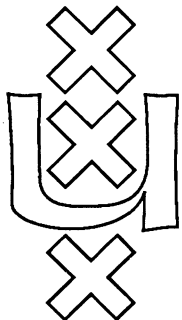


**Institute for Language, Logic and Information**

**CONCEPT FORMATION  
AND CONCEPT COMPOSITION**

Renate Bartsch

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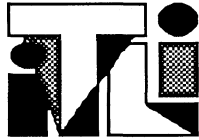
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## **CONCEPT FORMATION AND CONCEPT COMPOSITION**

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# CONCEPT FORMATION AND CONCEPT COMPOSITION

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## I. Concept formation: its basis and structure

Concepts are reconstructions of properties, including relational properties. Properties are realized by regularities in the world. If we take them to be identical with these regularities, non-realized 'properties' have to be merely mental constructs out of other concepts which are reconstructions of realized properties. These reconstructions are mental entities as far as the individual language user, or 'concept user', is concerned; they are social entities as far as the social coordination of the individual reconstructions is concerned. Social coordination takes place via the objective basis of concept formation, i.e. the existence of regularities in the world, which is tied to intersubjective judgements of semantically correct language use, especially the judgement of truth with respect to assertions and satisfaction generally with respect to speech acts.

I distinguish two levels of concept formation, the first, basic, level of quasi-concepts and the second level of the formation of (linguistically) explicated concepts. These two levels had been proposed earlier in Carnap 1928 (as 'Quasi-Begriffe' and 'Begriffe') and Wygotski 1934 (in the German translation: 'Komplex-Begriffe' and 'Begriffe'). The terms 'Quasi-Begriff' and 'Komplex-Begriff' refer to two different aspects of the constructs of the first level of concept formation, but they are contrasted in the same way to the second level of construction, the one of theoretically and formally explicated concepts. Both levels will be treated in what follows.

### 1. The first level of concept formation: quasi-concepts, or complex-concepts

The data for the formation of quasi-concepts are pairs consisting of an utterance and its satisfaction situation, i.e. the situation which makes it true that the utterance is satisfied. If the utterance is an assertion then the satisfaction situation is the situation that makes it true, if the utterance is a directive, e.g. a command, the satisfaction situation is the one in which the directive is satisfied.

#### 1.1. Ordering structures on sets of basic data

The basic data are the ones in which the utterance occasion includes the satisfaction situation, or is immediately (temporally and locally) connected with it. If a sufficient set of quasi-concepts are formed on this basis, utterance situation and satisfaction situation can be distant, and on the basis of triples consisting of the utterance itself, the utterance situation, and the satisfaction situation, relational concepts can be formed that pertain to the relationships between these situations, such as indexically bound concepts of temporal and spatial relationships. Tense and other deictic temporal expressions, as well as locally deictic expressions, are semantically based in this way. Furthermore, concepts can be formed of relationships between situations that form constellations which satisfy sentences in which causal, motivational, non-deictic temporal and spatial, and other relationships between situations are expressed.

The realistic content of a sentence consists of a situational property (or relation) and a deictic situational binding by Tense and other deictic temporal and local devices. The reconstruction of the situational property is the situational concept expressed in the sentence. The situational concept is what is satisfied by a satisfaction situation or constellation of that sentence. If we have a sequence of several utterances of a certain sentence  $\langle u_{11}, u_{12}, u_{13}, \dots \rangle$  and a corresponding sequence of satisfaction situations  $\langle s_{11}, s_{12}, s_{13}, \dots \rangle$ , the utterances show a certain regularity, namely the sentence uttered, i.e. the utterance type, and the satisfaction situations show a certain regularity, namely the realisation of the satisfaction conditions, i.e. the situational property or

situation type that corresponds to the sentence type by way of the relationship of satisfaction.

The reconstruction of the utterance type, i.e. of the sentence, and of the situation type, i.e. of the situational property, from the sequence of utterances and the corresponding sequence of satisfaction situations, is the formation of a concept of what the sentence uttered is like and the formation of a concept of what the corresponding type of satisfaction situation is like. The last is the first topic of this paper: How is a situational concept formed? This question and others will be investigated in terms of the necessary data and the necessary operations and combinations of these; the psychological process is something else, but the proposed kinds of data and the operations, expressed in terms of relations, will play a role in any reconstruction of this process.

From the point of view of concept formation, the basic set of pairs  $\{ \langle u_{11}, s_{11} \rangle, \langle u_{12}, s_{12} \rangle, \langle u_{13}, s_{13} \rangle, \dots \}$  of utterances of a certain sentence with the corresponding satisfaction situations can be taken as part of the realisation of a relationship between a sentence and a situational property, but the '....'-part is not filled in completely, because the realisation of the situational property is merely a partial one. Thus, there is no complete set available as the basic datum of concept formation. Rather at each moment there is given a finite sequence, for example  $\langle \langle u_{11}, s_{11} \rangle, \langle u_{12}, s_{12} \rangle, \langle u_{13}, s_{13} \rangle \rangle$ , of some members of this set. The question is how this sequence can be continued by a language user such that the continuation consists merely of members of the complete set.

If we are somewhat more careful about assuming a property, i.e. a complete set, as the realistic basis of the sequence, but rather merely assume a unique continuation of the above sequence, whereby the uniqueness is secured by socially, normatively, induced restrictions of application of the utterance type with respect to satisfying situations, the question arises how this uniqueness can be achieved. That a uniqueness is intended is self-evident; it follows from what it means to speak a common language, such that the same expressions mean the same for all language users and in this way serve well for information transfer in communication. But uniqueness need not be absolute in the sense of "one sign, one meaning". Rather it can be relative to certain circumstantial factors: The uniqueness is then "one pair (sign, contextual factor), one meaning". In order to achieve at least this context dependent uniqueness, it has to be possible to extract the contextual factor per utterance. This factor establishes the perspective under which the continuation of a certain sequence  $S$  of pairs  $\langle u_i, s_i \rangle$  of utterances and satisfaction situations is restricted, and the factor is sufficient if the perspective is clear and suffices for uniqueness of the continuation. Thus under perspective  $P^1$  the sequence is continued in another way than under perspective  $P^2$ , and with that  $\langle P^1, S(\langle u_i, s_i \rangle) \rangle$  is a representation of another property, expressed by  $u_i$ , than the one represented by  $\langle P^2, S(\langle u_i, s_i \rangle) \rangle$ , likewise expressed by  $u_i$ .

From a psychological point of view, we have to say now that two concepts are reconstructed with respect to one expression if the individual has constructed a way of continuing  $S(\langle u_i, s_i \rangle)$  under perspective  $P^1$ , and another way of continuing the same sequence under perspective  $P^2$ . This, so far, is an extreme case, because  $S(\langle u_i, s_i \rangle)$  is assumed to be the same sequence under both perspectives. This extreme case was the one discussed by Wittgenstein in his argument that in order to continue a sequence uniquely one would already need to know the rule that restricts the continuation. Next to presupposing what a good rule is in general, i.e. one the content of which is a regularity without breaks, a perspective serves to choose which specific rule is the one intended, in case there is more than one good rule or regularity for continuation. The normal, non-extreme, case is that for different perspectives, there are different sequences  $S(\langle u_{ri}, s_i \rangle)$  and  $S(\langle u_{rk}, s_k \rangle)$ , where  $u_{ri}$  and  $u_{rk}$  are of the same utterance type  $u_r$ , but at least some  $s_i$  and  $s_k$  are of a different situation type and thus give rise to different continuations for the two sequences, i.e. the regularities in  $s_i$  and  $s_k$  are different.

In principle, the presupposition of perspectives in concept formation can be dispensed with. Rather they can be constructed themselves if, for an expression, the set of utterance-satisfaction-situations is large. Then we can form 'similarity circles' (a term from Carnap 1928) on the basis of this set of data. With respect to the set of data, these are maximal subsets for which it holds that each member (here: satisfaction situation) of such a subset is similar to all the other members of the same subset (transitivity and exhaustiveness), and no member outside such a subset is similar to all its members (maximality). Each such maximal similarity set corresponds to a different property which is realized by its elements. From these sets also perspectives can be inferred as being those points of view that bring these properties under attention as the relevant aspects of the situations. To reconstruct the perspectives we need to consider similarity circles for different expressions. A perspective then is a higher order concept, namely a maximal similarity set of maximal similarity sets (i.e. a similarity circle of similarity circles) for different expressions. This reconstructability of perspectives leaves it open whether some perspectives might be innate, but in principle they can be understood as similarity circles of similarity circles, i.e. as second order concepts. The construction of similarity circles does not presuppose the availability of perspectives, though it will facilitate their constructions in practice. Transitivity and exhaustiveness of similarity within a similarity circle together with its maximality with respect to a set of data is a sufficient condition for the construction of a structure of similarity circles over a set of data.

For a perspective  $P^n$  and an utterance type  $u_r$ , the subsets of the set of pairs of utterances with corresponding satisfaction situation  $\{ \langle u_{ri}, s_i \rangle, \dots \}$  can be ordered: to a subset every additional satisfaction pair for  $u_r$  can be added whereby we achieve a bigger set such that the overall similarity, i.e. similarity with transitivity, between the members becomes weaker or stays at least equal. I.e. accidental similarities that have nothing to do with  $u_r$  are filtered out. In terms of features of the situations this would mean that we form sets of common features of situations which include other sets with less common features until we come to the limit of the minimum set of common features that is necessary and sufficient for a situation to be a satisfaction situation of  $u_r$ . This would be the limit of the filter consisting of sets of features, closed under intersection. But at this level of reconstruction we don't yet have features, because these are also concepts that have to be constructed themselves, and therefore we just assume an order of the subsets of situations by grades of similarity. For each member of a speech community, the ordered set of sets of satisfaction situations for  $u_r$  forms a sequence of growing sets, a filter under union, which converges to a limit which is the maximal set of satisfaction situations of  $u_r$ . Following the well-known method of completion of mathematical structures, we take the filter itself to be the concept. Its maximal element would be the complete realisation of the situational property or situation type, which we can take to be the minimal set of features or conditions sufficient and necessary for the application of  $u_r$ . The second elements  $s_i$  of the pairs  $\langle u_{ri}, s_i \rangle$  form the extension of the situational concept as far as it is determined after a finite sequence of these pairs. These quasi-concepts are approximations to the situational property realized by the maximal sequence, i.e. the maximal element of a filter of sequences of utterance-satisfaction pairs. The goal in concept formation is an optimal approximation to the situational property: If adding new pairs does not decrease similarity within the sequence of such pairs the concept achieved by this filter is a good approximation. This is all that is required.

The situational concept is the result of the operation of equivalence, i.e. identity, under the perspective  $P^i$ . With different members of a speech community, different filters of sets of pairs  $\langle u_{ri}, s_i \rangle$  correspond. The point is that they have to be equivalent in the sense that they approximate the same limit. Hereby the sets of satisfaction situations for utterances of  $u_r$  for different speakers are partially the same and partially different. But all these filters have to be directed towards the same limit, i.e. to the same concept,



which is achieved by the social pressure towards conformity of language use. This pressure controls the possible addition of new pairs to the sequences. The 'social concept' can be thought of as the union of all individual filters of the members of the speech community with respect to the use of an expression  $u_i$ , which is itself a converging filter, because every member-set of any individual-speaker's filter has to be a subset of some member-set of each of the others speakers' filters, and with that also of the union filter, i.e. of the 'social' filter. This requirement of conformity over the speech community means that social pressure with respect to conformity in correctness judgements, and especially truth judgement with respect to satisfaction situations, secures that the concepts of the individual language users are equivalent filters as far as their limit is concerned, and by this they are also equivalent with the intersubjective, i.e. socially co-ordinated concept. This concept is the social approximation of a property. From an epistemological point of view, it can be argued that this property is not more than the assumed limit of the coordinated filter which is reached when the similarity degrees of the approximations do not change any more by adding further satisfaction situations. The situational property, and certainly the socially coordinated situational concept can be identified as the filter itself with minimal and even zero change in similarity degrees by adding further situations.

The picture sketched in the last paragraph seems to be an idealization, because it requires that any utterance-satisfaction situation encountered by one language user has to be, sooner or later, also one which is encountered by the other language users. This could only be secured if everybody would make a recording of every such utterance-satisfaction situation and all others would go through this huge library of recordings from time to time and incorporate these into their own account of use of the expression in question. Further, if this in fact would be done, all the cases of deviant language use would mess up the filter such that a much too large and internally diverse maximal set of utterance-satisfaction situations of an expression would arise. This means that a concept would be constructed which is not much of a restriction on the use of the expression. Therefore, the requirement is a normative one and not a factual procedure for constructing concepts from all utterance-satisfaction situations of an expression. In the normative sense, it means that the expression has to be used such that the filter properties mentioned above obtain. Thus each utterance-satisfaction situation of an expression has to be such that the other members of the speech community can incorporate it into one of the member-sets of their concept defining filter without destroying the order of these member-sets according to diminishing or equal strength of similarity. Strength of similarity must diminish only gradually; the changes in strength of similarity may become smaller with growing sequences of utterance-satisfaction pairs. If this restriction is not followed, we have breaks in the sequences which destroy overall regularity and thus make the sequence bad. This would result in generating empty concepts for expressions, or internally incoherent ones, what amounts to the same, except if different contextual factors can be identified by means of which the disparate parts can be delineated as context-dependent meanings of the expression, i.e. as separate concepts. If an expression is not used in the continuous or 'smooth' way, language users will be puzzled by such an instance of language use, or will object to it, or will correct it, depending on their status as a more or less competent speaker.

### 1.1.1. Formal summary of Concept formation:

expression:  $e$ ; utterance:  $u_e$ , satisfaction situations:  $s_e$ ;  
 set of satisfaction situations with respect to  $e$ :  $S_e$ ;  
 similarity set: a set such that each member is similar to all others;  
 perspective  $P$ : similarity set of similarity sets for different expressions;  
 a subset  $S_{e,i}$  of  $S_e$  is harmonized with respect to  $P$  iff  $S_{e,i} \in P$ ;  
 a  $P$ -harmonized subset of  $S_e$ :  $P-S_{e,i}$ ; it is also called a ' $P$ -similarity set of  $e$ ';  
 In what follows we only consider  $P$ -similarity sets of  $e$ .

