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Semantics as a gateway to language*

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1. Overview

This paper presents an account of semantics as a system that integrates conceptual representations into language. I define the semantic system as an interface level of the conceptual system CS that translates conceptual representations into a format that is accessible by language. The analysis I put forward does not treat the make up of this level as idiosyncratic, but subsumes it under a unified notion of linguistic interfaces. This allows us to understand core aspects of the linguistic-conceptual interface as an instance of a general pattern underlying the correlation of linguistic and non-linguistic structures. By doing so, the model aims to provide a broader perspective onto the distinction between and interaction of conceptual and linguistic processes and the correlation of semantic and syntactic structures.

The next section gives a general sketch of the architecture that I assume for the language faculty, and identifies the semantic system within this architecture. In section 3, I motivate the status of semantics as a system in its own standing, and show what kind of phenomena such a semantic system should account for. In particular, I discuss linguistic and psycholinguistic evidence for a distinction of non-linguistic and linguistic (semantic) aspects of meaning.

On this basis, section 4 gives a definition of semantics that accounts for the general design of semantic systems in different languages and the way they are generated from conceptual representations. I illustrate how the definition can account for the linguistic organization of meaning discussed in section 3. The definition of semantics will be based on a unified notion of interface levels and the functions generating them (which I will call 'view functions').

In section 5, I show how this notion of interface levels allows us to characterize semantics and phonology as parallel systems within the architecture of the language faculty. Section 6 summarizes our results and shows that the different kinds of phenomena we discussed as evidence for a semantic interface can be characterized as typical phenomena of mental systems that serve as ‘gateways to language’.

2. The semantic system within the architecture of the language faculty

My account can be described within the framework of a Tripartite Parallel Architecture for the human language faculty, as proposed in Jackendoff (1997). In accordance with this framework I assume three mental modules, which are autonomous derivational systems, for the generation of phonetic-phonological structures (PHON), syntactic structures (SYN), and semantic-conceptual structures (CS).

The crucial connection we want to make in language comprehension and production is then that between PHON and CS: ultimately, we want to get from sound to meaning and vice versa. This connection is mediated by the syntactic system. In particular, syntax computes a mapping that enables us to correlate the linear order of a speech event with the hierarchical order of conceptual structures.

SYN does not link up the entire systems of PHON and CS indiscriminately, though: we do not want to take into account just any phonetic and conceptual representations, but only those configurations – and the relations between them – that are relevant for the linguistic system. In the present paper, I characterize these linguistically relevant configurations as representations that constitute the *linguistic interfaces* of PHON and CS. These interfaces serve as gateways to language: they integrate information from PHON and CS into the linguistic system. In a first approach, we can identify *Phonology* and *Semantics* as the linguistic interfaces of PHON and CS, respectively.

Figure 1 illustrates the architecture sketched here: ϕ_{PHOL} and ϕ_{SEM} represent the functions generating phonology and semantics; the boxes stand for the different modules, their dotted parts indicate components of the linguistic system.[1]

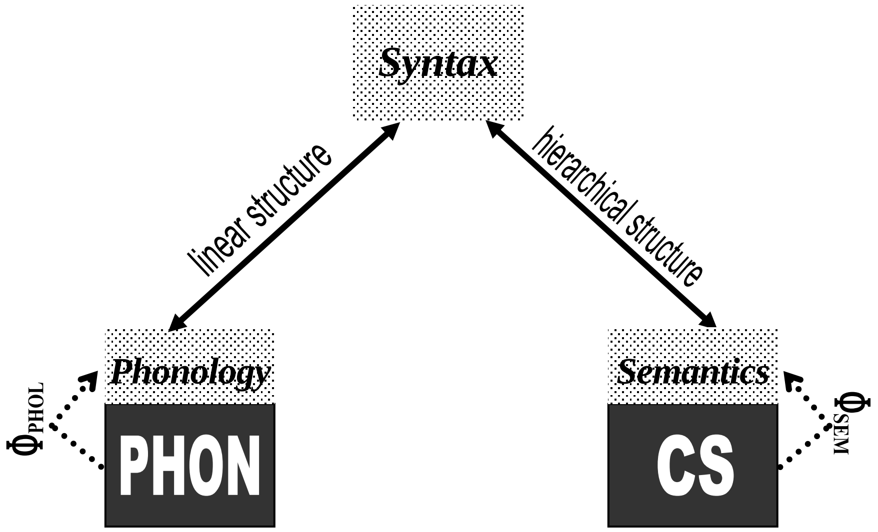

Figure 1. Phonology and semantics as linguistic interface systems.

As the graphic illustrates, semantics does not constitute a separate module, in accordance with the framework of a Tripartite Parallel Architecture (TPA). However, and deviating from the original account in Jackendoff (1997), semantics does constitute a system of its own, namely a system of linguistically motivated representations that establish a specific *view* of CS. In section 4 below, I will account for the semantic system and the view functions generating it by working out the notion of interface levels that the TPA-framework provides.

