

CHOMSKYAN LINGUISTICS AND HPSG AS COMPETING RESEARCH PROGRAMMES

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Abstract: A direct comparison of theories in linguistics is often problematic. In this article a concept of research programme is introduced which makes it possible to localize the problem exactly. The research programme can be evaluated as to whether and how different levels of adequacy can be achieved. The research programme of Chomskyan linguistics did not change between the 1960s and 1980s, but HPSG assumes a different research programme. Theories in Chomskyan linguistics can reach explanatory adequacy, but theories in HPSG cannot. It is shown in what respect the research programme of HPSG has to be modified to solve this problem.

Keywords: Chomsky, Head-Driven Phrase Structure Grammar (HPSG), levels of adequacy, research programme, paradigm, incommensurability, Kuhn

It is well known that it is often difficult to compare theories in linguistics. At first sight this may seem surprising, because the set of data to be accounted for by each theory is based on the same natural languages. It seems perfectly reasonable when Pollard & Sag (1987:10f.) argue that by reformulating various theories in a single, unification-based formalism they can be meaningfully compared as to their empirical consequences. The problem with such a proposal is that it only works in a context where uniform agreement exists on the nature of the data to be accounted for and on what counts as a minimal, good, or excellent account of these data.

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In this article two goals are pursued. First, we will deal with the question of why comparison in the general case is so difficult. In section 1 I will show that this difficulty is inherent in the nature of empirical sciences in general, and introduce a unit called research programme within which comparison is relatively easy. The second goal is to show that a meaningful comparison is also possible between research programmes. As a case study, I will present the research programme of Chomskyan linguistics (section 2) and compare it with the research programme of Head-Driven Phrase Structure Grammar (HPSG) (section 3). Finally, I will list the conclusions of this comparison and consider what consequences they may have for linguistic theory (section 4).

1. RESEARCH PROGRAMMES

Theoretical linguistics is an empirical science. Empirical sciences contrast on the one hand with formal sciences, on the other hand with applied sciences. As prototypical examples of formal sciences we can take mathematics, logic, and geometry, as prototypical examples of empirical sciences physics, chemistry, and biology, and as a prototypical example of an applied science medicine.

Every science is concerned with the solution of problems. The three types of sciences differ as to the type of problems they are concerned with. The difference between empirical and formal sciences is that in the former the subject matter is given in advance in a sense in which it is not in the latter. In Euclidean geometry, a set of five axioms defines the reality to be taken into account. Within this controlled reality, theorems can be proven as correct solutions to problems. By changing the fifth axiom, we move to a variant of Non-Euclidean geometry, which is a different reality. In empirical science, such a change of reality is not possible. The lack of control of reality is also the reason why problem solutions are hypotheses (theories) rather than theorems with proofs.

The difference between empirical and applied science is that the former is concerned with problems of understanding, the latter with practical problems. Whereas in a sub-discipline of biology the problem of why and how a particular disease affects people is studied, the corresponding sub-discipline of medicine searches for a cure for the disease as a solution to the problem of people's health being impaired.

Summarizing, we can say that empirical sciences are concerned with the solution of problems of understanding whose origin escapes the researcher's control. The solution found is usually called a theory.

Let us now turn to the scientific process leading from problems of understanding to theories. Most working scientists accept the hypothetico-deductive method as a basis for research in empirical science. This method, whose origin lies with Francis Bacon, can be visually represented as the empirical cycle in Fig. 1.

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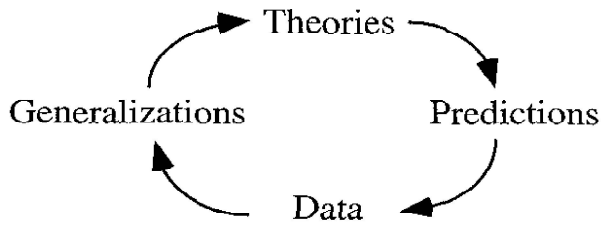

Fig. 1: The empirical cycle.

In the explanation of Fig. 1, the following quotes from Nagel (1961) are helpful:

(1a) "Scientific thought takes its ultimate point of departure from problems suggested by observing things and events encountered in common experience;
(1b) it aims to understand these observable things by discovering some systematic order in them; and
(1c) its final test for the laws that serve as instruments of explanation and prediction is their concordance with such observations." (1961:79)

(2) "the distinction between experimental laws and theories is based on the contention that laws subsumed under the first of these labels, unlike laws falling under the second one, formulate relations between observable (or experimentally determinable) traits of some subject matter." (1961:81)

The data, as stated in (1a), are observations whose origin is beyond the control of the researcher. Note that "beyond the control" does not mean that a controlled experiment is impossible, but that the researcher cannot change the state of affairs as in formal science. The purpose of the scientific process is understanding these observations as the natural consequence of some systematic order, (1b). This order consists of two types of laws, empirical laws generalizing about the data and theories explaining them. In (1c) these two types are not distinguished, but in (2) they are. Empirical laws have two functions in Fig. 1, on the one hand as generalizations, i.e. processed data which are on their way to being explained by a theory, on the other hand as predictions, i.e. consequences of the theory which can be tested against further data.

It has long been recognized that, though often sufficient as a model for the researcher in practice, the empirical cycle is not sufficient as an epistemological basis. At each step in the cycle various problems of indeterminacy arise. Typical instances of such problems are the questions listed in (3).

