

# The Nature, Use and Origin of Explanatory Adequacy

*Pius ten Hacken*

Swansea University

If we want to compare the explanatory and descriptive adequacy of the MP and OT, the original definitions by Chomsky (1964) are of little direct use. However, a relativized version of both notions can be defined, which can be used to express a number of parallels between the study of individual I-languages and the language faculty. In any version of explanatory and descriptive adequacy, the two notions derive from the research programme and can only be achieved together. They can therefore not be used to characterize the difference in orientation between OT and the MP. Even if 'OT' is restricted to a particular theory in Chomskyan linguistics (to the exclusion of, for instance, its use in LFG), it cannot be said to be stronger in descriptive adequacy than in explanatory adequacy in the technical sense of these terms.

*Keywords: Levels of adequacy, Chomskyan linguistics, research programme, Minimalist Program, Optimality Theory*

## 1 Introduction

In the Call for Papers of the workshop on Descriptive and Explanatory Adequacy in Linguistics, the organizers assume an opposition between the Minimalist Program (MP) and Optimality Theory (OT) as formulated in (1).

- (1) a. The MP is strong in explanatory adequacy, but struggles to get a sufficient degree of descriptive adequacy.
- b. OT is strong in descriptive adequacy, but struggles to get a sufficient degree of explanatory adequacy.

In this paper, an analysis of the term *explanatory adequacy* and the correlated term *descriptive adequacy* will be proposed so that the statements in (1) can be seen in the proper perspective.

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## 2 The historical origins of *explanatory adequacy*

The first time *explanatory adequacy* was used as a term in generative linguistics was in Chomsky's address to the 1962 International Congress of Linguists, published also as Chomsky (1964). Chomsky compares two types of device that grammars may be thought to model, one for language processing and one for language acquisition (1964:26). He refers to the second one, represented in Fig. 1, as "(1b)" in the quote in (2).

- (2) a. a grammar that aims for observational adequacy is concerned merely to give an account of the primary data (e.g., the corpus) that is the input to the acquisition device (1b);
- b. a grammar that aims for descriptive adequacy is concerned to give a correct account of the linguistic intuition of the native speaker; in other words, it is concerned with the output of the device (1b);
- c. and a linguistic theory that aims for explanatory adequacy is concerned with the internal structure of the device (1b); that is, it aims to provide a principled basis, independent of any particular language, for the selection of the descriptively adequate grammar of each language. [Chomsky (1964:29)]

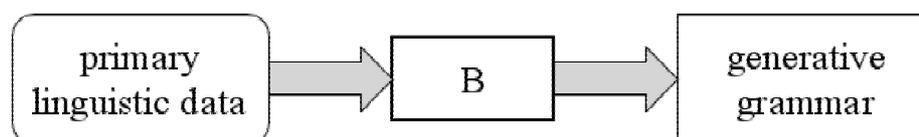


Fig. 1: Model of language acquisition

The approach to explanatory adequacy in (2) is to contrast it to observational and descriptive adequacy. Although (2) defines the three levels of adequacy in terms of Fig. 1, for a full understanding it is useful to refer also to the research programme of Chomskyan linguistics as represented in Fig. 2 (adapted from ten Hacken (2006:582)).