In the model advocated here, CS is an autonomous, extra-linguistic module that interacts with language via the semantic system. Hence, conceptual representations do not enter lexical information directly, but only in the form of their semantic 'proxies'. As a consequence of this, the lexicon does not contain non-linguistic information. This is consistent with assumptions in Two-Level models of semantics (cf. Bierwisch 1983; Bierwisch and Schreuder

1992; Lang 1994). In order to distinguish between linguistic and conceptual structures, these models introduce a semantic system SEM that accounts for those aspects of meaning that have reflexes in the linguistic system and is part of language, whereas CS is non-linguistic.

The approach I develop here accounts for semantic representations as distinct from general conceptual structures, but – unlike Two-level models – integrates the semantic system into CS. This reflects the fact that SEM and CS do not consist of ontologically distinct entities, and accounts for the close interaction between conceptual structures and lexical semantic structures in language acquisition and representation. Such an approach allows us to treat semantics as a system in its own right, without neglecting the close correlation of semantic and conceptual representations.

Note that this account distinguishes between a module like CS and the different (sub-)systems that its elements can constitute. We can define a system along the following lines: "A system is a functional whole composed of a set of component parts (subsystems, units) that, when coupled together, generate a level of organization that is fundamentally different from the level of organization represented in any individual or subset of the component parts." (Levine and Fitzgerald 1992: vii). Under this notion of system, then, a module can encompass several distinct systems, and in particular it can encompass different systems that access the same basic entities. In a general approach, we can think of a module as a superstructure that consists of all those systems that have privileged access to each other's state.

3. The linguistic organization of meaning: A task for SEM

The upshot is, then, that the conceptual module interacts with the linguistic system via a dedicated interface level, semantics, which constitutes a system in its own standing. The evidence for such a distinct system of meaning, with a structure that is independent from that of CS proper, comes from three main sources: (1) the meaning of lexical items is conceptually *underspecified*; (2) it is based on language-specific *configurations* of conceptual representations, and (3) it is based on language-specific *classifications* of conceptual representations.

3.1. Underspecification of meaning

A central feature of linguistic items is a particular flexibility of their meaning that can be described as an underspecification with respect to the conceptual representations they relate to. (1) and (2) illustrate this phenomenon with examples for some of the possible interpretations for a lexical item like *number (#)* or a phrase like *leave the institute*:

(1) a. You are the #1 in my life.
⇒ numerical rank (ordinal number assignment)

b. The #1 bus leaves from Porter Square.
⇒ numerical label (nominal number assignment)

(2) a. He left the institute an hour ago.
⇒ institute as a building: change of place

b. He left the institute a year ago.
⇒ institute as an organisation: change of affiliation[2]

In these cases, the different possible interpretations are not unrelated, but can be derived from a common basis. Both (1) a. and (1) b. refer to a number assignment, while both (2) a. and (2) b. refer to a change that has as its point of origin an entity related to an institution (the building its offices are in, or the organization it constitutes). Hence the semantic contribution of these items is underspecified; it can be specified by different, related conceptual representations as illustrated in (1) and (2), depending on the linguistic and extra-linguistic context.

3.2. Language-specific conceptual configurations

The way conceptual representations enter language is governed by language-specific constraints that can determine different configurations of conceptual representations for different languages, both on the lexical level and above.

On the lexical level, the meaning of a lexical item integrates different elements of CS with respect to language-specific constraints. For instance English has a lexical item *mare*, but not a single lexical item for 'female elephant'. Hence, the English lexicon invokes a conceptual configuration "female-horse" (as input for *mare*), but not a corresponding one for "female" and "elephant", whereas in other languages the lexicon might be organized differently.

To account for this phenomenon, Levelt et al. (1999) introduced a level of 'lexical concepts' into their model of language production, which can be regarded as a counterpart of our semantic level. Lexical concepts as defined by Levelt et al. are activated in a process of 'conceptual preparation', and connected with lemmata that relate the meaning of lexical items to their morpho-syntactic features and phonological representations. Lexical concepts are language-specific and integrate different conceptual representations with respect to lexical constraints. For instance for English, Levelt et al. assume a lexical concept MARE that integrates the concepts FEMALE and HORSE, but they do not assume a unitary lexical concept integrating the concepts FEMALE and ELEPHANT.

On a level above individual lexical items, languages can, for instance, impose specific configurations of event conceptualizations. As Nüse (this volume) shows, such a difference can be observed in the way English and German speakers segment events in language production. In his study, English and German speakers saw a short movie and were asked to describe what was happening, that is, the subjects had to give an on-line description of what they saw. A comparison of the number of single events mentioned by subjects from the two groups revealed that English speakers parsed the scenes into smaller units, they mentioned more single events than German speakers, suggesting that English and German induce different segmentations for event descriptions.

Interestingly, Nüse's study also shows that there are no such differences in non-verbalization tasks. When his subjects had to segment the movie by non-verbal means (they were asked to press a button whenever they thought one event ended and the next one began), English and German speakers did not differ in their responses. This suggests that there is a language-specific subsystem of CS that is activated for language production, but not for non-linguistic tasks – a system we can now describe as the linguistic interface level of CS: semantics.

3.3. Language-specific semantic classifications

The semantic classifications that are relevant in a language access conceptual representations. However, they are not necessarily based on salient conceptual features and/or conceptual classes. This leads to language-specific classifications that can look arbitrary from the point of view of the conceptual system. In the following paragraphs, I illustrate this with two examples from the nominal domain: (1) the [± animate] distinction underlying a grammatical classification of nouns, and (2) nominal taxonomies as accessed by numeral classifiers.