(3) a. Which aspects of the data are chosen as a basis for generalization?
b. How deep should the explanation provided by the theory be?

Problem (3a) arises because at any moment the set of data taken into account is necessarily finite, but infinitely many generalizations can be formulated on the basis of a finite set of data. Problem (3b) arises because any theory offered as an explanation contains statements which can be subject to *why*-questions. In principle, the chain of *why*-questions is infinite. In the practice of scientific research, questions such as (3) are hardly noticed, because there is a broad consensus among practitioners,

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which makes any discussion on such questions unnecessary in normal circumstances. As Kuhn (1970:43f.) points out, this consensus is implicit and tends to break down as soon as an attempt is made to formulate it explicitly. This explains why its existence is often not immediately observable. The gap between research practice and logical necessity is demonstrated impressively when reasoning systems are implemented on a computer, where every heuristic guideline to tackle (3a) has to be formally expressed (cf. Thagard, 1988).

A *research programme* is defined here as a set of assumptions shared by a scientific community which make it possible to use the empirical cycle productively while neglecting the epistemological problems associated with it in actual research. Thus, the research programme contains heuristic guidelines for the selection of and generalization about data to solve (3a) and unchallenged assumptions (i.e. immune to *why*-questions) as a basis for explanation to solve (3b). As such, a research programme has much in common with Kuhn's (1970) concept of *paradigm*. However, whereas a paradigm is first of all a social entity, retrievable through the primary identification of a group of scientists sharing it (Kuhn, 1970:176-178), a research programme as I intend it is first of all an intellectual entity. Thus, a research programme may in principle be shared by groups not actually in contact with each other. Whereas Kuhn assumes that paradigms exist at a number of levels, ranging from a research team of some 100 members to the community of all scientists, such that smaller groups share more assumptions, I only assume one level for research programmes. As I have suggested elsewhere, a research programme might be seen as a module covering the intellectual component of a paradigm in a modular analysis of the latter (ten Hacken, 1997a).

One of the central issues in the discussion of paradigms, which carries over to the discussion of research programmes, is the interpretation of the situation arising when two of them meet. Because of his statement that paradigms are incommensurable, Kuhn had to spend much of his time arguing that his approach entails neither irrationality nor relativism (cf. Kuhn, 1970b; Chen, 1997). The line of reasoning of his opponents is that since a fully rational choice between two paradigms is impossible, science is irrational and since progress in one paradigm need not be observable as such in another paradigm, a view of science including paradigms is relativist. It can be found for instance in the purely epistemological context of Laudan (1977:138-146) and in an application to linguistics in Elffers (1991:133-138).

As Kuhn demonstrates at various places, incommensurability need not entail lack of understanding. In the same way as people speaking different languages as their mother tongues can learn each other's native language in order to communicate, one can learn to reason within another paradigm without adopting it. Since it is possible to understand two paradigms, it is also possible to express rationally which paradigm seems more attractive. Therefore the choice is not arbitrary or irrational. It is not logically determined either, to the extent that there is no neutral language in which to discuss the two paradigms. The discussion will not result in a mass conversion of all adherents of one paradigm to the other, because the evaluation criteria of the two paradigms differ. A growing tendency for one paradigm to win out over another may

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occur as a slow process, dependent on the progress made. Kuhn insists that progress can be measured in terms of the area covered by theories in competing paradigms. This is not a movement towards the truth, but it is not relativism either. The non-identity of the target area of data for theories in different paradigms will inhibit absolute comparison and mass conversion, but over a longer period progress will be observable and influence paradigm choice.

Incommensurability is an essential criterion for the distinction of research programmes, because it can be used to show that the intellectual framework required to make the empirical cycle work is no longer the same. This point is elaborated by ten Hacken (1997a). One of the goals of this article is to show that Chomskyan linguistics and HPSG are two research programmes, no more, no less. Another goal is to carry out an evaluative comparison. At this point it may seem a contradiction to do so, because the possibility of a neutral higher-order language has just been denied. A very general set of criteria is still available, however. They are based on the assumptions that theoretical linguistics is an empirical science, that empirical science functions according to the empirical cycle, and that a research programme must contain enough specifications to make the empirical cycle work.

2. THE RESEARCH PROGRAMME OF CHOMSKYAN LINGUISTICS

In this section I will first propose a research programme (2.1) and then show that it is actually the research programme of Chomskyan linguistics, both in the 1960s and in the 1980s (2.2).

2.1. The Model

A research programme is a set of assumptions which cannot be justified, although they can be motivated. Even the assumption that language is a suitable object of study in linguistics has been challenged (cf. Yngve, 1996 and the review by ten Hacken, 1997b). Here I will concentrate on presenting the assumptions systematically, rather than on motivating them. Jackendoff (1993) gives an overview of evidence which can be taken to support the assumptions presented here. Botha (1989) gives a systematic overview of the discussion of their details and consequences. In the presentation below, the assumptions appear as facts.

In establishing linguistics as an empirical science, we first have to specify the relationship between *language* and *a language*. We want our overall theory to cover both, but the different nature of the phenomena requires different types of theories. A language is a mental system available to the native speaker. It consists of knowledge enabling the possessor to produce and process certain messages. It is described by a grammar. Language is a genetically determined mental system common to all human beings. It consists of knowledge enabling a child to learn its native language. It is described by a grammatical theory. The mental system of knowledge at the language-independent level is also called the language faculty or the language acquisition device

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(LAD). The mental system of language-specific knowledge is also called the competence.

