Now, the basic lexical entries for the singular/mass and the plural form of *newspaper* can be received from (20) by applying (9a) and (9b), respectively.

- (24) (a) $/newspaper/$; N +sg/+m; $\lambda x. T_n(x) \ \& \ \exists y[S_n(x) \ \& \ x R_n y \ \& \ y K_n newspaper]$
 (b) $/newspapers/$; N +pl; $\lambda x. U_n(x) \ \& \ \exists y[S_n(x) \ \& \ x R_n y \ \& \ y K_n newspaper]$

Again, on the basis of (24a) and (24b) we can obtain PFSs which represent results of specialization of the SFs in question.

For illustrating, let me only consider some contextual meanings of the singular/mass form of *newspaper*. Due to the fact that SING and TOP are members of V_T , the SF occurring in (24a) allows the derivation of PFSs such as given in (25a) - (25f). Evidently, to transform the original PFSs into its simplified variants now we have to apply not only axioms (13b) - (13g) but also several axioms that impose constraints on the use of SING or TOP.¹⁰

- (25) (a) $\lambda x. \underline{SING}(x) \ \& \ \exists y[\underline{ENT}(x) \ \& \ x = y \ \& \ y \triangleright newspaper]$
 $= \lambda x. \underline{SING}(x) \ \& \ \underline{ENT}(x) \ \& \ x \triangleright newspaper$
 $= \lambda x. \underline{SING}(x) \ \& \ x \triangleright newspaper$
 (b) $\lambda x. \underline{SING}(x) \ \& \ \exists y[x \triangleright \underline{mat.thing} \ \& \ x = y \ \& \ y \triangleright newspaper]$
 $= \lambda x. \underline{SING}(x) \ \& \ x \triangleright \underline{mat.thing} \ \& \ x \triangleright newspaper$
 $= \lambda x. \underline{SING}(x) \ \& \ x \triangleright newspaper_2$
 (c) $\lambda x. \underline{SING}(x) \ \& \ \exists y[\underline{ENT}(x) \ \& \ x = y \ \& \ y \leq newspaper]$
 $= \lambda x. \underline{SING}(x) \ \& \ \underline{ENT}(x) \ \& \ x \leq newspaper$
 $= \lambda x. \underline{SING}(x) \ \& \ x \leq newspaper$
 (d) $\lambda x. \underline{SING}(x) \ \& \ \exists y[x \leq \underline{institution} \ \& \ x = y \ \& \ y \leq newspaper]$
 $= \lambda x. \underline{SING}(x) \ \& \ x \leq \underline{institution} \ \& \ x \leq newspaper$
 $= \lambda x. \underline{SING}(x) \ \& \ x \leq newspaper_3$
 (e) $\lambda x. TOP(x) \ \& \ \exists y[\underline{ENT}(x) \ \& \ x = y \ \& \ y \leq newspaper]$
 $= \lambda x. TOP(x) \ \& \ \underline{ENT}(x) \ \& \ x \leq newspaper$
 $= \lambda x. TOP(x) \ \& \ x \leq newspaper$
 $= \lambda x. x = newspaper$
 (f) $\lambda x. TOP(x) \ \& \ \exists y[x \leq \underline{ment.object} \ \& \ x = y \ \& \ y \leq newspaper]$
 $= \lambda x. TOP(x) \ \& \ x \leq \underline{ment.object} \ \& \ x \leq newspaper$
 $= \lambda x. TOP(x) \ \& \ x \leq newspaper_1$
 $= \lambda x. x = newspaper_1$

According to (25a) - (25d), we have predicates that denote the set of single newspaper (in the

¹⁰ See Dölling (to appear).

To begin with, look at sentence (29).

(29) The newspaper called.

In analogy to (2), owing to the restriction imposed by the VP *called* on its arguments, (29) does not make immediately a statement on a newspaper. Strictly speaking, the sentence says that one or more persons that are associated in some way with a particular newspaper-as-institution called. In this manner, the DP *the newspaper* which refers originally to the respective institution is subject to a metonymic interpretation. Thus, the contextual meaning of (29) can be represented by PFS (29').

(29') $\exists x! \exists y [\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_3 \ \& \ y \triangleright \text{person} \ \& \ y \text{ ASSOC } x \ \& \ \text{CALL}(y)]$

Consider how the SF of sentence (29) can be compositionally derived.