An example from the domain of verbs is discussed in Tschander (this volume): Tschander shows that grammatical constraints on verbs of motion draw on subtle differences in the semantic representation of verbs which denote conceptually very similar situations.[3] This suggests a linguistic classification of meaning that does not follow salient conceptual taxonomies; in other words: it supports a distinction of a linguistic organization of meaning ('semantics'), and the organization of CS proper. Let me spell this out for the two examples from the nominal domain now.

3.3.1. The nominal [± animate] distinction

The distinction of animate and inanimate entities provides a conceptual basis for the grammatical [± animate] classification of nouns. As

Gelman and Gottfried (1996) show, children as young as three years are aware of the animate/inanimate distinction of objects, and for instance interpret the movement of animals and artifacts differently: they are more likely to attribute immanent cause to animals than to artifacts and are more likely to attribute human cause to artifacts than to animals, suggesting a conceptualization of animacy as a relevant object feature.

This differentiation of animate and inanimate objects is extra-linguistic. Yet the degree to which the differentiation is relevant for the behavior of nouns is language-specific. The boundaries between [animate] and [inanimate] nouns differ across languages;[4] they can be influenced by linguistic factors like diachronic and phonological phenomena and can be reflected by a wide range of morpho-syntactic phenomena in different languages.[5]

For instance in Persian, the [animate] category encompasses nouns referring to human beings and some animals; these nouns are pluralized more regularly than others,[6] and can take a plural suffix *-ān* that is not used with [inanimate] nouns. However, *derakht* ('tree') belongs to the [animate] category, i.e., the noun is treated on a par with nouns like *zan* ('woman'), but not with nouns like *gol* ('flower'). Yet one would not assume that speakers of Persian have a more 'personified' concept of trees than, say, speakers of English.

Hence even though the conceptual classes are presumably the same across languages, their elements can enter the corresponding classes in the grammatical system in a different way; the linguistic distinction, although it accesses conceptual features, is not a direct reflex of a conceptual taxonomy.

3.3.2. Nominal taxonomies established by numeral classifiers

In languages with a rich classifier system, numeral classifiers have a taxonomic effect on nouns; they are combined with classes of nouns that share certain aspects of their meaning. This combination has a conceptual basis, which is evident for instance in developmental phenomena. For one, the classification of nouns is productive, and the distribution of novel nouns in cardinal classifier constructions can be determined by their meaning.[7] Moreover, in first language acquisition one can observe conceptually based over-generalizations in the usage of numeral classifiers.[8]

However, the nominal classification does not necessarily reflect a *conceptual* taxonomy, that is, even though it is based on conceptual features, it does not necessarily relate to a classification that the conceptual system provides independently of (and prior to) the linguistic classification. This is because the combination of nouns and classifiers need not take into account conceptual features in a systematic way. In the same language, the classification can, among others, refer to different physical attributes of the nominal referent (shape, surface, size, …), to its function, and to instrumental criteria; yielding taxonomies like '[round object] vs. [small object] vs. [pet] vs. [food] …' that do not make much sense in the conceptual system.

Moreover, while conceptual classifications arguably remain the same, the semantic taxonomy that underlies the distribution of nouns and classifiers can change diachronically. Among others, this can lead to conceptually unmotivated classes like [animal or clothing or furniture], as is the case for the Thai classifier *tua*.[9]

So, although the taxonomic effect of numeral classifiers relates to conceptual features of nominal referents, the selection of those conceptual features that are relevant for the distribution of numeral classifiers and nouns is lexically, not conceptually governed. As a result the distribution of numeral classifiers and nouns is based on classifications that are dissociated from conceptual taxonomies.[10]

3.4. A linguistic structure of meaning

The examples we discussed in the preceding paragraphs illustrate the kinds of phenomena our semantic system has to account for: languages determine a specific view of the conceptual system, a linguistic structure of meaning, which is based on conceptually underspecified representations that enter language-specific configurations and are subject to language-specific classifications.

This leads to dissociations in the organization of the semantic system and that of CS proper, even though both systems build on the same basic conceptual material. Hence semantic representations have a somewhat dual status. On the one hand, they are grounded in conceptual representations. On the other hand, they are part of language: they represent exactly those aspects of meaning that are visible for the linguistic system; elements of the semantic system and classifications within this system account for linguistically, but not necessarily conceptually, relevant structures.

In a model that does not provide a separate level for linguistic aspects of meaning, the burden to account for semantic phenomena lies on the links between CS and the linguistic system, and in particular on links from CS to syntactic structures and the lexicon. Since these links need to access *linguistically* relevant classes of CS entities, this means that we would have to define classifications and configurations in CS that are governed linguistically, hence we would have to posit certain language-specific conceptual structures.

As we have seen in the present section, on the one hand these structures would have to be different for different languages. What is more, they might be accessed only for linguistic, but not for non-linguistic tasks (as Nüse's English/German study on event segmentation suggests). On the other hand, the conceptual features that these structures build on need not be salient in terms of conceptual representations; linguistic classifications of meaning are essentially independent of conceptual taxonomies. It might hence be desirable to have a sharper distinction between linguistic and genuinely conceptual phenomena.