Sequence of growing P-similarity sets  $S_{e,i}$ : P- $\Sigma_e$ ; if  $S_e \supset S_{e,i}$ ,  $S_{e,i+1}$  and  $S_{e,i}$ ,  $S_{e,i+1} \in \Sigma_e$ , then  $S_{e,i+1} \supset S_i$ ; this is a P-harmonized sequence; in what follows we only consider such sequences and therefore skip the P.

similarity degree of P- $S_{e,i}$ :  $D(S_{e,i}) > 0$

If  $S_i < S_{i+1}$  in a P-harmonized sequence of e, then the internal similarity of  $S_{i+1}$  is smaller or equal to that of  $S_i$ :

If  $S_i < S_{i+1}$ , then  $D(S_{i+1}) \leq D(S_i)$ .

A P-harmonized sequence of e grows monotonously by adding only satisfaction situations of e that conform to harmonization, i.e. if  $S_{i+1} = S_i \cup \{s_e\}$ , then also  $S_{i+1}$  is P-harmonized.

The n-th subsequence of  $\Sigma_e$  is the subsequence up to n:  $\Sigma_{e,n}$ .

We define a 'conceptual' equivalence on the set of subsequences: If  $D(S_{i+1}) = D(S_i)$ ,

then  $\Sigma_{e,i+1} \equiv \Sigma_{e,i}$ .

The n-th quasi-concept of e with respect to a P-harmonized sequence of sets of satisfaction situations of e is the equivalence class  $|\Sigma_{e,n}|$ . Note that  $|\Sigma_{e,i+1}| = |\Sigma_{e,i}|$  iff  $D(S_{i+1}) = D(S_i)$ .

The sequence of quasi-concepts converges to a limit iff: for each triple of indices  $i, i+1, k, k+1$ , with  $i < i+1 < k < k+1$ , and  $|\Sigma_{e,i}| < |\Sigma_{e,i+1}| < |\Sigma_{e,k}| < |\Sigma_{e,k+1}|$ , the differences between the internal similarity degrees of the maximal elements of the series grow smaller:  $\text{DIFF}(D(S_{j+1}), D(S_j)) > \text{DIFF}(D(S_{k+1}), D(S_k))$ . This means the difference between the quasi-concepts decreases. This means:

For growing n, the sequence of quasi-concepts of e approximates the concept expressed by e. Or, in other words, a concept is a converging sequence of quasi-concepts:  $c(e) := \lim (|\Sigma_{e,n}|)$  for growing n.

P-harmony of a sequence merely secures a set of necessary features, like the requirement of transitivity does for similarity in similarity sets. With this restriction on similarity we get 'cluster concepts' (or centralized complexes of concepts), like Wittgensteins example of the German *Spiel*, if we take as an perspective 'human activity'. P-harmony, or transitivity still permits breaks in the regularity of application of the expression, which are distortions of the monotonous decline of the differences between similarity degrees with growing numbers of application of the term. Only the monotonous decline secures the formation of a 'classical' concept with a conjunction of necessary and sufficient conditions of application of the expression.

If the requirement of continuous decrease in similarity difference is not fulfilled by a sequence, the sequence has to be broken up into subsequences by selection of sequences of similarity sets which do fulfill the requirement. These selected subsequences then form approximations to concepts, which together make up the centralized complex of concepts, such as the one of *Spiel*. These selected subsequences are harmonized with respect to more specific perspectives than the whole complex is.

Chain complexes and non-centralized heap complexes of concepts do not have an overall perspective of similarity; the perspectives change. The set of data, i.e. the set of satisfaction situations has to be divided such that sequences which monotonously decrease in internal similarity degree can be formed: each new coming satisfaction situation for e has to be measured with respect to similarity to the similarity subsets available and has to be added to that to which it is most similar, i.e. it has to be added

under the point of view of minimizing the decrease of the internal similarity degree of the set it is added to. If it fits to several subsets in this manner it is added to all of them. In this manner, complexes of concepts can be built up from the data, which are the incoming satisfaction/application situations. In fact, we have one overall set of satisfaction situations with the different similarity sets as a first order structure on this set, and the sequences or filters with these sets as elements as a second order structure. A satisfaction situation can be a member of several similarity sets, and a similarity set can be a member of different sequences or filters.

Metaphoric and metonymic transfers are breaks in the monotonicity of decrease of the internal similarity degrees of the similarity sets of satisfaction situations in the sequences. Each such break gives the starting point of a new sequence of sets of satisfaction situations. This starting point consists of a set of satisfaction situations united with the new satisfaction situation for the metaphorically or metonymically 'transferred' use. The result are chain and heap complexes of concepts for an expression, if the sequences are continued.

In the preceding paragraph, although I often used the term 'concept', I was really talking about quasi-concepts. At each point in time, an individual merely has constructed a quasi-concept with respect to the data available. The concepts as the limits of converging sequences of quasi-concepts become cognitive objects only by entering into a structure, in which they are ordered with respect to each other by syntagmatic semantic relationships and by paradigmatic semantic relationships, especially by hyponymy and opposition, and thereby can be partly analysed in terms of each other, for example in a feature analysis, or, more general, by means of meaning postulates.

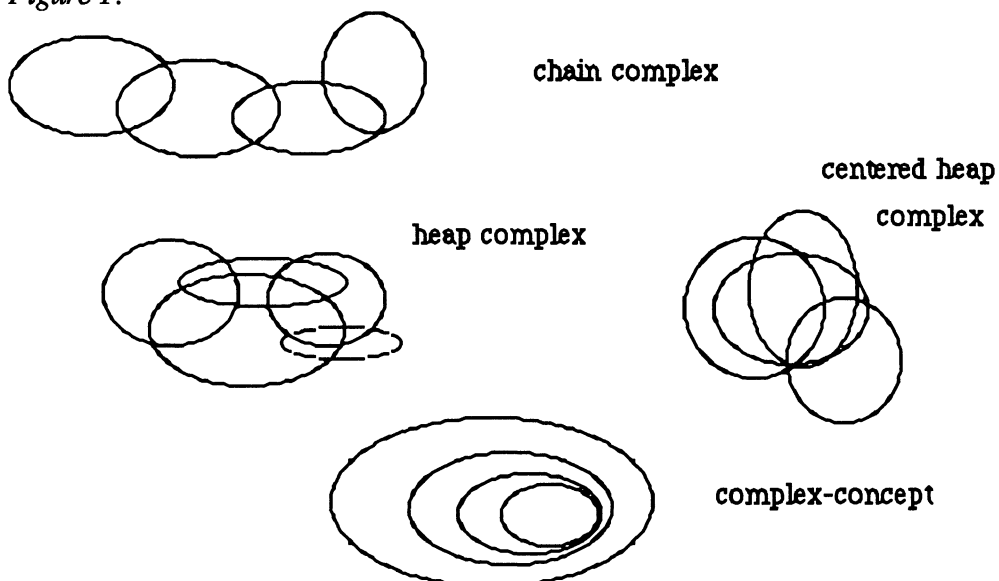
### 1.1.2. Prototypical organization of classes or categories

The considerations above pertain to the classic notion of 'concept', which is 'concept of a regularity that can be found in all cases of application (of the respective expression)', possibly relative to certain contextual factors. Cluster-concepts are understood as clusters of concepts differentiated out of sets of data according to contextual factors and perspectives. In the psychological literature also weaker requirements for applicability have been proposed, namely those of similarity to so-called prototypes (Rosch 1973, 1978). Here, a category or class is represented by the type of central members of the category with which all other members have more resemblance than with the prototypical members of the neighbouring categories under the same hyper-category (maximal similarity with members of own class and maximal dissimilarity with members of neighbouring classes. The type of the central members is called 'the prototype'. Not all the members are similar to the prototypical members in the same respects, and some are more similar to them than others, and are thus more central members of the category. For example, a blackbird is closer to the prototype of a bird than a chicken, or even a penguin. This means that the proto-type of, for example the noun *bird*, can best be thought of as a converging filter the elements of which each consists of kinds of birds. These sets are ordered according to internal coherence in the sense of strength of similarity. If we would speak in terms of features, this would imply that in the sets of kinds closer to the center, i.e. in the more coherent sets of kinds, more features of the members of the included kinds can be predicted on the basis of other kind-typical features they have, than it can be done for the kinds that are members of the less coherent sets, i.e. that are farther away from the center by having a lower degree of similarity between the kinds. The filter has as its limit a set of features typical for the more central kinds. Of course, also the kinds themselves, which are grouped together in a category, can be structured internally by degrees of similarity of their members with prototypical examples of the respective kind and dissimilarity with members of neighbouring kinds, i.e. of kinds belonging to the same closest hyper-category.

Structuring of classes (or categories) by prototypes implies that not all members of the class need to realize all the proto-typical properties, i.e. all the properties of the prototype. This means that the concept of such a class is a centralized complex of concepts, whereby the prototype or central concept overlaps in features with all the other concepts that characterize the subkinds that fall under the category. This complex of concepts is the conceptual equivalent of a heap-complex ('Haufen-Komplex') in the sense of Wygotski (1934), which is a set of situations of application of an expression which all overlap with one, the kernel, by way of similarity. In terms of features this means that there is a set of sets of features, i.e. a set of concepts, which contain each some of the features of the kernel. A special case is the one we find in the organization of a category by a prototype, where there is a set of prototypical situations of application of an expression and where the other situations of application are similar to all the prototypical situations. In terms of features this would mean that there is a common non-empty subset of features (i.e. features necessary for application of the expression) which is included, but is not identical with the prototype. If that subset is also a sufficient criterion for being a member of the category in question, a formal concept, holding together the complex of concepts that falls under that category, has been constructed. But that is only so when a feature analysis is available. Before that we merely have a converging filter of sets of situations of application ordered by the strength of their internal similarity, whereby the difference between strength of set-internal similarity goes to zero with growing sets.

Wygotski (1934) distinguishes chain-complexes from heap-complexes in that a chain complex is a sequence of situations of application of an expression such that each two in the sequence overlap by being similar to each other. In terms of features this would be described as a set of sets of features such that each member intersects with at least another member, but there is no common intersection for all the members. For both, chain- and heap-complexes, the similarity relationship is not transitive and thus does not amount to an identity with respect to a set of features. These two kinds of complexes are, according to Wygotski, the basis for concept formation of the first level in language and concept acquisition. By social pressure towards more restrictedness of the use of expressions, such that correct language use is achieved, complex-concepts are formed, which provide sufficient and necessary conditions for the correct use of expressions.

Figure 1:



The notions 'chain' and 'heap' complex can be used on two levels, on the basic level of situations, as chains and heaps of satisfaction situations formed by similarity, and

accordingly on the second order level as chains and heaps of sets of features (concepts used in conceptual analysis) formed by intersection. I shall now explicate the ways in which identity plays a role in concept formation.

## 1.2. The basic relationship: similarity, identity under perspectives

The basic operation of concept-formation is looking for similarity between situations, and if similarity is restricted to one perspective, the similarity is transitive and therefore an identity relationship relative to that perspective. But often, perspectives can be such that they permit sub-perspectives, and thus even within a single 'global' perspective a change of point of view for the similarity judgements can take place, such that not an identity, but merely a family-resemblance determines the application of an expression, even under one global perspective. An example is the family resemblance in Wittgenstein's example *Spiel*, under the global perspective 'human activity': subperspectives provided are 'recreational-professional activity', 'individual's-group's activity', 'instruments used in the activity', 'mental-physical activity'.

As long as perspectives are changed in applying an expression to situations, the similarity relationship between one situation of application and the next one can be perceived under these changing perspectives and thus we get all kinds of factual, even spatial and temporal relationships in which two situations may be identical in order for the same expression being applicable to both. This means, if in one situation a word used in an utterance was related to a perspicuous aspect (object or activity) of the situation, then in the next situation it can be applied to that which stood and also now stands in a perceivable relationship with that first object or activity. This is the so-called 'metonymic' transfer of use of expressions, which is due to contiguity relations of a factual kind, for example 'result-activity' in the transfer of *milk* in *the milk* and *milk a cow*, or 'instrument-activity' in *the jet* and *to jet to New York* (examples from Clark and Clark 1979), or 'institution-locality' in German *Schule*, which is used both, for the institution 'school' as well as for the building in which school takes place, and similar for German *Wache* for the institution 'guard', the group of people who guard an object, and for the house in which they perform their duty.

The above consideration shows that also metonymic transfer is based on identity between situations, namely by an identity of a pair that stands in a relationship, whereby the expression is transferred from one member of the pair to the other, and this not just between the members of the pair itself but also between their types or kinds. Many chain complexes, as they are described by Wygotski and others, are based on this operation which seems to be more complex than a transfer of an expression by simple identity of features. But if we just take into account the situations of application of an expression and not yet their internal build-up, the operation is a simple operation of similarity between the situations on the basis of some identity between each two situations in a sequence of application of the expression. Thus, identity is the basic requirement for transferring use of expressions: identity of expression corresponds with a similarity between the satisfaction situations, which amounts minimally to a partial identity between two successive situations of application.

Changing perspectives of identity results in chain and heap complexes of situations of applications. In order to secure the formation of quasi-concepts or complex-concepts the restriction has to be added that the similarity be transitive, i.e. it has to be an identity relationship. This happens by keeping constant the perspective under which identity is to be stated. The requirement of transitivity of similarity rules out that chain complexes can be complex-concepts; they can merely be complexes of concepts, i.e. polysemic complexes. Also heap complexes in general are not complex-concepts. Some heap complexes have an overall identity between situations of application, in terms of features: a set of necessary features, but only those that also have a set of sufficient features that are identical over all situations of application can be complex-concepts.

Under these definitions, Wittgenstein's example of a family resemblance which binds together the use of the expression *Spiel* does not refer to a complex-concept but merely to a chain-heap complex of concepts, whereby the part that is restricted by the perspective 'human activity' is a heap-complex, and only parts of it, restricted by further perspectives, are (complex-)concepts.

Some important very general perspectives under which similarity of situations is judged:

1. identity versus non-identity, applied temporally as constancy versus change, with the resulting notion of regularity as constancy in change
2. object, thing versus state, activity, process, event
3. quality versus quantity
4. form versus material
5. temporal, local, causal, means-ends and other relationships
6. behaviour of living things
7. use and function of things.

