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Inconsistency in two approaches to German affricates*

Part 1: The Basic Inconsistency of German Affricates
in Wurzel's approach

Abstract

Linguistics lacks clear methodological guidelines which could be made use of whenever one faces a contradiction. The basic inconsistency of German affricates provides an instructive example of the problems emerging from this situation. This paper aims to reveal why Wurzel's eclectic framework, applying both notions of structuralist phonology and SPE, yields an irresolvable inconsistency. CV phonology raised the hope that the latter could be void of the shortcomings characterising earlier approaches. The continuation of this paper, Rákosi (2014) will be devoted to the analysis of Prinz & Wiese's (1991) approach.
Keywords: inconsistency, affricates, SPE, structuralist phonology, p-model

1   Introduction

Cases in which an inconsistency is found to be irresolvable within a theoretical framework while it is solvable with the help of another theory are well-known to every linguist. It goes without saying that following clear methodological guidelines would be essential whenever one faces a contradiction variously labelled as an "exception" or

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"counter-example" and the like. Unfortunately, the nature of inconsistency in linguistics has not been studied at all so far and, accordingly, at present there are no generally known methodological tools at our disposal which could be relied on when one has to cope with contradictions. However, due to the well-known pluralism of linguistics and the conflicting interests of the social groups propagating particular approaches, analysing the treatment of inconsistency in current theories would inevitably compel us to take sides in present-day theoretical quarrels and thus blur the general methodological issue. Therefore, it seems to be reasonable to make the first step toward the clarification of the nature of inconsistency in linguistics by analysing merely historical examples and thus distance our analysis from the 'wars' between current linguistic theories. Having thus found an appropriate point of departure, later on, as a next step, the moral of the historical examples can be applied directly to the evaluation of current theories as well as to the task of deciding between them.

In order to illustrate the issue we have just mentioned, in this paper we will present a case study on the phonological structure of German affricates. The phonological problem that German affricates raise is relatively simple; therefore it can serve as a clearly understandable and instructive example of particular aspects of the treatment of contradictions in linguistics.

Affricates in German are *phonetically* bisegmental, because they consist of a plosive and a fricative. However, their *phonological* status is problematic: Are they single units or two-member consonant clusters? Accordingly, the literature on this question is burdened with the following contradiction:

(I)   (a) Phonologically, German affricates are equivalent to single consonants.
        (b) Phonologically, German affricates are equivalent to consonant combinations.

(I) is the *basic inconsistency of German affricates*.

There was consensus in the seventies and eighties that it cannot be the case that an element of the phoneme system behaves as a single segment and a segment cluster *at the same time*. Accordingly, the properties *biphonemic* and *monophonemic* were regarded as mutually exclusive. In this vein, Wurzel (1981) interpreted (I)(a) and (b) as mutually exclusive alternatives between which a decision has to be

made. In contrast, Prinz and Wiese adopt a different stance on this inconsistency. They are of the opinion that Wurzel's strategy is inherently mistaken. They argue that both members of (I) should be maintained because

> [F]rom a phonotactic point of view, affricates are equivalent to single consonants, while segmentally, they are combinations of segments (Prinz & Wiese 1991: 168; our translation).[1]

This kind of state of affairs is typical in linguistics: it is often the case that if no decision can be made between two rival hypotheses, then a new theoretical framework is proposed which separates the two conflicting statements by assigning them to different levels of representation. Despite the basic, everyday character of such situations, the logical background and the methodological tools related to such a resolution of inconsistencies in linguistics are anything but clear.

Therefore, we will raise the following problem:

(P)   (a)   *Why* is the basic inconsistency of German affricates *irresolvable* within Wurzel's approach?
       (b)   Does it become *solvable* within Prinz and Wiese's approach?
       (c)   Do the answers to (P)(a) and (P)(b) suggest generalisable methodological guidelines that may be applicable to the future treatment of inconsistency in linguistic theorising?

The structure of this paper will be as follows. Section 2 outlines the central concepts of a metatheoretical model which enables us to reconstruct and to evaluate the authors' attempts at the resolution of the inconsistency between (I)(a) and (b). In Section 3, Wurzel's argumentation will be analysed in order to find a solution to (P)(a). Rákosi (2014) will be devoted to (P)(b) and (P)(c).

2   The p-model of plausible argumentation

The basic idea of *the p-model of plausible argumentation* is that the structure of linguistic theories is based on various techniques of plausible argumentation. Such an approach has been put forward in Ker-

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[1]   Prinz & Wiese's (1991) approach has precursors, such as Clements & Keyser (1983) and Wiese (1988).

tész & Rákosi (2012).[2] In the next paragraphs we briefly summarise those fundamental principles which are crucial for the understanding of the reconstructions presented in Sections 3 and 4; for their comprehensive discussion see Kertész & Rákosi (2012).