4. Semantics as a linguistic interface level

In the present section I sketch an account that allows us to make this distinction. In accordance with the parameters we set up in section 2, I define a semantic system SEM as the linguistic interface level of CS. My notion of interface levels is based on a definition of view functions that operate on phonetic, syntactic and conceptual representations and generate linguistic interfaces in accordance with language-specific constraints; these interfaces are defined as relational structures. The view function that generates SEM prepares CS entities for language; it determines which conceptual representations and configurations enter the lexicon, and how they can be accessed by linguistic structures.

4.1. Linguistic interface levels

Within the framework of a Tripartite Parallel Architecture, the modules involved in the representation of linguistic structures and their meaning are linked up by correspondence rules that access interface levels within the modules. In accordance with this approach, I assume that each module *m* ($m \in$ {PHON, SYN, CS}) contains a linguistic interface level IL_m that is subject to correspondence rules. Following Jackendoff (1997), I regard the lexicon as a subset of these correspondence rules. I define a lexical entry as a triple $\langle\alpha,\beta,\gamma\rangle$, where $\alpha \in IL_{PHON}$, $\beta \in IL_{SYN}$, and $\gamma \in IL_{CS}$.

The correspondence rules establish homomorphisms between interface levels, that is, mappings between relational structures. Generally speaking, a homomorphism *f* of a relational structure s_1 into a relational s_2 maps the elements of s_1 onto those of s_2 and preserves the relations defined between them. The purpose of an interface level is now to make the elements of a module accessible for these homomorphisms. Accordingly I introduce interface levels as relational structures. They are generated by language-specific view functions that operate on the modules PHON, SYN and CS.[11]

Definition 1: View functions and interface levels
For every module *m*, where $m \in$ {PHON, SYN, CS},
there is an identified view function ϕ^L whose target is IL_m^L, the interface level of *m* for a given language L, such that

- ϕ: $m \rightarrow IL_m$, IL_m is a relational structure <E, R>, where
- E is a non-empty set of entities computed from a set *m*', such that
  $m' \subset \wp(|m|)$ and $\wp(|m|)$ is the power set of the phonetic, syntactic, or conceptual representations that are elements of *m*, and
- R is a non-empty set of relations over E computed from R^m, where R^m is a subset of the relations in *m*.

According to this definition, a view function ϕ operates on a module *m* and yields an interface system that can be regarded as a relational structure <E, R>. More specifically, it takes into account a subset R^m of the relations holding between the elements in *m*, and a subset *m*' of $\wp(|m|)$, the power set of the elements of *m*. $\wp(|m|)$ contains all sets of elements of *m*. ϕ takes some of these sets (namely those that are elements of *m*') and maps them onto interface level representations (E). In addition, ϕ generates specific relations between these representations (R), computed from the relations in R^m. This way, ϕ constitutes a relational structure <E, R> whose elements and relations are based on elements and relations of the source module *m*, but not identical to them; they constitute a system with an autonomous structure.

The elements and relations of this relational structure enter a homomorphism that connects them with interface level representations from another module. The homomorphism is established by correspondence rules:

Definition 2: Correspondence rules
For given interface levels IL_m and IL_n, where *m*, $n \in$ {PHON, SYN, CS}, and $IL_m = \langle A, \{R_1, \ldots R_i\}\rangle$, and $IL_n = \langle B, \{S_1, \ldots S_i\}\rangle$:
f is a set of correspondence rules between IL_m and IL_n iff
f is a homomorphism of IL_m into IL_n, such that

- for all $a \in A$: $f(a) \in B$, and
- for each *i*: if R_i is an *n*-ary relation and $a_1, \ldots , a_n$ are in A, then
  $R_i(a_1, \ldots, a_n) \Rightarrow S_i(f(a_1), \ldots, f(a_n))$.

In accordance with Definition 1, the interface levels IL_m and IL_n in Definition 2 are given as relational structures, that is, as ordered pairs consisting of a set of elements and a set of relations. The sets of elements are A and B, for IL_m and IL_n, respectively. The correspondence rules between the two interface levels are defined as the elements of a homomorphism *f* of IL_m into IL_n.[12] Being a homomorphism, *f* maps each element of A onto an element of B, such that the relations that hold in A are preserved in B. Crucially, the homomorphism correlating syntax and semantics focuses on hierarchical order, whereas the one that correlates syntax and phonology preserves the linear order between the elements.