Sub-perspectives are constructed by specification of qualities and forms according to modes of perception implied by the properties of the different senses. The first perspective certainly must be innate as the basic principle of all orientation, including concept formation. But innateness of this perspective does not mean that the concept of identity and non-identity has to be innate on the cognitive level; it rather has to function first on a pre-cognitive level, and it becomes a concept on the cognitive level by relating it to the outer-world relational property of something being identical with itself and being different from others. Innate patterns and procedures will become concepts only by relating them to corresponding properties in the world, or in models generally, by the experience of satisfaction. Establishing that experience as a semantic relationship requires to be able to refer to something in the world. This, again, presupposes to be able to make a difference between the inner and the outer world, or between self and other. Only then the cognitive level can be built up, in which complex-concepts occur as explicated concepts, i.e. as theoretical and formal concepts.

Similarity under a perspective, and likewise transitivity as only requirement on similarity in concept formation would lead to similarity sets which are too big. For example, the perspective 'activity' permits to group together all situations in which different activities, like 'running', 'walking', 'eating', 'singing', etc. together in one big similarity set, reflecting the common necessary features of all activities. In order to distinguish the different activities we need to take into account oppositions between them, i.e. dissimilarities. Of course in this way one can reconstruct immense sets of properties, which would mean that one acquires a much too fine system of concepts, as far as the daily requirements of orientation go. The lexical expressions incorporated within a language serve to make the socially required selection of properties and thus restrict concept formation to that, though this never means a closed restriction, because other properties can come under attention, and language can be used to either express them by compositional description, if that is possible, or language can be extended by metonymical and metaphorical transfer of expressions, or even by the introduction of new terms. The use of different expressions serves to establish the socially coded oppositions according to Von Humboldt's principle 'one sign - one meaning': with contrasting expressions there have to correspond contrasting similarity sets of satisfaction situations. - Synonymy does not disturb this principle, but this does not matter on this level because by the use of different expressions different similarity sets of utterance-satisfaction pairs are established, and it is a second step to find out that the similarity sets of satisfaction situations for the two different expressions converge to the same limit, and thus become aware of the synonymy. The internal similarity of the opposing sets is greater than the similarity induced by the perspective 'activity', in our example. In order to make a selection from the huge set of properties, and constructible similarity sets and concepts accordingly, before this selection is socially coded into language, requires that innate and acquired ways of experiencing and 'forms of life' serve as perspectives of identity and opposition.

Up to now I have discussed the formation of situational concepts on the basis of satisfaction situations for sentences. These can be quite complex sentences, but also one-word-sentences, or sentences containing just one content carrying word and a deictic expression, like *Run! I am running. Here is a bike.* etc. The next step is to re-construct how from sentences and their satisfaction situations the conceptual contribution of the parts of the sentences can be determined. This reconstruction is based on Carnap's (1928) method of constructing quasi-concepts by forming "Ähnlichkeitskreise" ('similarity circles') consisting of elementary experiences of sentence utterances and corresponding perceptions of satisfaction situations. It has been worked out, in combination with the method of semantic analysis of Ziff (1960), to greater detail in Bartsch (1969) as the method of 'contrast systems'. Since we don't know much about the qualitative aspects of experiences, the results of these methods are merely the structural properties of utterances and satisfaction situations, which are reflected in concept formation. In what follows, I present a summary of chapter II of Bartsch (1969).

### 1.3. Contrast systems of utterance-satisfaction situations

Carnap's (1928) basis of concept formation consists of elementary experiences ("Elementar-Erlebnisse"). He compares these units with the "Gestalten" of the Gestalt-Psychology (p. 91, 92): they are perceived as units, but have an internal structure that can be detected by analysis. This analysis, according to Carnap, is the method of forming sets of elementary experiences by making use of the similarity relationship. The resulting sets are the similarity circles which are defined by the requirement that each element of the circle is similar to all its other elements, and no element outside the circle is similar to all elements of the circle. These circles are then sets for which a common "Quasi-Bestandteil" (quasi-part or quasi-concept) is characteristic. These sets are not equivalence classes, because a member of one can also be a member of another circle. This means, the similarity circles may overlap each other. The advantage of this method is, that one can control for each elementary unit which one considers for membership in a similarity circle, whether it is similar to all the others that are already in the circle, but one does not need to presuppose a certain common feature or concept, as one would need for class formation. Rather the common feature is the result of the operation.

We could think of applying this Carnapian method to a certain kind of 'Elementar-Erlebnisse', namely those caused by pairs of utterances and satisfaction situations. But we have no way of referring to the 'Erlebnisse' ("experiences") directly. Therefore we apply the method to the pairs of (utterance, satisfaction) themselves. Sets of utterances and corresponding sets of satisfaction situations can be formed such that each member of a set is similar to all the other members, but no element outside is. This Carnapian method is combined with Ziff's (1960) 'Semantic Analysis' by means of forming, for each morpheme  $m_i$ , the pair consisting of the distributive set and the contrastive set of  $m_i$ , whereby the first is the set of utterances in which  $m_i$  occurs and the second is the set of utterances which are different from the first by just containing another, contrastive, morpheme  $m_x$  instead of  $m_i$ . Hereby, certain conditions must be observed in order for the contrast to be semantically relevant (Ziff 1960: 162), which I shall skip here. For concept formation, only parts of the distributive and the contrastive set of an expression are available, and these parts can be more or less instructive.

By way of example, I shall construct a contrast system which is optimally instructive as far as the parts are concerned that carry content which is part of the situational concepts expressed by the whole utterances, which are taken as primitive. Such a contrast system does not include negation. The simple example is:

$u_1$ : The child takes an apple.	result of analysis: ABC
$u_2$ : The child takes a ball.	result of analysis: ABD

u<sub>3</sub>: The child throws a ball.

result of analysis: AED

The similarity circles of utterances are: {u<sub>1</sub>, u<sub>2</sub>, u<sub>3</sub>}, which defines the part A:= *the child*; {u<sub>1</sub>, u<sub>3</sub>}, which defines part B:= *takes*; {u<sub>2</sub>, u<sub>3</sub>}, which defines part D:= *a ball*; {u<sub>1</sub>}, which defines part C:= *an apple*; and {u<sub>3</sub>}, which defines part E:= *throws* within this contrast system. With this, we get the results of analysis quoted in the schema above. With u<sub>i</sub> correspond satisfaction situations s<sub>i</sub>, which likewise form a contrast system with corresponding similarity circles: {s<sub>1</sub>, s<sub>2</sub>, s<sub>3</sub>}, which defines the regularity or quasi-concept expressed in this system by *the child*; {s<sub>1</sub>, s<sub>3</sub>}, which defines the quasi-concept expressed here by *takes*; {s<sub>2</sub>, s<sub>3</sub>}, which defines the quasi-concept expressed here by *a ball*; {s<sub>1</sub>}, which defines the quasi-concept expressed by *an apple*; and {s<sub>3</sub>}, which defines the quasi-concept expressed by *throws* within this contrast system. Note that a similarity circle by itself does not define an utterance part or a quasi-concept, it does so only by taking into account the contrast with the other similarity circles of the system. Let U be the set of the utterance similarity circles and S the set of the satisfaction situation similarity circles of this system. Then the construction of the quasi-parts means, for example, that not {u<sub>1</sub>} and {s<sub>1</sub>} by themselves, but that the pairs <{u<sub>1</sub>}, U\{u<sub>1</sub>}> and <{s<sub>1</sub>}, S\{s<sub>1</sub>}> define the utterance part *an apple* and its corresponding quasi-concept, respectively. The first part is the positive characterization and the second part the negative or contrast characterization of the utterance part *an apple* and its corresponding quasi-concept, respectively.

The example above was an example of an optimally instructive contrast system (for a general characterization of these cf. Bartsch 1969). There are other contrast systems which are less instructive, such that only bigger parts of the utterances and corresponding satisfaction situations can be singled out. To break these apart, further contrasts would be needed. Thus

u<sub>1</sub>: The child takes an apple.    *analysis*: the child takes, an apple  
 u<sub>2</sub>: The child takes a ball.      *analysis*: the child takes, a ball  
 u<sub>4</sub>: The man throws a ball.      *analysis*: the man throws, a ball

Likewise, we receive merely the quasi-regularities, or quasi-concepts, expressed by *the child takes, the man throws, an apple, and a ball*. In order to achieve a finer analysis we need one more suitable member in the contrast set, for example 'the man takes an apple'. The point is, that a similarity circle cannot define more than one part. If we would presuppose the parts of the above utterances and then look at the similarity circles, we would find that there are more parts than similarity circles: two parts would correspond to one single circle, which means that they cannot be distinguished by the method described. *The child* and *takes* would correspond to a single similarity circle, and *the man* and *throws* would correspond to a common one. Therefore the last system, without a suitable utterance added, does not suffice for a fine enough analysis. But by connecting several non-optimal contrast-systems, or their results, we get finer analyses which result in regularities in satisfaction situations that are quasi-concepts that correspond to words.

Since we have no means to represent the results, i.e. the quasi-concepts, themselves, we merely identify them by the data, i.e. the contrast systems, and the operation of forming similarity circles. If C is an optimally instructive contrast system and O is the operation of forming similarity circles, then O(C) is the set of pairs of utterance similarity circles with their corresponding situation similarity circles. This is the linguistic and conceptual analysis provided by the contrast system. A quasi-part, a quasi-lexem and a quasi-concept, is represented by the pair consisting of its utterance similarity circle and its situation similarity circle, respectively, and the contrast set consisting of the similarity circles of the other parts. All this amounts to the following definition of quasi-concepts:



If  $A$  is a quasi-utterance part in a contrast system  $C$ , whereby  $\langle \{u_i, \dots\}_A, \{s_i, \dots\}_A \rangle \in O(C)$ ,  $A := \langle \{u_i, \dots\}, U \setminus \{u_i, \dots\} \rangle$ , then the corresponding quasi-concept is  $c(A) := \langle \{s_i, \dots\}, S \setminus \{s_i, \dots\} \rangle$ . Hereby  $U$  and  $S$  are, respectively, the set of utterance and of situation similarity circles of  $C$ . Instead of this quite elaborate expression we can simply say,  $A := \{u_i, \dots\}$  in  $C$ , and  $c(A) := \{s_i, \dots\}$  in  $C$ .

In order to abstract from non-relevant linguistic and situational information, we can take utterance types and situations types, i.e. situational concepts, as the basis of construction of quasi-parts. A situational quasi-concept, as it has been introduced in the first part of this section, is a borderline case of a contrast-system with just a single utterance type and a single corresponding situation type, or, on the level of utterances and situations, a contrast system consisting just of a single utterance similarity circle and a single corresponding situation similarity circle. These borderline cases are the elementary data of which the quasi-parts are constructed by contrast systems and similarity circles. Note that the considerations at the beginning of this section can be strung together with the last part of this section by realizing that the similarity circles can be looked at as converging filters consisting each of a set of subsets of utterances or situations of the similarity circle with the so constructed quasi-part as the limit of the filter.

In the above considerations, the construction of situational concepts and the construction of parts of these has been described, both on the semantic level of *situational* concepts. This all has been achieved by making use of the notion of similarity, i.e. partial identity, between situations, and some formal restrictions on it (transitivity, exhaustiveness and maximality with respect to an available set of data). To this, one important aspect has to be added: Under the perspective of constancy, the notion of identity of an object, defined by space-time contiguity, leads to the general concept of a thing which transcends situations, i.e. reappears in different situations. This perspective may be built up, following ideas of Quine (1960) by developing a very basic theory about reoccurrence of certain patterns of regularities in different situations. By making use of the notion of identity of an object introduced according to these suggestions, a distinction is made between situational (quasi-)concepts and thing-(quasi-)concepts.

With this we have concluded the section on the formation of quasi-concepts, at least as far as they can be analyzed as situational quasi-concepts or as parts of these, and as thing quasi-concepts, and on the basis of these we can construct the complex-concepts as converging sequences. More involved, but in principle alike, is the construction of quasi-concepts that are concepts of constellations of situations; these are temporal, local, causal, and other relations. In order to get concepts of these, we have to construct filters of sets of utterances and filters of sets of corresponding constellations of situations. If it is presupposed that the utterances and the situations within the constellation are already analyzed in the sense that their utterance types and situation types are known on the basis of the previous steps of concept formation, we can simply perform the contrast analysis on the basis of these types, which are on this level complex concepts. Both roads, performing analysis in contrast systems of utterance-satisfaction pairs and establishing converging filters of the wholes and the quasi-parts, or establishing converging filters of whole utterance-satisfaction pairs and performing analysis in contrast systems of these filters lead to the same result.

#### 1.4. Concept generation and metaphoric and metonymic transfer

Psychological literature about concept acquisition, for example Wygotski (1934), and also Clark (1973), shows that the ways young children use words with respect to situations, activities and things are not restricted by perspectives. They change from one perspective to another in their judgement of identity between situations on the basis of which they continue to use an expression. The result are, according to Wygotski,

chain complexes or heap complexes that by correction, negative information, and by further positive information about the use of the expression become so restricted that complex-concepts are built up as the semantic information carried by the expression. Hereby, chain and heap complexes that are not replaced by complex-concepts can be understood as complexes of complex-concepts, whereby each such complex-concept is defined by an identity under a fixed perspective. One famous example of a chain complex is, translated into English, is the use of the expression *doggy* by a young child, first in a situation with a dog present, then with respect eyes, then with respect to buttons, and on the other hand for a furl, and then for a brush. Transfer from dog to eyes is metonymic on the basis of the 'whole-part' relationship, from eyes to buttons the transfer is metaphoric on the basis of similarity of the objects, from dog to furl it is again metonymic and from furl to a brush it is metaphoric, if we look at the matter from the adult point of view. Since these notions are used in Rhetoric under the presupposition that a deviation from established concepts takes place, but we cannot speak of such concepts on this level of concept construction, we rather might use the terms 'transfer by contiguity' and 'transfer by similarity', used in Jakobson 1960.

