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Inconsistency and plausible reasoning in an analysis of German affricates: A case study in the philosophy of linguistics

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Abstract

The paper puts forward a metatheoretical approach which is capable of accounting for the emergence and resolution of contradictions in linguistic theories. After the main tenets of this approach have been introduced, the authors illustrate them by carrying out a detailed case study on the argumentation structure of an analysis of German affricates. In the final section general conclusions are drawn that go beyond the particular case study and reveal hidden aspects of theory construction in linguistics. The main finding is that linguistic theories work in a way fundamentally different both from what the analytical philosophy of science and practicing linguists themselves assume.

Keywords: Theory of linguistics; Phonology; Plausible reasoning; Scientific argumentation; Scientific reasoning

1. Introduction

1.1. Metatheoretical preliminaries

In their well-known textbook on the philosophy of language, Devitt and Sterelny describe the relationship between linguistics and metascientific theories as follows:

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> There is obscurity and controversy not only over the problems for which we need theories of language but also over the status of the theories themselves. This issue of status is highly abstract: it requires a theory of theories of language, a 'meta-theory'. It would be nice to ignore the meta-theory and get on with the theory, but that is a luxury *we cannot afford*. We think that many mistakes in the theory of language arise from a *mistaken meta-theory*. Further, we think that these mistakes are often facilitated by a failure to be explicit about the meta-theory: *once the implicit meta-theory is exposed, it can be seen to be implausible and unsupportable* (Devitt and Sterelny, 1999, p. 9; italics added).

Each of the linguistic theories that evolved—partly as a result of, and partly as a reaction against the development of generative linguistics—in the second half of the twentieth century presupposes the existence of an implicit metatheory which it takes for granted and the background assumptions of which it does not query. Though the pluralism and heterogeneity of theoretical linguistics is well-known and thus the metatheories behind linguistic theories may also be diverse, a significant portion of these metatheories share certain well-describable common features. These common features correspond to the so-called 'standard' or 'received view' of the analytical philosophy of science[1]:

> While the assumption is not always explicit, linguists apparently take for granted the standard view of the structure, function, and methods for evaluation of explanatory theories in *empirical* science (Ringen, 1975, p. 3).

This approach has not changed a bit in the last decades—for the most part, the implicit metatheory of generative linguistics and that of the wider domain of current theoretical linguistics which developed in relation to generative linguistics *consider the above mentioned standard view as unquestionably valid*.[2] However, what the sentences quoted from Devitt and Sterelny's book suggest is that we need not accept the standard metatheoretical approach uncritically.

As the question of the applicability of the standard view was raised quite sharply but primarily with respect to the empirical status of generative linguistics in the metascientific debates in the 1970s and the 1980s, in this paper we wish to investigate it from a perspective largely neglected so far: from the perspective of certain peculiarities of *linguistic argumentation*.

As is well-known, within the standard view two criteria for the acceptability of empirical theories are especially relevant: scientific theories have to employ *valid deductive inferences*, and they have to be *logically non-contradictory*. If linguistic theories presuppose the standard view as their implicit metatheory, then (H1) follows as a consequence:

(H1) Acceptable linguistic theories
- (a) solely employ valid deductive inferences, and
- (b) maintain the law of non-contradiction.

[1] See Suppe (1977) for a detailed discussion of the 'received view'.

[2] Chomsky (2000) still maintains that linguistic theories should adopt the same criteria which *seem* to apply to scientific theories investigating any other aspect of the natural world. In advocating his recent approach to what he calls 'naturalism', he claims: 'a 'naturalistic approach' to the mind investigates mental aspects of the world as we do any others, seeking to construct intelligible explanatory theories, with the hope of eventual integration with the 'core' natural sciences.' (Chomsky, 2000, p. 76).

We intend to show that (H1) is 'implausible and unsupportable' for the reason that the practice of linguistic theorising differs significantly from the norm that (H1) imposes. We intend to argue for the following hypothesis, as against (H1):

(H2) There exist linguistic theories,
  (a) the claims of which bear plausible but not deductive inference relations to each other and
  (b) which violate the law of non-contradiction.

At the outset, we briefly need to present those considerations which motivate the opposition just shown between (H1) and (H2).

First: according to (H1), those linguistic theories which are characterised by (H2) should be considered unacceptable because they do not comply either with the criterion that we are to employ only valid deductive inferences or with that which requires them to obey the law of non-contradiction. At the same time, such a theory can still be 'successful', 'productive', 'workable' and, judging by the general reception, may significantly contribute to the proper handling of those problems the solution of which it regards as its objective (the expressions in quotation marks are used pre-explicatively).

Second: a significant number of practising researchers accept hypothesis (H1) while applying non-deductive inferences during the solving of a problem at almost every step—but they do so *without any overt reflection on this fact*. This can mean two things: either they labour under the delusion that—driven by the norms of the standard view—they are employing valid deductive inferences and proceed in a non-contradictory manner, whilst their inferences are in fact not deductive, and possibly contradictory; or they may be suspicious that they are not proceeding according to (H1) but they do so with a guilty conscience. That is: the image that a significantly large group of linguists project of their own work, either with an implicit or an explicit acceptance of (H1), differs substantially from some of the actual practice of their professional activity.

Third: in view of the complexity of the problems posed by the relation between (H1) and (H2), which could only be captured by rather lengthy metascientific analyses, we do not intend to *prove* (H2) exhaustively but only to demonstrate it through an expediently presented and therefore instructive example. For this reason, this paper centres on a *case study* whose only purpose is to support the *implausibility* of (H1) and the *plausibility* of (H2).[3]

1.2. On the case study

The case study will deliberately and consciously focus on an approach which is no longer up to date and belongs to the *history of linguistics*, but whose peculiarities make it particularly suitable for our purposes. The case study we chose will investigate Wurzel's reasoning in his analysis of German affricates (Wurzel, 1981).[4] So as to avoid misunder-

[3] Cf. (3) in Section 4.1.

[4] We will consider the whole of Wurzel (1981)—which is a particular (somewhat 'eclectic') version of generative phonology and a comprehensive approach to the segmental phonology of German—a 'theory'. Since the notion of 'theory' is not relevant for our line of thought, we will not define it. Wurzel's account of German affricates is an 'analysis' of certain data using basic tenets of this theory.

standings, it is useful to call the reader's attention to a couple of relevant considerations which concern both the choice and the nature of this case study at the outset.

First, the object of our investigation will *not* be the phoneme system of German, that is a subsystem of *language*, but particular aspects of phonological *inquiry*. Consequently, the discipline which our study belongs to and whose conventions it obeys is *not* linguistics, but *the philosophy of science*. Therefore, our aim is *not* to find the 'truth' concerning the phoneme system of German by selecting the 'best' phonological theory, but to analyse the argumentational structure of a particular phonological theory.

Second, in accordance with this, the case study is to be interpreted as a kind of *thought experiment* which starts from the reconstruction of certain aspects of an existing linguistic theory and which uses the result of the reconstruction as premises of conclusions concerning the nature of theory formation that *without* this reconstruction could not be drawn (Kertész, 2004a). In other words, we will strive to show two things. On the one hand, the reasoning applied in the theory we examine can be reconstructed with the help of the method we suggest. On the other hand, we will also show that the *conscious* use of the techniques of reasoning thus revealed may—*within* the boundaries of the given theory and *without* changing the historical conditions in which it was originally developed—outline novel and perhaps even more plausible solutions to the problems the theory tackles than those put forward by its proponents.

Third, it is one of the most widely applied methods of the philosophy of science that assumptions concerning the nature of scientific theories are exemplified by carefully chosen *case studies*. Normally, these case studies do not concern current theories, but are taken from the history of science. For example, Imre Lakatos analyses a geometrical problem discussed some 200 years ago in order to support his approach to the philosophy and methodology of mathematics. Sneed, the founder of 'the structuralist view of theories', built his approach on a careful analysis of Newton's theory of particle mechanics. Kuhn illustrated his famous claims that revolutionalized the philosophy of science by examples such as phlogiston theory, affinity theory in chemistry or Copernicus' astronomy.[5] It is no accident that in the philosophy of science very often historical case studies are chosen so as to exemplify certain well-defined issues. We know that Kuhn's *The Structure of Scientific Revolutions* (Kuhn, 1970) led to a new understanding both of the nature of scientific knowledge and the nature of the philosophy of science. One of the main claims of Kuhn's work was that the workability of philosophies of science may be judged by examining to what extent they are capable of accounting for the processes which were witnessed by the *history of science*. That is, the workability of a certain metascientific approach is to be seriously questioned if one can show that it does not capture most of the theories which in a given historical period were considered as 'scientific' and, at least to a certain extent 'acceptable', or at least as a possible alternative worth being disputed.

Fourth, we have further substantial reasons for choosing this very example. Namely, in the seventies and eighties Wurzel's phonology was considered to be successful and

[5] It is important to emphasize that in the heated discussions which these approaches gave rise to, one particular argument never occurred: namely, that the reason why these authors turned to such old theories is that they were not aware of later developments of the discipline at issue. That is, the fact that, as the object of our analysis, we chose an approach which was put forward about three decades ago must not mean that we have never heard of current approaches to the same issues, that we 'believe' in this theory or that we think it to be 'true'.

acknowledged as such,[6] although it was fiercely disputed as well.[7] Therefore it provides an excellent opportunity to test whether a theory which in a certain historical period was considered to be successful and workable complies with (H1) or not.

Fifth, there is, however, a peculiar factor which makes Wurzel's analysis particularly interesting from the perspective of linguistic argumentation: Wurzel's account is the seventh chapter of the academic grammar of the German language edited by Heidolph et al. What the editors set up as the main objective of the volume is a description of the system of language which should communicate not only the *results* of research, but it has to point out the *motives* for the decisions at issue as well and to reveal *possible alternative solutions* so that in obscure cases dogmatic preconceptions can be avoided. Accordingly, the authors did not strive to put forward a *resultative* grammar, but rather, a *problem-oriented presentation* of the grammatical regularities of contemporary German (Heidolph et al., 1981, p. 5).[8] Wurzel, acting all along under this guiding principle, endeavours to weigh up the possible arguments and counterarguments as carefully as possible (cf., for example, Wurzel, 1981, p. 912, 937f, 940, etc.) with the aim of finding the best possible alternative—not hiding the fact that sometimes he does not find a solution satisfactory in every respect. Accordingly, our task in the present paper is *not* to examine the general, declared methodological assumptions of generative phonology but to reveal the inference patterns *applied in the textual explication of Wurzel's argumentation*. Only in this way can we cast light upon how the practice of linguistic theorising potentially diverges from the declared norms.[9]

Finally, Wurzel's approach is relatively simple and is, therefore, well-suited for illustrating issues which turn up in many other—and perhaps 'better' and more 'adequate'—theories as well, but in a *more hidden* and *more complicated way*. In particular, both the technique of reasoning he applied and the mistakes he made seem to be *typical* and can be revealed relatively easily and clearly.[10] This facilitates drawing metatheoretical conclu-

[6] By 'successful' and 'workable' we mean—in full accordance with our approach to plausible reasoning as outlined in Section 2 of the present paper and as already mentioned in Section 1.1—the *heuristic potential* of Wurzel's analysis: namely, its capability of solving the problems it tackles by using its own means and/or its capability of raising new problems which can be captured by the same means or which, alternatively, give rise to approaches going beyond the scope of the theory at issue. By 'acknowledged as such' we mean that in the German literature it has been considered as a major achievement not only in the seventies and eighties but in current works as well. For later evaluations of Wurzel's analysis of German affricates see for example such classical contributions as Luschützky (1992), Prinz and Wiese (1991), Wiese (1996) etc.