(29'') $\begin{array}{l} /newspaper/; \text{ N}; \text{ SF}_B: \lambda x. x \ K_1 \text{ newspaper} \\ \quad \quad \quad \text{SF}_I: \lambda x. \exists y [S_I(x) \ \& \ x \ R_1 y \ \& \ y \ K_1 \text{ newspaper}] \\ \dots \\ /the \ newspaper/; \text{ DP } +\text{sg}/+\text{m}; \text{ SF}_B: \lambda P. \exists !x \exists yz [S_2(x) \ \& \ x \ R_2 y \ \& \ T_1(y) \\ \quad \quad \quad \& \ S_I(y) \ \& \ y \ R_1 z \ \& \ z \ K_1 \text{ newspaper} \\ \quad \quad \quad \& \ P(x)] \\ \text{sort3}: \lambda \rho \lambda P. \rho(\lambda x. \exists y [S_3(y) \ \& \ y \ R_3 x \ \& \ P(y)]) \\ / \\ /the \ newspaper/; \text{ DP } +\text{sg}/+\text{m}; \text{ SF}_I: \lambda P. \exists !x \exists yzu [S_2(x) \ \& \ x \ R_2 y \ \& \ T_1(y) \\ \quad \quad \quad \& \ S_I(y) \ \& \ y \ R_1 z \ \& \ z \ K_1 \text{ newspaper} \\ \quad \quad \quad \& \ S_3(u) \ \& \ u \ R_3 x \ \& \ P(u)] \\ / \\ /called/; \text{ VP } -\text{pl}; \lambda x. \text{CALL}(x) \\ / \\ /the \ newspaper \ called/; \text{ S } -\text{pl}; \text{ SF}: \exists !x \exists yzu [S_2(x) \ \& \ x \ R_2 y \ \& \ T_1(y) \\ \quad \quad \quad \& \ S_I(y) \ \& \ y \ R_1 z \ \& \ z \ K_1 \text{ newspaper} \\ \quad \quad \quad \& \ S_3(u) \ \& \ u \ R_3 x \ \& \ \text{CALL}(u)] \end{array}$

As the derivation is partly analogous to those performed before, in (29''), some steps are left out again. Note, however, that according to rule (R3) the SF_B of *the newspaper* is obligatorily transformed by means of *sort3* into its SF_I .

Now, we can obtain the PFSs of (29) as well as the PFSs of the DP *the newspaper* and the base form of *newspaper* by fixing the SF parameters in a way given in (29''').

(29''') $\begin{array}{l} /the \ newspaper \ called/; \text{ S } -\text{pl}; \rightarrow \text{PFS}: \exists !x \exists yzu [\text{ENT}(x) \ \& \ x = y \ \& \ \text{SING}(y) \\ \quad \quad \quad \& \ y \triangleright \text{institution} \ \& \ y = z \ \& \ z \triangleright \text{newspaper} \\ \quad \quad \quad \& \ u \triangleright \text{person} \ \& \ u \text{ ASSOC } x \ \& \ \text{CALL}(u)] \\ \leftrightarrow \exists !x \exists y [\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_3 \\ \quad \quad \quad \& \ y \triangleright \text{person} \ \& \ y \text{ ASSOC } x \ \& \ \text{CALL}(y)] \end{array}$

$$\begin{array}{l}
| \text{--- /called/; VP -pl; } \lambda x. \text{ CALL}(x) \\
| \\
| \text{/the newspaper/; DP +sg; } \rightarrow \text{PFS: } \lambda P. \exists!x\exists yz[u[\text{ENT}(x) \ \& \ x = y \\
| \qquad \qquad \qquad \& \ \text{SING}(y) \ \& \ y \triangleright \text{institution} \\
| \qquad \qquad \qquad \& \ y = z \ \& \ z \triangleright \text{newspaper} \\
| \qquad \qquad \qquad \& \ u \triangleright \text{person} \ \& \ u \text{ ASSOC } x \ \& \ P(u)] \\
| \qquad \qquad \qquad = \exists!x\exists y[\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_3 \\
| \qquad \qquad \qquad \ \& \ y \triangleright \text{person} \ \& \ y \text{ ASSOC } x \ \& \ P(y)] \\
| \dots \\
| \\
| \text{/newspaper/; N; } \rightarrow \text{PFS: } \lambda x. \exists y[x \triangleright \text{institution} \ \& \ x = y \ \& \ y \triangleright \text{newspaper}] \\
| \qquad \qquad \qquad = \lambda x. x \triangleright \text{newspaper}_3
\end{array}$$

Let me turn next to sentence (30) where in the relative clause the VP is predicable from material things, while in the main clause the VP is originally a predicate of mental objects.

(30) The newspaper lying on the table is intelligible.