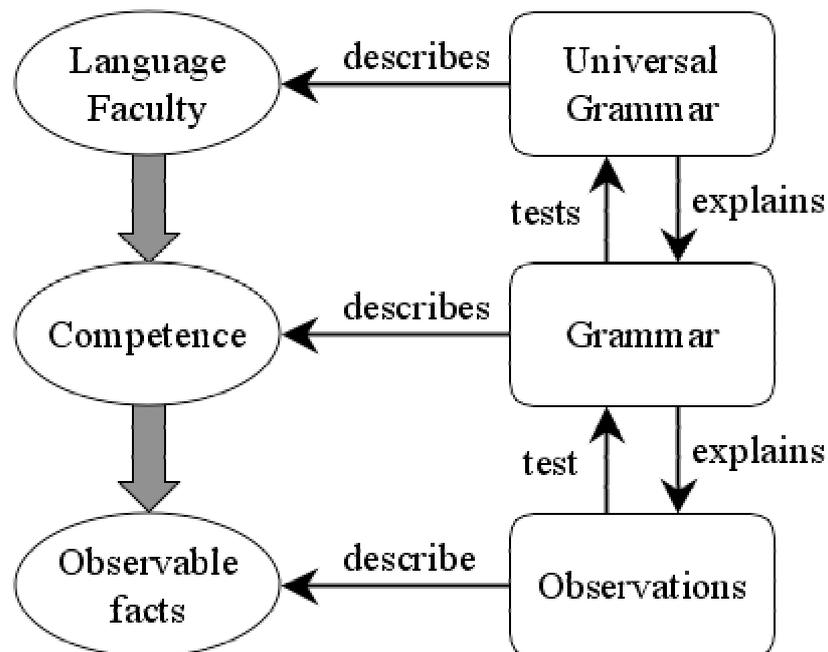


Fig. 2: The research programme of Chomskyan linguistics

In Fig. 2, the boxes on the left represent real-world phenomena and the boxes on the right theoretical constructs. Instead of the widespread ambiguous use of *grammar* and *universal grammar* (UG), these terms are here reserved for the theoretical concepts only. For the corresponding real-world items, *competence* (or *I-language*) and *language faculty* are used. The downward arrows indicate that the higher entity *underlies* the lower. This means that it is essential for its origin without determining all of its nature. In line with modern theory of cognition, e.g. Jackendoff (1989), it is assumed that observations are theory-driven constructs based on real-world facts. Therefore, instead of *data*, Fig. 2 depicts the observation of facts at the lowest level, where the facts belong to the outside world and the observations to the theoretical domain.

It is straightforward to match the three levels of adequacy in (2) with the three levels of theory in Fig. 2. Observational adequacy corresponds to a correct account of the observable facts, descriptive adequacy corresponds to a correct

account of the grammatical competence, and explanatory adequacy corresponds to a correct account of the language faculty.

### 3 The nature of explanatory adequacy in GB-theory

When Chomsky introduced the levels of adequacy in (2), his main argument was that observational adequacy is not an interesting goal to aim for (1964:52-55). There is an interesting relationship between the two higher levels of adequacy, hinted at in (3).

- (3) It is not necessary to achieve descriptive adequacy before raising questions of explanatory adequacy. [Chomsky (1965:36)]

Whereas (3) only states the temporal relationship as “not necessary”, the actual relationship is even stronger. A well-known theorem of mathematical linguistics is that for any finite set of data, an infinite set of context-free grammars can be devised. In the absence of any further evidence, we cannot even assume that the range of grammars to be considered is restricted to context-free grammars. Applying this insight to Fig. 2 raises a serious problem of indeterminacy. How can we discover which of the many possible grammars is the correct one? A central insight of Chomskyan linguistics depends on the analysis in (4).

- (4) The fundamental fact that must be faced in any investigation of language and linguistic behavior is the following: a native speaker of a language has the ability to comprehend an immense number of sentences that he has never previously heard and to produce, on the appropriate occasion, novel utterances that are similarly understandable to other native speakers. The basic questions that must be asked are the following:
1. What is the precise nature of this ability?
  2. How is it put to use?
  3. How does it arise in the individual?
- [Chomsky & Miller (1963:271)]

The three questions listed in (4) have often been repeated from the 1980s onwards, but usually in a different order. The reason is that Chomskyan linguistics uses question 3 in (4) as its primary tool to attack the indeterminacy problem, whereas question 2 is epistemologically side-tracked. This means that question 1, the basis for descriptive adequacy, can only be answered properly by simultaneously answering question 3. This is necessary to solve the indeterminacy problem. Therefore, (3) can be strengthened to the effect that descriptive adequacy can *only* be achieved as far as explanatory adequacy is achieved at the same time.

Questions 1 and 3 in (4) generate a tension because describing the observed I-languages in response to question 1 is easier with a more powerful grammar formalism, whereas explaining learnability in response to question 3 is easier with stronger constraints on the power of the grammar formalism. Question 2 is side-tracked in the sense that it does not have a role in constraining the theory. The only epistemological role assigned to the use of language is to produce the PLD in Fig. 1.

The transition from Chomsky's (1965) Standard Theory to Chomsky's (1981) GB-theory marks the solution of the tension between the two central questions. The difference in attitude is illustrated by the quotations in (5) and (6).

- (5) As a long-range task for general linguistics, we might set the problem of developing an account of this innate linguistic theory that provides the basis for language learning. [Chomsky (1965:25)]
- (6) What seems to me particularly exciting about the present period in linguistic research is that we can begin to see the glimmerings of what such a theory might be like. [Chomsky (1981:4)]

In (5), question 3 is set as a "long-range task", whereas in (6) an answer to this question has come in sight. In Standard Theory, competence was described in

terms of rewrite rules and transformations. Individual grammars were not learnable on the basis of PLD and the few universals that had been identified. In GB-theory, the Principles and Parameters P&P model managed to relax the tension between the constraints of expressivity and learnability. In fact, the tension was relaxed to such an extent that it lost its original epistemological significance. By adding parameters, expressivity could be increased without immediately affecting learnability.