In actual language use, grammatical competence interacts with a number of different systems of knowledge, e.g. social and emotional knowledge. Therefore, not every aspect of language use data needs to be explained by a theory of grammatical competence. The most direct way of gaining access to the knowledge in the competence is by judgements of whether a particular sentence is grammatically possible. A certain degree of abstraction is necessary in these judgements.

The assumptions on the nature of theories and data and on the relations between them can be represented as in Fig. 2.

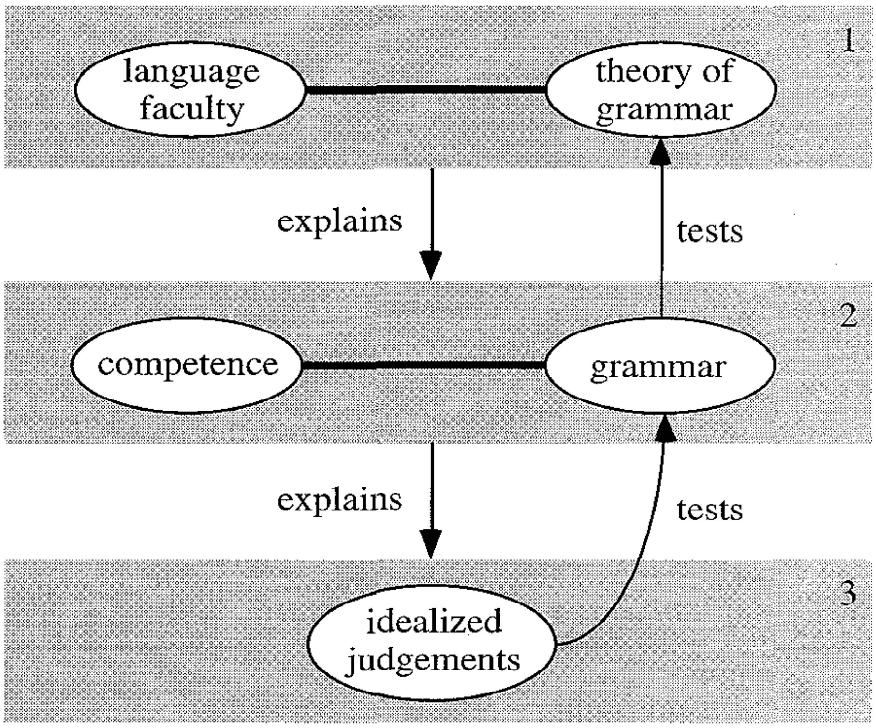

Fig. 2: Model of the Chomskyan research programme.

In Fig. 2, five entities are represented, divided over three levels numbered 1, 2, and 3. Level 1 is the language-independent level, level 2 the language-specific level, and level 3 the data level. The left-hand side of the figure represents nature, the right-hand side theory. The idealized judgements on level 3 are represented as midway between theory and nature. The bold lines linking the entities at the same level represent a descriptive relation. Thus grammatical theory describes the language faculty.

The labelled arrows in Fig. 2 suggest a cycle of explanation and tests. The observed grammaticality judgements are explained by the competence as described by the grammar. At the same time, they serve as a test of whether the grammar is correct as a description of the competence. For the relationship between level 1 and level 2, it should be borne in mind that the entities at level 1 are universal whereas there are in

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principle as many different pairs of entities at level 2 as there are different languages. The language faculty as described by the grammatical theory explains that for each language the competence described by the grammar can be learned. For this learning process two sources of data are available: the language faculty and a limited set of utterances. Utterances are a much less powerful set of data than grammaticality judgements, because the different components responsible for them are not sorted out and there is no equivalent to negative judgements. Nevertheless each grammar must be learnable, so that a grammar can be used to test whether the grammatical theory is specific enough.

Although both Fig. 1 and Fig. 2 represent the scientific process as a cycle, the mapping between them is not straightforward, because they represent different aspects of the process. Thus Fig. 1 does not relate the theory to anything in nature, while Fig. 2 does not differentiate generalizations and predictions. These differences are due to the fact that Fig. 1 fails to take a research programme into account, whereas Fig. 2 is the model of a particular research programme. In Fig. 2, the entities of levels 1 and 2 spell out the *theory* represented monolithically in Fig. 1. Conversely, the *idealized judgements* in Fig. 2 conflate the *data*, *generalizations*, and *predictions* in Fig. 1.

The fact that there are two levels of theory is not something specifically postulated for linguistics. It is a consequence of the fact that language can only be studied through particular languages functioning as fully-fledged systems. This situation contrasts with physics. We do not need a level of, say, earth-based physics as opposed to lunar physics, intermediate between observations and a universally applicable theory, because each of the parameters distinguishing the two supposed kinds of physics can be modified individually. The situation in linguistics has an analogue in zoology, where each species can be considered as a working system of a discrete type. It is not possible to vary individual properties of a species in the same way as parameters in a physical experiment. Therefore, in zoology there is one level of theory explaining life functions of individual species and a higher level of theory explaining them on a universal basis.