(i) Plausible statements. In most cases our hypotheses are not statements the truth of which is guaranteed. Rather, they are more or less *plausible* statements: we are ready to accept them to some extent on the basis of *sources* that support them.[3] Plausibility is gradual and strongly source-dependent. A statement may be very plausible according to one source, and less plausible with respect to other sources. It may also happen that some sources support the negation of the given statement and make it *implausible*. Further, if several sources support a statement, then its plausibility value is higher on the basis of all sources together than its plausibility value on the basis of any of the sources alone. It is also possible that neither a statement nor its negation is made plausible by a source; in such cases, we speak of *neutral plausibility* on the basis of the given source.

Plausibility can be represented numerically. These values merely indicate different relative strengths of reliability, supportedness, or acceptance within a theory (i.e., the argumentation process). Therefore, their manipulation cannot be described with the help of a logical calculus, it is more rudimentary. The plausibility value of statement p on the basis of the source S is such that:

$|p|_S = 1$, if p is true with certainty on the basis of S;
$|p|_S = 0$, if p is of neutral plausibility on the basis of S;
$0 < |p|_S < 1$, if p is plausible on the basis of S.

(ii) Plausible inferences. Deductive inferences the premises of which are true with certainty secure the truth of their conclusion. However, typically either there is no logical consequence relation between the premises at our disposal and the conclusion we want to arrive at, or

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[2] This approach has been motivated by the ideas of George Polya and Nicholas Rescher (cf. e.g. Polya 1948, 1954; Rescher 1976, 1987), and prepared e.g. in Kertész (2004) and Kertész & Rákosi (2006, 2009).

[3] Such – more or less reliable – sources are in linguistics, for example, corpora, theories, conjectures, the intuition of native speakers, experiments, fieldwork, historical documents, dictionaries, videotapes, and inferences (cf. Rescher 1976: 6f.; Rescher 1973: 63ff., Kertész & Rákosi 2012: 63ff.).

at least one of the premises is, instead of being certainly true, only plausible in the light of the given sources. Although both of these cases may occur separately, it is in combination that they are most frequent. In such situations, we can make use of *plausible inferences*. Plausible inferences are capable of making their conclusion plausible – but not true with certainty – on the basis of the content and plausibility value of their premises. Whether an inference is capable of fulfilling this task cannot be decided easily: besides logical considerations, a series of *informal* (content-related and context-related) factors have to be taken into consideration. For instance, if there is no logical consequence relation between the premises and the conclusion, then latent background assumptions are also needed, and these have to be plausible or at least not known to be implausible or false with certainty. In such inferences the connection between the premises and the conclusion cannot be reduced to the relationship between their logical structures but always rests on *a semantic relation* such as causality, analogy, similarity, sign, necessary or sufficient condition, part-whole relation etc.

(iii) The p-context. The p-context covers pieces of information which are relevant in conducting the argumentation process. It includes the sources in terms of which the plausibility value of statements can be judged, as well as a set of statements together with their relevant characteristics such as their plausibility values with respect to the sources in the p-context and their logical and semantic structure. The methodological tools related to the components of the p-context (for instance, the strategies of the resolution of inconsistencies, the methods for judging the reliability of the sources etc.) and the criteria of their usage also belong to the p-context.

(iv) The informational over- and underdetermination of the p-context. In a p-context the sources may yield too much information in the sense that there is a statement which is made plausible by some source while its negation is made plausible by another. In such cases, the p-context is informationally *overdetermined* (Rescher 1976: 2, Rescher & Brandom 1980: 3ff.), and the set of the plausible statements in the p-context is *p-inconsistent*. Nevertheless, the p-context may be informationally *underdetermined* as well (Rescher & Brandom 1980: 3ff.). A typical case of the informational underdetermination of the p-context is its *p-incompleteness*, insofar as there are statements which are neither plausible (in the extreme case: true with certainty) nor implausible (in the extreme case: false with cer-

tainty) with respect to any source given. A p-context may be simultaneously informationally under- and overdetermined.

