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## Interface and interaction

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### Interface relations

Language is used in interaction, in communication. Unperceivable thoughts are conveyed through perceivable sounds or through writing. Linguistic interaction is only possible through such interface relations. These relations between different kinds of phenomena do not concern just sound and meaning, but also linguistic structure and non-linguistic reality.

Sound waves that direct the listener's attention to some particular object on the one hand, and the object indicated on the other hand, have no direct link to each other as objects. The link has to be established by the interlocutors.

Linguistically the link has to be mediated through linguistic structure: sound has to be interpreted phonologically, and meaning does not only concern objects in the real world, but also a conceptual, semantic interpretation of them. This means that there are (at least) three different kinds of interface relations that are relevant for linguistic interaction: phonetic – phonological, phonological – grammatical, and the interface that concerns grammar and meaning.

Interface relations can be thought of either as essentially parallel or as relating two basically independent phenomena in closely connected but contingent ways. These two kinds of approaches will be called *parallel* conceptions and *interactive* conceptions.

If conceived as parallel, two sides of an interface could be seen as determining each other. A speech sound would have an unambiguous phonological characterization, which in turn could be automatically translated into a corresponding meaning or vice versa.

In a parallel conception, linguistic categories and properties of real objects may coincide in a way that could be so completely obvious for the analyst that categories and properties are not even distinguished. Such a conception reflects the situation of language use. We use language to make parallels to reality, and we try to make the fit as good as necessary.

Actually, for competent language users, interface relations seem to work rather automatically, often without much hesitation needed. For language learners the situation is different though.

The skills we use to interpret reality semantically, to express meaning in phonological categories, and to give this a phonetic realization are not automatic, they have to be developed. Even if some conditions are given from birth, including the human ability to develop a linguistic competence at all, very much of the interface relations that are fixed in a language has to be acquired through experience.

### Stability and development

If the correspondence relations of an interface are treated as fixed, a static linguistic situation can be described. If the associations are treated as open, with the possibility of being fixed temporarily, one can describe linguistic development, historic development as well as the development of a learner.

*Fixed* correspondences may be conceived as inherently necessary or as arbitrarily fixed. *Temporary* correspondences may be seen as arbitrary, but also as *motivated*. If different interpretations are available, some options could be used during one period, and different or partly different options during other periods.

A linguistic development can be described as a change from one static correspondence to another. In this case, the correspondences have to be treated as fixed arbitrarily rather than inherently. A stable situation can also be described by temporary correspondences as naturally as a development can, but the factors that affect the stability have to be taken into account in both cases.

For the language learner, *experience* is crucial. If the linguistic interface correspondences work well in the way they are set, there is no need to reevaluate them. To the extent that they are problematic however, reassessments are motivated.

The provisional character of interface associations can also be seen from the point of view of historical linguistic change. When some factor of a temporary situation is changed, others could easily be affected as a consequence of a changed situation, and such a change could in its turn motivate further changes. If a linguistic situation is described in terms of motivated relations, it will include in a natural way a description of tensions between different tendencies with different strength depending on circumstances.

### Logic and linguistics

In logical reasoning, assumptions have to be fixed in order to avoid inconsistencies. This is particularly evident when formal languages are used, languages that have been developed for formal derivations of logical inferences, languages that consist only of unambiguously distinct graphemic elements. The physical inscriptions or colour spots that are used should not admit any hesitation regarding which linguistic categories they are intended to convey. The associations to elements of meaning have to be strictly regimented by rules, if such associations are used at all.

Human language is ready for use in familiar situations, but also in new situations, unforeseen in one respect or another. The languages that we use every day, and that we need in the differing situations that we experience, are *flexible* languages, languages *open* for new situations. The languages that linguistics has to describe are these flexible languages.

In logic the task is a different one. In order to start his work, a logician must get rid of all linguistic flexibility that may cause confusion and inconsistencies in reasoning.

From a linguistic point of view, a situation of logical reasoning is not very different from any other situation of language *use*. In any situation when language is used, the parameters of linguistic interface correspondences have to be set in some way or another to get from sound or writing to meaning or vice versa. What makes reasoning different from other uses is that one has to take care to keep all parameters fixed. They have to be frozen, at least temporarily, for the sake of the argument.