With this difference between linguistics and zoology on the one hand and physics on the other in mind, it is also possible to gain a broader perspective on the levels of adequacy proposed by Chomsky (1964:28f.). Observational adequacy is adequacy at level 3, in natural science often referred to as "saving the appearances" or "getting the facts right". There are many ways to achieve this level, only some of which are adequate at the next level. In sciences with two levels of theory, the next level is descriptive adequacy, i.e. adequacy at level 2. A zoological analogue would be an adequate description of how the body of a robin works as a basis for explaining observations of robins. Explanatory adequacy is adequacy at level 1, describing the underlying universal system correctly. In physics and other sciences lacking the lower level of theory, explanatory adequacy is the next step beyond observational adequacy.

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2.2. The First and Second Chomskyan Schools

The research programme described in the previous section was labelled the research programme of Chomskyan linguistics in the caption to Fig. 2. The label implies that adherence to this research programme is a constant feature of Chomsky's work and the work by people elaborating his ideas. Such a statement is controversial in the sense that it is often not accepted that Chomsky's work actually displays a unity of this type. It is sometimes claimed that Chomsky is a "Serial Revolutionary" (Joseph, 1995:380), implying a continuous set of more or less radical breaks with earlier positions. A more common view is that there are two Chomskyan schools, centred on *Aspects* (1965) and *LGB* (1981), and preceded by a period more difficult to classify. This is the view of Kaldewaij (1986) and Matthews (1993).

Matthews (1993:233f.) discusses various differences between the first or classic Chomskyan school and the second Chomskyan school. Some of them are clearly irrelevant to the question of whether they adhere to the same research programme, e.g. the fact that the group of scientists of the second Chomskyan school was more international. Other differences have a more direct link to the problems dealt with and the types of solution considered in linguistic research. In the first Chomskyan school the goal of research was to formulate phrase structure rules and transformations for a language or a fragment of a language. In the second Chomskyan school, the goal is rather to explore the principles of grammar and the values of parameters required to account for data in different languages. Thus, the similarities in their titles notwithstanding, Matthews (1965) is a description of the syntax of the Hidatsa language taking Chomsky's formalism as its formal notation, whereas Rizzi (1982) explores issues such as the correct formulation of the parameter in subjacency distinguishing Italian and English.

Another difference is the function of rules to be formulated. In the first Chomskyan school, the rule system has many properties of a production system. All and only replacements described by explicitly formulated rewriting rules and transformations are possible in the derivation of a sentence. In the second Chomskyan school, individual rewriting rules or transformations have been replaced by $\bar{X}$-theory and move α, constrained by general principles. From "nothing is allowed, except when a rule allows it" we move to "everything is allowed, unless a principle forbids it".

The differences between the two schools have a huge influence on the daily practice of linguistic research. This fact by itself does not pre-empt, however, the question of whether the two schools constitute (only) different theories of grammar or also different research programmes. The latter case implies a difference in the relationships or nature of the entities represented in Fig. 2. In order to investigate this, we will consider how adherence to this model is expressed in some of Chomsky's works, representative of the two periods.

Chomsky (1965) gives many indications that the model in Fig. 2 is the backbone of his research programme. A selection is presented in (4-7).

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(4) "A grammar of a language purports to be a description of the ideal speaker-hearer's intrinsic competence." (1965:4)

(5) "Although [...] the speaker-hearer's linguistic intuition is the ultimate standard that determines the accuracy of any proposed grammar [...] it must be emphasized [...] that this knowledge may very well not be immediately available to the user of the language." (1965:21)

(6) "As a long-range task for general linguistics, we might set the problem of developing an account of th[e] innate linguistic theory that provides the basis for language learning." (1965:25)

(7) "Any such hypothesis [i.e. on the innate linguistic theory] can be falsified [...] by showing that it fails to provide a descriptively adequate grammar for primary linguistic data from some other language." (1965:26)

In (4) the relationship between *grammar* and *competence* is established. In (5) we find the idealization involved in the judgements and their use as a test for the grammar. The extensive discussion of the competence vs. performance distinction (1965:10-15) and data collection methods (1965:18-25) elaborates the nature of this relationship. In (6) theory of grammar is related to the language faculty, although slightly different terms are used, in particular "innate linguistic theory" instead of "language faculty". The relationship between levels 1 and 2 is formulated in (7). Therefore, the entities in Fig. 2 and their relationships can all be found in Chomsky (1965).

If we address the question whether Chomsky (1981) still adheres to this research programme, we have the problem that part of it is taken to be so obvious that an explicit statement is apparently unnecessary. What we do find is remarks such as (8) and (9).

(8) "In a highly idealized picture of language acquisition, UG is taken to be a characterization of the child's pre-linguistic initial state." (1981:7)

(9) "The theory of UG must meet two obvious conditions. On the one hand, it must be compatible with the diversity of existing (indeed, possible) grammars. At the same time, UG must be sufficiently constrained for the fact that each of these grammars develops in the mind on the basis of quite limited evidence." (1981:3)

In (8), "UG" is used for "theory of grammar" in Fig. 2 and "the child's pre-linguistic state" for the "language faculty". Thus (8) establishes the descriptive link at level 1. In (9) we find a direct expression of the trade-off at the basis of the explanatory and testing relationships between levels 1 and 2 in Fig. 2. For explicit statements of the lower parts of the model, we have to turn to more philosophically oriented works rather than this exposition of a new theory. Chomsky (1986) gives us the direct expression of the descriptive link at level 2 in (10) and an extensive discussion of the hazards of using judgements as data, which necessitates the idealization (1986:36-40).