[7] See for example Wiese (1985).

[8] This might appear as trivial from the point of view of present-day conventions of theory formation in linguistics. But in the seventies it was far from self-evident that a grammar of German should focus on an argumentative presentation of the issues it tackles.

[9] On an analysis of the same example from other points of view, cf. also Kertész (1993, Chapter 8), which discusses the heuristics of Wurzel's analysis of affricates built on plausible inferences from the perspective of the didactics of phonological problem solving, as well as Kertész (2004a, Chapters 21–26).

[10] That the technique of reasoning Wurzel uses is *typical* can be shown, of course, only by a series of further case studies leading to the same findings which we put forward in this article. The scope of the present paper does not permit such a detailed proof. Nevertheless, in other publications of ours we argued that the same mechanism of plausible reasoning can be revealed in very different linguistic theories such as Chomsky's Government-Binding Theory, Lakoff and Johnson's Cognitive Theory of Metaphor, Bierwisch and Lang's Two-Level Approach to Cognitive Semantics, and Gricean approaches to pragmatics. See Kertész (2004a,b), Kertész and Rákosi (forthcoming-a, forthcoming-b, in preparation).

sions whose tenability would be difficult to prove in the case of more refined, more complex and less faulty theories.

Based on these motivations, we intend to find an answer to the following question with this case study[11]:

(Q) Does Wurzel's analysis of affricates meet the requirements in (H1)?

As an answer to this question, we formulate the following *hypothesis*:

(H2′) It does not, because

(a) it is not deductive but *plausible* inference relations that the claims of Wurzel's analysis of affricates bear to each other, and

(b) it *violates* the law of non-contradiction.

The remarkable character of this hypothesis is highlighted especially well by the fact that Wurzel's approach is one of the theories that were rooted in Chomsky and Halle (1968),[12] thus general opinion would naturally embed it in the frame of linguistic theorising that Chomsky outlines in, for example, *Syntactic Structures* and some aspects of which we described in (H1).

1.3. On the structure of the paper

In accordance with what has been said we will proceed as follows.

We provide a brief summary of the basic tenets of our approach to plausible inferences in Section 2. The background knowledge necessary to understand point (a) of hypotheses (H1) and (H2) is summed up in Section 2.1, inasmuch as we survey the relation between deductive and plausible inferences. In Section 2.2, we illustrate point (b) of the two hypotheses referred to above by describing the correlation between inconsistency and the use of plausible inferences. We summarise the results of this survey in Section 2.3.

The above mentioned case study is presented in Section 3 by utilising the concepts and the background assumptions of the approach to plausible reasoning which have been introduced. In Sections 3.1–3.4, we reconstruct that system of plausible inferences which leads to a contradiction in Wurzel's analysis, and in Sections 3.5 and 3.6. we take stock of the possible ways of resolving this contradiction. We will show, however, that within Wurzel's system this contradiction is irresolvable and that, accordingly, (H2′) is tenable.

Finally, we will infer (H2) from the plausibility of (H2′) in Section 4. Accordingly, from this fairly special case study, we will draw *general* conclusions which have significance well beyond themselves and characterise fundamental mechanisms of theory-formation in linguistics. In this way we wish to undermine certain preconceptions which are widespread in linguistics but which in general remain non-reflected.

[11] Wurzel (1981) is a comprehensive approach to the phonology of German which might well be called a 'theory' in whatever sense. Part of this is Wurzel's account of affricates which we will treat as particular analysis carried out within the framework of that theory.

[12] Nevertheless, Wurzel (1981) is not a clear case of the SPE approach. For example, he attributes a substantial role to 'phonems' and 'variants'.

2. Plausible inferences in scientific argumentation

2.1. Basic notions

Given the constraints determined by the size and the genre of this paper, we are in no position to provide a precise explication of the basic notions; therefore we will consciously use them in a pre-explicative form. Nevertheless, we make the following terminological remarks in advance, which we do not intend to be precise explications but assistance in rendering our train of thought followable and understandable.

First, the notions of 'deductive', 'conclusive', 'demonstrative' and 'logical' inference are treated as synonyms; we will use the term 'demonstrative'. Second, we regard the basic concepts and the notational conventions of propositional logic as given, and they are not introduced systematically. Third, the notions of 'consistency' and 'non-contradiction', and those of 'inconsistency' and 'contradiction' are also treated as synonyms. Fourth: by 'probability' we do not understand mathematical probability but the *degree of plausibility* (on the relationship between the calculus of probability and plausibility, cf. Polya, 1954, 109ff). Fifth: by 'heuristics' we understand rules (i) the role of which is to survey (in a non-systematic manner) relatively large domains of problems, (ii) which may lead to the solution of a certain problem, but (iii) which do not necessarily yield the solution or the optimal solution of this problem. Sixth: by 'data' we understand such assertions that embody the knowledge available to us in a given informational state for the solution of a problem.[13]

Presupposing these terminological remarks, in what follows we analyse the role plausible inferences play in scientific argumentation by taking the classical works of George Polya and Nicholas Rescher as our starting point.[14] This does not mean, however, that what we establish is an eclectic union of significantly divergent approaches, as the two author's analyses are in close connection with each other.[15] What we therefore aim at is the establishment of a coherent metascientific analysis rooted in the classical approaches mentioned.

In introducing our methodological framework, we will make extensive use of quotations. In this way we want to demonstrate that the views which serve as our starting point for capturing relevant aspects of linguistic argumentation are nothing 'exotic', but have been present in the literature for several decades.[16] Nevertheless, we are well aware of the fact that we have made only the first steps towards elaborating the kind of methodology which we have been after. Clearly, such a methodology will fall and rise with the suc-

[13] According to this formulation, we call not only those assertions data which describe 'facts' or 'observations' in whatever sense of these terms, but also every background assumption which we use during the argumentation. On this interpretation of data cf. Rescher (1979, p. 69).

[14] There is a very rich literature on plausible inferences. However, we will restrict the discussion to the classical works of Polya and Rescher, because they put forward the main tenets which later research has been based on. Although Polya's and Rescher's ideas were published a couple of decades ago, they are still up to date. This is clearly witnessed by their being evaluated as 'pioneering' even in the latest literature. See e.g. Woods et al. (2000, 258).

[15] 'Polya's entire analysis of the logic of inductive reasoning can also be accommodated on the present approach.' (Rescher, 1976, p. 67).

[16] Quotations which serve only to illustrate our claims, will appear in the footnotes. However, those which play a substantial role in our line of thought will be integrated into the main text of this paper.

Table 1

Demonstrative inference (modus tollens)	Plausible inference (reduction)
If A, then B	It is certain that if A then B
not B	B has become certain
not A	A is more credible

cess or failure of carrying out further case studies similar to the one presented in this paper so as to justify, refute or refine our conclusions.

(i) *The notion of plausible inference*. The common features of plausible inferences can be summed up in two points as a first approximation:

> First, they *do not have* the *certainty* of a strict demonstration. Second, they are useful in acquiring essentially *new knowledge*, and even *indispensable* to any not purely mathematical or logical knowledge, to any knowledge concerned with the physical world. We could call the reasoning that underlies this kind of evidence 'heuristic reasoning' or 'inductive reasoning' or (if we wish to avoid stretching the meaning of existing terms) *'plausible reasoning'* (Polya, 1948, p. 221f; italics added).

The fundamental difference between plausible and demonstrative inferences can be illustrated by Table 1.

(ii) *The uncertainty of plausible inferences*. In this example both inferences have one common premise, namely, the first one. The second premise is, however, different. This leads to an essential difference with respect to the conclusions. While with deductive inferences the truth of the conclusion follows from the truth of the premises with *certainty*, in the case of plausible inferences the premises merely increase the *credibility* of the conclusion.

Consequently, plausible inferences are less reliable by nature than demonstrative inferences: they involve the possibility of mistakes, errors and rejectability (Polya, 1948, p. 221; Walton, 2001, p. 159, etc.).[17]

(iii) *The heuristic function of plausible inferences*. We very often find ourselves in a situation during the solving of a problem that, at a certain point, we have *several* hypotheses (conjectures) at our disposal *which mutually exclude each other*, but every one of which is supported by certain considerations and therefore each may represent a *possible alternative* in view of the amount of information that we possess. Then we *have to decide* between two competing hypotheses, but

[17] 'The plausible conclusion is comparable to a force which has *direction and magnitude*. This conclusion pushes us in a certain direction: A becomes *more* credible. This conclusion has also a certain strength: A may become *much more* credible or *just a little more* credible. The conclusion is not fully expressed and is not fully supported by the premises. *The direction is expressed and is implied by the premises, the strength is not*. For any reasonable person, the premises involve that A becomes more credible (certainly not less credible) but my friend and I may honestly disagree about the weight of the conclusion, since our temperaments, our backgrounds, and our unstated reasons may be different. Yet the strength of the conclusion matters. If two jurors judge differently the strength of a conclusion, one may be for acquittal and the other against it. If two scientists judge differently the strength of a conclusion, one may be for undertaking a certain experiment and the other against it.' (Polya, 1954, p. 113f; italics as in the original).

> [d]eductive logic alone will certainly not decide the issue. Logic merely tells us *that* the situation is not viable as it stands. It informs us *that* something must be given up, but does not provide any help in the question of *what*. [...] Plausibility theory takes us beyond logic and probability: it moves from the realm of *formal* into that of '*material*' considerations. It seeks to develop the more demanding machinery needed for making the inevitable choices in such cases of cognitive conflict through informational overdetermination (Rescher, 1976, p. 2; italics as in the original).

Thus plausible inferences are *heuristic tools* with the purpose of bringing us closer to the solution of a certain problem, inasmuch as they help us form an opinion of which possible alternative is the most promising on the basis of the information available for us at any given moment.[18]

(iv) *The partial basis of plausible inferences*. With demonstrative inferences, the premises make up a 'complete basis' in the sense that '[i]f we receive some new information that does not change our belief in the premises, it cannot change our belief in the conclusion' (Polya, 1948, p. 223). On the other hand, in the case of plausible inferences the premises make up only a 'partial basis', that is the complete basis has a part which is not expressed through the premises:

> [...] the premises constitute only one part of the basis on which the conclusion rests, the fully expressed, the 'visible' part of the basis; there is an unexpressed, invisible part, formed by something else, by inarticulate feelings perhaps, or by unstated reasons. In fact, it can happen that we receive some new information that leaves our belief in both premises completely intact, but influences the trust we put in A in a way just opposite to that expressed in the conclusion. To find A more plausible on the ground of the premises of our heuristic syllogism is only reasonable. Yet tomorrow I may find grounds, not interfering at all with these premises, that make A appear less plausible, or even *definitively refute it*. The conclusion may be shaken and even overturned completely by commotions *in the invisible parts of its foundation*, although the premises, *the visible part, stand quite firm* (Polya, 1948, p. 223f; italics added).