4.2. Definition of SEM as IL_{CS}

Within this framework, we can now account for SEM as IL_{CS}, the linguistic interface level of CS. In order to do so, we introduce a class of view functions ϕ_{SEM}^{L1}, ϕ_{SEM}^{L2} etc., that operate on sets of CS elements and generate language-specific interface representations for given languages L1, L2 etc. Hence a view function takes conceptual representations as its input and creates a semantic system for a particular language.[13]

Definition 3: SEM as the linguistic interface level of CS
For a given language L, ϕ_{SEM}^{L} is an identified view function that generates the interface level IL_{CS}^{L} of the conceptual system CS, and IL_{CS} = SEM, such that

- ϕ_{SEM}: CS → SEM, and
- SEM is a relational structure, SEM = <$\mathbf{E}_{SEM}$, $\mathbf{R}_{SEM}$>, where
- $\mathbf{E}_{SEM}$ is a set of typed semantic representations computed from CS',
  and for each $\varepsilon \in \mathbf{E}_{SEM}$, there is a $\sigma \in$ CS' such that $\phi_{SEM}(\sigma) = \varepsilon$,
  and for each $x \in \sigma$: there is a context CT, such that Int(ε, CT) = x
  [Hence ε ∈ SEM, x ∈ CS. *Int* is a context-sensitive interpretation function from SEM to CS.];
- $\mathbf{R}_{SEM}$ is a set of relations in $\mathbf{E}_{SEM}$.

ϕ_{SEM} in Definition 3 yields semantic representations based on a subset CS' of $\mathcal{P}$(|CS|), where $\mathcal{P}$(|CS|) is the set of all sets of CS elements. As CS' is a proper subset of $\mathcal{P}$(|CS<), ϕ_{SEM} does not operate on all possible sets of CS elements; furthermore it does not necessarily take into account all elements of CS: not all concepts and ensembles of concepts have to be linked to linguistic expressions. The relevant elements of CS can be primitive as well as complex representations, depending on the lexical patterns of different languages. This way, ϕ_{SEM} takes into account language-specific configurations of conceptual elements. For instance, taking the above example from Levelt et al. (1999), we can think of a view function ϕ_{SEM}^{E} for English that maps the complex conceptual representation "female-horse" onto a semantic constant MARE (as semantic input for the lexical item *mare*), but does not provide a unitary element of SEM for the conceptual representation "female elephant".

For each element ε of SEM, ϕ_{SEM} identifies a set σ of conceptual representations; σ encompasses the possible specifications of ε. Consider, for instance, the representation of *the # 1* from (1) above. For the interpretation of this phrase, ϕ_{SEM}^{E} provides an underspecified semantic constant NU that is related to a set of possible specifications σ = {NL, NR}, the conceptual representations of *numerical label* and *numerical rank*.[14]

For a given context CT, an interpretation function *Int* maps ε onto a specific element x of σ, that is, in our example: Int(NU) $\in$ {NR, NL}. Hence, like in Two-Level models of semantics *Int* correlates underspecified and flexible semantic representations with conceptual interpretations.[15] For instance, *Int* maps NU onto NL in the preferred reading of 'the #1 bus' (numerical label), and onto NR in 'the #1 in my life' (numerical rank).

$_{SEM}$ can also provide additional elements within the set of possible conceptual specifications, for instance as a basis for repair mechanisms in the generation of enriched interpretations of the kind discussed by Piñango (this volume). As Piñango shows, constructions like (3) receive an interpretation that includes an iteration (in the example, an iteration of the 'hopping'-action), whereas in the syntactically identical example in (4) no such iteration is triggered (the interpretation does not specify iterated acts of gliding):

(3) The insect hopped effortlessly until it reached the garden.
(4) The insect glided effortlessly until it reached the garden.

This can be captured by a CS function ITERATION that maps an event *e* onto a set $\{e_1, ..., e_n\}$ of multiple instances of *e*. This conceptual representation is then made available in the linguistic system via SEM. ϕ_{SEM} includes the enriched variant as part of the possible specifications for the semantic representation SR_C of a clause C, that is, ϕ_{SEM} identifies a set of conceptual representations $\sigma = \{e$, ITERATION(e)} for SR_C. For a given context, *Int* yields the enriched variant as the interpretation for the clause whenever otherwise the conceptual representation would be ill-formed, hence: $Int(SR_C)$ = ITERATION(*e*) when *e* would be ill-formed in CS, while ITERATION(*e*) is well-formed. This way, ϕ_{SEM} organizes the access of linguistic representations to conceptual processes.

On the other side, semantic representations are correlated with syntactic representations. ϕ_{SEM} lays the grounds for this correlation by defining a set $\mathbf{R}_{SEM}$ of relations that hold between the elements of

SEM. $\mathbf{R}_{SEM}$ accounts for semantic classifications. Note that the distinctions that define the relevant classifications are *linguistically* motivated. As the examples above illustrated, distinctions like [± animate] that are reflected by grammatical phenomena do not necessarily observe conceptual taxonomies: certain conceptual differentiations, but not others, are linguistically relevant, and the relevant features need not be conceptually salient.

Hence, $\mathbf{R}_{SEM}{}^{P}$ as established by a semantic view function $\phi_{SEM}{}^{P}$ for Persian, would compile semantic constants relating to humans and animals (like WOMAN and HORSE) together with TREE as [+ animate], but would exclude constants like FLOWER, which are classified as [– animate] together with HOUSE etc., in accordance with the grammatical constraints in Persian. Figure 2 illustrates the dissociation of conceptual and grammatical classifications, and the definition of a semantic [± animate] taxonomy by $\phi_{SEM}{}^{P}$ (Pictures stand for conceptual representations, while capitalized words stand for semantic constants. In order to avoid terminological confusion, I refer to the grammatical [± animate] classification as '[± a]', and to the conceptual distinction as 'inanimate' vs. 'animate').