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(10) "a particular grammar [is] a theory concerned with the state of mind/brain of the person who knows a particular language" (1986:3)

Therefore we can conclude that in the second Chomskyan school the model of Fig. 2 also represents the research programme adhered to. The theories exposed in *Aspects* and in *LGB* are different theories of grammar intended to function in the same context. This analysis of the relationship between the two theories explains why it is possible to describe the development from the former to the latter as a series of small steps, justified by reference to a commonly accepted core of data and framework of background assumptions, as van Riemsdijk & Williams (1987) do. Although the two theories are quite different, van Riemsdijk & Williams's historical description illustrates that it is not possible to find a clear boundary separating the first and second Chomskyan schools in the development from the theory of *Aspects* to GB-theory.

3. HEAD-DRIVEN PHRASE STRUCTURE GRAMMAR (HPSG)

HPSG is generally presented as an alternative to Chomskyan linguistics. It therefore seems a straightforward option to approach it with the hypothesis that it constitutes a separate research programme, distinct from the one in Fig. 2. I will here first present the model of HPSG corresponding to Fig. 2 (3.1), then evaluate this model in comparison to that of Chomskyan linguistics (3.2).

3.1. The Model

In investigating the hypothesis that HPSG has a research programme different from that of Chomskyan linguistics, two problems have to be faced. First, the literature on HPSG consists of expositions of linguistic theories with few explicit references to the underlying assumptions of the research programme. There is nothing for HPSG comparable in size to Chomsky's writings on metatheory. Second, the research programme is still very young. As shown by ten Hacken (1997c), the earliest stages of a research programme often do not display all of its details in their definitive form. Thus, some of the properties of Chomskyan linguistics which were to become essential later are not represented explicitly in Chomsky (1957).

The main sources for HPSG are two books by Carl Pollard and Ivan Sag, which I will refer to as P&S (1987) and P&S (1994). They represent three versions of the theory, which is a sign of the rapid development of the ideas. In chapter 9 "Reflections and Revisions" of the 1994 book, some of the basic theoretical decisions of the first eight chapters are reversed. These decisions are not part of the research programme, but rather of the same kind as the transition from *Aspects* to *LGB*. The information needed for reconstructing the research programme of HPSG is found mainly in the introductions of both books and chapter 1 of P&S (1994).

The major divergence from the research programme of Chomskyan linguistics is that P&S do not want to commit themselves to mentalism. P&S (1987:1-6) discuss the

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opposition between what they call conceptualism and realism. In order to avoid confusion, it should be borne in mind that what they call conceptualism is what Chomsky calls realism (e.g. 1986:252). Chomsky's use of realism as an equivalent term for mentalism in linguistics is based on the assumption that linguistic theory describes an empirical entity, existing in the real world, namely in the mind of human beings. P&S call situation semantics an example of a realist theory "because it locates meaning not in speakers' heads but in the world" (1987:5). Rather than choosing between the two types of realism, their conclusion is what is formulated in (11). The argument and the conclusion are briefly summarized in P&S (1994), which shows that it is still accepted.

(11) "Fortunately it does not seem necessary to settle this question [i.e. the choice between realism and conceptualism] in order to have a workable linguistic theory. [...] linguists can theorize about signs without knowing for sure whether they are [in] the mind, out of the mind, or somewhere in between." (1987:6)

It is not possible to maintain the research programme in Fig. 2 while remaining neutral as to the interpretation of the term realism. By its reference to "language faculty", "competence", and "idealized judgements" the model is committed to a mental reality. In order to achieve neutrality as desired in HPSG, these entities have to be replaced. Other features of the model are compatible with a neutral position. They include the three levels, with grammatical theory at level 1, grammar at level 2, and data at level 3. Minimal adaptations of the model are therefore a reinterpretation of the nature of the data and a new status of the objects described by the grammar of a language and by the grammatical theory. Starting from level 1, P&S (1994:14) define them as in (12-14).

(12) "the central goal of linguistic theory [is] to characterize what it is that every linguistically mature human being knows by virtue of being a linguistic creature"

(13) "a theory of a particular language – a grammar – characterizes what linguistic knowledge (beyond universal grammar) is shared by the community of speakers of that language"

(14) "language [...] does not consist of [...] individual linguistic events or utterance tokens [...] . Instead [it] is the system of linguistic types."

If we insert the entities suggested here into the empty positions in Fig. 2 resulting from the non-commitment to mentalism, we obtain Fig. 3. Although "shared knowledge" appears twice in the figure, the interpretation of the two occurrences is meant to be different in accordance with the level at which they appear and statements (12) and (13). The model in Fig. 3 is incomplete in the sense that the arrows connecting the entities have not yet been labelled. Whether it is justifiable to label them in the same way as in Fig. 2 is the question to be addressed in the next section.