(v) *The context-dependence of plausible inferences*. Due to the reason already mentioned in (iv), the conclusions of plausible inferences are context-dependent in a substantial and non-trivial way. The reason is that the credibility of conclusions cannot be established 'absolutely', but depends significantly on the 'strength' of the premises. How credible a conclusion is can be judged only relative to the premises in particular and the properties of the partial basis in general (see e.g. Polya, 1954, 115f; Rescher, 1976, 111ff; Walton, 2001, p. 164).[19]

[18] Cf. the quotation in (i) Polya (1948, p. 102; 1954, p. 140) and Walton (2001, p. 164) as illustrations of this tenet. See also Allan's (2003) instructive paper on similar issues with respect to *linguistics*.

[19] At this point, it is essential to draw attention to the problem of assertions of the structure 'if A, then B'. We know that assertions of this kind cannot be translated as $A \supset B$, i.e. as a conditional (which merely asserts $\sim(A \,\&\, \sim B)$), without loss of information. If A and B are both true, then $A \supset B$ will be true even if there is no content relation between A and B. With plausible inferences, however, the expression 'if A, then B' can by no means be rendered by a conditional. Therefore in what follows—as a first approximation—assertions of this type are analysed as B being a necessary condition for A (B cannot be true without A), and A being a sufficient condition for B (each time A is true, B is also true).

Table 2

Demonstrative	Shaded plausible		Plausible
It is certain that if A, then B B false A false	It is certain that if A, then B B less credible A less credible	It is certain that if A, then B B more credible A somewhat more credible	It is certain that if A, then B B true A more credible
modus tollens	*shaded modus tollens*	*shaded reduction*	*reduction*

(vi) *Plausible inferences and the informational background*. We said in point (iii) that plausible inferences are heuristic tools. Problem-solving is, however, nothing else but a *process* during which we *reconsider* the available information again and again. This means that changes in the informational background may affect the plausibility of the premises, which—as a result of the context-dependence of plausible inferences mentioned in the previous point—may significantly influence the plausibility of the conclusion, too. Plausible inferences are therefore *dynamic*, since changes in the plausibility of the premises are concomitant with changes in the degree of the plausibility of the conclusions: they become more or less plausible. George Polya assumes that in this process the conclusion of a plausible inference changes *monotonically*, when one of its premises changes monotonically, and that this change is *continuous* (Polya, 1954, p. 41; Walton, 2001, p. 161). These two properties lead us to discover a peculiar and very important relation between plausible and demonstrative inferences:

> [...] our pattern of plausible inference has a 'limiting form', which is a pattern of demonstrative inference. As the premises of the plausible inference 'tend' to the corresponding premises of the limiting form, the plausible conclusion 'approaches' its extreme limiting strength. Still shorter: there is a continuous transition from the heuristic pattern to a demonstrative pattern (Polya, 1954, p. 42).

This can be illustrated by Table 2 (cf. Polya, 1954, p. 26).

In the first case, we know that one of the necessary conditions of A is not satisfied, which requires us to conclude that A is false. In the second case, we are not certain any more about the falsity of B, therefore we cannot conclude with certainty that A is false. In the third case, we have gained possession of information which supports the satisfaction of this necessary condition to some extent, even though it does not verify it—this evidently increases the plausibility of A. And finally in the fourth case, we know certainly that one of the necessary conditions of A is true; this, however, is still not enough for us to be able to consider A true as it is possible that A has a further condition which is not satisfied.

Thus the plausibility of the conclusion is heavily dependent on how plausible the premises are: there is a strong correlation between the strength of the conclusion and the plausibility of the premises. In the case of the above pattern, this means, for example, that 'our confidence in a conjecture is influenced by our confidence in one of its consequences and varies in the same direction' (Polya, 1954, p. 25). If, for example, the second premise is very weak, it obviously does not increase the plausibility of the conclusion significantly, perhaps not at all, but in any case, it does not argue against it; if, however, it is 'almost certain', the plausibility of the conclusion will be higher. A similar observation can be made in the case represented in Table 3, too.

Table 3

Demonstrative	Shaded plausible
It is certain that if A, then B	It has become less credible that if A, then B
B false	B false
A false	A somewhat more credible
modus tollens	*shaded modus tollens*

The two premises of our first inference characterise a situation in which one of the necessary conditions of A is not satisfied—therefore A is evidently false. We do not know for sure in the second case whether B is a necessary condition of A but only suspect that it is so; the falsity of B does not exclude A in this case.

(vii) *The generality of plausible inferences*. Though George Polya demonstrated plausible inference and heuristic reasoning through the example of mathematics, he believed their usage to be desirable and even inevitable in other domains of cognition, too, and he also found them present in our everyday thinking (Polya, 1954, p. 114). This, however, does not mean that *their function* is the same in, for example, mathematics or in the humanities. In mathematics, the role they play is primarily connected to achieving results, discovering correlations, choosing the axioms of a theory or hitting upon the essential ideas needed to develop exact proofs. And though we may come across non-demonstrative inferences in the explication of mathematical theories, too, these can only be used as abbreviations facilitating understanding (Polya, 1948, 102f). But in the vast majority of scientific theories—in those natural sciences, humanities and social sciences which declare themselves empirical—non-demonstrative inferences can not only be the means by which new hypotheses are *discovered* but they may also *play an important role in evaluating these hypotheses* (for a more detailed discussion on this, cf. Rescher, 1987). This latter statement obviously applies to linguistics, too.

2.2. Inconsistency and plausible inference

As we know, the law of non-contradiction is one of the pillars of rationality in science according to the standard view of the philosophy of science.[20] Inconsistent theories are unacceptable because they are pregnant with destructive logical and epistemological consequences. It is accepted wisdom that (a) anything can be deduced from a logical contradiction, (b) contradictions cannot be true, (c) one cannot rationally believe in a contradiction, (d) if contradictions were acceptable, human beings could not be rationally criticised for their opinions and (e) if contradictions were accepted, nothing could be denied (cf. Priest, 1998). At the same time, we know that '[w]hen we look closely at scientific practice, including the construction of models and theories, we not infrequently find toleration of inconsistency *even within individual theories*, at least in their nascent phases,

[20] See for example: 'For it can easily be shown that if one were to accept contradictions, then one would have to give up any kind of scientific activity: *it would mean a complete breakdown of science.* This can be shown by proving that *if two contradictory statements are admitted, any statement whatever must be admitted*; *for from a couple of contradictory statements any statement whatever can be validly inferred.'* (Popper, 1962, p. 313; italics as in the original and added).

or as long as they continue to promise interesting results' (Nickles, 2002, p. 20; emphasis added).

To resolve the thus outlined tension between scientific practice and the ideal view of science, the need to handle contradictions in logic and in the philosophy of science has grown more and more definite in the last two or three decades. The development of the so-called 'paraconsistent logics' has played an important role in this shift of emphasis, the most important feature of which is that they are capable of reconstructing contradictory systems in a non-contradictory manner (an easily intelligible overview of the operative principles of paraconsistent logics is provided by e.g.: Rescher and Brandom, 1980; Priest, 1998; Fehér, 1990a,b). Parallel with the development of paraconsistent logics, but partially as a result of processes independent of it, the focus of interest has also changed for philosophers of science: *the processes of theory development and problem-solving* have also become interesting research topics beside the investigation of the logical structure of theories (cf. Nickles, 1980). During this process, the realisation that several scientific theories are either inconsistent or are irreconcilable with accepted views or with views believed to be accepted, has received increased attention. This shift of emphasis has raised delicate questions, such as: How can an inconsistent theory avoid turning into logical chaos? Is it rational to accept an inconsistent theory? Can inconsistent theories be true? (For more on this issue, cf. Meheus, 2002).[21]

A possible way of answering the questions just mentioned is to recognise that there exists a strong correlation between the contradictions arising in scientific theories and the mechanism of the use of plausible inferences. Drawing upon Rescher's classical investigations, we can summarise the correlation between inconsistency and plausibility according to the following points.

(viii) *The plausibility of the premises and the emergence of contradictions*. What characterises scientific inquiry for the most part is, among other things, that we do not have a sufficient amount of reliable information to decide on the truth of a given hypothesis. Those *premises* which we are compelled to treat as the starting point of our reasoning *are not to be regarded as certainly true*, but can only be assumed to be *plausible* in the given context, that is, they are *more credible* than their potential alternatives if certain conditions are satisfied.[22] Such premises may lead to contradictions:

> We know that in the case of *deductively valid* arguments one cannot reason from true premises to mutually inconsistent conclusions by the principle of classical deductive logic. But this is not so in *argumentation of sub-deductive strength*. Here it becomes entirely possible – in theory, at any rate – to *build up highly cogent arguments for mutually inconsistent conclusions*. When the premises at our disposal are *merely plausible* [...], it becomes altogether feasible to build up highly convincing arguments on the one side for P and on the other for $\sim P$ (Rescher and Brandom, 1980, p. 160; italics as in the original and added).

[21] We note that the role played by contradictions in linguistic theorising has been investigated by only a few so far. Edith Moravcsik's two publications, which give an illuminating and systematic overview of contradictions arising in syntax, can be regarded to be the standard works in this field: see Moravcsik (1993) and Moravcsik (in press).

[22] 'Much if not most of our thinking is carried on under conditions where we do not deem the premises from which we reason to be absolutely certain truths, but merely very probable or *plausible* suppositions.' (Rescher, 1987, p. 303; italics added).

(ix) *Informational over- and underdetermination*. There are essentially two possible situations in which contradictions may emerge. On the one hand, the base may be *overdetermined* by the available amount of information, and it therefore contains contradictory pieces of information. On the other hand, the basis may be *incomplete* (cf. point (iv))—when it *does not contain a sufficient amount of information*—and we may reason from it to a contradictory set of conclusions through the use of plausible inferences (Rescher, 1976, 97f).

(x) *Plausible inferences and resolving contradictions*. To resolve contradictions, we need to exceed purely formal considerations. In cases where we consider inferences to be tools in information processing (for more on this, cf. Rescher, 1976, 97ff), plausible inferences can be perceived as converting a set of premises into a piece of information with a certain plausibility, that is into a conclusion (cf. also point (vi)). This provides an opportunity for us to *compare* the conclusions that can be drawn from particular subsets of an informational set and choose the one which appears to be the most probable, the most optimal, and the most credible for us.[23]

(xi) *The double relationship between plausible inferences and the emergence of contradictions*. Summing up what has been stated above, we may establish two essential relations between plausible inferences and contradictions:

(a) On the one hand, we have to reason on the basis of not completely trustworthy information—that is, building on a partial basis (cf. (iv), (vi) and (viii)). We know that only plausible inferences can be drawn from a partial basis, and these inferences can lead to contradictory conclusions in certain cases: to explain one's data, one may set up hypotheses which mutually exclude each other but which are plausible in certain respects (in a given context). This means that the use of plausible inferences may lead to contradictory alternatives. That is, the emergence of contradictions may have its *sources* in plausible inferences.[24]
(b) On the other hand, one may use plausible inferences once again to *resolve* the (possible) contradictions that emerge among the conclusions of plausible inferences obtained from the partial basis, examining which is the most credible out of the *alternatives* in a given context—hoping that sooner or later an informational state is reached wherein novel contradictions do not arise any more (cf. also (xii) and (xiii) on this issue). That is: one of the possible *means* of resolving contradictions is plausible inference.