There are at least two possibilities for explaining the acceptability of the sentence. First, we have recourse to a kind of 'sortal crossing' and claim that in (30) the noun *newspaper* is used to refer at the same time to a material thing and to a mental object.¹³ Second, following suggestions made by Dölling (1992) and Nunberg (1995), we assume that the noun is used to refer to only one sort of entity, i.e. either to a material thing or to a mental object, and, as a consequence, the meaning of one of the VPs has to be shifted accordingly. Preferring the latter approach, I suppose that in (30) the VP *is intelligible* has a derived meaning under which it can be applied to newspapers-as-material-things. Then, (30') can be viewed as the PFS of (30).

(30') $\exists!x\exists y[x \triangleright \text{newspaper}_2 \ \& \ \text{LIE_ON_THE_TABLE}(x) \ \& \ y \triangleright \text{ment.object} \\ \ \& \ x \text{ TRANSP } y \ \& \ \text{INTELLIGIBLE}(y)]$

The compositional derivation of the SF of (30) is given by (30''), where, however, a number of complexities are ignored again.

$$\begin{array}{l}
(30'') \quad \text{/newspaper/; N; } \text{SF}_B: \lambda x. x K_l \text{ newspaper} \\
| \qquad \qquad \qquad \text{SF}_T: \lambda x. \exists y[S_l(x) \ \& \ x R_l y \ \& \ y K_l \text{ newspaper}] \\
| \dots \\
| \\
| \text{/the newspaper lying on the table/; DP +sg/+m;} \\
| \qquad \qquad \qquad \text{SF: } \lambda P. \exists!x\exists y[T_l(x) \ \& \ S_l(x) \ \& \ x R_l y \ \& \ y K_l \text{ newspaper} \\
| \qquad \qquad \qquad \ \& \ \text{LIE_ON_THE_TABLE}(x) \ \& \ P(x)] \\
| \dots \\
|
\end{array}$$

¹³ See Pustejovsky (1995) and Copestake & Briscoe (1995) for an approach of this kind. In Dölling (to appear), I demonstrate that the respective proposals run into serious difficulties.

/is intelligible/; VP -pl; $\mathbf{SF}_B: \lambda x. \text{INTELLIGIBLE}(x)$
 /
 $\mathbf{sort2}: \lambda P \lambda x. \exists y[S_2(y) \ \& \ y R_2 x \ \& \ P(y)]$
 /
 /is intelligible/; VP -pl; $\mathbf{SF}_I: \lambda x. \exists y[S_2(y) \ \& \ y R_2 x \ \& \ \text{INTELLIGIBLE}(y)]$
 /
 /the newspaper lying on the table is intelligible/; S -pl;
 $\mathbf{SF}: \exists !x \exists yz[T(x) \ \& \ S_1(x) \ \& \ x R_1 y \ \& \ y K_1 \text{newspaper}$
 $\ \& \ \text{LIE_ON_THE_TABLE}(x)$
 $\ \& \ S_2(z) \ \& \ z R_2 x \ \& \ \text{INTELLIGIBLE}(z)]$

With respect to (30''), two remarks are in order. First, it should be noticed that the \mathbf{SF}_B of the VP *is intelligible* is transformed into its \mathbf{SF}_I by means of *sort2*. Evidently, the operation is justified as according to rule (R2) the SF of each VP has to be subject to the respective inflection. Second, for the sake of brevity, I have left out all parts of the SF which ultimately have no influence on the PFS (30'). In particular, in contrast to the derivation of the SF of sentence (29), the application of *sort3* to the DP *the newspaper lying on the table* has not been taken into consideration.

Now, the PFSs of sentence (30) as well as of relevant constituents can be determined as follows:

(30'') /the newspaper lying on the table is intelligible/; S -pl; \rightarrow

$\mathbf{PFS}: \exists !x \exists yz[\text{SING}(x) \ \& \ x \triangleright \text{mat.thing} \ \& \ x = y$
 $\ \& \ y \triangleright \text{newspaper}$
 $\ \& \ \text{LIE_ON_THE_TABLE}(x)$
 $\ \& \ z \triangleright \text{ment.object} \ \& \ x \text{ TRANSP } z$
 $\ \& \ \text{INTELLIGIBLE}(z)]$
 $\Leftrightarrow \exists !x \exists y[\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_2$
 $\ \& \ \text{LIE_ON_THE_TABLE}(x)$
 $\ \& \ y \triangleright \text{ment.object} \ \& \ x \text{ TRANSP } y$
 $\ \& \ \text{INTELLIGIBLE}(y)]$

— /is intelligible/; VP -pl; $\rightarrow \mathbf{PFS}: \lambda x. \exists y[y \triangleright \text{ment.object} \ \& \ x \text{ TRANSP } y$
 $\ \& \ \text{INTELLIGIBLE}(y)]$

/the newspaper lying on the table/; DP +sg/+m; \rightarrow

$\mathbf{PFS}: \lambda P. \exists !x \exists y[\text{SING}(x) \ \& \ x \triangleright \text{mat.thing} \ \& \ x = y$
 $\ \& \ y \triangleright \text{newspaper}$
 $\ \& \ \text{LIE_ON_THE_TABLE}(x) \ \& \ P(x)]$
 $= \lambda P. \exists !x[\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_2$
 $\ \& \ \text{LIE_ON_THE_TABLE}(x) \ \& \ P(x)]$

...