(v) The concepts of data and evidence. P-inconsistency and p-incompleteness often arise from situations in which there is conflicting evidence or no evidence for a given hypothesis, respectively, in the given p-context. In the terminology of the p-model this means the following. According to the p-model, *data* are plausible or certainly true statements. In particular, the structure of linguistic data consists of a statement with an *information content* capturing some characteristic of the object of investigation and a *plausibility value* originating from some direct source such as corpora, linguistic intuition, experiments, etc., or from a compound of such sources. A datum is *evidence for* a hypothesis if it is a premise of a plausible inference that makes this hypothesis plausible. Similarly, a datum is *evidence against* a hypothesis if it is a premise of a plausible inference that makes this hypothesis implausible. Thus, p-inconsistency emerges if certain data provide evidence for a statement but other data provide evidence against it. P-incompleteness may result from the lack of data that could serve as evidence for or against a certain statement.

(vi) Problems, their solution and their resolution. We call instances of informational over- or underdetermination *p-problems*. If a p-context is characterised by over- and/or underdetermination, then it is called *p-problematic*. In order to solve a problem, we have to re-evaluate the p-context by revising its elements (see *(viii)* on this). A *solution of a p-problem* is achieved if a p-context has been arrived at in which either (a) the statement in question is unanimously supported or opposed by the sources, that is, it is either plausible or implausible on the basis of *all* sources in the given p-context, or (b) the statements generating p-inconsistency can be represented in such a way that they become separated systematically and this separation is well-motivated.

It is possible that a problem has several solutions. The *resolution of a p-problem* is a solution of the given problem which is, when compared with other solutions, the best according to a set of criteria accepted as well as the information available to us.

(vii) Plausible argumentation. To achieve the solutions or the resolution of a given p-problem, we need a heuristic tool that enables us to *re-evaluate the p-context*. This heuristic tool is what we will call *plausible argumentation*. In simple terms, plausible argumentation is the transformation of a p-problematic p-context into one which is no

longer (or at least, less) problematic. This involves the successive re-evaluation of a problematic p-context by the elaboration of possible solutions to its p-problems, the evaluation of the alternative solutions and the comparison of the latter. Its aim is the detection of all available solutions and the decision as to which of them is to be accepted as the resolution of the given p-problem.

(viii) The cyclic nature of plausible argumentation. The above characterisation of plausible argumentation indicates that the argumentation process is basically not linear, because the re-evaluation of a problematic p-context usually does not lead immediately to an unproblematic one but may raise new problems. This may require the revision of previous decisions or the assessment of other alternatives etc. Therefore, throughout the argumentation process one returns to the problems at issue again and again, and re-evaluates the earlier decisions about the acceptance or rejection of statements, the reliability of the sources, the plausibility values of the statements, the workability of methodological norms, the conclusions previously reached by inferences etc. In sum: one *retrospectively re-evaluates* the information at one's disposal (cf. Rescher 1976, 1987). Thus, retrospective re-evaluation is *cyclic* in nature. Of course, cyclic returns are also possible within an argumentation cycle. If one is not satisfied with the fulfilment of some step during the current cycle in the face of the information obtained in a later stage, then one may start a sub-cycle.

(ix) The prismatic nature of plausible argumentation. Plausible argumentation is not only cyclic, it is also *prismatic*. This means that the cycles continuously change the perspective from which the pieces of information constituting the p-context are evaluated (cf. Rescher 1987). In this way, one modifies the p-context again and again and – if no resolution of the initial p-problem is achieved – sets up new, re-evaluated versions of it. Thus, the newer and newer argumentation cycles gradually elaborate diverse constellations of statements, plausibility values, sources, and methodological principles etc., i.e., rival solutions.

(x) Problem solving strategies. A constitutive characteristic of plausible argumentation is that usually the re-evaluation of the p-context cannot be complete. There are often practical limits that do not allow us, for example, to take every source of the starting p-context into consideration, to produce and evaluate all information potentially inherited by them, or to perform a complete test of inconsistency during the coordination of the p-context etc. Therefore, one has to rely on *problem-solving strategies* that are capable of ensuring that the ar-

gumentation process takes a relatively comprehensive range of information into consideration.

The choice of the problem-solving strategy which can be applied in the current state of the elaboration of the p-context requires the use of heuristic considerations as well, because there are no exact criteria which would allow one to determine which perspective has to be taken in a given situation. Basically, one can choose between three strategies for treating p-inconsistency:

– *The Contrastive Strategy*. The essence of this strategy is that it develops p-context version germs in such a way that it treats the p-context versions containing the contradictory statements as rival alternatives. That is, one aims at reaching a decision between them on the basis of the information at one's disposal.
– *The Exclusive Strategy*. This strategy is applied after the Contrastive Strategy when a decision has been reached between the two rival p-context versions elaborated. It aims at checking as comprehensively as possible whether the p-context version chosen can be extended in such a way that it is capable of explaining phenomena that could be accounted for within the rejected p-context version. This, of course, may lead to the emergence of new p-problems.
– *The Combinative Strategy*. This strategy consists in treating the two rival p-context versions not as rivals but as two parts of a whole that have to be maintained simultaneously. The two co-existing p-context versions making up the whole p-context have to be gradually elaborated. In such cases, one has to try to elaborate two unproblematic p-context versions. If one succeeds, then the initial p-problem is solved by the simultaneous but systematically separated maintenance of the two rival p-context versions. Nevertheless, it is essential to check whether the separation of the two p-context versions is well-motivated.