To sum up: the simplest way to characterise the strong correlation between plausible inferences and the emergence of contradictions is to regard plausible inferences as one of the possible *sources* of the *emergence* of contradictions on the one hand, and as one of the possible *means* to *resolve* contradictions on the other.

[23] 'On the basis of logic [...] one cannot tell what may reasonably be accepted in the face of imperfect, indeed conflicting data. [...] In providing a tool for handling cognitive dissonance, *plausibility theory* affords a reasonable basis for discriminating the inferences which can and cannot be drawn from the inconsistent data-base yielded by the conflicting reports of imperfect sources.' (Rescher, 1976, pp. 4–5; italics added).

[24] Of course, a partial basis does not necessarily lead to the emergence of contradictions, but the emergence of contradictions is one possibility that may arise from the peculiarities of the basis.

(xii) *The cyclic nature of plausible reasoning*. We *reason cyclically* by starting off from an inconsistent set of premises. We return to the problems in question again and again, and supplementing the partial basis with different latent background assumptions we transform the set of information at our disposal by drawing additional plausible inferences, and re-*evaluate* the credibility of the respective data (hypotheses, alternative explanations). During these cyclic returns we aim to filter out hypotheses unacceptable for some reason gradually, according to different—possibly contradictory—considerations (cf. e.g. Rescher, 1976, p. 111, 118; 1987, p. 304 etc.)

This way it becomes possible to compare one's cycles and to assess one's progress. First and foremost, there are two questions one may consider during this process:

(a) The first question is whether one has managed to root out the contradictions *within a particular cycle* (that is whether one has gained a consistent set of information), or whether at least the plausibility of any of the contradictory hypotheses has increased.
(b) The second question concerns the degree of plausibility of the *complete* amount of information within a reasoning cycle as compared to the total of other reasoning cycles. But this cyclic method of reasoning is by no means equal to vicious circularity in argumentation:

> The sort of 'self-criticism' at issue does not reflect any *vicious* or *vitiating circularity*, but in effect amounts simply to a *feedback* process that uses later, more refined stages of the analysis to effect revisionary sophistications in the materials from which earlier stages proceeded. One indeed returns to 'the same point' but does so *at a different cognitive level* (Rescher, 1976, p. 119; italics as in the original and added).

(xiii) *The prismatic nature of plausible reasoning*. According to Rescher, the course of thinking which applies demonstrative reasoning and regards the law of non-contradiction as a non-violable methodological principle appertains only to an extremely narrow sphere of the sciences, to mathematics and logic. The sciences belonging to this group have an axiomatic structure; inconsistency is *a fatal error* for them. It is, however, a different situation in the case of most other sciences. Research is not axiomatic, but *prismatic*, inasmuch as one tries to approach the given problem from several points of view during the cycles of reassessing what is known. Here inconsistency is *commonplace*.[25]

(xiv) *Consistency as an ideal*. Obeying the law of non-contradiction is an important norm, which definitely has to be respected in every case when it is at all possible. In a significant number of cases, however, it can only be regarded as an *ideal* which one has to strive for by every possible means but which often cannot be fulfilled during scientific inquiries (Rescher, 1987, p. 316).[26]

[25] 'There is a vast difference between the case of reasoning from premises pre-established as certain (as certainly true), and that of reasoning from premises whose acceptability is based on a footing of mere *plausibility* (as plausibly or presumably true). If we are engaged in inquiries where we do not simply reason *deductively from pre-assured premises*, or if *the course of argumentation is* [...] *not deductively conclusive*, then it may make perfectly good sense to [...] consider an issue *prismatically*, by proceeding in the variable light of not merely different but even *inconsistent perspectives*.' (Rescher, 1987, pp. 306–307; italics added).
In a similar way, Polya (1981, Vol. II, 68) also calls attention to the prismatic nature of problem-solving.

[26] 'The presence of (weak) inconsistencies seems to be, in fact and principle, inevitable [...].' (Fehér, 1990a, p. 234).

Demonstrative reasoning and plausible reasoning bear different relations to the question of the tolerability of contradictions. In purely deductive systems (disregarding paradoxes) contradictions may not emerge, neither may the necessity to *handle* (in some sense of this word) *contradictions* arise.[27] Whereas in the case of plausible reasoning the *provisional* acceptance of inconsistency may be an option to consider:

It may become even reasonable in certain circumstances for a person to *accept a set S of statements of whose inconsistency he is certain*, for example when the following conditions obtain:

1. There is powerful reason for accepting each and every member of the propositional set *S*.
2. The set *S* is inconsistent (and is recognized as such).
3. Although consistency can always in theory be restored regarding *S* by *deleting* certain of its elements, this can (as ever) be done in various ways, and *given the limitations of information-access and processing under which we actually labor in practice* there simply is no feasible way of justifying any one of these consistency-restoring resolutions vis-à-vis its alternatives.

In circumstances of this sort it would be quite reasonable to retain one's commitments to *S*—at any rate provisionally, until further notice. For in such a case, the desideratum of consistency-elimination conflicts with other cognitive desiderata (viz., adhesion to the probative standards that endorse the *S*-elements) in such a way that the latter could well outweigh the former in the specific circumstances at issue (Rescher and Brandom, 1980, 51f; italics as in the original and added).

(xv) *The local nature of consistency*. It is a consequence of the way our cognition is structured that we always strive for consistency. However, we have to pay a heavy price to preserve consistency because it involves *loss of information* as we have to abandon some of the mutually inconsistent but nevertheless possible pieces of information. This means that we have to disregard some of the alternatives which we have at our disposal and which we cannot exclude with complete certainty at the given moment. We can only achieve *local consistency* at the level of the subject matter of our inquiry by narrowing down upon the domain of phenomena to be captured; but there is no guarantee that we will ever reach a completely consistent system. This is so because globally there may arise contradictions among the locally consistent subsystems which are *irresolvable* in the given informational state.[28]

(xvi) *The rationality of plausible reasoning*. Contrary to what was said in Section 1 of the present study concerning the standard view of the analytic theory of science, rationality cannot be equated with the use of demonstrative inferences. It does not follow from the

[27] 'With inferential [...] reasoning, *consistency is everything*. When our starter set of initially accepted premises is not consistent, we can reach no viable results from it. When our conclusions are inconsistent, we are in an untenable position.' (Rescher, 1987, p. 311; italics added).

[28] '[...] we shall always strive for consistency *locally* – in any *particular* area of inquiry – under the aegis of locally applicable resolution criteria. Still we can – and should recognize that there may not, nay sometimes will not be any such criteria that are *globally* invariant across the whole spectrum of our investigative concerns.' (Rescher, 1987, p. 312; italics as in the original and added).

fact that the conclusion of plausible inferences is not certainly true—but only credible, fallible, context-dependent—that it is not rational.[29]

(xviii) *Inconsistency and rationality*. In connection with what was said earlier about inconsistency, 'in spite of its being *always actually weakly inconsistent*, we can consider actual science a *completely rational and truly scientific enterprise*' (Fehér, 1990a, 238f; italics added; see also Rescher, 1988, Chapter 5).

2.3. Summary

As a summary of the discussion in Sections 2.1 and 2.2, we may establish that plausible inferences and the emergence of contradictions are essentially interrelated the following ways:

(a) On the one hand, one *source* from which contradictions emerge in scientific theories is that we are compelled to start reasoning on the basis of uncertain information, from an incomplete and/or inconsistent informational basis, and consequently to use plausible inference patterns; and plausible inferences, in their turn, may guide us to arrive at possibly contradictory conclusions when the given problem to be solved is approached from different directions.
(b) On the other hand, one *tool* to *resolve* the contradictions that thus emerge in the theory is to narrow down the range of possibilities with plausible reasoning to the point where the resulting informational state is already manageable for us—at least locally—but is not yet concomitant with an unacceptable loss of information.
(c) Plausible reasoning has to tackle the *informational overdeterminacy* of a contradictory data set.
(d) During the plausible reasoning process mentioned in point (b), one proceeds *cyclically*, inasmuch as one returns to one's earlier assumptions again and again, continuously reassessing them.
(e) Cyclic reassessments are *prismatic*, because one approaches assumptions from forever new points of view.
(f) In certain cases the contradictions stemming from the uncertainty of the initial assumptions and the incomplete nature of the data set can be resolved through this cyclic and prismatically proceeding mechanism of plausible reasoning, but in other cases globally non-resolvable contradictions may have to *be accepted* while striving for consistency locally.

The tools of plausible reasoning starting from inconsistent background assumptions are typically employed during much of the problem-solving activities in linguistics. To exemplify this assumption,[30] after the introduction of the background assumptions with the help of which the case study mentioned in Section 1 can be presented, we analyse the argu-

[29] 'But in going beyond the purely formal considerations of logic [...] plausibility theory *does not go beyond the limits of rationality*. Seeking to provide a 'sensible way' out of such conflicts – one in which reasonable people can readily agree – it aims at *rational* alignment and coordination of inferences.' (Rescher, 1976, p. 5; italics added).
[30] Of course, a general proof of this assumption would be far beyond the scope of the present paper. Therefore, as already mentioned, we will only exemplify it by the case study to follow.

mentational structure of Wurzel's account of German affricates and draw our conclusions with respect to hypotheses (H2) and (H2′) in the next part of our paper.

3. A case study: on hypothesis (H2′)

3.1. Raising the problem

It is one of the most debated problems in German phonology whether the two native affricates—[pf] (cf. e.g. *Pflicht*) and [ts] (cf. e.g. *Zehn*)—are mono- or biphonemic[31]:

(P) Are native German affricates biphonemic or monophonemic?

The data at our disposal are already contradictory to start with, as 'affricates have features which do not lend themselves easily to a uniform interpretation' (Wurzel, 1981, p. 938) and thus do not allow for a direct solution to the problem (P). Given the complexity of the data, we might even believe that there is no straightforward answer to (P). But Wurzel argues that 'we cannot content ourselves with declaring that affricates have both monophonemic and biphonemic properties' (Wurzel, 1981, p. 938), because '[n]o matter how we establish a system of features, it has to be such that it is capable of characterising every producable and distinguishable sound segment' (Wurzel, 1981, p. 900). Therefore there cannot be an element in the phoneme system which behaves as a segment and a segment cluster *at the same time*, since every phoneme has to be well-definable as the aggregate of phonological features. This, in turn, means that the properties *biphonemic* and *monophonemic* are mutually inconsistent in Wurzel's analysis. Furthermore, Wurzel also presupposes that what is achieved by phonological features not only determines the substantial properties of the particular segments, but also captures their relations to other segments at the same time, and thus we also define their place in the phoneme system. The relations among the elements of the phoneme system are given, among others, by *structural rules*. Thus what Wurzel investigates first and foremost is whether affricates *behave as single phonemes or as clusters of two phonemes in certain structural rules*.

We will reconstruct his arguments—in the spirit of the discussion in Section 2.2—as *divided into argumentational cycles* in Sections 3.2–3.4. of this paper. The analysis will show that as a result of two equally plausible inferences, two mutually contradictory conclusions can be drawn from the premises. In Section 3.5, we examine those arguments put forward by Wurzel which he intended to employ to resolve this contradiction and we will also make an attempt to introduce further considerations.