/newspaper/; N; $\rightarrow \mathbf{PFS}: \lambda x. \exists y[x \triangleright \text{mat.thing} \ \& \ x = y \ \& \ y \triangleright \text{newspaper}]$
 $= \lambda x. x \triangleright \text{newspaper}_2$

For reviewing this section, let me say what has been done in determining the meaning of

particular sentences. Starting from a hypothesis on the contextual meaning which the sentence considered has, I have explored how this meaning or, more specifically, the PFS representing it can be received. Thus, it has been demonstrated, first, the derivation of the underlying SF by semantic composition and, second, the production of the PFS by fixing the SF parameters appropriately and reducing the original PFS by means of equivalent replacement. In addition, I have displayed what PFSs of constituents are given immediately with the PFS of the sentence. However, while the operations being necessary for computing SFs have been explicitly performed the mechanism that underlies the fixation of SF parameters has been left in the dark up to now. Strictly speaking, the PFSs considered so far have been not really derived but rather only postulated. Therefore, in order to fill this gap, I will now turn to investigation into the respective procedures of interpretation.

6 Abductive interpretation of semantic forms

Given a SF which represents the context-independent meaning of an utterance α , we can produce the conceptual content CC of α by interpreting SF(α) in context, i.e., by relating SF(α) to conceptual world knowledge which is the background of α . Following the abductive interpretation model developed by Hobbs et al. (1993), I assume that to interpret a SF requires to explain it by abduction or, more precisely, to prove it from facts and axioms in the respective knowledge base plus assumptions that have to be made in addition. Generally, abduction is a mode of inference which can be characterized by schema (A), where $\psi[d]$ is a proposition that has to be explained, $\forall x[\phi[x] \rightarrow \psi[x]]$ is an axiom that is used to explain $\psi[d]$, and $\phi[d]$ is a fact or an assumption, which can be thought as an explanation of $\psi[d]$.

$$(A) \quad \frac{\forall x[\phi[x] \rightarrow \psi[x]] \quad \psi[d]}{\phi[d]}$$

In words, from $\forall x[\phi[x] \rightarrow \psi[x]]$ and $\psi[d]$, one concludes $\phi[d]$. As this mode of inference is not valid, of course, there may be several possible explanations of $\psi[d]$. Therefore, criteria are needed to choose between the possibilities. However, given that explanation $\phi[d]$ has been abductively generated it is evident that $\psi[d]$ follows logically from it and $\forall x[\phi[x] \rightarrow \psi[x]]$. In this manner, a possible conceptual content CC(α) can be identified with a set of primary facts or assumptions that, together with suitable axioms, entails logically SF(α). Further, on this point of view, the derivation of PFS(α) is actually part of the logical derivation of SF(α).

Let me I consider once more sentence (28), labelled as (31) here.

$$(31) \quad \text{The newspaper was bankrupt.} \quad (= (28))$$

With the assumptions made in the last section, (31') can be taken as a simplified variant of the SF derived by semantic composition.

$$(31') \quad \exists!x\exists yz[S_2(x) \ \& \ x R_2 y \ \& \ T_1(y) \ \& \ S_1(y) \ \& \ y R_1 z \ \& \ z K_1 \text{ newspaper} \\ \ \& \ \text{BANKRUPT}(x)]$$

Then, according to my approach, by interpreting abductively the SF of sentence (31) we get its PSF (31'') as a by-product.

(31'') $\exists!x[\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_3 \ \& \ \text{BANKRUPT}(x)]$

Before examining the abductive interpretation of (31'), let me present some further axioms that are needed for performing derivations in this section.