In conclusion, we can say that the attempt to operationalize explanatory adequacy as formulated in (2c) led to a more advanced framework that allows for a deeper explanation of the data. In doing so, it opened up a new range of questions. It would be wrong to say that the P&P model caused the loss of the tension between descriptive and explanatory adequacy. Instead, the indeterminacy problem re-emerged at a deeper level.

#### **4 The use of explanatory adequacy in the MP**

The transition from GB-theory to the MP can be considered from two perspectives. For the syntactician, the transition consists above all of the replacement of a constraint-based approach by an approach based on economy. Whereas in GB-theory, move  $\alpha$  is constrained by principles, in the MP movement must be motivated. This revolutionizes the way syntacticians formulate their accounts for linguistic phenomena, but it does not directly affect the way these accounts are interpreted in terms of Fig. 2.

The MP can also be seen as an attempt to tackle the second-order indeterminacy problem raised by the solution of the tension between descriptive and explanatory adequacy in Fig. 2. The central idea in this perspective is that the MP reaches for a deeper level of explanation. An important step in this effort

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is the formulation of additional research questions. A new, extended list of questions is given in (7).

- (7) a. What exactly are these properties of things in the world?  
b. How do they arise in the individual  
c. and the species?  
d. How are they put to use in action and interpretation?  
e. How can organized matter have these properties (the new version of the unification problem)? [Chomsky (1993:46)]

The context of (7) is a presentation of the goals of linguistics as compared to other, more established sciences. The “properties of things in the world” in (7a) refers to I-language as a component of the human brain. The three questions in (4) are then (7a), (7d), and (7b), respectively. Two new questions are formulated. (7e) was added as a fourth question to the list by Chomsky (1988). In this more accessible work, he formulates it as “What are the physical mechanisms that serve as the material basis for this system of knowledge and for the use of this knowledge?” (1988:3), i.e. how is language realized in the brain. The fifth question, (7c), concerns the evolutionary origin of the language faculty.

In the same way as among the questions in (4), Chomsky selects one of the questions to determine the nature of explanation he wants to add to his framework, whereas the other question is epistemologically side-tracked. As also suggested by the order of questions in (7), the evolutionary origin of the language faculty is chosen to extend the model and the realization of the language faculty in the brain is treated in much the same way as the question of language use. The result can be represented as in Fig. 3.

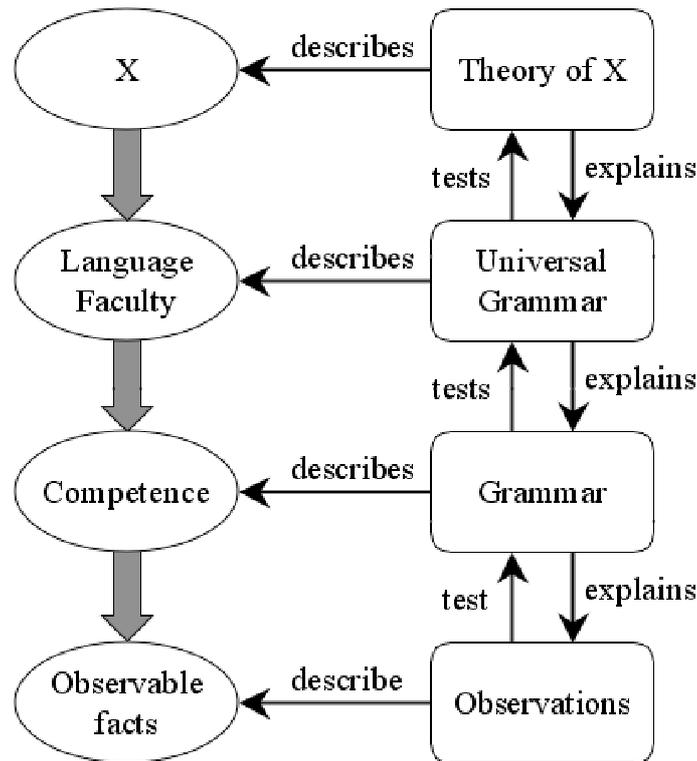


Fig. 3: Extended research programme of Chomskyan linguistics

The entire model of Fig. 2 is part of the model in Fig. 3. The extension adds a level with an entity X underlying the language faculty and a theory of X. In the same way as the language faculty underlies the competence in the sense that it is at its origin, the new real-world entity underlies the language faculty in the sense that it is at its origin. The two top levels in Fig. 2 represent language in the individual and the species. What underlies the origin of the language faculty in the human species must be a set of general biological principles. Since in the course of the twentieth century biology has been unified with chemistry and chemistry with physics, this level is no longer part of linguistics proper but belongs to the sciences in general. This the reason Chomsky (1993) refers to the “new version of the unification problem” in (7e).