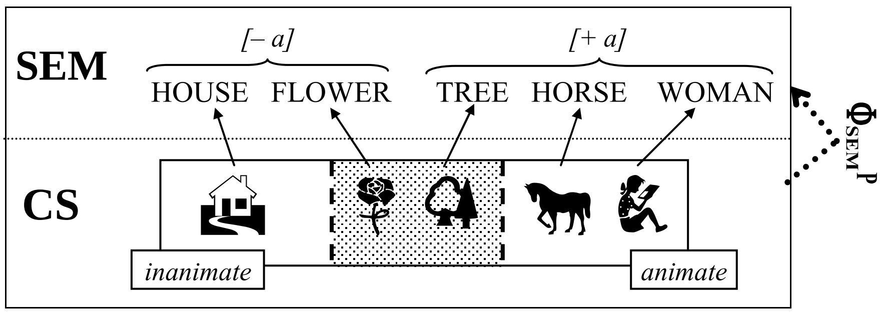

Figure 2. Access to conceptual features for a semantic taxonomy

The relations that constitute $\mathbf{R}_{SEM}$ identify the argument structure of lexical items. Conceptual interpretations restrict the upper number of arguments; the actual number is specified in accordance with the item's syntactic combinatorial potential, and is indicated by λ-bound positions in the semantic representation (and reflected by its type). Correspondence rules between SEM and SYN constitute a homomorphism f_{SEM} of <E_{SEM}, R_{SEM}> into IL_{SYN}, the interface level of SYN, which preserves the hierarchical order defined by R_{SEM} (in accordance with Definition 2).

Let me emphasize at this point that a view function as defined in Definition 3 operates on a language-independent conceptual system CS and generates language-specific representations that constitute an interface level IL_{CS}^{L} *for a particular language L*. As the Persian and English examples illustrated, this implies that there can be different view functions ϕ_{SEM}^{L1}, ϕ_{SEM}^{L2} etc. for different languages L1, L2, which operate on the same conceptual system CS. It also means that semantic systems are not only specific for language *per se*, but that they can also account for idiosyncratic phenomena in a particular language, or display properties that are characteristic for a particular language family.

However, Definition 3 does not exclude the possibility that there are also universal features of view functions ϕ_{SEM}. The definition allows universal semantic structures as well as idiosyncratic ones (as is also the case for syntactic and phonological structures). Take contiguity constraints operating on color terms as an example. These constraints are presumably universal; they have the effect that only contiguous sectors of the color spectrum are lexicalized. As a result, there is for instance no color term that covers both red and green and does not include yellow.[16] Under the account put forward here, such a phenomenon can now be identified as a universal constraint on view functions to the effect that for any language L, the view function ϕ_{SEM}^{L} discounts those conceptual configurations that represent discontiguous sectors of the color spectrum.

5. Semantics on a par with phonology

In the present section, I sketch an account of phonology that provides us with a unified perspective on semantics and phonology as parallel systems within the architecture of the language faculty. In particular, our definition of phonology can be subsumed under the same notion of interface levels and view functions as our definition of SEM: Based on Definition 1, we can define *Phonology* as the linguistic interface level of PHON. I call this interface level ‘PHOL’. PHOL is generated by a view function ϕ_{PHOL} from phonetic to phonological representations, as formalized in Definition 4.

Definition 4: PHOL as the linguistic interface level of PHON
For a given language L, $\phi_{PHOL}{}^{L}$ is an identified view function that generates the interface level $IL_{PHON}{}^{L}$ of the phonetic system PHON, and IL_{PHON} = PHOL, such that

- ϕ_{PHOL}: PHON $\rightarrow$ PHOL, and
- PHOL is a relational structure, PHOL = $\langle \mathbf{E}_{PHOL}, \mathbf{R}_{PHOL} \rangle$, where
- $\mathbf{E}_{PHOL}$ is a set of phonological representations computed from PHON’,
- and for each $\varepsilon \in \mathbf{E}_{PHOL}$, there is a $\sigma \in$ PHON’ such that $\phi_{PHOL}(\sigma) = \varepsilon$,
- and for each $x \in \sigma$: there is a context CT, such that $\rho_{PHON}(\varepsilon$, CT$) = x$
- [Hence $\varepsilon \in$ PHOL, $x \in$ PHON. ρ_{PHON} is a context-sensitive function from phonological to phonetic representations.];
- $\mathbf{R}_{PHOL}$ is a set of relations in $\mathbf{E}_{PHOL}$.

PHOL is derived from PHON in a way parallel to the way SEM is derived from CS: phonological representations are generated by a view function ϕ_{PHOL} that operates on a subset PHON’ of PHON whose elements are sets of PHON entities. ϕ_{PHOL} yields the elements of PHON and the relations holding between them. On the phoneme level, ϕ_{PHOL} operates on sets of allophones. The choice of a specific allophone in a given context is governed by rules that derive phonetic representations from phonological representations. I refer to the set of these rules as ‘ρ_{PHON}’ in Definition 4.