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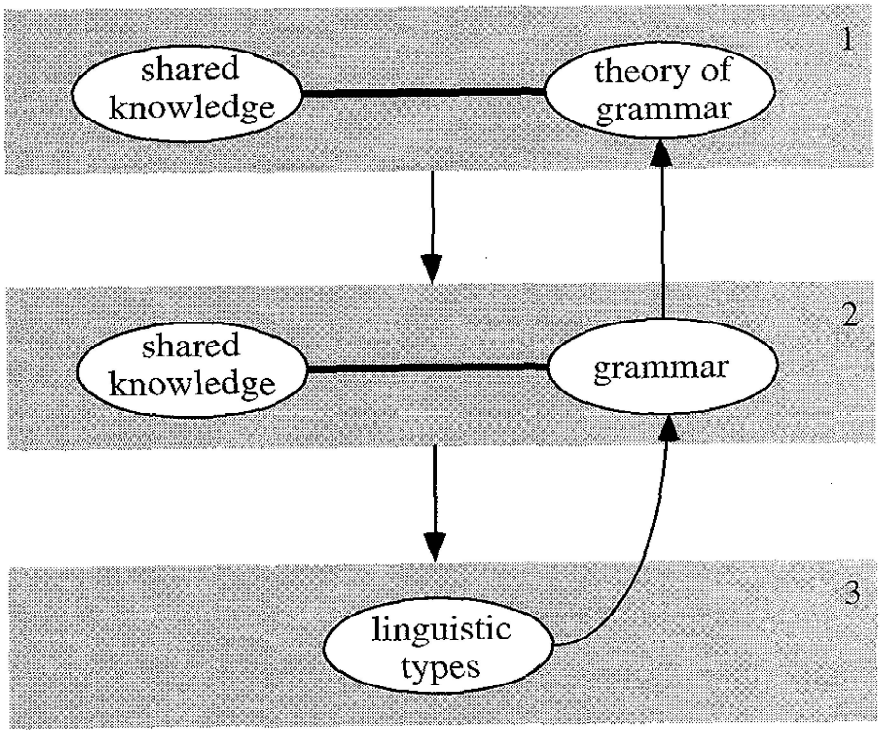

Fig. 3: Partial model of the HPSG research programme.

3.2. Explanation and Testing in HPSG

The purpose of this section may be formulated as finding out whether the arrows in Fig. 3 can legitimately be labelled as *explains* and *tests* in the same way as the arrows in Fig. 2. Only to the extent that this is the case can descriptive and explanatory adequacy be achieved in HPSG. The working method will consist of a systematic comparison of the entities in Fig. 3 with the corresponding entities in the research programme of Chomskyan linguistics, followed by an analysis of the significance of the differences and similarities found.

Let us start at the bottom level. The labelling in Fig. 2 and Fig. 3 suggests a significant difference between the data in Chomskyan linguistics and HPSG, because the former takes grammaticality judgements, the latter linguistic types as data. In (15) the HPSG data concept is nevertheless directly linked to a concept of Chomsky's system, which suggests a large degree of agreement on this point.

(15) "The distinction between the system of constraints and the collection of linguistic entities that satisfies it can be viewed as corresponding both to Chomsky's (1986) distinction between *I-language* and *E-language* and to Saussure's (1916) distinction between *langue* and *parole*. Though only the latter is directly observable, only the former can be embodied as a mental computational system shared by members of a linguistic community." (P&S, 1994:58, references adapted.)

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In (15) a number of terms are introduced which need to be explained before we can assess the value of this statement. To this end I will relate them to terms discussed here so far. Starting with the terms referring to HPSG-entities, "the collection of linguistic entities" in (15) can be identified with the "linguistic types" at the data level of Fig. 3. "The system of constraints" is a fairly vague term, which can refer at the same time to the shared knowledge in Fig. 3 and to the linguistic description of this knowledge, without distinguishing between levels 1 and 2. The ambiguity between an empirical entity and the theory describing it is familiar from the use of *grammar* by Chomsky (1965) and illustrated for level 1 in (6) above. The reference to a mental system in (15) is not in contradiction to (11). On the contrary, "can be embodied" in (15) admits exactly the two options as required by (11).

The relationship to the Chomskyan research programme is established by a reference to the contrast between I-language and E-language. This pair of terms is introduced by Chomsky (1986) to replace the term pair competence vs. performance because of ambiguities which had arisen in the use of the latter (cf. ten Hacken, forthcoming). The identity of I-language with competence as intended in Fig. 2 is clearly expressed in (16):

(16) "The I-language, then, is some element of the mind of the person who knows the language, acquired by the learner, and used by the speaker-hearer." (Chomsky, 1986:22)

E-language corresponds to performance. We did not mention performance in the context of the research programme of Chomskyan linguistics because it does not play a direct role, but serves only to denote what data in linguistics are *not*. Performance is seen by Chomsky as the result of a number of factors, competence being an important one. Performance differs from the data of Chomskyan linguistics in two ways. First, it can contain elements which do not belong to the data to be explained because they do not reflect competence directly, but competence as filtered by a number of cognitive constraints, e.g. speech errors. Second, performance does not contain anything corresponding to negative grammaticality judgements, i.e. the information that a particular sentence is ungrammatical.

From this explication of terms we can conclude that (12) oversimplifies the relationships between a number of contrasts. Leaving aside the fact that Chomsky repeatedly and consistently distinguishes I-language and competence from Saussure's *langue* (e.g. Chomsky, 1965:4; 1986:19), the term pair used by Chomsky is never intended to define the data in the way suggested by (15). If data in HPSG are made to correspond to E-language, the differences between E-language and grammaticality judgements turn into conceptual problems for HPSG.

Another problem with the data concept of HPSG is raised by the statement in (17).

(17) "types of conceivable linguistic entities [are modelled] as rooted labelled graphs of a special kind—totally well-typed, sort-resolved feature structures" (P&S, 1994:57f.)