- (32) (a) $\forall x[\text{BANKRUPT}(x) \rightarrow x \triangleright \text{institution}]$
 (b) $\forall x[\text{CALL}(x) \rightarrow x \triangleright \text{person}]$
 (c) $\forall xy[x \text{ ASSOC } y \rightarrow x \triangleright \text{person} \ \& \ y \triangleright \text{institution}]$
- (33) $\forall x \text{ ENT}(x)$
- (34) $\forall xyz[x \leq y \leftrightarrow z \triangleright x \rightarrow z \triangleright y]$
- (35) $\forall xy[x \triangleright y \rightarrow x K_n y]$
- (36) $\forall x[\text{SING}(x) \rightarrow T_n(x)]$
- (37) (a) $\forall x[\text{ENT}(x) \rightarrow S_n(x)]$
 (b) $\forall x[[\lambda x. x \triangleright \text{institution}](x) \rightarrow S_n(x)]$
 (c) $\forall x[[\lambda x. x \triangleright \text{person}](x) \rightarrow S_n(x)]$
- (38) (a) $\forall xy[x = y \rightarrow x R_n y]$
 (b) $\forall xy[x \text{ ASSOC } y \rightarrow x R_n y]$

With respect to axioms (32) - (38), I will here confine myself to following comments: According to (32a) - (32c), the application of the predicates BANKRUPT, CALL and ASSOC is restricted to the respective ontological sorts. (33) is the most general ontological axiom, i.e. it is true of each element of the domain of discourse. Axiom (34) is part of the characterization of the relationship between kinds and instances. Finally, (35), (36), (37a) - (37c) and (38a) - (38b) are axioms that govern the fixation of SF parameters K_n , T_n , S_n and R_n , respectively.

In (31''), I give a possible logical derivation of (31'). In addition, the proof is illustrated by the graph of figure 2. Note that SF (31') is an existentially generalized conjunction. Thus, to prove it each of its conjuncts must be proved, using facts and axioms or making assumptions.