3.2. First cycle: plausible reasoning in favour of the monophonemic solution

The first two arguments of the author take two structural rules as their starting point:

(1) (a) If a vowel /V/ follows a formative-initial /$C_3C_2C_1$/ consonant cluster, then the consonant cluster /C_2C_1/ also occurs in the same position.

[31] This way of raising the problem clearly goes back to the pre-generative tradition, because the question merely is: one phoneme or two? However, as we already mentioned, Wurzel's solution is embedded into an 'eclectic' framework which makes use of basic assumptions of early generative phonology as outlined in Chomsky and Halle (1968).

(b) If a vowel /V/ follows a formative-initial /C_2C_1/ consonant cluster, then the consonant /C_1/ also occurs in the same position.

First of all, we mention the fact that (1) may be correlated with the phenomenon which Greenberg calls 'resolvability' and which he describes as follows: 'Every initial or final sequence of length m contains at least one continuous subsequence of length $m - 1$' (Greenberg, 1978, p. 250). Nevertheless, on the one hand, Greenberg's generalisation quoted above is formulated in an unusually imprecise manner. On the other hand, he emphasises the fact that though he believes it to apply to a significant majority of languages, it does not apply to every language. Moreover, it is only supported by certain clusters of data even in particular languages, allowing for many exceptions. Therefore this generalisation has 'only statistical validity' (Greenberg, 1978, p. 250). Consequently, the assumption that (1) is nothing else but the manifestation of 'resolvability' in the German consonant system is of no relevance for defining what the *argumentational status* of (1) is in Wurzel's analysis.[32]

One can only understand the role played by (1) in Wurzel's argumentation if due emphasis is given, in accordance with these considerations, to the *non-demonstrative nature of the inferences* that the *structural rules*, (1)(a) and (1)(b) included, represent in the phonemic system of the German language. This becomes obvious once their origin is taken into consideration: Wurzel's writing contains tables on pages 978–981 in which he lists the formative-initial and the formative-final consonant clusters in German. It is evident from these tables that only three groups of data support part (a) of rule (1): /ʃpr_/, /ʃpl_/, /ʃtr_/. There is no other evidence in favour of it, and it cannot be deduced from any further claim of the approach. We may add to this that, starting from these three cases, he might as well have formulated other structural rules than this, e.g. even one which states that words starting with three consonants are of the form /ʃC_2C_3_/. The latter hypothesis can in fact be found even in Wurzel: 'In case a formative starts with three consonants in German, the first consonant may only be /ʃ/' (Wurzel, 1981, p. 978).

So we have to conclude that these structural rules are only more or less weak *analogical inferences*. But analogical inferences—as it turns out from Polya's writings referred to above—are special instances of plausible inferences, whose credibility is influenced obviously not only by the size of the data set they can describe but also by the stringency of their testing.

In consequence, one of the starting points of Wurzel's argumentation, that is (1)(a) and (1)(b), is *already the result of plausible inferences.* Since—as it will be shown—Wurzel uses (1)(a) and (1)(b) as premises during the subsequent argumentation, the argumentational status of (1)(a) and (1)(b) corresponds exactly to the situation illustrated in Section 2.2(viii). That is: the subsequent argumentation is built *on premises uncertain from the outset*, as these premises were received as conclusions of plausible inferences. (Cf. also e.g. Section 2.1(vi) on this issue.)

Wurzel applies (1) to the *dental* affricate and puts forward a kind of *indirect proof* (Wurzel, 1981, p. 938):

[32] The notions 'phoneme' and 'rule' are themselves controversial notions. We note that the interpretation of the rules of generative phonology is far from being unambiguous and it raises many metascientific problems, cf., for example, Hutchinson (1980).

(2) Let the formatives containing the dental affricate [ts] in formative-initial position be given, e.g. *zwar* [tsvɑ:r]. Let us assume that the dental affricate is biphonemic and let us see what follows from this assumption. From this assumption it follows that the dental affricate has the phonemic structure /ts/. For this reason, the phonological representation of the formative *zwar* will be /tsvɑ:r/, and rule (1)(a) can be applied to the dental affricate; however, what follows from (1)(a) is that the /sv_/ phoneme cluster also exists, but no formative exists with this structure. Consequently, our initial assumption was false. Therefore the contrary assumption has to be accepted: the dental affricate is monophonemic. If we assume that the dental affricate is monophonemic, then /t^s/ will be analysed as a single phoneme in the formative *zwar*, and according to (1)(b), there exists therefore a formative of the structure /vɑ:_/. And this is true, cf. *war*.

This reasoning can be reconstructed the following way:

(3) Premises:

P1: The dental affricate is biphonemic, that is, its phonemic structure is /ts/.
P2: *Zwar* is an existing formative in German.
P3: The rule marked (1).
P4: There exists a German formative with the structure /svɑ:_/.
P5: There exists a German formative with the structure /vɑ:_/.

Inferences:

(a) It is possible that if P1 & P2 & P3, then P4
P4 has been refuted
∼(P1 & P2 & P3) is more credible, which is equivalent to saying that P1 & P2 & P3 is less credible.[33]

We may conclude that out of P1, P2 or P3, at least one is probably false; it is our task to decide which one. Because P2 is certain, we may abandon P1, but we may also abandon P3.

(b) It is possible that if ∼P1 & P2 & P3, then P5
P5 has become certain
∼P1 & P2 & P3 is more credible.[34]

Wurzel examines the *labial* affricate on the basis of the following 'mirror-image rule':

(4) If the phoneme cluster /C_1C_2_/ occurs formative-initially, then there exists a formative in which the phoneme cluster /_C_2C_1/ occurs formative-finally.

[33] This inference is an instance of *shaded modus tollens*: {It is possible that if *A*, then *B*; *B* has been refuted} ⇒ ∼*A* is more credible (that is, *A* is less credible).
[34] This inference is an instance of *shaded reduction*: {It is possible that if *A*, then *B*; *B* has become certain} ⇒ *A* is more credible.

The acceptability of this structural rule is weakened by several exceptions, however, which Wurzel also mentiones (Wurzel, 1981, p. 938): *Twist*, *Schwall*, *quer*.[35] Because (4) is thus not without exceptions, its logical status can be argued to be the same as that of (1): it relies on *plausible* inference, and the conclusion of this plausible inference is used as a *premise* in the subsequent argumentation.

Starting from (4), Wurzel employs the method of *indirect proof* (cf. Kertész, 1993 on this) again and argues the following way:

(5) Let the formatives containing the labial affricate [pf] in formative-initial position be given, e.g. the formative *Pfote* [pfo:tə]. Let us assume that the labial affricate is biphonemic, and let us see what follows from this assumption. From this assumption it follows that the labial affricate has the phonemic structure /pf/. Rule (4) is consequently applicable to the formative *Pfote*. And what follows from (4) is that the phoneme cluster /_fp/ occurs formative-finally. However, there exists no such phoneme cluster: only /pf/ may occur formative-finally, cf. *Topf*/tɔpf/, but not /fp/. Consequently, our initial assumption was false. Therefore the contrary assumption has to be accepted: the labial affricate is monophonemic. If we assume that the dental affricate is monophonemic, then /p^f/ will be analysed as a single phoneme in the formative *Pfropfen*, and according to (4), there exists therefore a formative of the structure /_rp^f/. And this is true, cf. *Karpfen*.

The structure of the argument can be reconstructed as follows:

(6) Premises:

P1: The labial affricate is biphonemic, that is, its phonemic structure is /pf/.
P2: *Pfote* is an existing German word.
P3: The rule marked (4).
P4: There exists a German formative with the structure /_fp/.
P5: *Pfropfen* is an existing formative in German.
P6: There exists a German formative with the structure /_rpf/.

Inferences:

(a) It is possible that if P1 & P2 & P3, then P4
P4 has been refuted
∼(P1 & P2 & P3) is more credible, that is P1 & P2 & P3 is less credible.

One may conclude that out of P1, P2 or P3, at least one is probably false. It is our task to decide which one. Since P2 is certain, we may choose to abandon P1 or P3.

(b) It is possible that if ∼P1 & P5 & P3, then P6
P6 has become certain
∼P1 & P5 & P3 is more credible[36]

[35] We may further add that Wurzel does not even think of examining whether the phoneme clusters /tv/, /kv/, and /ʃv/ are monophonemic or not.

[36] (6)(a) is an instance of *shaded modus tollens* and (6)(b) that of *shaded reduction*.

The inferences reconstructed in (3) and (6) lead to the formulation of the following *plausible* generalisation, which may be regarded as one possible solution to the problem (P):

(7) Native German affricates are monophonemic.

3.3. Second cycle: plausible reasoning in favour of the biphonemic solution

At this point, however, the question whether we could argue otherwise immediately emerges. The answer is that we can, and in fact we have to! The reason is the following.

As we know, Wurzel obtains (7) through the application of plausible inference patterns. But we also saw in Section 2.1(iv) of the present study that in the case of plausible inferences, it may happen that we obtain some new information that leaves the validity of the premises intact, but still influences the argumentation in a direction 'just opposite to that expressed in the conclusion' (Polya, 1948, p. 223). Since, as was shown, Wurzel employs plausible inference patterns in the case discussed above, the appearance of novel considerations which influence the argumentation in a direction opposite to (7) cannot be excluded in advance. And if novel considerations indeed arise and they have exactly this result, then this means that *two conclusions are drawn which each derive from equally acceptable premises but which contradict each other*. Thus the fact that Wurzel obtained (7) through plausible reasoning naturally involves the possibility that a conclusion contradictory to (7) can be drawn.

Wurzel actually *realises* this possibility and *indeed* proceeds according to this realisation. To understand his subsequent steps in argumentation, we, first of all, have to sum up the following aspects of his procedure up to this point:

(a) He defined a certain set of data as a starting point.
(b) He formulated certain rules as a result of the application of plausible inference patterns (cf. (1) and (4)).
(c) He considers these rules and the description of the data to be premises of plausible inferences.
(d) He presents (7) as a plausible conclusion arising from these premises.

But: during this procedure, he correlates *certain* data with *certain* rules to form premises. Wurzel himself also makes it clear though that these rules and data could be correlated in other ways, too. More explicitly, the rules and the data can also be correlated through a mapping which is the reverse of what he did in (2) and (5) (Wurzel, 1981, pp. 938–939). Thus we face exactly the same situation as is described in Section 2.1(iv) and is analysed in Section 2.2. Without abandoning the structural rules employed as premises (that is, (1) and (4)—in other words, the visible part of the basis), the plausibility of novel premises which may lead to a conclusion possibly contradictory to (7) has to be accepted. Let us see whether it is indeed so. In fact it is easy to realise that it *is*, since what follows from Wurzel's premises formulated expressis verbis is the argumentation below (cf. also Kertész, 1993, 2004a):

(8) Let the formatives containing the labial affricate in formative-initial position be given, e.g. the formative *Pflicht* [pflɪçt]. Let us assume that the labial affricate is biphonemic.

Then the labial affricate has the phonemic structure /pf/. Rule (1) is consequently applicable to the formative *Pflicht*; and what follows from (1) is that the phoneme cluster /fl/ occurs in the given position, and so does the phoneme /l/. And this assumption is correct as *flicht* and *Licht* are existing German formatives. Consequently, the labial affricate is biphonemic according to this reasoning. If we start from the assumption that the labial affricate is monophonemic, then its phonemic structure is /p^f/ and only point (b) of rule (1) can be applied to it; the labial affricate indeed satisfies this rule as besides e.g. the formative *Pflicht*, the formative *Licht* also exists.