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The properties attributed in (17) to linguistic entity types (i.e. data in HPSG) are explained by P&S (1994:17f.). They imply that whenever a feature is of the appropriate sort for a particular entity, it must be specified down to atom level. This requirement creates a considerable amount of ambiguity of a type which to my mind is both artificial and undesirable. The following example illustrates this. English has a feature grammatical gender, specified as feminine for *she*, as shown by the example graph of P&S (1994:17). Let us now look at the examples in (18).

(18) a. A student entered my office.
b. She asked if I had received her essay.
c. I wonder how many students will come to my seminar.

In (18a) it can be argued that *student* displays a certain type of ambiguity which is resolved when the discourse continues with (18b), although I suspect most linguists would prefer to regard *student* in (18a) as vague in the relevant respect, rather than ambiguous (cf. Cruse, 1986:49-83). In (18c), however, the specification of gender for *student* cannot but distort the representation.

Summarizing our discussion so far, the data concept in HPSG generates a number of problems not present in the data concept of Chomskyan linguistics. I will assume from here onwards, however, that these problems are solved in one way or another, so that the research programmes can be compared as to the other levels as if the data were unproblematic.

Let us then turn to level 2, the level where descriptive adequacy can be attained. In Chomskyan linguistics, the relationships between the entities at level 2 and the data can be summarized as follows:

1° The grammar *describes* the competence.

2° The competence as described by the grammar *explains* the idealized judgements.

3° The idealized judgements *test* the adequacy of the grammar.

Essential for this cycle is the fact that competence is an empirical entity. In this way it can be ensured that the grammar describing it is neither too permissive nor too restrictive, so that explanation and testing are possible.

In HPSG the relationships are basically the same:

1° The grammar *describes* shared knowledge at the level of the language community.

2° This shared knowledge as described by the grammar *explains* the (existence or non-existence of) particular linguistic types.

3° The (existence or non-existence of) particular linguistic types *tests* the adequacy of the grammar.

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By replacing the set of linguistic types by the answer to the question of whether a particular type exists, some of the conceptual problems of the HPSG data concept can be circumvented. The essential condition for the attainability of descriptive adequacy is fulfilled because the shared knowledge is an empirical entity, existing independently of the grammar and the data.

Finally, let us turn to level 1, the level where explanatory adequacy can be attained. Both in Chomskyan linguistics and in HPSG there are four entities distributed over levels 1 and 2. The relationships between entities at the same level are descriptive and relate a theoretical to an empirical entity. What is of special interest is the nature of the relationships between different levels, as represented by the arrows.

The crucial point why in Chomskyan linguistics the downward arrow can be labelled *explains* and the upward arrow *tests* is contained in (9) cited above from Chomsky (1981:3). There are two opposing forces at work. In order for the competence to be learnable, given limited evidence from only positive data of poor quality, the language faculty must define a constrained search space. On the other hand, in order for all attested languages to be described by a grammar admitted by the theory of grammar, the theory of grammar must be sufficiently permissive. For any property of competence in any language there are only two options: either it is innate or it is learnable. Both options are restrictive. If something is innate, it must be reflected in the competence for any language. If it is not innate it must be possible to derive it from limited evidence. These opposing forces create the essential tension for a potentially explanatory relationship. Whether explanatory adequacy is in fact attained depends on qualities of the theory of grammar, not on the research programme.

In order to assess whether a similar relationship between level 1 and level 2 exists in HPSG, we have to look at the motivation given for classifying a property of shared knowledge of the language community as language-specific or language-independent. An important component of this motivation can be derived from the comparison of the grammar of a particular language and the theory of grammar (or UG) in P&S (1994:58). It is summarized in Table 1.

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Table 1: Differences between theoretical entities at levels 1 and 2 in Fig. 3 according to P&S (1994:58).

	Universal Grammar	Particular Grammar
Lexicon	—	System of lexical entries
Linguistic ontology	Inventory of universally available sorts of linguistic entities, with specification of appropriate attributes and value sorts	Selection and further articulation
Schemata	Inventory of universally available phrase types	Selection and further articulation
Constraints	Universal constraints of well-formedness	—

If we first consider the arrow from level 1 to level 2 in Fig. 3, it is clear from Table 1 that it can be labelled at least as *constrains*. UG in HPSG determines a kind of maximal search space for a particular grammar, because only from what is offered by UG can sorts and phrase types be selected, and further articulation can only restrict, not override or expand options offered by UG. The universal constraints of well-formedness cannot even be modified at all. If we then turn to the arrow from *grammar* at level 2 to *theory of grammar* at level 1, it is clear that this arrow can be labelled as *tests*. For any language, it must be possible to formulate a grammar which at the same time satisfies the constraints of the data and the constraints of UG. If this is not possible, the theory of grammar must be adapted.

The central question is now whether the label *constrains* on the arrow from level 1 to level 2 can be tightened to *explains*. In order to do so, we have to assess the balance between forces to strengthen the constraints and forces to relax them. Here we are faced with a problem. The research programme of HPSG surely specifies forces to relax constraints: whenever a language does not satisfy a constraint, the easiest way out is to relax or abolish the constraint. The research programme fails to specify, however, why and how we need to strengthen UG. The only reason for a strong UG seems to be theoretical elegance or simplicity. The only motivation for a particular way to strengthen it seems to be a generalization about available descriptive resources (i.e. the grammars for various languages we have). For a qualification as *explains*, these restrictions impose insufficient limitation.