The transfer between situations of application of an expression that form a chain or heap seems, from the point of view of a semantically competent speaker, to be metaphoric or metonymic. Only if an expression is understood as a carrier of a complex-concept, metaphoric and metonymic uses of words can be understood as such, namely as involving a deviation from a semantic norm. Before a normative fixation of the semantic aspect of language use is achieved, the so-called metaphoric and metonymic transfer of an expression from one situation type to another is simply choosing another perspective of identity for the comparison between the previous situations of application with the new situation of use of the expression, which are then identical in another aspect than the situations considered before. On the basis of identity of this different aspect within the situations the expression is transferred. If use according to this aspect is continued, a new concept expressed by the old expression is generated. From the point of view of transitivity of similarity, or, equivalently, a constant perspective of identity, such a transfer is a break in the regularity characteristic for the concept formed previously to go with the expression, but it is also a continuation of the old sequence of situations of use, or at least of a subsequence of it with well remembered situations of use of the expression. And this continuation takes place on the basis of identity under another point of view, i.e. under another perspective. Metaphoric and metonymic use of a term can thus be understood as going back to previous sequences of situations of application of the expression, which are now seen under another perspective and thus are continued under another aspect of identity. We can picture this whole situation in the following way: The concepts expressed by an expression form a branch consisting of sequences of situations of use, with a main branch or line of use, which is the normal use or central concept, and a couple of side branches which are continuations of the main branch by changing the perspectives of identity. These side branches can become normal use in certain contexts, and further new branches can evolve out of them (cf. Bartsch 1984a,b).

In metaphoric transfer of an expression which has been used for an object, state or process (including activities), the expression is newly used for an aspect of the object, state or process which is selected under a new perspective and now is the aspect which is identical in the transfer from the old use to the new use and thus determines the similarity. In metonymic transfer, under the new perspective a part or aspect of the old situations of application is chosen which stands in a certain relationship of contiguity, for example in the process-result relationship, with the object, state, or process denoted by the expression so far. The expression is now used in a new situation of application which is identical with the old situations of application as far as this selected part or aspect is concerned. In this way each metaphoric or metonymic use can be regarded as the starting point of a new twig at the branch of the conventionalized uses of an expression, and with that as the construction of a new concept, that can become part of the conventionally fixed concepts carried by an expression under different perspectives.

A polysemic complex is such a branch of conventionalized ways of use of an expression, i.e. a complex of concepts with such a branch structure. Possible new uses by way of metaphor or metonymy are the buds from which new twigs can grow by adding further utterance-satisfaction pairs under the newly established aspect of identity.

The level of quasi-concepts and their limits, borrowing Wygotski's term: complex-concepts, can be transformed, or better: mapped, for a larger or smaller part into the level of (theoretical and formal) concepts by certain operations performed on quasi-or complex-concepts. These are operations that are typical for the formation of syntagmatic and paradigmatic lexical and conceptual fields. Within syntagmatic semantic fields concepts of the first level, i.e. quasi-concepts and converging sequences of quasi-concepts, the complex-concepts, become concepts of the second level, i.e. linguistically explicated concepts by being integrated into sets of generally true sentences, i.e. into simple or more involved theories. Then we can speak of a 'theoretical' concepts. But I shall mostly just use the term 'concept', because the attribute 'theoretical' has the connotation of 'highly abstract and involved', what is not intended here, though it is included as a special case. Within paradigmatic fields, especially taxonomies, complex-concepts become formal concepts in the sense that now an, at least partial, analysis of the concepts in terms of features, i.e. in terms of other concepts, or in terms of meaning postulates, and in terms of oppositions is spelled out. Like with regard to the term 'theoretical', I mostly shall not use the attribute 'formal' because of connotations not intended here. The second level of concept formation is the representational medium assumed in cognitive psychology. It is essentially linguistically organized.

## **2. The second level of concept formation: explicated concepts, i.e. theoretical and formal concepts**

Concepts of the first level, quasi-concepts and their limits, complex-concepts, become (theoretical) concepts and (formal) concepts, short: (explicated) concepts, if they have received a place in a semantic field. Two kinds of semantic fields are distinguished, syntagmatic fields and paradigmatic fields. Firstly, I shall introduce the notion of a syntagmatic field. For an expression A it explicates generally true relationships of entities (objects, situations, institutions, activities, or actions) to which A applies, with other entities and situations. Indirectly, this can be formulated in terms of relationships between the concepts characterizing these entities with the concepts characterizing the others. A special case is a script or frame of A. It is based on a set of generally true sentences about internal relationships within the entities (objects or situations) to which A applies. Indirectly, the corresponding relations between concepts are explicated in scripts and frames. Scripts and frames are special syntagmatic fields, namely those which contain internal relationships of the objects or situations described by the respective lexical item.

Syntagmatic fields have true sentences as their basis, but differently from the first level of concept formation, these are generally true sentences, while the ones of the first level were accidentally true sentences, together with their satisfaction situations. In this sense the second level of concept formation is a 'theoretical' level of the construction of concepts, and it is this level which, according to Wygotski (1934), is typically the topic of teaching activities in school. He therefore claims that concepts, other than the complex-concepts, are formed as the result of schooling.

After having described syntagmatic fields as structures that determine concepts, I introduce paradigmatic fields. They can be understood as sets of analytic sentences, i.e. also generally true sentences, but those in which implications and oppositions between concepts are expressed. This provides a logical analysis of concepts in terms of other concepts.

## 2.1. Syntagmatic fields: (theoretical) concepts

Let *A* be a lexem which expresses a concept. This is the case for a basic noun or verb. Then a syntagmatic field is a set of sentences generally true with respect to entities (including institutions, activities, events, etc.) being *A*. This includes theoretical truths as well as prototypical and stereotypical truths. I include necessary truths as those general truths that are true relative to an unquestioned, i.e. presupposed, theory. If *X* is a variable over sentential surroundings of generally quantified *A*, i.e. over the sentential complements of 'A in general', we can define the complete syntagmatic field of A as that part of the universal general quantifier generated on the basis of *A* that is restricted by necessity relative to presupposed theories (short: RELNEC), and by stereotypicity (short: STEREO), i.e. as the set of properties *P* expressed by *X* such that  $(G(A))(X)$  is relative necessarily or stereotypically true, i.e. the set  $SYN(A) := \{P \mid \text{RELNEC or STEREO: } P \in G(A)\}$ . A sentence is stereotypically true if and only if it is considered to be true as long as no information to the contrary is given. If a property *P* can be analyzed into a relation *R* and a restricting complement *Q*, then the syntagmatic relationship between general *A* and restricting *Q* can be represented on a meta-level by ' $R(A, B)$ ', or ' $ARB$ ', whereby *A* and *B* represent the respective concepts on the meta-level, and *R* represents that syntagmatic relationship between them which holds if and only if on the object-level a sentence of the form "A in general stands in relationship *R* with some *B*" is true. Examples of syntagmatic fields we find in Artificial Intelligence literature and in literature about Lexical Semantics have to be understood in this way. Prominent syntagmatic relationships are 'part of', 'result of', 'cause of', 'goal of', 'origin of', 'participant of', including special participant relationships such as 'actor of', 'beneficiary of', 'object of', 'locality of', 'instrument for', and all kinds of functional relationships. In fact, all two- or more-place verbs and other relationships can be used as object-language basis for corresponding meta-language syntagmatic relationships between concepts.

The complete syntagmatic field of *A* comprises all the general knowledge about entities to which *A* is applicable. Since our knowledge is structured into special fields or theories, the complete syntagmatic field of a lexem *A* will never play a role as a whole; rather we will deal with partial syntagmatic fields. Such fields are generally delineated by topics, perspectives and methods by which sets of generally true sentences become fields of knowledge, or theories. In fact, syntagmatic fields of *A* are nothing more than sets of sentences true with respect to *A* in general which are delineated by a topic, perspective, and method for acquiring knowledge. An expression *A* can be elaborated in several syntagmatic fields, which means that the first level concept, the complex-concept, expressed by *A* is developed into several different (theoretical) concepts.

The set of syntagmatic relationships in which an expression *A* stands is the set of sentential object language contexts in which the expression stands. This is the set of contexts that together with the expression *A* form a semantically acceptable sentence, i.e. is a sentence that can be true, also called 'a structurally semantically correct sentence'. The set of contexts is called 'the semantic distribution' of an expression. One part of the semantic distribution was the above mentioned complete syntagmatic field. The other part is the accidental semantical distribution  $S_A$ , consisting of all contexts, which together with the expression yields sentences that can be accidentally true. These are sentences that are not necessarily true and that are not identity statements between proper names or sortal names.

$S_A := \{s \mid s \text{ is complementary to } A \text{ in } s \ \& \ s \text{ can be accidentally true}\}$

Two expressions *A* and *B* which can be substituted for each other in all sentences *salva* possible accidental truth ('*salva pat*') have the same accidental semantic distribution. If

B can be substituted for A in some sentences *salva pat*, they have a partially common accidental semantic distribution; if no such substitution is possible they have an incompatible accidental semantic distribution, and if all the *pat*-sentences of A become *pat*-sentences of B by substitution of B by A, the accidental semantic distribution of B is included in that of A. These relationships between the distributions are the basis for the following semantic relationship between A and B:

$S_A = S_B$  : A and B induce the same semantic presuppositions.

$S_A \cap S_B \neq \emptyset$  : A and B have a common part in their semantic presuppositions.

$S_A \supset S_B$  : the semantic presuppositions of A are included in those of B.

## 2.2. Paradigmatic fields: (formal) concepts

Two expressions A and B stand in a semantic paradigmatic relationship with each other relative to sentential context X if each forms together with X a structurally semantically correct, i.e. a semantically acceptable, sentence. This means A and B can be substituted for each other in such a sentence *salva structural semantical correctness*. With respect to a sentence s and an expression A in s we can form the class of expressions that are substitutable for A in s *salva structural semantical correctness* of s. This class is called 'the paradigm of A with respect to s'. It is an equivalence class with respect to the complement of A in s, and it can be represented by any of its members, relative to s. Instead of a single sentence, we can consider a set of sentences that contain A and with respect to which we form the paradigm of A. It is the intersection of the paradigms of A with respect to all the members of this set of sentences. The bigger the set of sentences, the smaller the paradigm will be. If two expressions have the same semantic distribution, in the sense defined above, they are semantically equivalent. The paradigm of A with respect to its semantic distribution consist of semantically equivalent expressions; these are called the 'synonyms' of A. Synonymy is one of the paradigmatic relationships we find in paradigmatic fields.

The method by which the paradigmatic relationships can be established is comparison and, according to this, ordering of semantic distributions of expressions. Within a paradigm, i.e. a set of lexems which are equivalent with respect to a certain object language sentential context, an order can be defined by means of the relationships: hypernymy, hyponymy, synonymy, contrarity and opposition. If the sentential context used to delineate a paradigmatic field of A is a set of sentences, then, the more sentences the smaller the paradigmatic field will be. In the extreme case it merely consists of a set of synonyms. If the sentences form a coherent set of sentences by being formulated under a certain perspective the paradigm will exhibit a structure of paradigmatic relationships.

The paradigmatic relationships will be defined on the basis of semantic distributions, especially on the basis of syntagmatic fields. A certain subset of the complete syntagmatic field of A is the set of necessarily true sentences ('RELNEC-true') about A's in general, restricted by an, in the broad sense, theoretical point of view, T. I call this 'the characteristic field of A with respect to T'. The set of complements of A with respect to the members of this field I call 'the characteristic semantic distribution of A with respect to T'. The characteristic semantic distribution together with the accidental semantic distribution form the semantic distribution of A with respect to T. Ordering relationships between the characteristic distributions are used for defining the well-known paradigmatic relationships. Let  $F_{A,T}$  be the characteristic distribution of A with respect to T. We can represent it by the general quantifier expressed by ' $\lambda X$  T-RELNEC-[General(A)](X)', semantically:  $\{P \mid T\text{-RELNEC: } P \supset A\}$ . This means that we do not refer to the complete characteristic syntagmatic field, but only a coherent part of it, determined by some theoretical point of view. This secures that we can find order relationships among the members of the paradigm.

Between the so restricted characteristic distributions of lexems A, B, C, ... we can find a partial order according to inclusion, and we can find substructures which are taxonomies, i.e. partially ordered sets with a maximal (or minimal) element, and the operation 'union' (or 'intersection'). Note, that a taxonomy always presupposes some perspective T of judgement under which the relevant syntagmatic fields of terms are selected, and with that their relevant parts of the characteristic distributions. In what follows, I simply write ' $F_X$ ' for the T-characteristic semantic distribution of an expression X, because T remains constant. Prominent theoretical perspectives are 'natural kind', 'biological kind', and with that the sub-perspectives 'chemical nature' and 'form', 'genetic structure', 'behaviour', 'origin', further the perspective 'artifact' with the sub-perspectives with 'chemical nature', 'form', 'function of artifacts', and another main perspective 'institution', with certain juridically, socially, or politically relevant sub-perspectives. A paradigmatic field is formulated under a constant perspective, with a fixed set of sub-perspectives.

$F_X \supset F_Y$  : Y is hypernym to X, or: X is hyponym to Y.

This means: all properties of Ys are also properties of Xs.

$F_X = F_Y$  : X and Y are synonymous.

$F_X \cap F_Y \neq \emptyset$  : X and Y have a common hypernym, and if  $F_X \cap F_Y$  has a name, this is the lowest common hypernym of X and Y.

$F_X \cap F_Y = \emptyset$  : X and Y do not have a common hypernym. I.e. there is no T-taxonomy in which both appear.

'X and Y are in opposition' means that X and Y are not synonyms and that the closest hypernym of X is also the closest hypernym of Y. 'X and Y are contrary' means that X and Y are not in the hyper- or hyponymy relationship and that they have a common hypernym. Opposition implies contrariness.

A paradigmatic field is part of a paradigm delineated by a context (or set of contexts which belong together under a certain theoretical perspective), whereby a partial order holds among the members, and there is a defining highest concept, which is the common hypernym H of the field. The elements of the paradigmatic field of H are all Y such that  $F_H \supset F_Y$ . The structure of the field is given by all ordering relations between the elements of the paradigmatic field. A paradigm is a paradigmatic field if its delineating set of contexts contains the characteristic semantic distribution of its common hypernym.