At this point in time, we do not know what the real-world entity underlying the language faculty is. By extrapolating from Fig. 2, however, we can derive a number of relevant properties. An entity of this type is ideally

described by a theory of the appropriate kind. Of course, we do not have such a theory yet. We know, however, that it will explain Universal Grammar in a way parallel to how UG explains individual grammars. Conversely, UG can be used to test this new, high-level theory as it is one of the phenomena covered by it. We can use this additional level without knowing in any detail what the real-world entity and the theory describing it are, because in linguistics we are only interested in the effects they have on the language faculty and UG.

This extension of the model has repercussions for the discussion of the levels of adequacy. As formulated in (2), the levels of adequacy correspond to the levels of theory in Fig. 2. Since Fig. 2 is entirely subsumed in Fig. 3, GB-theory and the MP are equivalent in terms of (this variety of) explanatory adequacy. Explanatory adequacy is achieved if UG correctly describes the language faculty. The difference between the GB-theory and the MP can only be expressed by naming the type of adequacy corresponding to the additional level in Fig. 3. The two main possibilities how this can be done are formulated in (8).

- (8) a. Extending the three levels of adequacy in (2) by adding a new, higher level, e.g. *unificational adequacy*.
- b. Relativizing the opposition between descriptive and explanatory adequacy to the level of theory at which it applies.

Whereas (8a) is an adequate way to dispose of the naming problem, it does not add any insight. Therefore, option (8b) will be pursued here in order to explore the insight that can be gained by it.

## 5 Relativized explanatory adequacy

The general idea of relativized explanatory adequacy is that the opposition between descriptive and explanatory adequacy is formulated without referring to a particular level. This enables us to apply it to any level, highlighting the similarities and parallels between the individual levels.

## 5.1 The nature of relativized explanatory adequacy

Explanatory and descriptive adequacy can be relativized with respect to the level of application by the definitions in (9). These definitions refer to the underspecified architecture in Fig. 4, and use the notion of *level* as defined more formally in (10).

- (9) a. Descriptive adequacy is achieved relative to level  $i$  iff the theoretical entity at level  $i$  describes the real-world entity at level  $i$  adequately.  
 b. Explanatory adequacy is achieved relative to level  $i$  iff there is a theoretical entity  $t$  at level  $i + 1$  such that  $t$  adequately describes the real-world entity at level  $i + 1$  which underlies the real-world entity at level  $i$ .
- (10) a. At each level  $i$ , a theoretical entity  $t_i$  describes a real-world entity  $r_i$ .  
 b. At level 0,  $r_0$  are observable facts and  $t_0$  observations.  
 c. For each  $r_i$  and  $r_{i+1}$ ,  $r_{i+1}$  underlies  $r_i$ .

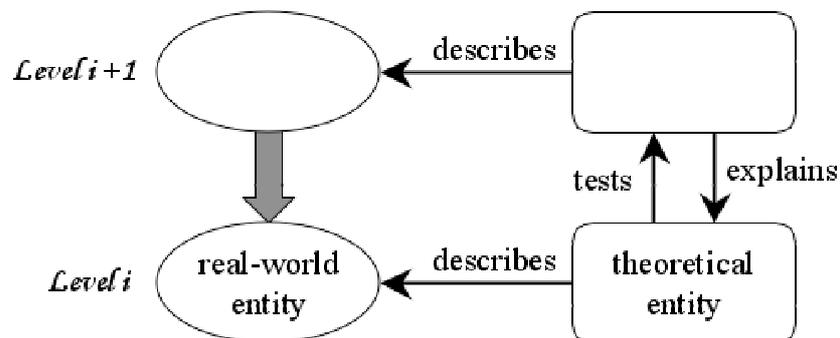


Fig. 4: Architecture for relativized descriptive and explanatory adequacy

In Fig. 4, levels  $i$  and  $i + 1$  are represented, but only for level  $i$  all elements are named, thus highlighting that this is the level with respect to which descriptive and explanatory adequacy are expressed. Informally stated, relativized descriptive adequacy concerns the arrow labeled “describes” in Fig. 4 and relativized explanatory adequacy the arrow labeled “explains”. However, whereas descriptive adequacy can be expressed directly as a relationship between the two elements at either end of the arrow as in (9a), explanatory adequacy has to refer to all four elements in Fig. 4. As expressed in (9b), the

identification of the element from which the “explains” arrow starts is not possible without mentioning the real-world entities at both level  $i$  and level  $i + 1$ .