The direct correspondences that are assumed to hold in logical contexts, relations between referents and referring expressions and between truth values of propositions and states of affairs, are not direct in the sense that physical properties of states of affairs can be directly represented or relevant as such in reasoning. Empirical questions have to be settled, in one way or another, arbitrarily or grounded in argumentation, *before* a deduction can start.

Predicates are assumed to hold, or not to hold, but the character of this relation does not concern logical reasoning. Predicates are assumed to hold about objects, and objects have to be identified by linguistic means before reasoning starts, just as objects are identified in any situation. Logic concerns which interface correspondences that hold, or are assumed to hold, but not how they are established empirically.

We could think of the world in terms of objects with physical *properties*, but what is important for the interface relations, in logic as well as in linguistics, are not the properties as such but the *conditions* used to establish the correspondences. Empirical reality is not represented directly in language, whether used in reasoning or for other purposes, but only indirectly, via the mediating conditions.

Hypothetical reasoning is possible without reference to any world, actual or possible, just in terms of logical relations between conditions. Even if unspecified and unknown correspondences between linguistic categories and something they should correspond to is assumed in possible world semantics, neither logical reasoning nor linguistic semantics depends on such vacuous projections, cf. Henningsson 1989.

In probability theory, possibilities are discussed without any links given in advance to outcomes of specific experiments. Actually, if the outcome of a statistical experiment were given before it was performed, there would be no point in discussing probabilities at all. Correspondences between linguistic categories and a reality they may apply to are not associations which are forever given and possible to discover in some way, at least not in probability theory, or in linguistics, even if that is the case in Fregean mathematical logic.

Even though human categorization and the reality categorized are independent of each other, and independent in different respects, this does not mean that correspondences between them are arbitrary. Not any empirical reality fits any condition. Categories and non-linguistic reality may be compatible or not compatible, and in this way they constrain each other. A certain situation may fit some conditions but not others. A certain conditions will be applicable to a certain spectrum of possible situations but not to other situations.

The interface correspondence relations that need to be described in linguistics are open relations of matching, not (hypothetically) pre-established relations of direct correspondences in terms of unknown intensional functions. Such functions can not do any linguistic work. The linguistic work that is relevant in connection with intensional functions is the work done when the functions are specified linguistically (in the meta-language, that is, in the ordinary flexible language we use every day; cf. Dowty, Wall & Peters 1981: ch. 1, 2, 6 and p. 59).

When a language is described, one describes how mappings are made between linguistic categories and non-linguistic reality. When logical

reasoning is described, such mappings, established by using language as means, will be premises of reasoning, explicitly or implicitly.

### Interaction between language and speech

It has been argued above that there is reason to treat many interface correspondences temporarily as open and temporarily as fixed, in linguistic development as well as in the context of logical reasoning. Entities that can be open or fixed temporarily are generally called *parameters*.

Furthermore, when many parameters are considered, one is focussed at a time. When one parameter has been considered and given a value, another one will be free for consideration. As regards language use, a first distinction can be made between interface correspondences that are fixed in the state of language used in some situation, and those correspondences that are set in speech, by speaker and listener each in his or her own state of language.

Listeners are ready to interpret what they hear in certain ways, and speakers are ready to express their thoughts and feelings in certain ways, each characterized by certain linguistic interface relations.

In the beginning of a human life, there is not much experience to rely on to establish such relations. Some genetically determined dispositions must be given from the start, but once a readiness to interpret exists, an interaction between experience and routines of interpretation can begin. The cognitive development that takes place through experience has been discussed and investigated by Piaget 1947, 1968 in terms of *assimilation* and *accomodation* of schemata. What occurs in perception can be assimilated to existing schemata or structures, but it may also cause these structures to accomodate to new kinds of experience. See Henningsson 1976, Bates & Elman 1992 and Pienemann forthc.

The impression made depends on what there is to experience as well as on how it is interpreted. The world that a growing child lives in may not change at all at the same rate as the child's readiness to interpret it.

A cognitive development could be seen as an *interaction* between ways of interpreting in situations as they occur, one after the other. Linguistically this would mean an interaction between language and speech: language is used to produce and to interpret speech in occurring situations, and the experience gained in these situations in its turn may lead to a reevaluation of some linguistic parameter.