ρ_{PHON} is a counterpart of the interpretation function *Int* from Defintion 3. In order to indicate this parallelism, we can refer to *Int* as ‘ρ_{CS}’, the set of (context-sensitive) rules that derive conceptual from semantic representations. The view functions ϕ_{PHOL} and ϕ_{SEM} generate underspecified phonological and semantic representations as part of lexical entries; ρ_{PHON} and ρ_{CS} specify this information by mapping it onto phonetic or conceptual representations, respectively.

Like semantic information, phonological information is underspecified in terms of phonetic representations. And like semantic information, phonological information is part of lexical entries, and is language-specific. The view function ϕ_{PHOL} prepares phonetic representations for the grammatical system, just like ϕ_{SEM} prepares conceptual representations for the grammatical system.

Due to this intermediary function, ϕ_{SEM} and ϕ_{PHOL} observe both language-specific constraints, and universal constraints that can be grounded in the systems feeding CS and PHON. Language-specific constraints are evidenced in the generation of semantic or phonological representations of particular lexical entries, say, MARE in SEM^{E} and /meər/ in $PHOL^{E}$ for English, or in language-specific classifications like [± animate] or [± aspirated], which can have a different impact and different boundaries within SEM^{L1} or SEM^{L2} and $PHOL^{L1}$ or $PHOL^{L2}$ for different languages L1 and L2. Examples for extra-linguistically based universal constraints are the above-mentioned contiguity constraints on color terms in SEM (which are grounded in our conceptualization of the color continuum as represented by the visual system), and constraints in PHOL that reflect anatomical limitations and rule out phonemes that are based on, say, pharyngeal nasals.

Both PHON and CS interface with non-linguistic systems: CS interacts with mental modules that represent spatial and visual information, emotion, and others.[17] The phonetic system has interfaces to auditory and motor systems: on the one hand phonetic representations provide an analysis for acoustic events (in the case of sign languages: visual events), on the other hand they serve as a basis for the motoric plan in speech production.

Another feature that sets phonetics on a par with the conceptual system and phonology on a par with semantics is the gradience vs. non-gradience of rules. Phonetic rules are gradient, while phonological rules are not. This is paralleled in CS: conceptual features are typically based on prototypes or 'best examples', whereas semantic classifications are presumably non-gradient and govern grammaticality judgements.

Hence the definition of SEM and PHOL as parallel linguistic interface levels for CS and PHON, respectively, is supported by a number of shared substantial properties. Table 1 summarizes some of the parallels between the systems:

Table 1. Parallels between PHOL/PHON and SEM/CS

	PHOL	PHON	SEM	CS
underspecified	✓	×	✓	×
in lexical information; language-specific	✓	×	✓	×
interfaces with non-linguistic systems	×	✓	×	✓
gradient rules	×	✓	×	✓

6. Gateways to language

As a result of our discussion, we can now account for the dissociations of linguistic and non-linguistic aspects of meaning that we discussed in section 3, as typical phenomena of linguistic interface levels. Given our characterization of interface levels and the view functions generating them, underspecification, language-specific configurations and classifications are exactly the kinds of phenomena one would expect in a system that constitutes an interface between non-linguistic and linguistic structures. Accordingly, as our discussion has shown, they can be observed on the interface levels of PHON and CS alike. The following list illustrates the way our view functions account for these phenomena.

Underspecification on interface levels:
View functions provide sets of possible conceptual (or phonetic) interpretations for semantic (or phonological) representations, e.g.:
ϕ_{SEM}^{E} {NL, NR} $\rightarrow$ NU
(as input for English # as in *the # 1*)
ϕ_{PHOL}^{E} {[p], [p^h]} $\rightarrow$ /p/
(as input for English /p/ in aspirated and non-aspirated contexts)

Language-specific configurations on interface levels:
View functions yield language-specific conceptual (or phonetic) configurations as input for lexical items, e.g.:
$\phi_{SEM}{}^{E}$ (female-horse) → MARE
(as input for English *mare*)
$\phi_{PHOL}{}^{E}$ ([tʃ]) → /č/
(as input for the intial phoneme in English *cheese*)

Language-specific classifications on interface levels:
View functions define a set of relations between semantic (or phonological) representations and account for linguistic classifications, e.g,:
ϕ_{SEM}: language-specific boundaries for [± animate]
(based on animacy in the conceptual system)
ϕ_{PHOL}: language-specific boundaries for [± aspirated]
(based on aspiration in the phonetic system)

As the examples emphasize, the approach sketched here aims to account for semantics and phonology as parallel systems within the architecture of the language faculty, namely as interface systems that provide gateways to language for conceptual and phonetic representations, respectively. As I hope to have shown, within this approach semantic considerations are integrated into a broader model of linguistic subsystems and their association with non-linguistic mental systems. The notion of interface levels and the definition of SEM as the linguistic interface level of CS makes explicit the way conceptual structures enter language. By doing so it provides a basis to account for the relations between semantic and conceptual structures and the fine-tuning of meaning by conceptual interpretations.

Crucially, the model acknowledges linguistic aspects of meaning as grounded in conceptual representations, but characterizes them as forming a separate system in its own standing, with an organization that does not necessarily reflect conceptual structures. According to the model proposed here, SEM is a particular relational structure that – while being part of CS and created by a view function that operates on CS – is generated in accordance with linguistic constraints, that is, constraints that are independent from conceptual phenomena, and can be arbitrary from a conceptual point of view. As a result, SEM and CS proper constitute autonomous subsystems, with independent and possibly divergent organizations.