As it is introduced above, a paradigmatic field can be understood as a set of true meta-language sentences about paradigmatic relationships between a set of lexems with a common hypernym. Instead of lexems we can address the corresponding complex-concepts and then say: A complex-concept has a corresponding (formal) concept, which is the pair consisting of the complex-concept and the paradigmatic relationships it is in. A complex-concept can be incorporated into different paradigmatic structures or fields, because the fields can be formed on different paradigm's, according to different points of view for selecting a delineating set of contexts. This way the complex-concept can be elaborated formally in different ways and thus gives rise to different formal concepts. We see from the definitions above that formal concepts are results of ordering operations on sets of theoretical concepts, i.e. on sets of complex-concepts together with their characteristic semantic distributions.

### 2.3. Definitions of concepts: Implicit and explicit definitions

Syntagmatic and paradigmatic fields are the basis for definitions of concepts. A syntagmatic field provides an implicit definition of a concept. This is typical for any theoretical concept: a term that expresses it has, within the context of the theory, no other

meaning than what is spelled out by the sentences of the theory, i.e. its theorems, and minimally its axioms. The use of this term with respect to a model is restricted by nothing else than the requirement that the sentences of the theory have to be true in the model. And this restriction on the use of the term is the meaning of the term, i.e. is the (theoretical) concept it carries under the theoretical point of view selected. Everything that is not ruled out by the theory is possible, as far as the theory is concerned. In this way the theory puts some restriction on the set of accidentally true sentences, at least for those that accept the theory. But different complex-concepts may, under a certain point of view, exhibit the same structure, i.e. entities fulfilling these different complex-concepts form models for the same theory. This means, these complex-concepts have under that point of view the same semantic distribution. Such a theory, then, is not sufficient to distinguish the two complex-concepts, and there may be sentences possibly true with respect to one of these complex-concept, but not with respect to the other.

Whether restrictions on a term by syntagmatic fields can be sufficient to direct its use in all accidentally true sentences is an interesting question. The question can be put sharper: Does a maximal characteristic syntagmatic field determine the whole semantic distribution of a term? Or: Can we infer what are the possibly true sentences of a language from the sentences of a language which are generally true, and especially necessarily true relative to the whole of presupposed theories? This means: Are the implicit definitions provided by a maximal characteristic syntagmatic field sufficient to exclude the generation of structurally semantically incorrect sentences, and is it sufficient to enable us to generate all structurally semantically correct sentences? This is the question of whether the maximal characteristic syntagmatic field of an expression is sufficient to define semantic acceptability, i.e. delineate the set of all semantically acceptable sentences. This question can be called the question about semantic consistency and completeness of the characteristic syntagmatic semantic field of an expression. The fact that new theories are developed and therefore the syntagmatic fields of expressions are never complete suggests that the maximal syntagmatic field at a certain point in history *ex negativo* determines what is semantically acceptable at that point in history, namely every sentence the truth of which is not excluded by our general knowledge. But this is not quite so because such a relative maximality of a syntagmatic field in history may not be sufficient to make a difference between two different complex-concepts. Thus, there may be difference in experience which is not matched by difference in theory, i.e. some experience is not theoretically explicated.

On the other hand, the fact that a single complex-concept can be developed into different theoretical concepts by different theories suggest that sentences which are possibly true with respect to one theory may be semantically unacceptable in another theory, or even, if they are acceptable in different theories the sentences differ in meaning, if the theories do not include each other. Thus, there is no overall notion of semantic consistency for the whole syntagmatic field, but merely for coherent parts of it. In view of this diversity, the role of the level of complex-concepts, and the existence of commonly accepted background theories is essential for the development of socially coordinated concepts. This is, in fact, what general education is all about.

It has to be kept in mind that necessity always is relative to a presupposed theory. If a theory or part of it is questioned in a discussion, one has to retreat to necessity relative to a weaker presupposed theory which can be accepted by all participants of the discussion, in order to secure a common definition of the (theoretical) concepts used in the discussion. Thus, the concepts determined by a syntagmatic field are flexible, because they change with a change of background theory. People can differ in the theoretical concepts they attach to an expression on some level or specialisation of theory, but they still attach the same complex-concepts to them, induced by common background experience. Thus they can communicate and refer to the same entities and situations, as far as these are characterized by the complex-concepts. In addition to this commonality in background experience, there can be a weaker common background theory behind

the theories about which people disagree. By this common background theory, also concepts are available to restrict commonly acceptable use of the expressions involved and thus make a meaningful discussion possible. Thus, complex-concepts and common theory concepts are available as the basis for communication in a speech community. Both are flexible: complex-concepts can change with changing common background experiences, concepts can change with changing common background theories.

Fodor (1987: 125/126) gives the following argument against 'Meaning Holism and Verificationism': Theoretical connections and verification procedures 'connect terms with their denotations in too many ways. Think of the routes along which stars can get connected to tokenings of 'star': ... The point is that 'star' is not umpteen ways ambiguous; these different routes do not determine correspondingly different semantic values for 'star'. On the contrary, what determines the semantic value of 'star' is precisely what all these routes have in common; viz., the fact that they connect 'stars' with stars. ... That theories mediate the semantically relevant concept-to-world connections does not imply Meaning Holism. For we get meaning by quantifying over the routes from a symbol to its denotation. .... what determines their meanings is which things in the world the theory connects them to. The unit of meaning is not the theory; it's the world-symbol correlation however mediated.' Fodor claims that this is so in the same way for terms like 'proton', 'chair', 'water'. I would make a distinction between the first and the last two. For the first the problem exists whether two different theories which use the term 'proton' are about the same thing. They might be so incompatible that it makes no sense to speak about two different routes to the same thing. With respect to 'chair' or 'water' there is, in my approach to concept formation, the possibility of identifying the denotation by means of complex-concepts and by doing this, we can connect different routes or theories to the same thing, although it is looked at from different points of view.

The other important type of definition is the explicit definition. It is based on paradigmatic semantic fields. In the explicit definition of a term A, its closest hypernym ('genus proximum') and the differentia specifica are given. In giving the differentia specifica one refers to one or more terms that are in opposition with A. The differentia specifica between two terms A and B in opposition is the following: For A it is that part of its characteristic semantic distribution which is not part of the characteristic semantic distribution of B, and for B it is that part of its characteristic semantic distribution which is not part of that of A. These parts are thus the parts of the characteristic syntagmatic fields of A and B that lie outside the intersection of their fields. For n terms in opposition, the differentia specifica for each of the terms X is the part that does not lie in any of the pairwise intersections of the characteristic syntagmatic field of X with those of the other terms.

Differentia specifica of A in opposition to n terms  $X^i$ ,  $i:= 1, \dots, n$ , =def.  $\{P \mid P \in F_A \ \& \ \forall X^i: P \notin F_{X^i} \cap F_A\}$

A term that is explicitly defined has, in this way, got assigned a formal concept. The term is, by that definition, embedded in a paradigmatic field, minimally in a small taxonomy consisting of the genus proximum and an opposition under it. If the genus proximum is embedded into a larger taxonomy constructed under the same perspective as the one relevant for the small taxonomy, then the term is also embedded into that larger taxonomy. This means that branches can be added to a taxonomy if and only if they are formulated under the same perspective of looking for similarities and oppositions. Taxonomies that are formulated under different perspectives cannot be unified into a larger one, although the highest hypernym of the one taxonomy occurs also in the other.



## II. Concept formation: the construction of new concepts

In a realistic grammar, like Montague Grammar and its derivatives, complex predicates are constructed from basic ones in syntactic composition, and with this a modeltheoretic interpretation corresponds, such that properties and relationships are composed by Boolean combinations of sets and additional quantification over possible worlds and other indices in order to capture intensional phenomena. This is called a "realistic" interpretation because it is based on truth values, such that properties can be taken as functions from indices to sets of entities which satisfy the predicate; especially, a set of entities is their denotation in the real world. This method of compositional realistic interpretation has been extended for polysemic complexes in Bartsch 1987, where the construction of properties is described as an intersection of perspectives, which are sets of properties, with polysemic complexes, called 'pre-properties', which likewise are sets of properties, though with another structure on them than the class structure of perspectives, which are simply second order properties.

The question now is, whether and in what sense we can talk about composition of concepts. Is such a composition to be understood as a reconstruction of the realistic interpretation on the mental level? What would this amount to? What is the relation between properties and concepts and what are the consequences for composition? A property is what an entity has or realizes if it satisfies the predicate expression that expresses the property. The corresponding concept is what the language user expects the entity to have, will it satisfy the predicate expression. The language user needs the concept as a reconstruction of the property in order to know what to expect, and to expect what others will expect, of an entity if the expression is applied to it. Thus, a concept is information about the conditions of application of an expression and, in this way, the representations of this information, or the operations performed on them, have a semantic correlate: units of information and operations performed on them. The information is about the relation between expressions and possible situations of their application. What such a possible situation is can only be explained on the basis of the relationship of the expression to sets of satisfaction situations one has been acquainted with and formal restrictions on adding more satisfaction situations to it.

The question of what representations are, is an issue discussed in Cummings 1988. I shall not deal with the question of what conceptual representations might be materially. I merely concentrate on structural, formal properties of such representations. I use linguistic expressions as names of (quasi-)concepts, or of the limits they approximate, the concepts of the first level ('complex-concepts' in the sense of Wygotsky 1934):

For example, the name *lion* stands for the accidental semantic distribution of the natural language expression *lion*, a subset of which corresponds with a quasi-concept on the first level of concept formation of an individual. The expressions of this subset are expressed in the utterances that are satisfied by the situations that form the maximal similarity set of satisfaction situations, in which the sequence which is the quasi-concept ends at a certain point in time. Such a quasi-concept under a perspective **P** up to a point in time was defined in the previous chapter as a **P**-harmonic sequence of maximal similarity sets of satisfaction situations ending in the maximal similarity set of satisfaction situations of utterances with a positive use of *lion*, at that point in language use of an individual. The sentential complements of unnegated *a-*, *some-*, *the lion* within the utterance expressions (types of the utterances) are a subset of the (accidental) semantic distribution *lion*. Such a subset, if restricted to a perspective **P**, is a partial representation of the existential generalized quantifier over the property **LION**, restricted to the perspective **P**. When the individual gets to know a further (accidental) property of a lion that falls under perspective **P**, the partial representation grows by adding that property to the quantifier. On the first level of concept formation, this means to add a new satisfaction situation to the quasi-concept. The 'complex-concept' as the limit of a converging **P**-harmonic sequence of quasi-concepts will simply be

represented by  $LIM_P(lion)$ , which is the conceptual reconstruction of the property  $LION$  under  $P$ . The name  $LION_T$  stands for a theoretical concept of a lion as far as it is explored in a theory  $T$ ; it is thus the characteristic semantic distribution of the natural language expression *lion* with respect to  $T$ . The natural kind theory about lions, for example, defines a theoretical concept  $LION_{NK}$ , that is the sortal concept corresponding as a theoretical reconstruction to the property  $LION$  under the natural kind perspective  $NK$ . In this way it is a partial representation of the universal generalized quantifier over the property  $LION$ , restricted to  $NK$ .  $LION_{NK}$  is, at the same time, the theoretical concept corresponding, on the second level of concept formation, to the 'complex-concept'  $LIM_P(lion)$  of the first level of concept formation; it is a theoretical explication of this 'complex-concept'. So far this terminological clarification.

In the previous chapter, the lexical knowledge of a language user was divided into two levels of concept formation, the first was his 'experiential knowledge', i.e. what he 'knows' by experiencing the use of an expression with respect to satisfaction situations, and the other was his 'theoretical knowledge', i.e. what he knows in terms of generally true sentences containing that expression. Based on this, his 'formal' or 'analytical knowledge' was formed by paradigmatic ordering of theoretical knowledge. His analytical knowledge is what he knows in terms of logically definable relationships of an expression with other expressions. 'Having a concept', i.e. knowing what to expect with respect to the use of its expression, comprises these kinds of knowledge. In order to represent such knowledge we have to formulate sentences which are true with respect to the set of data that constitute this knowledge. We have done this for the 'experiential knowledge' in terms of converging sequences of sets of data, by which the knowledge of the first level of concept formation was represented. For the second level, the one of linguistically explicit representation, the representation was, firstly, in terms of syntagmatic semantic fields, i.e. 'general' or 'theoretical' knowledge. Furtheron, the 'formal' or 'analytical' knowledge of the second level was represented by the relationships within paradigmatic semantic fields, which were defined in terms of the characteristic semantic distributions of expressions.

The 'experiential knowledge' of the first level of concept formation has not the form of (linguistic) representations, though on a meta-level it is, of course, represented linguistically, when talked about in a theory of concept formation. The labels on the quasi-concepts, or on the converging sequences of these, used in this meta-theory are simply linguistic labels or descriptions of these; they are not to be understood as first order concepts or concept representations themselves. On the first level there are no operations on these labels, though there are set-theoretic operations on the denotations of these labels. Operations on labels belong to the second level of concept formation. On the first level we have merely sets and sequences of similarity sets of satisfaction situations, and correspondingly sets of utterances and sequences of these. The first level operations performed with regard to these are segmentations into similarity sets and conjoining of new elements under conservation of the similarity sets and their order of similarity degrees, or if that is not possible with respect to new data, delineation of new similarity sets by performing further segmentations.

The first and the second level of concept formation have to be related in a structuralistic way: On a set of satisfaction situations connected with one similarity set of utterances by the satisfaction relationship, a structure is established which consists of a set or collection of different similarity subsets, or more precisely: quasi-concepts. Corresponding collections of converging sequences of quasi-concepts, i.e. collections of first-level concepts, are what corresponds on the first level with polysemic complexes of concepts of an expression on the second level. Further, the opposition of similarity sets within a set of similarity sets, i.e. opposition under a perspective, corresponds with the opposition of (theoretically defined) concepts under a hypernym concept, the genus proximum. This means that there is a structure preserving mapping, an injective homomorphism, from the theoretical/analytical second level into the experiential first level, whereby concepts are mapped on quasi-concepts, or on

'complex-concepts' as limits of converging sequences of quasi-concepts. And the other way around, there is a structure preserving mapping, a surjective homomorphism, from a part of the experiential level onto the theoretical/analytical level. Not every structural detail of the experiential level needs to be accounted for in theory formation, i.e. in formulating true general sentences. But by extending theory formation, larger parts of the experiential level will be analyzed, and the hypotheses formulated in theories give rise for extending the experiential level in a guided way by creating situations for testing of hypotheses.