The structure of the argument:

(9) Premises:

P1: The labial affricate is biphonemic, that is, its phonemic structure is /pf/.
P2: *Pflicht* is an existing formative in German.
P3: The rule marked (1).
P4: There exist German formatives of the structure /flɪ_/.
P5: There exist German formatives of the structure /lɪ_/.

Inferences:

(a) It is possible that if P1 & P2 & P3, then P4 & P5
P4 & P5 has become certain
P1 & P2 & P3 is more credible

(b) It is possible that if ∼P1 & P2 & P3, then P5
P5 has become certain
∼P1 & P2 & P3 is more credible.[37]

(9)(b) leads to a conclusion which is just the opposite of the conclusion in (9)(a), that is, a *local contradiction* arises. This, however, (contra Wurzel's opinion) can be resolved as we can make a decision between (9)(a) and (9)(b). On the one hand, we can say that we employ Ockham's razor and therefore choose the biphonemic solution, as this does not result in the introduction of a new phoneme.[38] The relevance of this principle is emphasised in Wurzel's argumentation with respect to the analogous problem of the interpretation of diphthongs (Wurzel, 1981, p. 920). On the other hand, these two lines of reasoning are not completely independent: every example that complies with (9)(a) will necessarily comply with (9)(b), too.

As for the dental affricate, the following reasoning presents itself:

(10) Let the formatives containing the dental affricate in formative-initial position be given, e.g. the formative *zehn* [tse:n]. Let us assume that the dental affricate is bipho-

[37] Both (9)(a) and (b) are instances of *shaded reduction*.

[38] Please note that referring to Ockham's razor should be treated with caution and needs refined evaluation relative to the particular context of reasoning. In fact, one analysis may be simpler in certain respects than a competing analysis, whereas the competing analysis will be simpler in another respect. Such considerations appear to be instructive cases of prismatic and cyclic argumentation.

nemic. Then the dental affricate has to have the phonemic structure /ts/. Rule (4) is consequently applicable to the formative *zehn*. What follows from (4) is that the phoneme cluster /_st/ occurs formative-finally. This assumption is correct, since the formative *Nest*, for example, is an existing formative, whose phonological representation is /nɛst/. Therefore, the dental affricate is biphonemic according to this reasoning. [39]

The structure of the argument is similar to the previous ones[40]:

(11) Premises:

P1: The dental affricate is biphonemic, that is, its phonemic structure is /ts/.
P2: *Zehn* is an existing formative in German.
P3: The rule marked (4).
P4: There exists a German formative with the structure /_st/.

Inference:

It is possible that if P1 & P2 & P3, then P4
P4 has become certain
P1 & P2 & P3 is more credible.[41]

That is we obtain the following possible solution as a plausible generalisation on the basis of (9) and (11):

(12) Native German affricates are biphonemic.

3.4. Summary

The gist of Wurzel's argumentation we have reconstructed so far—in the light of the general mechanism described in Section 2 of the present study—can be summed up as follows:

Contradictory conclusions—i.e. (7) and (12)—have been reached on the basis of two, *equally plausible* inference sequences, while the premises have remained valid in both inference sequences.

The second inference sequence (cf. (9) and (11)), which has led to the biphonemic solution, has come about as a result of a procedure during which the information available after the monophonemic solution has been *prismatically*—from another point of view—re-evaluated. The argumentation was accordingly *cyclic*, since the prismatic re-evaluation of the information occurred in a subsequent cycle of the argumentation.

[39] If we want to examine the hypothesis which treats the dental affricate as monophonemic, then there is only one example to consider, namely the formatives of the structure /t^{s}v_/, but formatives with a /Cv_/ structure have been excluded from the domain of rule (4) by Wurzel.

[40] We have to point out that Wurzel's reasoning is faulty, since though he tries to find out what happens if one assumes that the dental affricate is monophonemic, what he examines is not how formatives with the structure /t^{s}K_/ behave, that is, whether there also exists /_Kt^s/ in every such case, but he just simply makes reference to the fact that there exists not only *Nest* but *Netz* in correlation to *zehn*.

[41] This inference is an instance of *shaded reduction.*

As a special manifestation of the general mechanism described in Section 2, what we can establish at this point of the analysis of his argumentation is that Wurzel's analysis leads to two conclusions that contradict each other on the basis of (a) an inconsistent set of data, (b) premises that make up only a partial basis, (c) the use of plausible inference patterns, and (d) the application of cyclic and prismatic reasoning.

We have emphasised in Section 2.3 that there exist two fundamental relations between plausible inferences and the emergence of contradictions. Accordingly—after establishing that the plausible inferences conducted thus far have led to a contradiction—we will continue our presentation with an exploration of the argumentational structure of those attempts that may be made in conformity with the cyclic and prismatic nature of plausible inference, starting from Wurzel's original train of thought and then gradually breaking away from it to *resolve* the contradiction.

3.5. Wurzel's attempts at resolving the contradiction

Third cycle: Wurzel draws further structural rules and other considerations into his attempts at the solution. He introduces the following structural rule:

(13) If preceding a vowel, the phoneme /v/ can only occur alone or as part of a two-member phoneme sequence.

Examples: *schwingen* [ʃvɪŋən], *winken* [ʃvɪŋkən].

The argument is based on the fact that there exist such formatives as e.g. *zwingen* [tsvɪŋən] or *zwar* [tsvɑ:r]; if the dental affricate were biphonemic in these latter cases, then their phonemic representation would have to contain the phoneme sequence /tsv/. This, however, is impossible as it contradicts rule (13). At the same time, if we assume that the phonological representation of the dental affricate is /t^s/, and we regard it as monophonemic, we do not violate (13) since the phoneme /v/ occurs as part of a two-member phoneme sequence.

If this argument were independent of (1), it could be used to provide independent evidence and, as part of a plausible inference sequence—at least temporarily, at this stage of the argumentation—to tip the balance in the favour of a monophonemic interpretation of the data. Wurzel's reasoning is, however, incorrect, inasmuch as he treats (13) as an independent argument, since as long as we regard (1) as valid, (13) will be true almost 'automatically': first of all, (1) excludes formatives of the structure /tsv_/, and, also as a consequence of (1), (13) merely states that formatives of the form /C$_1$ʃv_/ and /C$_1$kv_/ are not possible (because there is no other formative-initial syllable besides /ʃv_/ and /kv_/ in which a consonant and /v/ precedes a vowel. Thus (13) does not create a new situation, and *as a result of its weakness* it is not able to resolve the contradiction. We may, however, try to use (13) as a very weak analogical inference if we give up (1).[42]

The last structural rule of Wurzel is the following:

(14) Not only short vowels, but also long vowels and diphthongs may precede a single consonant.

[42] Cf. also the possible cycles after Table 10 on this.

The monophonemic nature of /t^{s}/ becomes more credible on the basis of this rule (cf. *Mieze*, *Brezel*, etc.). The structure of this argument corresponds to *shaded reduction*, which has been shown before and which is therefore not presented here in detail. But the credibility of /p^{f}/ decreases (cf. */taopf/, */to:pf/)—the structure of this argument is *shaded modus tollens*, which has also been shown already and which we do not have to repeat here in detail for this reason.

Wurzel develops two further arguments: one is based on the study of stress relations in non-native words, and the other is based on the observation that affricates 'participate in certain peripheral phonological alternations' (Wurzel, 1981, p. 940). The first of these arguments is refuted by Kertész (2004a, 341f), and the other one is immediately withdrawn by Wurzel himself. The situation can be summed up on the basis of this information in Table 4.

Thus we can make the substantial claim that the contradictory nature of the approach—as a result of the failure of the attempts to resolve the contradiction—has not decreased but increased, since the amount of inconsistent information has grown as compared to the level reached in cycle 2. At this point the argumentation that Wurzel sets forth comes to an end. Consequently, *the 3-cycle argumentation he has presented terminates in a contradiction which appears irresolvable*.

To understand this conclusion, one needs to differentiate between two points of view: between the *irresolvability* of a contradiction and the application of a possible *heuristic* tool to resolve a problem arising in a theory that contains an irresolvable contradiction.

Table 4

	[ts]		[pf]	
structural rule	**biphonemic**	**monophonemic**	**biphonemic**	**monophonemic**
(1)	–	+	+	–
(4)	+		–	+
(14)		+		–

Here the mark '+' denotes that the given phoneme cluster satisfies the relevant rule, '–' means the cluster does not satisfy the rule, and the shaded cells indicate that the relevant rule cannot be applied to the given phoneme since its conditions of use are not satisfied.

A contradiction within a theory is deemed *irresolvable* if one of the following conditions is satisfied (cf. also point (xii)):

(a) If one does not find a cycle among the ones already executed which, considering the whole spectrum of the information available,[43] renders one of the two hypotheses clearly more plausible than the other.
(b) If one does not find a cycle among the ones executed which satisfies the condition mentioned in (a) and which altogether appears more correct and more credible than any other argumentational cycle.

Nevertheless, the presence of such an irresolvable contradiction does not mean that it is impossible to find another *heuristic* tool at some point in the argumentation to resolve a given problem in a non-contradictory way. One can always decide—in the absence of convincing plausible arguments, even in an arbitrary manner—not to use any of the contradictory claims as premises in subsequent inferences (cf. the quotation taken from the book by Rescher and Brandom (1980) in point (xiv)). This decision is no doubt one of the heuristic tools available. And Wurzel does precisely this: though, as we saw, one cannot decide between the monophonemic and the biphonemic solution on the basis of those plausible arguments which he shows, and therefore his system contains an irresolvable contradiction, he still accepts (7) as the premise of his subsequent reasoning. Let us take a closer look at what it means when on the one hand, a theory contains an irresolvable contradiction, while on the other, there may be found a non-contradictory heuristic tool to resolve the problem which motivated the development of the theory itself!

In this respect, Wurzel's analysis is characterised by exactly the same dichotomy as what is plastically formulated in Rescher and Brandom (1980, 51f))—cf. (xiv). On the one hand, he is evidently fully aware of the principle that the consistency of a theory can always be restored by *deleting* certain of its elements, since in his subsequent argumentation, as has been mentioned, he accepts (7) as a premise while deleting (12) from among the premises. In this way he avoids the destructive consequences stemming from the presence of inconsistent premises. On the other hand, however, he has to accept at the same time that 'the desideratum of consistency-elimination conflicts with other cognitive desiderata [...] in such a way that the latter could well outweigh the former in the specific circumstances at issue' (Rescher and Brandom, 1980, p. 52). Therefore all those bits of information that bear upon (12) remain part of the approach, as he neither refutes them nor can he eliminate them since their elimination, given the complex properties of German affricates, would result in the loss of such a large amount of information that he—likewise in the spirit of Rescher and Brandom, 1980—cannot accept.