The simplest application of (9) is the case where  $i = 1$ . In that case, the real-world entity in Fig. 4 is the competence in Fig. 2 and the theoretical entity the individual grammar. For  $i = 1$ , descriptive and explanatory adequacy according to (9) correspond directly to the concepts in (2b-c). Note that it is not necessary to specify the entities at level  $i + 1$ . Explanatory adequacy at level 1 requires that the competence is learnable in the way it is described by the grammar. It is a property of the description of the competence.

If  $i = 0$ , the focus of attention is the linguistic facts. Descriptive adequacy means that the facts are described correctly. Explanatory adequacy means that they are described such that they can be produced by an underlying competence. The difference from observational adequacy in (2a) is above all that level-0 descriptive and explanatory adequacy are properties of the way the data are treated, whereas observational adequacy is a property of the grammar.

The scope of the model can be extended to the MP when  $i = 2$ . At this level, descriptive adequacy means that the language faculty is described correctly and explanatory adequacy that it is described such that its emergence in the course of evolution was possible. It is essential to see the difference between level 2 descriptive adequacy and level 1 explanatory adequacy. Level 1 explanatory adequacy is a property of the competence, but level 2 descriptive adequacy is a property of the language faculty. An idealization such as instantaneous language acquisition is perfectly reasonable in the context of level 1 explanatory adequacy, but much less so in level 2 descriptive adequacy. At level 2, explanatory adequacy can be achieved without specifying the overarching theory at level 3. Only the influence on the emergence of the

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language faculty should be specified, and this only to the extent that the logical problem of its emergence can be solved.

## **5.2 The use of relativized explanatory adequacy**

The reason why the concept of relativized explanatory adequacy is interesting is that there are interesting parallels between the applications to different levels. There are at least two areas where such parallels can be observed. First, at different levels there is an opposition between logical and practical problems. Second, at different levels there is a tension between descriptive and explanatory adequacy.

The opposition between a logical problem and a corresponding practical problem was identified by Hornstein & Lightfoot (1981) for (first) language acquisition. The practical problem is the version that is recognized in real life. The logical problem makes abstraction from a number of factors that complicate the problem. A formulation of the practical problem may seem simpler, because many factors are added to it by common-sense knowledge. The logical problem is how the child manages to construct a highly complex system on the basis of restricted input. The simple answer is to refer to the language faculty. A more interesting answer is a description of the properties of the language faculty that make first language acquisition possible by filling the logical information gap between the input and the acquired competence.

A similar opposition between logical and practical problems can be observed in various other areas. White (2003:22-56) discusses the logical problem of second language acquisition. Here there is also an information gap, but this time between on the one hand the L2 input (naturalistic or teaching) and the L1 competence, and on the other hand the interlanguage competence. This gap is less impressive than in the case of first language acquisition, because the second language learner has access to more types of data, e.g. explicit teaching

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and negative evidence, and in general achieves a lower level of competence. Nevertheless, White argues that it cannot be bridged without assuming the involvement of the language faculty. An important class of evidence is those cases where the learner's interlanguage competence diverges in parameter settings both from the L1 competence and from the I-languages in the L2 speech community. Interlanguage competence and its acquisition therefore provide further evidence for the nature of the language faculty.

A third example where logical and practical problems have been distinguished is in the discussion of language change. Roberts & Roussou (2003:9ff.) see the logical problem as the question of how change can ever take place. Their answer is that change takes place when the parameter setting of the originating I-language cannot be obtained on the basis of the input the child gets in language acquisition.

If we compare these three logical problems, the last one stands out as not involving an information gap. Although it is a logical problem in the sense that it makes abstraction of certain superficial observations in order to make research in a particular area relevant to the study of the language faculty, it does so in a different way. As opposed to the first two it does not take the form of using a gap between input conditions and observed output to measure the contribution of the language faculty. The main epistemological difference between the first two problems is that first language acquisition is crucial for the existence of language in a way second language acquisition is not. Only first language acquisition is a problem that directly renders the architecture in Fig. 2. The other two provide external evidence.

The three problems considered so far all concern explanatory adequacy of level 1. Let us now consider pairs of logical and practical problems at other levels. At level 0, the question is how to account for the linguistic facts. The

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logical problem is that of linguistic creativity. This is of course a well-known subject in early generative grammar, corresponding to Chomsky's (10).