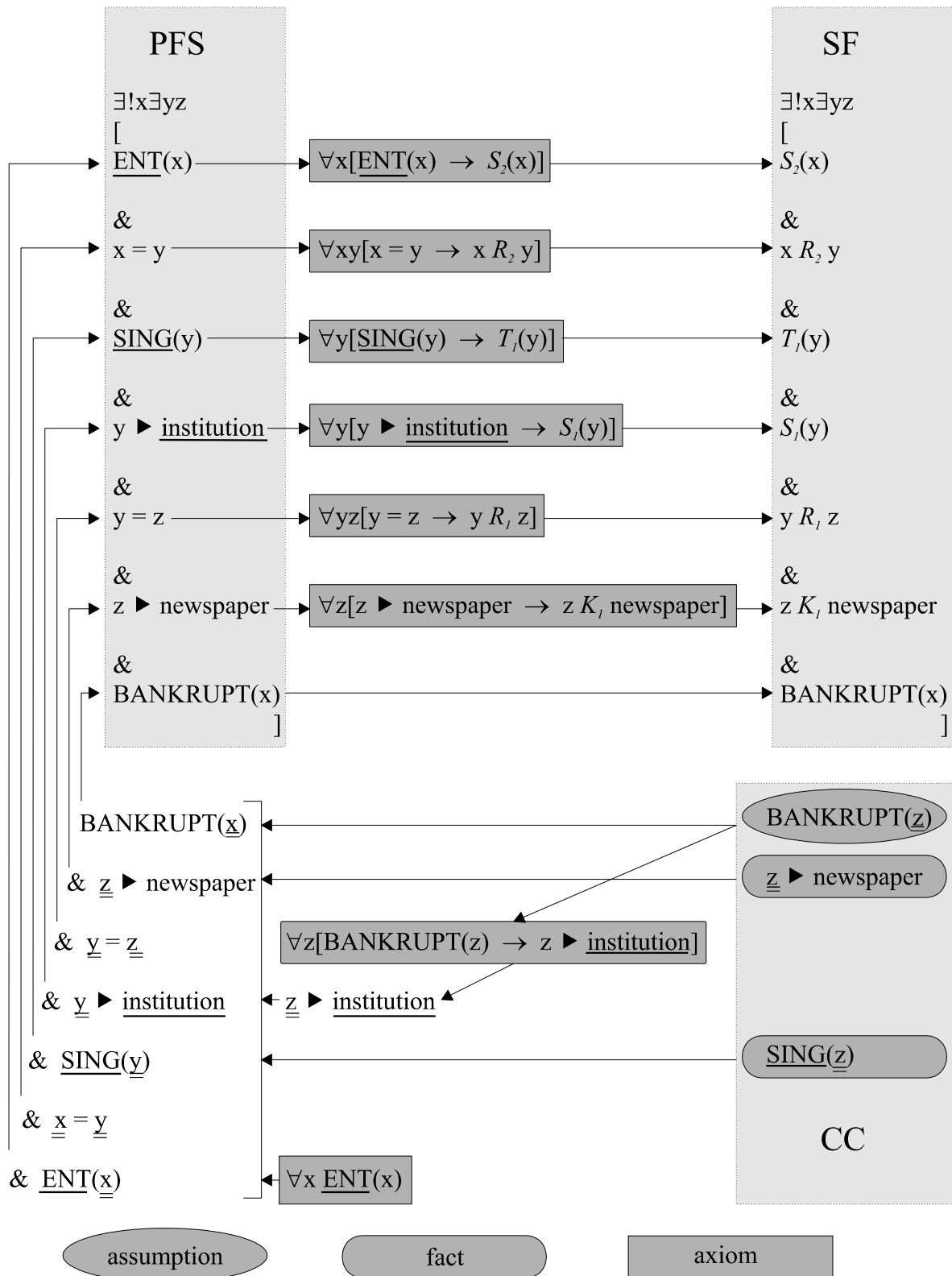


Figure 2

(31''')	1. $\underline{z} \triangleright \text{newspaper}$	(fact)
	2. $\text{SING}(\underline{z})$	(fact)
	3. $\text{BANKRUPT}(\underline{z})$	(assumption)
	4. $\forall z[\text{BANKRUPT}(z) \rightarrow z \triangleright \text{institution}]$	(axiom (32a))
	5. $\underline{z} \triangleright \text{institution}$	(3., 4.)
	6. $\text{SING}(\underline{z}) \ \& \ \underline{z} \triangleright \text{institution} \ \& \ \underline{z} \triangleright \text{newspaper}$ $\ \& \ \text{BANKRUPT}(\underline{z})$	(1., 3., 5.)
	7. $\text{SING}(\underline{y}) \ \& \ \underline{y} \triangleright \text{institution} \ \& \ \underline{y} = \underline{z} \ \& \ \underline{z} \triangleright \text{newspaper}$ $\ \& \ \text{BANKRUPT}(\underline{y})$	(6.)
	8. $\underline{x} = \underline{y} \ \& \ \text{SING}(\underline{y}) \ \& \ \underline{y} \triangleright \text{institution} \ \& \ \underline{y} = \underline{z}$ $\ \& \ \underline{z} \triangleright \text{newspaper} \ \& \ \text{BANKRUPT}(\underline{x})$	(7.)
	9. $\forall x \text{ENT}(x)$	(axiom (33))
	10. $\text{ENT}(\underline{x})$	(9.)
	11. $\text{ENT}(\underline{x}) \ \& \ \underline{x} = \underline{y} \ \& \ \text{SING}(\underline{y}) \ \& \ \underline{y} \triangleright \text{institution}$ $\ \& \ \underline{y} = \underline{z} \ \& \ \underline{z} \triangleright \text{newspaper} \ \& \ \text{BANKRUPT}(\underline{x})$	(8., 10.)
	12. $\exists!x\exists yz[\text{ENT}(x) \ \& \ x = y \ \& \ \text{SING}(y)$ $\ \& \ y \triangleright \text{institution} \ \& \ y = z \ \& \ z \triangleright \text{newspaper}$ $\ \& \ \text{BANKRUPT}(x)]$	(11.)
	13. $\exists!x[\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_3 \ \& \ \text{BANKRUPT}(x)]$	(12., axioms (13a), (13d), (13g))
	14. $\forall x[\text{ENT}(x) \rightarrow S_2(x)]$	(axiom (37a))
	15. $\forall y[y \triangleright \text{institution} \rightarrow S_1(x)]$	(axiom (37b))
	16. $\forall xy[x = y \rightarrow x R_2 y]$	(axiom (38a))
	17. $\forall yz[y = z \rightarrow y R_1 z]$	(axiom (38a))
	18. $\forall z[z \triangleright \text{newspaper} \rightarrow z K_1 \text{newspaper}]$	(axiom (35))
	19. $\forall y[\text{SING}(y) \rightarrow T_1(y)]$	(axiom (36))
	20. $\exists!x\exists yz[S_2(x) \ \& \ x R_2 y \ \& \ T_1(y) \ \& \ S_1(y) \ \& \ y R_1 z$ $\ \& \ z K_1 \text{newspaper} \ \& \ \text{BANKRUPT}(x)]$	(12., 14. - 19.)