What we see then is that, on the one hand, Wurzel's analysis contains a contradiction which is irresolvable in the above sense, and on the other hand, he only uses one of the contradictory claims—i.e. (7)—as a premise in his subsequent reasoning. Why should he allow for this duality? In other words: once he cannot resolve the contradiction between (7) and (12) through plausible reasoning, why does he decide notwithstanding not to use (12) as a premise (while it stays part of his approach)? The answer is simple: this deci-

[43] Even if only provisionally and only 'up to a point'—cf. Rescher, 1987, p. 304—as it may become possible later on to execute other cycles in the light of new information.

sion has a *heuristic* motivation, inasmuch as it has to solve the problem posed by the task of working out the phonemic system of the German language. To build up this phonemic system, he *has to* decide whether the affricates will be independent phonemes in the system or not. It is not by chance that he emphatically treats the solution to the problem posed by the affricates as a prerequisite for the elaboration of the consonant system:

> In what follows, we will analyse and classify consonants according to how we analysed and classified the vowels of the German language with the help of phonological features in the previous section. This obviously *presupposes* that it is known which consonant-segments occur in German. Again, it is only possible to answer this question *if we can make a distinction between a single phoneme and a phoneme cluster in every single case* (Wurzel, 1981, p. 937; italics added).

Because of this heuristic reason, he has to make this decision even if there are no plausible arguments at his disposal which he could use to decide between (7) and (12).[44]

That the argumentation shown above runs into contradiction may in principle be a consequence of two factors. First: The information available is indeed contradictory to such an extent that it is not possible to find a consistent solution to (P). Second: Though it is possible to resolve the contradiction on the basis of the information available, Wurzel did not manage to find those plausible arguments that he could have used to resolve it. Therefore—as part of the present argumentation-analysis—we have to investigate *the question of which of these two cases holds true*. Consequently, what we show in the argumentation-analysis below is *further possible* argumentational cycles which are de facto *missing from* Wurzel's explicitly presented analysis, but which can be executed by making use of the information contained within the system—that is, the partial basis and the plausible inferences that can be drawn from the basis—and which *could also have been* executed by Wurzel.

3.6. Further possible plausible inference cycles

Fourth cycle: We might try to make the application of the structural rules *systematic*. This means that every structural rule is checked against the whole domain of the data:

(15) If we check with respect to (6)(b) whether Wurzel's investigations were comprehensive, then we have to conclude that they were not: a (6)(b)-type inference has to be performed for every possible formative of the structure /p^{f}C_/. If we do this, we get a negative result: /p^{f}l/ is possible formative-initially (cf.: *Pflaume*); we cannot find, however, a formative with a final /lp^{f}/. Thus, as a result of a reasoning similar to (6)(a), we have to draw the plausible conclusion that the credibility of the monophonemic nature of the labial affricate has decreased.

[44] This conclusion of ours is in full accordance with what Nickles maintains: The point here is that *heuristic fertility trumps consistency*. Researchers rarely reject a promising approach on the ground that it is apparently inconsistent. [...] The question reduces to that of when and where heuristic appraisal, including matters of cognitive economy, overrule consistency demands. Unfortunately, this area of methodology remains very underdeveloped (Nickles, 2002, pp. 20–21; emphasis as in the original).

The situation has changed the way illustrated in Table 5.

Fifth cycle: What we have found is that the labial affricate does not satisfy (4) either in its monophonemic or in its biphonemic interpretation. One has to try to resolve this local inconsistency by all means. Let us first consider not accepting (4) as a structural rule—this is anyway motivated by the fact that several counterexamples argue against it (cf. Section 3.2); see Table 6.

Sixth cycle: In the informational state represented in Table 6, it is only a single structural rule, viz. (1), which forces us to introduce a new phoneme to our system, the phoneme /t^s/. We may decide not to introduce a new phoneme /t^s/ and to abandon (1). Thus we would proceed similarly as in the case of (4), since this rule was also rejected because of the existence of counterexamples (Table 7).

Seventh cycle: In this way, however, a decision is made solely on the basis of a single structural rule, that is, we may say that the solution indicated in Table 7 would result in an unduly great loss of information (cf. Section 2.2(xiv)). But such great loss of information cannot be tolerated for heuristic reasons, as it removes us from the proximity of a potential solution to (P). It would be worth therefore trying to maintain (4) and regarding the formatives with the structure /Cv_/ as exceptions on the basis of the assumption that we might be able to find an explanation for the behaviour of such phoneme clusters later on. That the exceptions have a similar structure may give us some hope:

(16) (4) cannot be applied to /t^s/ because the only such formative onset is /t^{s}v_/, but that is classified as an exception because of its structure.
(17) As /f/ is the voiceless counterpart of /v/, as a result of analogical reasoning, /pf/ can also be regarded as an exception to (4).

Table 5

	[ts]		[pf]	
structural rule	**biphonemic**	**monophonemic**	**biphonemic**	**monophonemic**
(1)	–	+	+	–
(4)	+		–	– (15)
(14)		+		–

Table 6

	[ts]		[pf]	
structural rule	**biphonemic**	**monophonemic**	**biphonemic**	**monophonemic**
(1)	–	+	+	–
(14)		+		–

Table 7

	[ts]		[pf]	
structural rule	**biphonemic**	**monophonemic**	**biphonemic**	**monophonemic**
(14)		+		–

On the basis of these considerations we obtain the situation summarized in Table 8.

Eighth cycle: If we bring (1) back, too, then the situation in Table 9 arises.

The foregoing conclusions are summed up in Table 10.

However, the complications are still not over. Among others, the following need to be considered thoroughly.

First: It should also be examined *whether a different result would be reached by executing the cycles in a different order*. The answer is yes. There is only a single exception: to be able to check whether (4) is satisfied or not, the fourth cycle is indispensable, therefore the simplest thing to do is to make it part of the verification of this rule. The other cases, however, can be examined in any order (what is more, structural rules may even be given up). Therefore there is no mechanic way to decide what to lift from the partial basis (cf. Section 2.1(iv)) as a latent premise. Thus depending on where one starts his reasoning, a different result is obtained in each case.

Table 8

	[ts]		[pf]	
structural rules	**biphonemic**	**monophonemic**	**biphonemic**	**monophonemic**
(4)	+	(16)	(17)	–
(14)		+		–

Table 9

	[ts]		[pf]	
structural rule	**biphonemic**	**monophonemic**	**biphonemic**	**monophonemic**
(1)	–	+	+	–
(4)	+			–
(14)		+		–

Second: *It is not only the introduction of a structural rule that needs to be accounted for but also its abandonment*: one only has the right to give up definitively (4) or (14), for example, if one makes sure that no other rule can be found for their counterexamples that can account for their recalcitrant behaviour (as giving up a rule is always concomitant with a loss of information, the acceptability of which one has to weigh up).

Table 10

Cycle	[ts]	[pf]
1	M	M
2	b	b
3	m	m/b
4	m	m/b
5	M	B
6	m	b
7	b	B
8	m	B

What M denotes is that the monophonemic nature of the relevant phoneme cluster is credible; m means that monophonemicity is possible, but less credible; B and b have a similar meaning with respect to biphonemicity.

Third: as has already been indicated with respect to (3) and (6) in Section 3.2, *if a phoneme* (*cluster*) *does not obey a structural rule*, *one can proceed in two different ways*. One can conclude that the given phoneme cluster is not biphonemic, but monophonemic (or conversely), or, alternatively, the relevant structural rule can also be abandoned. Thus every time the inference at issue is an instance of shaded modus tollens, one faces two options. Therefore the eight cycles above (disregarding their order) represent *only one side* of the 'prism' through which the behaviour of the affricates is observed: those situations where either (1), (4) or, for that matter, (14) are given up, also have to be examined respectively.

Fourth: Consequently, the respective cycles are not to be regarded as linearly ordered, but as possibilities of the same rank. This, however, does not mean that the alternatives are equally plausible. The problem is that it is impossible to quantify the degree of credibility and it may show great cross-individual variation depending on which factor is important for a linguist and which one is less so (cf. the quotation in Footnote 17). The procedure of deciding between the alternatives, i.e. the mechanism of cyclic and prismatic assessments, contains several constituents that are relevant but not subject to formal and algorithmic treatment.

Fifth: As a consequence of this latter problem, it would not lead to a solution either to devise a computer programme with the help of which all the possible solutions that are compatible with the data could be surveyed.[45]

Sixth: Novel (structural) rules may also be found. For example, instead of (1)(a), (18), which has already been mentioned in Section 3.2, can also be introduced to the system:

(18) Formatives with an initial consonant cluster of 3 members are of the form /ʃC_2C_3_/.

By applying (18) we would get both affricates as monophonemic. Or: if we abandon (1), we might refer to (13) and could even set up (19) through analogical reasoning (cf. *Sprosse*, *spleißen*, *Straße*, and *Pfriem*, *Pflaume*):

(19) If preceding a vowel, the phonemes /l/ and /r/ also occur as part of a 3-member phoneme sequence.

[45] For a general discussion of the evaluation of computer programmes that model scientific discoveries, cf. e.g. the 19 (1989)–22 (1992) volumes of the *Social Studies of Science*.

According to this rule, the labial affricate is biphonemic.

Seventh: Taking the moral of Table 10 into consideration, we may also consider (20) as a possible solution:

(20) The dental affricate is monophonemic and the labial affricate is biphonemic.

To entertain the possibility of this solution is contrary to Wurzel's procedure, and in fact well exceeds the limitations of his system. This is so because, on the one hand, Wurzel accepts the latent premise that the two affricates are to be treated uniformly (either both of them are treated as monophonemic or as biphonemic). On the other hand, as we have already referred to, he finds a *paraconsistent* way out of the informational state containing an irresolvable contradiction when he accepts (7) as a premise of his subsequent inferences, simply disregarding the plausible arguments against (7) and in favour of (12) and thus making no simultaneous use of (7) and (12) as premises.[46]

However, *the plausibility* of the so far unconsidered assumption that the dental affricate may be mono-, and the labial affricate biphonemic, *is relatively high* as compared to the previous proposals for the following reasons.[47]

(a) In point 3.6. of the present study we executed many more argumentational cycles than Wurzel did, therefore we have considered and assessed a lot more data than he.
(b) The many argumentational mistakes committed by Wurzel[48] all indicate that there is a very strong background assumption lying behind his reasoning: the assumption that the two native affricates of German have to be treated uniformly. We have not found, however, an argument in his argumentational cycles so far which would render it necessary to accept this assumption.
(c) Among the possible solutions that have been presented thus far, it is (20) that is compatible with the greatest number of argumentational cycles.
(d) All this does not mean, however, that (20) could be accepted as a solution to (P). It is obviously not a suitable tool either to provide the *ultimate solution to resolve* the contradiction between (7) and (12), but can only be regarded as an attempt to find the answer which is the most credible on the basis of the data available. (20) satisfies only condition (a)—mentioned in point 3.5.—of the resolvability of the contradiction, and it does not satisfy condition (b): though it presents the alternative in which the dental affricate is monophonemic as more credible than the one in which it is biphonemic; we cannot, however, say that either one of the argumentational cycles that support this decision appears to be definitely more probable, to contain fewer open problems or to be more satisfactory than the others. Still, as one of the results

[46] See Section 2.2 for the notion of paraconsistency.
[47] A very convincing illustration of the mechanisms of plausible reasoning with respect to German affricates may be the fact that—starting from a different partial basis and applying different cycles of prismatic evaluation of assumptions—in Dogil and Jessen (1989) on the one hand it is also maintained that the two native affricates of German cannot be treated uniformly, but on the other hand (in contrast to our conclusion which remains within Wurzel's framework) the authors conclude that it is the labial affricate that is clearly monophonemic whereas the dental affricate may be biphonemic.
[48] Cf. (9), (11), (15), or, for example, the fact that he disregards (14) with the explanation that '/ʃ/ is also almost exclusively preceded by short vowels only' (Wurzel, 1981, p. 939).

of our argumentation-analysis it draws attention to a new alternative to solve (P), which has a relatively high plausibility as compared to other alternatives, but which is not recognised by the maker of the approach.