- (10) The most striking aspect of linguistic competence is what we may call the 'creativity of language', that is, the speaker's ability to produce new sentences, sentences that are immediately understood by other speakers although they bear no physical resemblance to sentences which are 'familiar'. [Chomsky (1966:4)]

Chomsky does not explicitly distinguish a logical and a practical problem in (10), but there are clear parallels with the logical problem of language acquisition. There is an information gap between the input and the performance of speakers. This can be solved by assuming the existence of linguistic competence that transcends the input. In the context of (10) it is essential to distinguish the problem under consideration from the problem of the creative use of language, i.e. the use of linguistic competence, which, as Chomsky states, "still seems to elude our understanding" (1975:77). The creative use of language can be seen as the practical problem corresponding to the logical problem in (10). It is not accidental that linguistic competence is at the origin of creative use in the same way as the language faculty is at the origin of the competence.

When we pursue this line of reasoning to level 2, we expect to find a logical problem pertaining to the origin of the language faculty. In current discussion, the origin is interpreted as the evolutionary origin. In generative linguistics, we find two main positions as to the evolutionary origin of human language. One, represented by Jackendoff (2002:231-264), analyses the evolution as a succession of steps resulting in the language faculty as the human species has it now. This results in intermediate stages of which at least one receives a name, *protolanguage* (2002:238).

The other, represented by Hauser et al. (2002), approaches the evolution of the language faculty analytically in the same way as Chomsky approached the

problem of (10) analytically. Chomsky (1980:224-226) analyses what underlies linguistic performance into a number of interacting modules. One of them is grammatical competence. Another is what he calls “pragmatic competence” which “places language in the institutional setting of its use, relating intentions and purposes to the linguistic means at hand.” (1980:225). Yet other components, such as free will, remain outside the domain of analysis. Hauser et al. (2002) argue that the language faculty should also be analysed into components. They distinguish the *Faculty of Language in the Narrow sense* (FLN), as the main object of attention, as well as a number of other components that belong to the *FL in the Broad sense* (FLB), e.g. the conceptual-intentional module and the sensory-motor module (2002:1570-1). FLN is “the abstract linguistic computational system alone” (2002:1571), whereas the other two named components of FLB are interfaces to sound and meaning.

At first sight it is tempting to see the difference between the two views of evolution as one between a logical and a practical problem of language evolution. There are various reasons to be sceptical of such an approach, however. The logical problem of language acquisition makes the idealization of instantaneous acquisition, whereas more realistic studies of the process, cf. Guasti’s (2002) overview, would never make such an idealization. Hauser et al. (2002) also propose a kind of instantaneous evolution, based on their analysis of the transition from a species without to a species with the language faculty in (11).

- (11) For example, suppose we adopt the conception of hypothesis 3, oversimplifying radically, that the interface systems—sensory-motor and conceptual-intentional—are given, and the innovation that yielded the faculty of language was the evolution of the computational system that links them. [Hauser et al. (2002:1578)]

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In (11), “hypothesis 3” refers to the hypothesis that only FLN distinguishes human language from communication systems used by other species. Even though (11) is formulated as an example of a possible supposition, the status of instantaneous evolution is not that of an idealization but of a hypothesis. Ten Hacken (to appear) gives a more elaborate analysis of the difference between the two analyses and the discussion between their proponents.

Let us now turn to the parallels between different levels in the tension between (relativized) descriptive and explanatory adequacy. For level 1, this tension is explained in section 3 above. The central properties are that expressivity and learnability exert opposite forces on the power of the constraints governing the way competence can be described. This tension was resolved by the new P&P framework.

At level 0, the tension concerns the way linguistic facts are described. Descriptive adequacy requires that all grammaticality judgements and other data can be accounted for. Explanatory adequacy means that this account has to be in terms of regularities rather than lists. This tension was solved at the start of generative linguistics when Chomsky proposed to use rewrite rules and transformation rules as a way to describe the mental component underlying these data. While it may seem trivial now, this tension is what makes observational adequacy as defined in (2a) not worthwhile as a goal.

At level 2, the tension between descriptive and explanatory adequacy concerns the language faculty. Expressivity now means having enough parameters available to describe the differences between I-languages. The constraining factor is that the language faculty must have emerged in the course of evolution. There are two approaches to making the evolution operational as a criterion. In Jackendoff’s (2002) approach, each intermediate stage is motivated by competitive advantages compared to the preceding stage. In Hauser et al.’s (2002) approach, the essential property that makes the language faculty

operational is a formally relatively simple element, FLN, for which evolution by exaptation is conceivable. It is the latter approach that is adopted in the MP. The new mechanism corresponding to rewrite rules and transformations at level 0 and principles and parameters at level 1 seems to be the set of economy principles. As described, for instance, by Chomsky (2000), these economy principles are meant to be derived from external necessity and to be sufficient to derive from the FLN all properties of the language faculty which we need in view of its function in the account of language.