How can we make use of this view on lexical knowledge in order to understand concept composition? Concept composition then must be composition of knowledge. It can be described in a language of knowledge representation, the semantics of which gives the conditions of when these representations are correct on the basis of the data available. The constructions and definitions given in the previous chapter contain all the information necessary for formulating the correctness conditions for the basic notions of concept representation. To do this would more or less be a summary of that chapter. Combinations of these representations will be Boolean, or at least definable in terms of Boolean operations on the data. We distinguish the data that constitute the conceptual knowledge of one or more language users at a certain time from the data he gets from the situation of language use, together with more or less information about the satisfaction situation for that specific language use. Both kinds of data will play a role in understanding and interpretation, viewed from a cognitive point of view.

Operations on the second level of concept formation are formulated in terms of Boolean operations on the characteristic semantic distributions of expressions, and additionally on the stereotypical distribution of expressions. A derivative of this are formulations in terms of 'sematic features', which are the result of a conceptual analysis on the basis of paradigmatic relationships between concepts, which are defined in terms of characteristic semantic distributions. All this can be expressed or interpreted in sets of general sentences which are held true. The justification for assigning truth to general sentences, with respect to sets of accidentally true sentences and experiential knowledge is a matter of the theory of knowledge and Philosophy of Science in particular, and will not be dealt with in this essay.

Operations on the first level are formulated in terms of sequences of similarity sets of satisfaction situations which fulfill certain formal restrictions. This first level becomes important for the analysis of new creative metaphoric and metonymic language use, which is not yet based on theoretical or stereotypical knowledge. The traditional analyses of these phenomena, which are all on the second level, always turn out to be non-compositional, except if one already presupposes the results of metaphoric and metonymic operations as parts of an existing polysemic complex of properties and thus can use the method of Bartsch 1987, as has been done by Leezenberg (1989ms). This approach is similar to Stern's (1985), who uses an metaphoric demonstrative operator, which maps a property onto a set of properties, the possible metaphoric interpretations, from which the intended one is selected by means of a filter consisting of restricting contextual information. But this compositional approach will not do for new creative metaphors and metonymies, because it does not give an account of how they are formed on the basis of information on the conceptual level. On the other hand, the non-compositionality of traditional approaches, e.g. Cohen (1979), or Bartsch (1984) arises because of the inclusion of the non-boolean operation of canceling features of a concept in order to achieve sortal or 'selectional' correctness and then build a new concept by combining the transferred features with additional ones from the new situations of application, whereby the new concept is expressed by the 'old', by now metaphorically used, expression. In the next section I shall demonstrate how far we can get in an analysis of these phenomena on the second level of concept formation, using the tools developed in the previous chapter. Because of the shortcomings of this method with regard to creative and poetical metaphors, another, though structurally similar, analysis shall be formulated on the first level of concept formation.

## 1. Concept composition on the second level

On the second level of concept formation we have, for an expression  $A$  and a theory  $T$ , its characteristic semantic distribution  $F_{A,T}$ , and, in some cases, also a stereotypical distribution  $F_{A,St}$ . The members of  $F_{A,T}$  express properties from the set  $A_T := \{P \mid P \supset A, \text{ with respect to } T\}$ , i.e. from the universal generalized quantifier over  $A$  restricted to  $T$ . On the second level of concept formation,  $F_{A,T}$  is the set of complements of 'A in general' in true sentences, as far as  $T$  is concerned. Likewise,  $F_{A,St}$  is the set of complements of 'A in normal cases' or of 'A stereotypically' in sentences held true. With respect to  $A$ , there can be different theories  $T$ , and there are sometimes "prototypical stories" about a member of category  $A$ , which by generalization, be it justified or not, become stereotypes or stereotypical stories, i.e. sentences held true of members of  $A$  in normal cases.

### 1.1. Interpretation of Metaphors on the second level

A sentence like 'Robert is a wolf', or 'This is a wolf' with respect to Robert, can be interpreted on the background of the prominent theory  $T^0$  about animals, the biological theory. The predication is made under the perspective of identifying an entity as belonging to a biological kind. Then the composition that takes place in this sentence just says that about the individual referred to by 'Robert', or 'this', all properties expressed by the members of  $F_{A,T^0}$  hold. Thus we may expect in case of truth, that Robert will indeed be a wolf, biologically speaking. But the above sentence can also be interpreted on the background of another theory, say  $T^1$ , the ethological theory about the behaviour of wolves, which is less prominent, but nevertheless sometimes at issue. In that case  $F_{A,T^1}$  is a set of behavioural properties, or at least we can select this set from the theory  $T^1$  under the perspective of characterizing the behaviour of an entity. Wolves are known to care for their family but fight hard while hunting for food, and are fierce against enemies. Using the theoretical concept of a wolf according to  $T^1$ , restrictions on applying the term 'wolf' are merely provided as far as the behavioural properties go. Therefore, under the perspective of behaviour, the sentence 'Robert is a wolf' or 'this is a wolf' with respect to Robert just gives us the information that Robert satisfies the behavioural concept defined by  $T^1$ , i.e. satisfies the characteristic semantic distribution  $F_{A,T^1}$ . Thus we can expect that in case of truth of the sentence, Robert cares for his family and is fierce against others when competing with or fighting against them. This can be true about a man called 'Robert', but also about any other entity, including wolves, which show this kind of behaviour.

The third way of interpretation on the conceptual level is by means of the prototypical story about a wolf, and the stereotype about wolves in general based on it. Here the concept, i.e. the stereotypical semantic distribution  $F_{A,St}$ , represents, semantically speaking, all properties which are stereotypically attributed to a wolf on the basis of the prototypical wolf. This is the wolf who ate Little Red Riding Hood's grandmother and the goats, whereby the stereotypical generalization from this story is that the wolf is cruel, but not so very clever. The above sentence is true about Robert under the perspective of personal character precisely if he satisfies  $F_{A,St}$ , i.e. is cruel and not so clever.

Note that this approach to metaphorical use does not require a clash between features, for example between the fact that Robert is a man, and thus cannot be a wolf because of incompatible features. Even of a biological wolf we can say, like about Robert, under the perspective of his fierce behaviour: 'Look he is a real wolf', or 'Look, this wolf is a real wolf'. This then is not a tautology, but expresses that he is a very typical wolf as

far as the stereotype goes. The pronoun 'he', or the demonstrative description identifies the entity as one, which includes his sortal properties given in  $T^0$ , while the predication 'is a real wolf' is done under the perspective of theory  $T^1$  or under the stereotypical theory. In those special cases in which feature clash occurs by applying the most prominent theory  $T^0$ , it is simply a pragmatic matter that we then have to choose another perspective of predication than the one defined by the question 'to which biological kind does  $x$  belong?', namely the perspective defined by 'what is the behaviour of  $x$  like?', and with it the ethological theory  $T^1$ , or the stereotypical theory, will be used in interpreting the predication. This pragmatic aspect of re-interpretation in case of apparent contradiction or tautology, according to the maxims of truthfulness and informativeness, has nothing to do with the semantics of metaphor, and is not specific to the phenomenon of metaphorical language use, though it can be an initiating prompt for trying to find the right interpretation. According to the theory advocated here, feature clash and elimination of features is no part of the semantics of metaphor. Feature clash is merely the result of the inappropriate application of one prominent perspective of interpretation in circumstances in which another perspective is at issue. Flexibility of perspectives prevents feature clash to begin with, and thus elimination of conflicting features is not an issue. Therefore it is not at all excluded that metaphoric language use fits into a compositional semantics. Such a semantics is possible in the way sketched above, which is related to Black's (1962, 1979) interaction view on metaphors.

The difference of this approach with traditional ones is that concepts are used as theoretical concepts on the basis of available theories, including stereotypical ones, which are selected as interpretational background according to perspectives provided by the context. Thus we indirectly select, but do not cancel features. Of course, we have to know whether an utterance or utterance part is directed towards identification of biological kind, or behaviour, or personal character, or even morphological form. The last would provide a possible interpretation for a sentence like 'What a leeuw, look at his mane!' uttered about a man. We know the relevant perspective from the questions asked or assumed to be at issue in a conversation. Assumed questions provide the perspectives for interpretation of those sentences which are informative as answers to these questions. If we also take into account 'formal' or 'analytic' concepts carried by an expression, we can make use of implicational relationships and oppositions. Thus, the example 'Robert is a wolf' can be contrasted with 'Robert is a fox' on the background of biological kind theories, or on the background of stereotypical theories. The last gives the interesting opposition between the stereotypes of a wolf and a fox under the more specific perspective of intelligence: with respect to it, he is a wolf and not a fox, i.e. he is fierce but not so clever.

This approach is promising for metaphors that can be interpreted on the basis of 'theories', i.e. on the basis of general knowledge, including stereotypes, and conceptual analysis based on these. The interpretations above, suggested for 'wolf' and 'fox', are of this kind. But there are others which are not quite as simple, especially those in poetry, which require a closer look into a deeper level, namely the one of experience, the first level of concept formation, which is not (yet) explicated by being formulated in theories, i.e. in sets of generally true sentences or in sets of stereotypical sentences. Here 'experiential knowledge', often provided within the poetic text itself and then made use of in metaphoric language use based on these previous experiences, replaces general knowledge. The method used in interpretation is based on the disposition of building polysemic complexes or their equivalents on the first level of concept formation. Hereby, similarity and contiguity within and between situations are the relationships which constitute metaphoric and metonymic use of expressions.

## 1.2. Interpretation of polysemic expressions

I shall first repeat the basic idea of Bartsch 1987 about the construction of properties under perspectives and also give a reformulation in order to make use of this formal apparatus for cognitive processes of interpretation.

A perspective is a second order property, i.e. a property of properties in which it is spelled out what these have in common, namely an included first order property. To look at something under perspective **P**, for example looking for an activity-property, means to attend to the first order property 'activity' and see in what way it is specified in this case. This means to look for a property in opposition to other properties that fall under 'activity-property'. The general method of concept formation is: Look under a perspective, which provides an identity of classification, for differences and classify the differences, i.e. form subclasses with characteristic properties which make up the differences to the other sub-classes under the identity. This means, that at the same time one takes into account similarity and opposition.

A polysemic complex is of the same type as second order properties are; it is a set of first order properties. But they do not necessarily include a common property. Rather they are a collection, i.e. their second order property does not express more than that they belong to the same collection. This means that the members of a polysemic complex cannot in general be derived by specification from a common included property, though this is so in the most regular cases, namely in a centered complex. The principles of forming these collections are metonymy and metaphor, which, more generally, amount to contiguity and similarity (cf. Jakobson 1960). Hereby, similarity is not transitive over the whole polysemic complex, i.e. is not an identity of a common property. Since the set of properties that form a polysemic complex is not a class but a collection, we cannot define it by a common property, but rather by a recursive definition starting with one property as the first member of the polysemic complex of the expression A.

Recursive definition of a **POLCOMP(A)**:

1.  $P \in \text{POLCOMP}(A)$
2. If for all situations  $s$  in which  $P'$  is realized, the expression A is taken to be satisfied by  $s$ , and there is a  $P$  with  $P \in \text{POLCOMP}(A)$  such that **METO**( $P',P$ ) or **META**( $P',P$ ), then  $P' \in \text{POLCOMP}(A)$ .

This means that there are two conditions for  $P'$  being a member of a polysemic complex of the expression A: first, if  $P'$  is a property of something,  $e$ , then the application of the expression A with respect to it must result in a true sentence, i.e.  $|A(x)|$  is true for assignments  $g$  with  $g(x)=e$ . This condition would also be fulfilled by a homonym, for example by the two meanings of *bank* as  $P$  and  $P'$ . The second condition excludes homonyms. It states that there is a metonymic (contiguity) or metaphoric (similarity) relationship of  $P'$  to at least one other member of the polysemic complex.

The expression A used under perspective **P** then expresses the property P in the intersection of **P** and **POLCOMP(A)**:

$$P \cap \text{POLCOMP}(A) = \{P\}$$

If there are more than one property in the intersection, the interpretation of A under **P** is not unique. Then more specific subperspectives of **P** have to be used in order to achieve uniqueness. Such a specification can, for example, be provided by a description of the intended referent of predication, or by his sortal properties. Consider the example *this man is a wolf* and assume that **P** is the perspective 'behaviour-properties'.

Then the demonstrative description *this man* provides a further restriction, namely that the property to be selected belongs to the properties a man may have, i.e. belongs to **H**, the set of (accidental) human properties, or in other words, the set of properties compatible with being a man, which is the existential generalized quantifier expressed by *a man*:: $\{P \mid P \cap \text{MAN} \neq \emptyset\}$ . The intersection to which the interpretation of *is a wolf* has to belong is then  $\mathbf{H} \cap \mathbf{P} \cap \text{POLCOMP}(A) = \{P\}$ . We can also take  $\mathbf{H} \cap \mathbf{P}$  to be the subspective 'behaviour properties of men'. Of the property which is the interpretation of *is a wolf* in the above sentential context it is thus required that it is an (accidental) human behaviour property as well as a theoretical or stereotypical, i.e. general, wolf behaviour property, because the perspective **P** selects, by intersection, from the polysemic complex for *wolf* the theoretical or stereotypical behaviour concept *WOLF*, i.e. the concept that is defined by the ethological or stereotypical theory about wolves. It is a partial reconstruction of the universal general quantifier expressed by *a every wolf*, namely  $\{P \mid P \supset \text{WOLF}\}$ , restricted to the ethological or the fairy tale theory about the wolf, i.e.  $\{P \mid P \in \mathbf{F}_{\text{ETH}, \text{wolf}}\}$  or  $\{P \mid P \in \mathbf{F}_{\text{STEREO}, \text{wolf}}\}$ .

The polysemic complex of *wolf* on the linguistically explicated level, i.e. the second level of concept formation, consists of a set of theoretic or stereotype concepts, each of which is defined by a theory formulated under a perspective, for example the biological kind perspective, the ethological perspective, the fairy tale perspective, the morphological or external appearance perspective.