Thus the following refined answer can be given to the question we posed at the end of the previous subsection:

The contradiction between (7) and (12) cannot be resolved with the available tools, on the basis of the available information and within the confines of the given approach. However—still within the confines of this approach—we may find argumentational cycles which Wurzel did not discover and whose plausibility may be higher than that of other cycles.

4. Conclusions

4.1. The plausibility of (H2′) and (H2)

(a) We presented a case study in Section 3, which centres around the behaviour of German affricates. We saw that two mutually inconsistent solutions to the problem (P) can be gained with plausible reasoning in Wurzel's analysis.

(b) The argument-analysis in Section 3.6. showed that the inferences that are not discussed *expressis verbis* in Wurzel's quoted writing but which can be made on the basis of the data available do not lead to a consistent solution to (P), either. As a result of the analysis of the argumentational cycles presented—with no claim to completeness—the contradictory nature of the approach stands out plastically. Thus the conclusion in Kertész (2004a) that the contradiction is *not resolvable* in the given informational state in any argumentational cycle, has been reinforced again with the introduction of new considerations. Therefore there is no other way of handling this informational state than to have recourse to the help of a *paraconsistent* logical system. This was not discussed here, as Kertész (2004a) already presented a reconstruction of Wurzel's analysis of affricates which was performed with the help of paraconsistent logic.

(c) Thus hypothesis (H2′) was reinforced and we obtained an answer to question (Q). We would like to stress the fact that during the metatheoretical analysis performed in Section 3 *we*, *too*, were working only with a partial basis, plausible premises and plausible inference patterns deriving from these. At the same time, the plausibility of (H2′) is strong in the current informational state of our *own* argumentation, since we have no knowledge of any plausible argument that would contradict (H2′) on the basis of the facts considered so far, though the subsequent emergence of such arguments is obviously not excluded.

(d) Consequently, we thus accomplished the task that we set out to accomplish in the present paper: *we reinforced the plausibility of* (H2′) *through the case study presented, and as a consequence of that, we also have to accept* (H2).

4.2. Perspectives and open questions

The hypotheses that we formulated as the starting point of the paper thus having been reinforced, in this short outlook we may try to survey some more remote and indirect con-

sequences of (H2′) and (H2), which *take us far beyond* the details of the argumentation that is reconstructed in the case study.

(a) In the spirit of the quotation from Devitt and Sterelny (1999) mentioned in Section 1 we reflected upon linguistic theory-formation at a metascientific level. As a result of this reflection, we showed how a metatheory which may be used to grasp the inference procedures applied in linguistics coherently may work—here demonstrating this metatheory only in outlines and in operation, without aiming at completeness, and explicating it only partially and fragmentarily. The metatheory-fragment presented revealed the correlation between the emergence of contradictions and the mechanism of plausible reasoning in a successful linguistic theory. The revelation of this correlation did not only have a descriptive function, however, as it also made us realise what a segmental phonologist does when he argues, reasons, weighs things up and puts forward or rejects hypotheses. The metatheoretical reflection may also have a *constructive function*, inasmuch as it may increase the problem-solving ability of the practicing linguist—in this case by acknowledging the use of plausible and paraconsistent reasoning in linguistics. Such a metatheoretical reflection can draw the linguist's attention to a much wider choice of possible solutions to the relevant problem. For example: it may shed light on the productivity of the conscious and reflected use of plausible inference patterns in linguistic problem-solving; it may make the linguist aware of the necessity of the development of such heuristics which utilise the techniques based on plausible reasoning from inconsistent data sets in order to try to find a solution to linguistic problems which involves the loss of the least amount of information; it may produce such alternative solutions that the linguist who may not, or only erroneously, reflect on his own activities at the meta-level takes otherwise no notice of; and the list can be continued. Therefore we may make the following claim: the 'plausible and supportable' metatheoretical reflection—to remind the reader of the quotation from Devitt and Sterelny (1999)—which is compatible with the practice of theory-formation in linguistics, may contribute to the accomplishment of the given scientific tasks that the linguist faces. (On the same thesis through the example of other metatheories, cf. also Kertész, 2002a,b and in general Auroux and Kouloughli, 1993).

(b) It is emphasised here that what we examined in this study was not the abstract structure of the phonological theory, but the argumentational techniques applied in the textual explication of the theory. *What types of argumentational patterns are allowed by the abstract structure of theories and what types are not* is an essential question which nevertheless emerges. Thus, for example, we know well that subsequent developments in phonology led to the construction of theories different from the type represented in Wurzel's analysis, and the problem-solving capability of these theories well exceeds the latter. This is quite easy to track in the changes in how the problem of affricates is treated. Thus, for example, the contradiction which turned out to be irresolvable in Wurzel's work, is in fact resolvable by rather simple tools, though their use induces problems of a different kind (cf. Wiese, 1988, 1996; Prinz and Wiese, 1991; Luschützky, 1992; Dogil and Jessen, 1989 etc.).[49] We could come to interesting conclusions if we compared the results of our present study with the argumentational tools that other phonological theories employ to solve the problem of affricates.

[49] Surely, we need to *show* this by in-depth case studies concerning further developments. As an immediate continuation of the present paper in this direction let us mention Kertész and Rákosi (in preparation) where the simple tools mentioned are discussed in detail.

(c) It is to be noted though that the resolution of contradictions arising in theories is a major driving force behind scientific inquiries, a force which *plays a progressive role*. Therefore to accept an irresolvable contradiction and to reconstruct it with paraconsistent tools is only a 'last resort', that is, it should only be considered as an option if no ray of hope is to be seen within the confines of the relevant theory. As we showed, on the basis of the data examined, Wurzel's analysis may indeed be regarded as a case where all else fails. Once more, let us illustrate this by a quotation:

> [...] *we should not overhastily give up* the requirements of classical logical consistency as a norm of scientific methodology and turn to paraconsistent logic, lest we lose the [...] urge to eliminate inconsistencies and, by that, lose an essential motor of scientific change. [...] without the permanent turning up of inconsistencies *and* without the constant urge to localize and eliminate them, science would stop changing and come to a standstill. The presence of (weak) inconsistencies seems to be, in fact and principle, *inevitable* [...] (Fehér, 1990a, p. 234; emphasis as in the original and added).

Nevertheless, we must not exclude the possibility of a much more radical stance at the outset. In particular, further case studies might even show that living with irresolvable contradictions and reconstructing them with paraconsistent tools is the best we can achieve in most linguistic theories and that this is the default case rather than the peculiarity of certain extreme approaches.[50] Such a radical finding would lead, of course, to an even deeper revaluation of theory formation in linguistics than the cautious conclusions we have drawn in the present paper. The question is whether in future one may run the risk of putting forward metatheoretical analyses justifying such a radical turn.

(d) We know from George Polya's books that mathematics cannot do without plausible inferences, either, as these latter have a decisive role in the discovery of theorems and proofs. By acknowledging this role, Polya made a significant contribution to the development of mathematical heuristics and didactics, since he made those aspects of mathematical problem-solving public which had been considered to be the private matter of researchers until that time. In linguistics, however—as opposed to mathematics—the components and the consequences of plausible reasoning may be present not only in the process of discovery but (as we saw through the example of Wurzel's analysis of affricates) also in the explication of the theories, therefore their role is more substantial than in mathematics. We need to assume that the exploration of the argumentational structure of theories in linguistics, if based on the application of plausible inferences, might make a significant contribution to the development of the *didactics of linguistics*: it could make the *heuristics* of linguistic problem-solving teachable. (Such an attempt was made in Kertész, 1993, by drawing examples from the segmental phonology of German).

(e) The case study also illustrates, among other things, that the image that some of the linguists paint of their own activities by insisting on (H1) without any reflection, is fundamentally distorted, since, as we saw, the structure of linguistic argumentation does not necessarily correspond to the standard view that (H1) represents. This distorted self-image *causes serious damage*, because it blocks the linguist's access to several techniques of problem-solving that are based on plausible inferences and propagates an often destructive

[50] We are grateful to an anonymous referee for encouraging us to raise this issue.

scale of values which is legitimised with an incorrect—or at least incomplete—view of science.

(f) By arguing in favour of (H2) as opposed to (H1), we did *not* question either the rationality of linguistics, or its scientific quality, or its prestige. The modest contribution we made was merely intended to tighten the gap between the unreflectedly accepted *norms* and the actual argumentational *practice* of linguistics. Currently, the state of the art view in the philosophy of science considers the tightening of this gap to be one of the most important tasks of metascientific reflection. By presenting the metascientific frame outlined in Section 2 and through the analysis shown in Section 3 we have pointed out that the accomplishment of this task is *a real possibility*.

(g) If we realise that basically linguistic theories are not built up according to the constraints posed by the standard view of the philosophy of science, but, in the spirit of (H2), prismatically, cyclically, and through plausible inferences, then we cannot expect to be able to find a single correct answer to our questions, which we then try to defend by all possible means.[51] It is not the case that we start inquiry with a set of certain premises from which we deductively infer true conclusions. Rather, the only thing the linguists can do is to strive for the continuous, cyclic and prismatic correction of knowledge, taking into consideration the greatest possible amount of plausible assumptions. That view of linguistics, which follows from (H2), is not compatible with an unreflected and absolutistic treatment of particular theories, particular points of view, particular methods and theses, and the unreflected rejection of other points of view. It may, however, lead to the tolerant acceptance of the current pluralistic state of linguistics, in which radically different theories make up a complicated network, and to the conscious utilization of the opportunities that the current situation offers for the solution of the prevailing problems of linguistics.

Though these perspectives, which we have only made a preliminary characterisation of, may force us to reassess our metalinguistic thinking at least partially, they might also raise a number of unsolved problems. These open questions can only be answered if, on the analogy of the case study presented here, we perform further case studies—that appear to be typical or, for that matter, extreme cases according to some carefully chosen point of view—possibly in great numbers, on the basis of which the characteristic and successful strategies of linguistic problem-solving may crystallise. In this respect, the present paper does not only supplement our previous studies we have referred to, but is at the same time a preliminary study to further inquiries whose objective is to explore the argumentational structure of linguistic theories systematically and to utilize the perspectives gained from this exploration.

5. Uncited references

Rescher (1993),Walton (1992).

[51] See also Allan (2003, p. 533) on the same issue from a related but different point of view: 'There are no rational grounds for any human being to claim by right that only one of the possible models of taxonomies of a natural phenomenon is the true one. There may be reasons for preferring one model to any other in a given context, but these reasons will be based upon the perception of its consistency, coherence, efficacy and practical value within that context; in a different context some of these advantages may vanish. Such criteria apply to linguistic models (that is, linguistic theories or theories of language): different models satisfy different sets of conventions and must be evaluated for their superiority in a given context.'

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