To illuminate the abductive interpretation of (31'), let me make some supplementary remarks in regard of logical derivation (31'''). First, taking into account that a definite DP refers typically to an entity being accessible to the respective discourse, I assume that the existence of exactly one instance of the kind *newspaper* is presupposed. More specifically, by taking propositions $\underline{z} \triangleright \text{newspaper}$ and $\text{SING}(\underline{z})$ to be facts in the knowledge base, the reference of the DP *the newspaper* is resolved into discourse entity \underline{z} . Second, as the copula-adjective construction *is bankrupt* is obviously the constituent which conveys the new information, the knowledge base is updated by making the assumption $\text{BANKRUPT}(\underline{z})$. As a consequence, the set that is formed by atomic propositions $\text{SING}(\underline{z})$, $\underline{z} \triangleright \text{newspaper}$ and $\text{BANKRUPT}(\underline{z})$ may be viewed as the conceptual content CC of (31). Third, further propositions are derived by making additionally use of axioms in the knowledge base. In particular, from assumption $\text{BANKRUPT}(\underline{z})$ and axiom (32a), it follows that $\underline{z} \triangleright \text{institution}$. In this way, to meet the sortal constraint imposed by BANKRUPT on arguments, the meaning of *newspaper* is contextually specialized to its 'institution' reading. With axiom (33), we get the original PFS of sentence (31), which on its part can be simplified to (31'') by means of axioms (13a), (13d) and (13g). Finally, the proof of SF (31') is closed by using axioms which characterize parameters S_n , R_n and T_n .

As mentioned above, we need criteria to decide among several potential explanations of a SF. An obvious criterion is whether the assumptions made in the process of derivation are consistent

- 8.3 $\underline{z} \triangleright \text{newspaper}_3$ (7., 8.1, 8.2)
8.4 $\text{newspaper} = [\text{newspaper}_1 \vee \text{newspaper}_2] \vee \text{newspaper}_3$ (axiom (13a))
8.5 $\text{newspaper}_3 \leq \text{newspaper}$ (8.4)
8.6 $\forall z[z \triangleright \text{newspaper}_3 \rightarrow z \triangleright \text{newspaper}]$ (8.5, axiom (34))
8.7 $\underline{z} \triangleright \text{newspaper}$ (8.3, 8.6)
9.1 $\forall u[\text{CALL}(u) \rightarrow u \triangleright \text{person}]$ (axiom (32b))
9.2 $\underline{u} \triangleright \text{person}$ (3., 9.1)
10. $\text{SING}(\underline{z}) \ \& \ \underline{z} \triangleright \text{institution} \ \& \ \underline{z} \triangleright \text{newspaper}$
 $\ \& \ \underline{u} \triangleright \text{person} \ \& \ \underline{u} \text{ ASSOC } \underline{z} \ \& \ \text{CALL}(\underline{u})$ (1., 2., 3., 4., 6., 7.)
11. $\text{SING}(\underline{y}) \ \& \ \underline{y} \triangleright \text{institution} \ \& \ \underline{y} = \underline{z} \ \& \ \underline{z} \triangleright \text{newspaper}$
 $\ \& \ \underline{u} \triangleright \text{person} \ \& \ \underline{u} \text{ ASSOC } \underline{y} \ \& \ \text{CALL}(\underline{u})$ (10.)
12. $\underline{x} = \underline{y} \ \& \ \text{SING}(\underline{y}) \ \& \ \underline{y} \triangleright \text{institution} \ \& \ \underline{y} = \underline{z}$
 $\ \& \ \underline{z} \triangleright \text{newspaper} \ \& \ \underline{u} \triangleright \text{person} \ \& \ \underline{u} \text{ ASSOC } \underline{x}$
 $\ \& \ \text{CALL}(\underline{u})$ (11.)
13. $\forall x \text{ ENT}(x)$ (axiom (33))
14. $\text{ENT}(\underline{x})$ (13.)
15. $\text{ENT}(\underline{x}) \ \& \ \underline{x} = \underline{y} \ \& \ \text{SING}(\underline{y}) \ \& \ \underline{y} \triangleright \text{institution}$
 $\ \& \ \underline{y} = \underline{z} \ \& \ \underline{z} \triangleright \text{newspaper} \ \& \ \underline{u} \triangleright \text{person}$
 $\ \& \ \underline{u} \text{ ASSOC } \underline{x} \ \& \ \text{CALL}(\underline{u})$ (12., 14.)
16. $\exists!x\exists yz[\text{ENT}(x) \ \& \ x = y \ \& \ \text{SING}(y)$
 $\ \& \ y \triangleright \text{institution} \ \& \ y = z \ \& \ z \triangleright \text{newspaper}$
 $\ \& \ u \triangleright \text{person} \ \& \ u \text{ ASSOC } x \ \& \ \text{CALL}(u)]$ (15.)
17. $\exists!x\exists y[\text{SING}(x) \ \& \ x \triangleright \text{newspaper}_3 \ \& \ y \triangleright \text{person}$
 $\ \& \ y \text{ ASSOC } x \ \& \ \text{CALL}(y)]$ ((16.), axioms (13a), (13d), (13g))
18. $\forall x[\text{ENT}(x) \rightarrow S_2(x)]$ (axiom (37a))
19. $\forall y[y \triangleright \text{institution} \rightarrow S_7(y)]$ (axiom (37b))
20. $\forall u[u \triangleright \text{person} \rightarrow S_3(u)]$ (axiom (37c))
21. $\forall xy[x = y \rightarrow x R_2 y]$ (axiom (38a))
22. $\forall yz[y = z \rightarrow y R_1 z]$ (axiom (38a))
23. $\forall ux[u \text{ ASSOC } x \rightarrow u R_3 x]$ (axiom (38b))
24. $\forall z[z \triangleright \text{newspaper} \rightarrow z K_1 \text{ newspaper}]$ (axiom (35))
25. $\forall y[\text{SING}(y) \rightarrow T_7(y)]$ (axiom (36))
26. $\exists!x\exists yzu[S_2(x) \ \& \ x R_2 y \ \& \ T_7(y) \ \& \ S_7(y) \ \& \ y R_1 z$
 $\ \& \ z K_1 \text{ newspaper} \ \& \ S_3(u) \ \& \ u R_3 x \ \& \ \text{CALL}(u)]$ (16., 18. - 24.)