All parameters can not be set or reset simultaneously. Only when some of them are fixed is it possible to evaluate one of them. From this point of view, an interaction between language and speech is conceivable in the following way: in speech situations, parameters are set in certain ways in routine interpretive judgements to handle occurring situations. If it is a recurring experience that a parameter is set in a certain way, that parameter setting could be adopted as a component of the scheme of interpretation. The new enlarged system of parameters will now be used as the interpretive routine in following situations.

The interaction between language and speech can be approached from either point of view. One may primarily consider parameter changes in language states, as has been done in generative research, cf Chomsky 1981. Parameter changes have mostly been studied for historical development. Historical variations and changes imply that interpretive variations also occur in speech and that accommodations have a basis in speech experience, but that aspect does not seem to have attracted so much attention.

The dynamics of language development have also been studied in models approximating aspects of language use. In connectionist or PDP (Parallel Distributed Processing) computer models, associations between arrays of linguistic items have been 'trained', see Rumelhart & McClelland 1988, Johansson 1995. Between the input nodes and the output nodes there are other, hidden, nodes which are 'taught' to mediate the right associations between input and output. If the network of nodes associates correctly, these associations are reinforced, while if the connections associate in a wrong way, the associations used will be weakened.

Models of this kind could capture certain features of cognitive development, as for instance that the early confrontations of an interpretive system are decisive for its development. Still, it seems that no parameters are ever definitely set, and the network could not but remain on a statistical level. Factors of occurrence can be correlated, but the models do not go beyond this.

In early generative grammar, see for instance Chomsky 1964, it was a decisive point of argumentation against the Immediate Constituent analysis that a cooccurrence of linguistic forms could not determine a syntactic analysis. Not only syntactic but also lexical homonymy exemplify this argument.

In order to be further developed, structural conceptions need to take speech interaction into account, particularly when questions of interface

relations are considered, as in Chomsky 1992, and speech oriented conceptions need to take structure into account. Would it be possible for the two approaches to near one another and learn from each other? I think so.

Generative theories and connectionist theories are not as different as they may seem at first glance. There are many hidden similarities. The two kinds of theories represent the autonomy of linguistic interpretation in different ways, but the indirectness of interface relations can be accounted for, whether the mediating nodes are hidden or not. In generative grammar, the empirically established links are described in the format of lexical items. Structural patterns are taken for granted in both types of theories.

Examples of trends of convergence, that is, constructive ways of thinking, that aim at capturing the interaction between language and speech have been considered along generative lines by Piattelli-Palmarini 1989 and from a connectionist starting point by Bates and Elman 1992. The parallels and connections between the approaches can be seen and developed more easily when generative grammar is compared with the competition model elaborated by Bates and MacWhinney (MacWhinney 1987; Bates & MacWhinney 1987). In this model the relations between cues and grammatical categorizations are dealt with.

In PDP theories, parallel operations are stressed, and sequential operations are given less emphasis, while the contrary is the case for generative grammar. However, both types of operations are admitted in both kinds of theories. *Features* are the parallel items of generative grammar. Features represent *analogies*.

Analogies are treated in very different ways in generative and connectionist theories, but they are necessary in both. Analogies can be seen as the means of establishing interface relations. Analogies of meaning are connected to analogies of sound. Analogies are provisional, empirical, motivated relations, not universal relations. Analogies can be combined in certain ways but they may also compete with each other.

If some entities are interpreted as similar in some relevant respect or dimension of comparison, this can be described by associating them with the same feature. Analogies, whether expressed in terms of features or not, concern associations between non-linguistic phenomena and categorizations of them.

Analogies can be made in comparisons between different objects, but analogies can also be made for relations, cf. Gentner 1983. Structural

analogies and metaphors have been studied by, among others, Langacker 1986, and Sowa 1993. Unification of features is discussed by Kay 1979.

An interaction between synchrony and diachrony can be developed from a Saussurean perspective. Such an interaction can also be applied to the linguistic development of language learners, see Henningsson 1976. The role of analogy is crucial in such interaction. Saussure 1916 characterizes analogy as the mechanism of language. Analogy takes care of the renewal of a language as well as the preservation of it.

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