Whereas in Chomskyan linguistics the research programme forces us to choose for any property a classification as either innate or learnable, in HPSG we are never forced to place a property in UG. No intrinsic reason makes it impossible to specify a non-constraining UG, i.e. one where the inventories of sorts and schemata are simply the superset of whatever we might need in any grammar and where the set of constraints is empty. Therefore, the relationship expressed by the arrow from level 1

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to level 2 in Fig. 3 cannot be labelled *explains* but only *constrains*. As a result, the research programme of HPSG does not in its present state allow for a theory of grammar to attain explanatory adequacy.

5. CONCLUSION

In this article, an evaluative comparison of the research programmes of Chomskyan linguistics and HPSG has been undertaken. The research programme of Chomskyan linguistics was shown to be structured as in Fig. 2 both in Chomsky (1965) and in Chomsky's work from the 1980s. The research programme of HPSG, with full labelling of the arrows, was demonstrated to be as in Fig. 4.

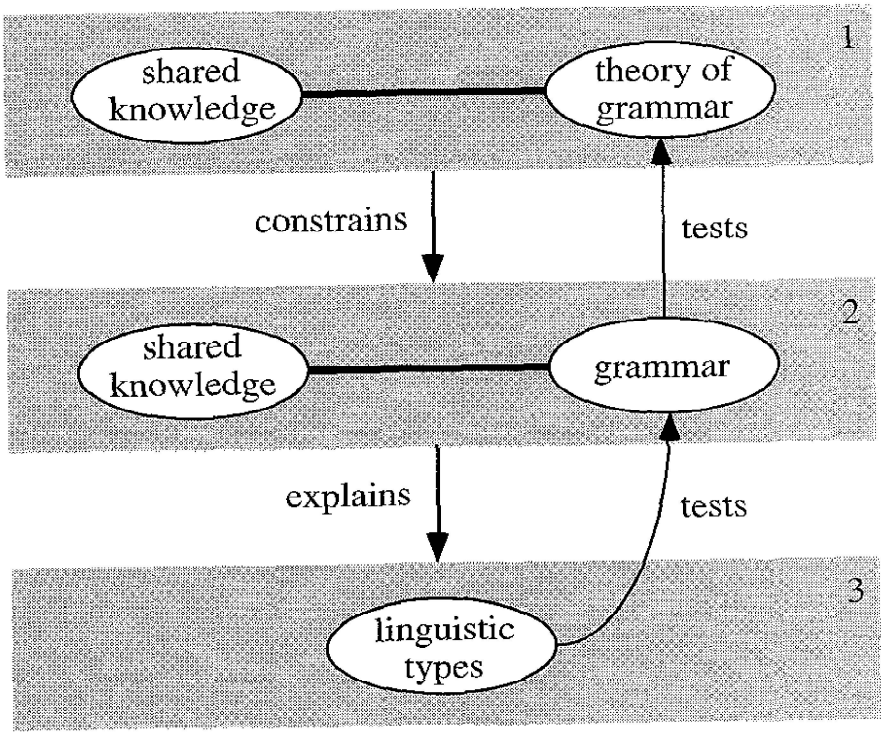

Fig. 4: Model of the HPSG research programme (final version).

As a conclusion of the comparison of these research programmes we found that in Chomskyan linguistics explanatory adequacy can be attained, whereas in HPSG descriptive adequacy is the highest attainable level. The reason why in Fig. 4 explanatory adequacy is excluded in principle is that level 1 entities do not explain but only constrain level 2 entities. This is in turn caused by the absence of an inherent force which would make it inevitable to specify a property at level 1. This force would be a restriction on what can be specified at level 2 in addition to what is available in UG. Without such an inherent force counterbalancing the force to have sufficient expressive power for the description of individual languages at level 2, the tension essential for explanatory adequacy is missing.

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In order not to be misunderstood I would like to formulate two caveats. First, the fact that a research programme makes it possible to attain a certain level of adequacy does not imply that any theory within this research programme actually attains this level. Thus I am not claiming that Chomskyan linguistics attains a higher level of adequacy than HPSG. Second, the fact that the research programme of Chomskyan linguistics offers the possibility of attaining explanatory adequacy does not imply that it incorporates the only way to do so. In fact, in ten Hacken (1997a) I show that LFG achieves the same in a different way.

It is interesting to consider how the research programme of HPSG can be improved. The fact that HPSG is so similar to Chomskyan linguistics in its research programme suggests that a relatively small modification, turning the *constrains* arrow in Fig. 4 into an *explains* arrow, would make it a research programme of equal force. This modification would need to provide a force making it *necessary* to locate certain information at level 1 rather than level 2. Such a force is a question about language to be answered by linguistic theory. Chomsky (1986:3) formulates the questions in (19).

(19) a. What constitutes knowledge of language?
b. How is knowledge of language acquired?
c. How is knowledge of language put to use?

Question (19a) is the one answered at level 2, determining descriptive adequacy. Question (19b) on learnability is the guiding principle of Chomskyan linguistics. As shown in ten Hacken (1997a:295-298), LFG chooses (19c) instead. In order to improve its research programme, HPSG could choose (19b) or (19c), or come up with another suitable question. To my mind it seems improbable, however, that the neutral position as to mentalism, formulated in (11), can be maintained.

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