In the same way we can treat the, by now famous, example *stone lion*, following the analysis given by Franks (1989) as "made from stone and being a lion as far as appearance is concerned", as the intersection between the universal generalized quantifier over the property **MADE FROM STONE** and the existential generalized quantifier over the property corresponding to the theoretical concept  $\text{LION}_{\mathbf{AP}}$ , which is the intersection between the external appearance perspective **AP** with the  $\text{POLCOMP}(\textit{lion})$ . Hereby, I do not assume *STONE LION* itself to be a member of the polysemic complex for *lion*, rather the theoretical concept  $\text{LION}_{\mathbf{AP}}$  as it is defined by a theory providing a general description of the morphological form of a lion, independent of whether the material is flesh, bones, and blood, stone, wood, or what ever. The existential generalized quantifier over the property corresponding to this theoretical concept contains all these possible material properties. This amounts to the following composition on the level of second order properties:  $\{\text{LION}_{\mathbf{AP}}\} = \mathbf{AP} \cap \text{POLCOMP}(\textit{lion})$ , and further:  $\{\text{STONE LION}\} = \{P \mid \text{MADE FROM STONE} \supset P \ \& \ P \cap \text{LION}_{\mathbf{AP}} \neq \emptyset\}$ . This means that the singleton formed by the property *STONE LION* is the intersection of the universal generalized quantifier over **MADE FROM STONE** and the existential generalized quantifier over  $\text{LION}_{\mathbf{AP}}$ . The difference with Franks(1989) is the following: He takes the modifier *made from stone* as a defeater of central essence properties of the 'lexical concept' of *lion*, such that only appearance properties remain, which then form the 'sense' generated from the lexical concept used in this context. I rather do not speak of defeat or canceling of properties, but of perspective-dependent selection of a theoretical concept from the polysemic complex of *lion*. In doing this, I can give a compositional treatment in the strict sense, because I do not cancel anything but use purely Boolean composition.

In all cases in which a concept reconstructing the property specified in the intersection, is already conventionally included in the polysemic complex and, hereby, is reconstructed as a concept belonging to the complex of concepts associated with expression A, we can simply parallel the above construction on the level of concepts and sets of concepts. This means that, instead about properties, we talk about concepts and set-theoretic operations on sets of concepts.  $\text{POLCOMP}(A)$  is then understood as

a collected set of concepts and  $\mathbf{P}$ , the perspective, as a classified set, i.e. a class, of concepts.

## 2. Interpretation of transferred use of an expression: creative metaphors and metonymies on the first level

The case in which  $A$  is used under  $\mathbf{P}$ , but a reconstruction of the property expressed in this case is not yet included in  $\text{POLCOMP}(A)$ , requires the generation of a new concept in finding the corresponding property  $P'$  that is a member of  $\mathbf{P}$  and can also be incorporated as a member of  $\text{POLCOMP}(A)$ . The principle of reconstruction of the intended property is that concept formation must be based on information available at the time of interpretation. We can assume that  $A$  is uttered truthfully with respect to  $s$  under  $\mathbf{P}$ . Let us recapitulate what this amounts to in terms of available information.

**Data:**

1. Expression  $A$  is used with respect to situation  $s$  truthfully, i.e.  $s$  is intended as a satisfaction situation of  $A$ .
2.  $A$  is used under perspective  $\mathbf{P}$ .
3. The property that has to be assigned as being expressed by  $A$  under  $\mathbf{P}$  with respect to  $s$  has to be eligible as a potential member of the polysemic complex of  $A$ .

**Goal:** Find a  $P'$  with  $P' \in \mathbf{P}$  and  $P'$  being realized in  $s$  such that it fulfills both conditions for being a member of the polysemic complex of  $A$ .

The reconstruction of the  $P'$  that satisfies the above requirements is the concept that has to be constructed from the data available. The data of concept formation are 1. how  $A$  is used up to now, 2. that  $A$  is used now truthfully with respect to  $s$  under  $\mathbf{P}$ , and 3. the use of  $A$  now is such that it can be connected with previous use by the operations of metonymy or metaphor. With these data we can design the following procedure of concept formation, which is a reconstruction of  $P'$ , the goal of interpretation.

### *Procedure of concept construction:*

- I. Take the set of previous satisfaction situations for  $A$ .
- II. Delineate a (new) similarity set for  $A$  under  $\mathbf{P}$ , named:  $S_{A,\mathbf{P}}$ .
- III. Extend that set with the new satisfaction situation  $s$  of  $A$  such that this extension obeys  $\mathbf{P}$ -harmony and opposition to other  $\mathbf{P}$ -properties, and that we can construct a sequence of growing subsets up to  $S_{A,\mathbf{P}} \cup \{s\}$  with a converging decline of the internal similarity degree. If that is not possible for  $S_{A,\mathbf{P}}$ , then delineate a smaller similarity set for  $A$  under  $\mathbf{P}$  which satisfies these conditions and name it  $S_{A,\mathbf{P}}$ .

If  $S_{A,\mathbf{P}} \cup \{s\}$  is such a similarity set, we have constructed a quasi-concept for the new use of  $A$  under  $\mathbf{P}$  with respect to  $s$ , which is the sequence  $\Sigma_{A,\mathbf{P},s}$ , ending in  $S_{A,\mathbf{P}} \cup \{s\}$ . It is the result of interpretation. This is how far, at this moment, we can approximate the concept that reconstructs the property expressed by  $A$  under  $\mathbf{P}$  with respect to  $s$ . There are several points at which an ambiguity or indeterminacy can arise:

The quasi-concept may be indeterminate enough to permit more than one continuation of the sequence and thus may not be specified enough with respect to the property intended, if there is indeed exactly one intended. That often is not so: It is also possible that the indeterminateness is a feature of the text such that more than one interpretation is possible by choosing different continuations of the sequence, something that is typical of poetic texts.



If we are not informed enough about the satisfaction situation  $s$  towards which the use of  $A$  is directed, we might construct more than one sequence to begin with, because  $s$ , as far as we have information about it, may fit with different  $S_{A,P}$ , and thus give rise to different sequences, i.e. different quasi-concepts, and with this, of course, it gives rise to different concepts approximated by these.

The point of indeterminateness is that the more we know already about the satisfaction situation for the new use of  $A$  the more precise the interpretation can be. In literary texts, more or less information about  $s$  is provided in the text around the use of  $A$ , such that  $s$  than can be further elaborated by constructing the concept expressed by  $A$  in this case. The concept, and therewith the elaboration, is not necessarily unique. The creativity employed in the interpretation of metonymic or metaphoric language use is nothing more than the generation of the concepts possibly expressed by  $A$  in this case. At the same time, this means an elaboration of the satisfaction situations of  $A$  which are possible with respect to previous satisfaction situations of  $A$  and the context given.

### **Summary:**

**The data:** 1. how  $A$  is used up to now, i.e. the set of satisfaction situations of  $A$  up to now; 2. partial information about the new satisfaction situation  $s$ ; 3.  $A$  is used truthfully with respect to  $s$  under  $P$ .

**Procedure of construction:** see above I.- III.

**Result:** a quasi-concept  $\Sigma_{A,P,s}$ , approximating, by permitting one or more continuations converging each to a limit, one or more concepts which are reconstructions of properties realized in  $s$ .

It has been sketched how transferred language use, i.e. metaphors and metonymies, can take place on the second, as well as on the first level of concept formation. Children's transfer of expressions takes place on the first level, and, so does quite a lot of poetic language use. In a poem, relevant experience with respect to a word can be built up by previous context, and partial information about a satisfaction situation with respect to the same expression in transferred use can likewise be built up in the context. In this way a poem can be self-contained, to a certain extent. Also individual experience of previous use of an expression can be made use of, if it is intersubjective enough in order to be presupposed as a background for interpretation. Even that kind of poetic linguistic transfer which is based on stories and mythology known in a culture can be located on the first, the experiential level, because these stories, or parts of these, can be taken on a par with satisfaction situations for certain expressions and thus can become part of similarity set of satisfaction situations and sequences of these. On this level, interpretation can take place merely by recurrence to experiential knowledge, i.e. without recurrence to theoretical or stereotypical knowledge, that forms the theoretical background of second level interpretation. The claim is that in interpretation of an expression  $A$  with respect to a situation  $s$  under a perspective  $P$ , concepts are formed that can be taken to be expressed by  $A$  under these conditions.

The above considerations seem to require that the satisfaction situation  $s$  of a metaphoric sentence is, at least, partially available to the interpreter. This is the case if a sentence is used with the situation of satisfaction in sight, or if the context provides sufficient clues about it. Then the metaphoric expression serves as a tool for investigating this situation in such a way that one will find a property realized in it that makes the metaphoric sentence true and that can be expressed by the metaphoricly used expression. In such a case the metaphoric sentence cannot appear to be false, though it may appear to be true, but turn out to be false with more careful inspection. In order for a successful interpretation to be possible on the experiential level, the first level of concept formation, the situation has at least to be such that one can find something in it that supports truth of the metaphoric sentence. Only then we can make use of the situation in interpretation, in the way described above. Less information

composing expressions (according to their syntax and subcategorizations), which means that possible satisfaction situations for the whole expression can, in principle, be integrated in a harmonic and monotonic way with the quasi-concepts of the non-negated parts of an expression; **accepting information**, i.e. believing it, means in fact performing this integration; **interpreting** an expression with respect to an index means finding out satisfaction or truth of it at that index; and **knowing** something means accepting information on the basis of having found it true.

According to what is said above, to construct a composed concept by way of accepting the sentence *There is a brown horse* at least means to delineate a similarity subset within the one for *horse*, which is also a similarity subset within the one of *brown*, and add the new one to that. If one, up to that point, had no experience of a brown horse, the situation added to both sets would be the only member of the intersection. If even no satisfaction situation is given with the expression, but one is told that there are brown horses, the addition of this sentence to the accidental distributions of *horse* and *brown* just means that the sentence has to be related to the respective quasi-concepts. To relate an expression to a quasi-concept means that its satisfaction situation can be or is integrated in a harmonic and monotonic way either within the quasi-concept or in an extension of it towards its limiting concept; this disjunction means that the satisfaction situation of the expression is taken to be a member of the maximal similarity set of the limiting concept, i.e. of the 'approximated' concept. The lexical constraint for the composed concept corresponding to the whole true sentences *There is a brown horse* is that this concept is part of the intersection of the concepts for the two components. If the expression *brown horse* is used without any existential implication it can merely be understood lexically in the sense that the expression is, in principle, relatable to the two composing concepts, i.e. that any possible satisfaction situation for it could be integrated into them in a harmonic and monotonic way. I use the following terminology: A composite concept is formed if its expression is found to be relatable to the positively composing concepts, whereby the syntax of the expression defines the kind of composition. To mark a composed expression as being relatable to the existing conceptual structure means that it is possible that it has a satisfaction situation that is integratable into the existing conceptual structure in a harmonic and monotonic way. If a composite concept is in fact integrated in this way, it is taken to be instantiated in the world. Note that our whole conceptual structure, as it is treated here, is knowledge about the world. Therefore, pure concepts, i.e. concepts without existential assumption, are merely expressions that are relatable to the knowledge about the world in the way described. If a composed expression contains a negated expression, this means that possible satisfaction situations have to be such that they are not relatable in a harmonic and monotonous way to the (quasi)-concept of the expression under negation.

Consider now the expression *unicorn*. A unicorn is like a horse, except that it has got a horn on its nose. If something is a unicorn, it is not a horse, though it is similar to a horse. Therefore it cannot be constructed as 'horse with a horn', parallel with 'horse with a blond mane': the satisfaction situations for *unicorn*, if there were any, would not be a subset of those for *horse*. Rather they would form an opposition with those of *horse* under a common genus proximum, 'horse-like'. What does it mean that we have constructed a concept for the expression *unicorn* according to the above definition? We just have to follow the definition: we insert the expression *horse-like* into our paradigmatic semantic network of natural kind terms and place under it as hyponyms *horse* as well as *unicorn*. The hyponym *unicorn* has to be marked as merely possible. If it were inserted without this mark, it would be taken as instantiated in the world. Instead of integrating a marked expression *unicorn* into such a taxonomy, we can simply say: the expression is connected to such a taxonomy in the sense that it is possible that it be integrated. This is, what the construction of a non-realized concept amounts to. We can, of course, think of instantiating the constructed concept in another, mythological world, and then insert this expression into a taxonomy with respect to such a world. The taxonomic order just means that there are a set of general

about *s* is required if in the previous text a semantic distribution of the expression has been built up that is later used as the contextually established meaning of the expression when it serves as the concept expressed by the metaphorically used expression, like a 'theoretical' concept can in the examples treated in chapter 1.1. Interpretation on the second level of concept formation, as discussed in 1.1., does not require extensive information about *s*. If the interpreter has no information about *s* that can be used in finding out the property meant by the metaphoric expression, he still can understand the metaphor on the basis of the perspective of predication and general knowledge from the characteristic semantic distribution of the metaphoric expression. If that results in a unique interpretation, the interpreter, in this way, has constructed a possible satisfaction situation and the metaphoric sentence can be judged as true or false, depending on whether this possible situation is found to be realized or not.