Note that this notion of semantics deviates from the one underlying a common definition of 'semantic violation' in psycholinguistic and neurolinguistic studies, as illustrated by (5) and (6):[18]

(5) Das Lineal wurde gefüttert. ('The ruler was fed.'; German)
(6) Jill entrusted the recipe to platforms.

In both examples the verb has a conceptual representation that requires an animate entity as a patient (in the case of 'feed') or recipient (in the case of 'entrust'). However, this is a conceptual requirement that does not have a grammatical reflex; from a grammatical point of view, both (5) and (6) are perfectly well-formed. Hence in our sense of 'semantic', this would not qualify as a semantic violation (a violation of a semantic animacy constraint would be visible for instance, in the use of *who* instead of *that* as in *'The recipe who lies over there', or in the use of *someone* in the place of *something*).

In fact one might argue that sentences like (5) and (6) do not constitute a conceptual violation either, since there is a valid conceptual representation for them – albeit one that goes against our experience, where rulers are not entities one feeds, and one does not entrust things to platforms. However, this emancipation from experience is exactly what makes language so powerful as a mental capacity: in contrast to a mere communication system, language is a secondary representational system (in the sense of Bickerton 1990), and as such, it allows us to generate conceptual representations that are in principle independent of our perception, and of our view of what the actual world is like. Within the present account, then, violations of the kind illustrated in (5) and (6) could be classified as violations of conceptual expectations,[19] that is, of expectations set up by our experience as represented in the conceptual system.

Notes

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1. For the purpose of exposition, I ignore correlations of the syntactic system with extra-linguistic systems here. A possible approach would be to regard the syntactic system of language as the linguistic interface SYN^L of a more general module SYN of generative computation, with other (non-linguistic) interfaces for instance with musical cognition (cf. Lerdahl and Jackendoff (1983) for a generative analysis of musical cognition).
2. Cf. Bierwisch and Schreuder (1992, 31f.).
3. For similar phenomena from the domain of verbs cf., for instance, Pinker's (1989) discussion of the semantic contraints governing conative alternations in English (Pinker shows that these constraints relate to features that are not salient in the conceptualization of the event a verb refers to), or Härtl's (2001) analysis of psych verbs like *frighten* vs. *fear* (Härtl argues that such psych verbs relate to similar conceptual structures, while differing with respect to their grammaticalized event structure).
4. Cf. Ortmann (1998) for a cross-linguistic discussion of the conceptual features that are relevant for these boundaries.
5. Cf. Comrie (1989: chap. 9), Dahl and Fraurud (1996).
6. This is in accordance with a 'plurality hierarchy' suggested by Smith-Stark (1974); cf. the diachronic discussion of nominal number in Persian in Wiese (1997a).
7. Cf. Carpenter (1991) for Thai.
8. Cf. for instance Matsumoto's (1985) study on the acquisition of Japanese classifiers.
9. DeLancey (1986) gives a diachronic analysis of *tua*.
10. Cf. Wiese (forthcoming) for a detailed account of the semantic vs. conceptual phenomena involved in the distribution of numeral classifiers.
11. In Wiese (1999), view functions were called 'filters'. This terminology might have been slightly misleading, given that these functions do not only account for language-specific choices of CS entities, but also for linguistically relevant relations between them. With the terminology used here, I relate to the notion of *view* that is familiar within object-oriented programming; cf. for instance Shilling and Sweeney (1989).
12. Links between two interface levels are bi-directional, of course. The definition of correspondence rules above focuses on the mapping from IL_m into IL_n, leav-

ing it open whether the same or a different homomorphism is to be employed for correspondences in the other direction (that is, from IL_n into IL_m).

13. View functions create the semantic system as a relational structure and account for its conceptual basis. By doing so, they set the parameters for correlations between conceptual and linguistic representations in language production, but they do not model the process itself. For an account of the incremental mapping of (partial) conceptualizations of events onto semantic representations (‘pre-verbal messages’) in language production cf. Guhe (this volume).
14. For detailed definitions of conceptual representations for number assignments cf. Wiese (1997b: chap. 4.3.5 and 9.2).
15. I do not treat the details of the conceptual specification by *Int* in the present paper. We might think of it as a process that is based on the abductive fixation of underspecified parameters, along the lines proposed by Dölling (this volume; 2001: chap. 1).
16. For a discussion of lexical and conceptual aspects of contiguity constraints cf. Bickerton (1990: chap. 2).
17. For a discussion of the interaction of CS with non-linguistic modules see Jackendoff (1992; 1997).
18. Examples for semantic violations, from studies presented in Friederici et al. (1993) and Ainsworth-Darnell et al. (1998), respectively.
19. This view is also in accordance with the fact that in recordings of ERP components on the scalp, the same N400 effect (a negativity with a maximum in the centro-parietal area of the brain, about 300-500 ms after a stimulus) has been observed in response to stimuli as illustrated above, and to stimuli that are unexpected (in the sense of having a low Cloze probability), for instance ‘ladder’ in a sentence like “The dog chased our cat up the ladder.” (cf. Kutas and Hillyard 1984).

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