In conclusion, relativized descriptive and explanatory adequacy highlights a number of parallels between different levels of explanatory depth. If the transition from Standard Theory to GB-theory is seen as reaching for a deeper level of explanation, the transition from GB-theory to the MP can be considered as having a similar impact.

## **6 The logical origin of explanatory adequacy**

For a theory to achieve explanatory adequacy, whether in the sense of (2c) or of (9b) two conditions have to be fulfilled. First, the theory has to address a question that asks for an explanation (of the relevant type). Second, it has to propose a plausible answer to this question. The type of question to be asked is exemplified by the questions listed under (4) and (7). From an epistemological point of view it is essential to separate the choice of a question and the effort to answer it. Once a question has been chosen, scientific practice can work along the empirical cycle in (12).

- (12) a. Select a set of data.
- b. Formulate appropriate generalizations about the data.
- c. Formulate a theory as a hypothesis about the system underlying these generalizations.
- d. Test the theory by deriving new generalizations and carrying out experiments.

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The procedure in (12) is cyclic, because the experiments in (12d) will yield new data, extending the set in (12a), which will typically lead to additional or corrected generalizations in (12b) and an adaptation of the theory in (12c). The empirical cycle in (12) does not work in isolation. Without proper guidance, there are too many possible observations, too many possible generalizations, and too many possible theories. Ten Hacken (2006, to appear) elaborates this point and develops the notion of a *research programme*. A research programme is a set of assumptions that guides the selection and constrains the search space for each of the elements in (12) combined with criteria to evaluate the success of alternative theories. Chomskyan linguistics can be seen as a research programme in linguistics. Other research programmes are, for instance, Lexical-Functional Grammar (LFG) and Head-Driven Phrase Structure Grammar (HPSG).

It is not always easy to recognize the boundary between what belongs to the research programme and to the theory. In the case of Chomskyan linguistics, we are lucky in this respect, because the assumptions of the research programme have been discussed, attacked and defended to such an extent that they have been made much more explicit than is usual for research programmes. Moreover, Standard Theory, GB-theory and the MP constitute successive stages of the theory, which can be interpreted as operating within the same research programme. A strong motivation to consider them part of the same research programme is that they use the same criteria to measure success.

The question of the explanatory adequacy of the MP, as raised by (1a), can only be answered by means of the reference framework made available by the research programme. The research programme determines the question underlying explanatory adequacy. An isolated theory is like an isolated answer. The MP's potential for achieving explanatory adequacy derives from the research programme of Chomskyan linguistics. The extent to which this explanatory adequacy is realized can only be measured by means of the criteria

that are also part of the research programme of Chomskyan linguistics. Therefore, the research programme is the origin of the explanatory adequacy of a theory.

## 7 The opposition between the MP and OT

The MP is not only a theory that determines an approach to the questions asked by the research programme of Chomskyan linguistics. It also involves a formalism for the expression of the answers. The formalism is essential to achieve a sufficient degree of formalization to make claims precise and discuss them meaningfully within the research programme. Typical examples of components of formalisms are the ones listed in (13).

- (13) a. Phrase structure rules
- b. Feature structures
- c. Transformation rules
- d. Unification operations

In practice, a formalism usually consists of a selection of elements. Standard Theory uses (13a) and (13c), LFG uses (13a) and (13b), HPSG (13b) and (13d). The choice of formalism is to a large extent independent of the research programme. Whereas it is often possible to translate a theory from one formalism into another, it is much more difficult to translate a theory from one research programme to another one. The reason is that in one case, only new means of expression of the ideas have to be found, in the other a new underlying motivation.

The most striking difference between the MP and OT is the formalism used. MP uses *merge* as its central operation and trees as the way to represent the resulting structure. OT, as presented by Archangeli (1997), uses GEN and EVAL as its operations and represents the results in terms of tableaux.

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Against this background, we can consider different interpretations of the nature of OT. If the description of the formalism exhausts its definition, we expect that it can be used in principle in various research programmes. In the same way as the mechanisms in (13), OT would only determine *how* theoretical statements are made, not *what* they are made about and *why* they are interesting. In this *formalism interpretation*, no questions as to the truth of OT arise. The only questions concern its expressivity. Alternatively, if OT is a proper theory, it has to be embedded in a research programme. In this *theory interpretation*, it makes sense to consider questions of truth and adequacy and use the evaluation criteria provided by the research programme.