### 3. Lexical understanding and concept formation

The composed common noun expression *brown horse* is **interpreted** at an index (world, time, etc.) as the intersection between the extensions of the parts, i.e. the intersection of the set of brown things with the set of horses. In terms of satisfaction situations it is the intersection of the set of satisfaction situations for *brown* with that for *horse*. On the level of concepts we can say that we **understand** the expression **lexically** when we know that its satisfaction situation would have to be such that it is possible to add it to the quasi-concept of *brown*, as well as to that of *horse*, salva monotonicity and continuity of the similarity. This is the lexical constraint for all possible satisfaction situations for composed expressions of this kind. Thus, the sentence *This is a brown horse* is understood if we realize that its satisfaction situation has to be such that it is possible to add it to the quasi-concept of *brown* as well as to the one of *horse* in a such a way that the monotonic decline of the similarity degree of the maximal similarity sets of the respective satisfaction situations towards a limit is not impaired. That this is indeed possible with the situation pointed out as the satisfaction situation of the sentence means that one recognizes that truth of the sentence is compatible with the conceptual background one has. If a language user realizes that other language users whom he accepts as his models for correct language use differ in the assessment of truth, then he has to adjust his construction of quasi-concepts, either for *brown* or for *horse*, such that the publicly accepted satisfaction situation fits into the construction. Note, that interpreting at an index means to perform a Boolean composition in the area of property realizations at the index and thus can be expressed in a realistic semantics, while lexical understanding means to figure out, according to the linguistic composition of the expression, to which quasi-concepts a possible satisfaction situation has to be suitable in a P-harmonic and monotonic way. The relationship between both is established by the fact that a property is reconstructed as the limit of a harmonic and monotonic sequence of quasi-concepts. Therefore, recognition of truth implies that for the situation pointed out as a satisfaction situation, harmonic and monotonic integration into the structure of quasi-concepts can be achieved. If we accept certain information as true without checking, we just integrate the satisfaction situation type belonging to the utterance according to its composition to the quasi-concepts of the non-negated parts of the utterance. Thus, if we accept the sentence *Some horse has a blond mane* as true, we add this sentence to our set of (accidentally) true sentences, and with this to the (accidental) semantic distributions of *horse*, *blond*, and *mane*. It then belongs to our linguistically explicit knowledge. This means that we 'construct' a situation type such that we can add any realization of it to the quasi-concepts of *horse*, *blond*, and *mane* on the first level of concept formation, salva harmony and monotonicity of similarity. This construction, as far as the lexicon is concerned, consists in nothing more than relating or connecting, in the way described, the expression *Some horse has a blond mane* to the quasi-concepts of the three concept expressing words involved. - The syntactic aspects of understanding will be treated in section 4. - Summarizing: **Lexical understanding** means relating the whole expression, in principle, though not yet factually, to the quasi-concepts of the

sentences that are commonly true of horses and of unicorns, and that there are others that are true of one kind in contrast to being false about the other, in a world in which both kinds exist. In other words: both expressions have a part of their characteristic semantic distribution in common and another part that makes up the opposition.

Now let us have a look at the composition *fake gun*, in the analysis given by Franks (1989) as 'something that is a gun merely in appearance', i.e. it is not a gun, though it is a gun as far as appearance goes. There is a theoretical concept of a gun as far as its shape is concerned:  $GUN_{AP}$ . Under the perspective AP, something that is a fake gun is a gun. This theoretical concept belongs to the polysemic complex of *gun*. It can serve as a genus proximum for the concepts of the kinds GUN and FAKE GUN, which form an opposition under it. The concept expressed by *fake gun* then is defined as the union of the characteristic semantic distribution of  $GUN_{AP}$  with the differentia specifica, i.e. the set of general sentences about fake guns which forms the opposition to those about guns.

We see that concept composition provided by explicit definitions is integration, or possible integration, of an expression into a paradigmatic semantic network. As far as instantiation of the concept is assumed, these structures can be mapped into the experiential data of the first level of concept formation. Anyway, they serve as constraints on the use of expressions with respect to experiences. This follows from the structure preserving mapping from the second level into the first level, whereby expressions of the second level are related to quasi-concepts of the first. In our example it means that the quasi-concept of *fake gun* has to belong to the polysemic complex of *gun*, and that it has to form an opposition to the quasi-concept of *gun* under the broader quasi-concept 'gun-like in appearance' which is the first order result of looking for general properties of guns under the perspective AP. The other way around, *fake gun* can be learned by ostension instead of by explicit definition. That proceeds according to the procedure sketched above for forming polysemic complexes of quasi-concepts, if the learning situations are ones in which simply the word *gun* is used also for toy guns, besides the expression *fake gun*. On the basis of experiences and observations expressed in general sentences, the theoretical and analytical concept is developed in the way indicated in the previous chapter.

#### 4. Syntactic (truth functional) understanding and concept formation

Lexical understanding has to be combined with syntactic-morphological understanding: The two sentences *The snake eats the bird* and *The bird eats the snake* are the same as far as lexical understanding goes, but they differ in **syntactic-morphological understanding**. Interpretation, i.e. the satisfaction situation, of both sentences is lexically constrained by having to be related harmoniously and monotonously to the (quasi-)concepts of *snake*, *bird*, and *eat*. Further, there is the syntactic constraint according to the first sentence, whereby the entity which is the snake is the acting participant ('actor') and the one which is the bird is the directly affected participant ('goal'). According to the second sentence the actor- and goal-relationships hold the other way around. In order to express this difference conceptually we cannot simply relate the respective (quasi-)concepts by the relationships ACTOR and GOAL, because these relationships are not about the concepts but about some possible entities involved. Syntactic understanding, other than lexical understanding, cannot be described simply in terms of relationships of the expression to concepts or in terms of relationships between, or operations on, lexically expressed concepts. The syntactic-morphological aspect of understanding requires to make use of the notion of reference to individuals and actions or situations in the world or in models such that relationships between these entities can be expressed. The notions of 'reference to entities' and 'satisfaction of concepts by entities' play a role in interpretation with respect to a (partial, possible) world and, herewith, also in understanding a sentence, i.e. in understanding what the truth conditions of the sentences are, or in other words, what a satisfaction situation

must look like for the sentence to be true. Understanding what the truth conditions of a sentence are in these semantic terms amounts to the construction of a situational concept. It is here, that some kind of modeltheoretic conception is involved which assumes the construction of certain kinds of entities such that concepts are not just realized in situations, or are satisfied by situations, but are realized also by entities in situations. Only this makes possible to really understand a concept like *HORSE* and the composed *BROWN HORSE*:

In the previous section, lexical understanding of the expression *brown horse* has been treated. This was incomplete because it has to be aided by understanding the syntactic composition in terms of reference and satisfaction: the expression *brown horse* is applicable with respect to all situations in which we can assign a referent which satisfies the concept *BROWN* and the concept *HORSE*. This adds something to the lexical restriction which merely requires that we can relate the expression to the concept of *horse* as well as to the concept of *brown*. The lexical restriction has to be further specified, because for expressions like *horse on a brown blanket* and *brown horse on a blanket* lexical understanding, as far as it has been treated up to now, would be the same; both composed expressions are relatable to the (quasi-)concepts of *brown*, *horse*, *blanket*, and *on*. Only the syntactic construction makes for the difference. The difference is expressible by taking into account the possible referents in the satisfaction situation, whereby with respect to the first expression there has to be a referent which is brown and which is a horse, while with respect to the second there has to be one which is brown and which is a blanket.

The semantic reconstruction in this essay has as its basic data situations and not entities. The reason was, that, under an ontogenetic perspective, whole situations are what we experience first, and that an analysis of these takes place as the result of applying certain formal operations. Thus, the concept of *horse*, to begin with, is determined by sets of horse-situations, rather than by sets of horses. What then would be the conceptual reconstruction of sets of horses? Do we have to fill up our internal semantic space with masses of partial objects of all kinds and thus construct an internal universe? That is unnecessary. Rather assume a second kind of ordering on sets of situations which amounts to another point of view of identity than the one for forming similarity sets, namely the identity of an object or individual as a sequence of situations in time and space, united by the constancy of realization of a sortal concept in a contiguous way through space and time, while permitting continuous change in the realization of quality, quantity, and local and other relational concepts. To speak of a horse, and understand what a horse is, then means to connect the expression *horse* to constraints with respect to sequences of similarity sets, i.e. (quasi-)concepts, as well as with respect to sequences of situations which approximate possible continuants, i.e. objects. The idea is that an object can be approximated by forming sequences of growing temporally ordered sequences of situations that are successfully taken to be experiences about the same individual. Such more or less complete sequences form part of the history of an individual. The individual is projected from such a sequence by assuming spatial, temporal and sortal contiguity between the temporally ordered situations in the sense that gaps between known life-situations can be filled by more situations the individual was involved in. The constraints that emerge for the application of the term *horse* such that it is applied to a horse as an individual, the individual-concept of *horse*, are: Elements in the (quasi-)concept of *horse*, i.e. in the maximal similarity set of *horse*-situations, are also elements of an approximation of some projected individual, i.e. are also elements of the history of an individual, thus constructed. According to this approach, an individual concept of *horse* is the intersection between the situational concept of *horse*, the approximation by sequences of '(quasi-)concept' of *horse*, with the approximation of an object, i.e. with a thing-history. This intersection cuts out that part of the history of a thing which is a horse-individual. The concept of horses as individuals, i.e. the general concept of a horse-individual, then is reconstructed as a maximal similarity circle the elements of which are individual concepts of horses.

An individual can be involved in a situation in different ways: it can be an active participant, a directly affected participant, an indirectly affected participant, a carrier of the property realization that make up the situation, etc. These so-called 'roles' are expressed morpho-syntactically in composed linguistic expressions and are part of a situational concept expressed by a sentence. The above example *brown horse on a blanket* versus *horse on a brown blanket* has to be treated on this level: Though a situation from the maximal similarity circle of *brown* appears in the history of a horse and in the history of a blanket with respect to each of the two expressions, it does so in different ways. The first expression says that a brown situation is part of the history of a horse and also of a blanket, but in such a way that the horse shows the property BROWN, while the second expression says also that this property occurs in both histories, but that the blanket shows or carries the property BROWN. In order to provide a conceptual correspondent to a nominal term in a case, relative to a certain kind of verb, we can construct an intersection between the role concept, expressed by the case with respect to the verb, and the individual concept and the verb concept, if we assume this connection as realized in the world. If we do not assume realization, we can understand the composition at least in the sense that we find out that such an intersection is possibly not empty. That is: for each of the components, the quasi-concept for the noun, the quasi-concept for the verb, the partial history of an individual restricted by the noun, and the quasi-concept of the role we check whether it permits to integrate a situation which is also integratable into the other non-negated components. This is a test for compatibility of the restrictions that are defined by the requirement of integratability into all component-sets. For the concepts expressed by the noun, verb, and case, integratability means that addition of a situation to the respective similarity sets has to observe harmony with respect to a perspective and monotonicity with respect to similarity degrees; for the individual history, integratability means addition of the situation observing spatial, temporal, and sortal contiguity. This will be exemplified in the following paragraph.

What does the construction of a situational concept amount to? How is it related to the corresponding situational property, or the situation type? Constructing the situational concept expressed by a sentence means to collect the set of constraints on situations which can serve as possible satisfaction situations of that sentence. For the sentence *The snake eats the bird* there are first the lexical constraints explicated above. These are put into conjunction with those which can be derived from morpho-syntactic information: there must be two referents the reference to which was previously indicated in the discourse, or to which the speaker refers demonstratively, such that one satisfies the concept *SNAKE* and the other the concept *BIRD*, and the situation satisfies the concept *EAT*, whereby the *snake*-referent is the agent-participant of the *eat*-situation and the *bird*-referent is the directly affected participant of the *eat*-situation. The basic semantic notions of reference and satisfaction function in the truth conditions. On the conceptual level, i.e. in understanding what these semantic notions are, 'reference' is relating the expression to an approximated individual history, 'satisfaction' is intersecting this with the role-concept and with the maximal similarity circle of situations, i.e. with a possible concept-approximation for the verb. In order to be able to understand such a sentence, one has to be aware of the role-concepts of 'agent participant' and 'directly affected participant' in actions, or more generally situations. One must have acquired these concepts on the basis of experiences one gets early in life as an agent or causer of some effect and as someone who is acted upon by others. The notions of reference and satisfaction have to be learned in experiencing symbolic action, i.e. action by means of signs and especially by means of linguistic expressions. Without such a basic "Aha-Erlebnis" about the use of signs, conceptual representation of sentence meaning would be impossible. In such an experience, many data, consisting of utterance-situation-pairs accompanied by an approving gesture or attitude, are understood as belonging into one single similarity class, by which the concept is delineated which reconstructs the relationship SATISFY up to a certain point by collecting data and constructing similarity sets, individual histories and role-concepts such that the operation of intersection can be performed successfully, i.e. with non-empty result. Likewise the

relationship REFERENCE in satisfaction situations has to be conceptually reconstructed from experiencing a demonstrative gesture accompanying an utterance-situation pair. Reference to individuals means conceptually connecting linguistic expressions to individual histories. Understanding a sentence as providing some known information means that it has a satisfaction situation that is already part of the intersection of all general and individual concepts positively involved; to understand it and accepting it as true means to that these have to be extended by its satisfaction situation by integrating it in the way described, and then the intersection contains this new satisfaction situation; to just understand it without truth assignment means to see whether an extension of the general and individual concepts is possible such that integration of the possible satisfaction situation would be secured.

In the beginning of this essay I assumed satisfaction situations as data, which were unanalyzed wholes, ordered in similarity sets according to similarity between experiences of these integral wholes. The data came in utterance-situation pairs, whereby 'truth' was the basic relationship between the utterance and its (satisfaction)-situation. After having constructed (quasi-)concepts for (quasi-)parts of unanalyzed situations and, additionally, having constructed the concepts of individuals in roles with respect to actions, and having reconstructed the basic truth-relevant semantic concepts of reference and satisfaction, the old situations can be analyzed in these terms, reconstructed as situational concepts, and thereby can be described by descriptions of situation types. Likewise new situations can be analyzed in these terms, and others can be constructed as possible situations on the conceptual level. To construct situational concepts requires to make use of conceptual correspondents to the truth-semantic apparatus consisting of the semantic notions of 'reference', 'satisfaction', and the semantics of the truth functional connectives. But all these were expressible in terms of laying structures on sets of satisfaction situations, taking these to be approximations, either of general or individual concepts (histories), performing set-theoretic operations on these and connecting linguistic labels to these. From a genetic point of view we have taken the notion of 'truth', or assent and dissent, as basic, like in the work of Quine (1960) and Davidson (1984), and thus have started with data that are whole, unanalyzed sentences with their whole, unanalyzed satisfaction situations, i.e. the situations which make the sentences true. After having structured the sets of data by similarity sets and sequences of these in order to delineate quasi-concepts and define concepts as limits of sequences of these, and by individual histories, and after having included conceptual versions of the basic semantic notions indispensable for understanding syntax, we have now closed the circle by providing a conceptual correspondent for Tarski's definition of truth by means of the notions of reference and satisfaction, and thus have included a concept of compositional semantics into concept formation. Concept composition has been described as a conceptual reconstruction of compositional semantics, which requires an understanding (on the cognitive level) of the role of the basic semantic notions of reference and satisfaction in assigning truth. This understanding, which connects expressions to general and individual concepts, and compositions of these, amounts to realizing that certain structures can be laid on sets of experiences of situations, and set theoretic operations on these or on extensions of these under additional constraints about the preservation of certain properties of these structures can be performed successfully, i.e. with non-empty results.

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