Note that by assuming $\text{CALL}(\underline{u})$ and $\underline{u} \text{ ASSOC } \underline{z}$ a new discourse entity \underline{u} is introduced. In lines 8.1 - 8.7, 9.1 and 9.2, it is displayed that both assumptions may be made because they do not run into an inconsistency. Unlike that, to assume $\text{CALL}(\underline{z})$ is not allowed because by using axiom (32b) it could be inferred $\underline{z} \triangleright \text{person}$ from $\text{CALL}(\underline{z})$. Obviously, as a newspaper cannot be a person, the result would be incompatible with knowledge base.

Summing up, I have outlined how the SF of an utterance is abductively interpreted with respect to the context and how, in doing so, the context-dependent meaning of the utterance is logically derived. Obviously, two important aspects of context are general knowledge about the world and specific knowledge about the current situation, i.e. the situation in which the sentence is used. I have shown how world knowledge is involved in the process of abductive interpretation. However, it should be emphasized that other factors have likewise important

effects on the way the interpretation is performed. The problem is to find the explanation of the utterance that the best satisfies not only conceptual constraints but also a set of morpho-syntactic as well as pragmatic constraints. Thus, it needs no further discussion that abductive interpretation is usually more complex than suggested before. In view of it, I concede that the abductive framework drawn upon requires a lot of additional investigation for providing adequate explanations. At the same time, I claim that the approach developed here goes beyond the devices proposed by Hobbs et al. (1993) with respect to at least two features. First, by assuming several obligatory operations of SF inflection, an extensive potential for varying the meaning contextually is not simply postulated but systematically produced in semantic composition. Second, as sortal restrictions imposed by predicates on their arguments are not imported into SF of lexical items but viewed as particular axioms, the approach takes into consideration that they reflect ultimately constraints on conceptualization of the world. As a result, lexical knowledge and conceptual world knowledge are left to be separate.

7 Conclusions

In this paper, I have presented a unified account of two types of systematic meaning variation: contextual specialization and contextual shift of meaning. As a general assumption, it has been argued for a level of semantic form which represents the context-independent meaning of expressions and, in this manner, is essentially underspecified in regard of the information conveyed by the respective utterance. Importantly, expressions are provided with a specific potential to vary their meaning as their semantic form contains particular parameters which can be fixed in the course of interpretation. More specifically, I have shown that lexical semantic entries of common nouns have a basic potential of variation, which permits to specialize the lexical meaning differently in different contexts. Moreover, it has been shown that in semantic composition additional parameters are introduced by means of obligatory operations. Extending in this way the potential of meaning variation of lexical or complex expressions, not only further possibilities of contextual specialization but also preconditions of contextual shift of meaning are supplied. Finally, it has been demonstrated how the semantic form of an utterance is abductively interpreted against general and specific world knowledge in order to produce its conceptual content. In the process of abductive interpretation we can discriminate a particular level of structure that is generated by fixing parameters of semantic form and, thus, represents the context-dependent meaning of expressions occurring in the utterance. Consequently, as it is exactly this level where the results of both contextual specialization and contextual shift of meaning appear, I have demonstrated that systematic meaning variation results generally from abductive fixation of parameters being characteristic of underspecified semantic representation.

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