The evidence as to whether the formalism interpretation or the theory interpretation of OT is correct is somewhat mixed. Archangeli (1997:2-4) suggests that the research programme of Chomskyan linguistics constitutes the background of OT. On the other hand, Bresnan claims that “LFG is actively being developed in an OT setting” (2001:122, fn. 1). In fact, in a single volume we find Legendre et al.’s (1998) analysis of *wh*-chains competing with an MP account and Bresnan’s (1998) analysis of weak cross-over effects in an LFG framework.

The best conclusion we can draw is that OT is different things to different people. As a technique it is used in different theoretical settings. Bresnan’s use of OT does not compete with the MP in any direct sense. We could assume that LFG as a research programme competes with Chomskyan linguistics, although, as discussed in detail by ten Hacken (to appear), such discussions are often indirect and usually problematic in nature. When Legendre et al. (1998:285-287) discuss the relationship between OT and MP, however, they treat them as alternative ways of accounting for the same phenomena. This is only possible if they make a different set of additional assumptions, both theoretical and meta-theoretical, than Bresnan.

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There is a clear parallel between OT and phrase structure grammar. Phrase structure grammar is used in Standard Theory to generate deep structures and in LFG to generate c-structures. The formalism is basically the same, but it is used in different research programmes. In the MP the last vestiges of explicitly formulated phrase structure rules have long been dropped. The question whether phrase structure rules contribute to explanatory adequacy can only be addressed meaningfully within a particular research programme. That the MP has a higher degree of explanatory adequacy than Standard Theory depends on the relationship of both theories to the research programme of Chomskyan linguistics. Arguably, part of this increase in explanatory adequacy can be attributed to the abolition of phrase structure grammars in a general sense, but this evaluation depends more on the nature of Chomskyan linguistics than of phrase structure rules. It is not possible to use this evaluation as a basis for drawing a parallel conclusion as to the position of phrase structure rules in LFG. Similarly, the contribution of OT to explanatory adequacy can only be determined in the comparison of two full theories in the same research programme, not as an element of the formalism used both in Chomskyan linguistics and in LFG.

## **8 Conclusion**

In this paper, an analysis of explanatory and descriptive adequacy has been proposed as an approach to the central claims in (1). It was first of all shown that the levels of adequacy as originally proposed by Chomsky (1964) do not apply in any transparent way to the MP. As they are formulated in (2) they lack the necessary generality. In order to solve this problem, the concept of relativized level of adequacy was introduced in section 5. This concept is more generally applicable and can be used also in the context of the MP. Adequacy of any level

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cannot be assigned to a theory in isolation, however. It crucially depends on the embedding of the theory in a research programme.

At this point, we can summarize the nature, use, and origin of explanatory adequacy as follows. Explanatory adequacy means that, at a particular level of theoretical depth, the real-world entity at this level is adequately explained in terms of the level above it. The use of discussing explanatory adequacy at different levels is to show the logical connections between the historical stages of theoretical discussion in a field. Its origin is always a research programme. The role of the research programme is on the one hand to determine the questions with regard to which an explanation has to be provided, on the other hand to provide evaluation criteria to determine to what extent the potential explanatory adequacy is realized in a theory.

The way the tension between descriptive and explanatory adequacy is constructed as an opposition between different theories, as in (1), is highly problematic. The problem of indeterminacy as discussed in section 3, implies that they can only be reached together. If the MP and OT in (1) are to be understood as comparable entities, this implies a particular interpretation of OT, because explanatory adequacy does not come from a theory, but from a research programme. Assuming that both are theories in Chomskyan linguistics, we exclude from consideration any use of OT in other research programmes, e.g. LFG. In the context of Chomskyan linguistics we can compare the extent to which explanatory adequacy is realized by the MP and OT, but we cannot construct this as a contrast in which the MP is better at explanatory adequacy and OT better at descriptive adequacy. As Chomsky (1998:117) emphasizes, *explanatory adequacy* is a technical term and should not be confused with the potential of a theory to provide explanations. The most plausible interpretation of (1) is then that description is easier in OT than in the MP, considered as two

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alternative theories in Chomskyan linguistics. *Description* in this informal use is only vaguely related to *descriptive adequacy* in the technical sense.

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*Pius ten Hacken*  
*Department of Translation*  
*School of Arts*  
*Swansea University*  
*Singleton Park*  
*Swansea*  
*SA2 8PP*  
*United Kingdom*  
*p.ten-hacken@swansea.ac.uk*