(xi) The logical background of the problem solving strategies. Classical logic cannot explain how it is possible that there are scientific theories that contain contradictions but are fully functional. To wit, according to classical logic, anything follows from contradictory premises. Therefore, inconsistencies are seen to lead to logical chaos and are deemed to be intolerable.

In the second half of the twentieth century several attempts were made to develop non-classical logics in which it is not the case that

anything follows from a pair of contradictory statements. More precisely, let ⊨ be the relation of logical consequence. ⊨ is *explosive* if and only if for every statement *A* and *B*, {*A, ~A*} ⊨ *B, where '~' stands for the logical constant of negation.* Classical logic is explosive. A logic is said to be *paraconsistent* if and only if its relation of logical consequence is not explosive. (For recent surveys see, for example, Priest 2002a,b, Meheus (ed.) 2002, Priest et al. (eds.) 2004, Priest & Tanaka 2009, Tanaka et al. (eds.) 2013 etc.). In the current literature it is generally acknowledged that some version of paraconsistent logic is inevitable whenever one deals with inconsistency.

The most natural extension of the p-model's inventory presented seems to be Rescher & Brandom's (1980) paraconsistent logic. Its basic idea is that Kripke-style semantics is modified in such a way that one cannot draw inferences from premises which belong to different possible worlds. Thus, if *A* and *~A* are separated from each other into different possible worlds, then they are harmless and do not lead to logical chaos.[4]

Having introduced the p-model as a metatheoretical framework, in the next section we will apply it to the metatheoretical reconstruction of Wurzel's analysis of German affricates.

3   On (P)(a)

3.1   *The reconstruction of Wurzel's (1981) attempt to solve the contradiction (I)(a) and (b)*

Wurzel considers only the affricates [ts] and [pf] and, accordingly, (I) is made more specific in that it is retrospectively re-evaluated as (Iw):

(Iw)   (a)   The German affricates [ts] and [pf] are monophonemic.
       (b)   The German affricates [ts] and [pf] are biphonemic.

In the terminology of the p-model this means that Wurzel (1981) applies the *Contrastive Strategy* (see (*x*) in Section 2): he deems (Iw)(a) and (b) as rival alternatives between which a decision has to be made.

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4   For details, see Rescher & Brandom (1980), Kertész & Rákosi (2013: Section 3.2).

In order to come to a decision between (I$_W$)(a) and (b), Wurzel makes use of a series of *structural rules* in that he examines whether the conflicting statements are compatible with these structural rules and the relevant data. In other words, he tests whether the given data, combined with the structural rules, provide evidence for or against (I$_W$)(a) and (b) in the sense of (*v*) in Section 2.

Cycle 1: The first structural rule (SR1) pertains to possible formative-initial consonant clusters in German:

(SR1) (a) 0 < |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.|$_W$ < 1

     (b) 0 < |If a vowel /V/ follows a formative-initial /C_2C_1/ consonant cluster, then the consonant /C_1/ also occurs in the same position.|$_W$ < 1

(SR1) 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: 250). Greenberg emphasises the proviso that although he believes that it applies to a significant majority of languages, it does not apply to every language. Moreover, it is supported only by certain clusters of data even in particular languages, allowing for many exceptions. Therefore, this generalisation has, in his view, "only statistical validity". Wurzel is aware of the counterexamples against the structural rules, too. Therefore, (SR1)(a) and (b) are plausible but not true with certainty on the basis of Wurzel (1981) (abbreviated as W) as a source in the sense of (i) in Section 2.

Wurzel applies (SR1) to the alveolar affricate [ts] (Wurzel 1981: 938) and examines whether this rule is compatible with (I$_W$)(a) or (I$_W$)(b). He makes use of the following linguistic data:

(D1) (a) 0 < |*zwar* [tsvɑːr] ('although'*)* is a German formative.|$_W$ < 1

     (b) 0 < |No formative exists with the structure [sv_] in German.|$_W$ < 1

     (c) 0 < |There exists a formative of the structure [vɑː_] in German, cf. *war* ('was').|$_W$ < 1

The statements in (D1) have to be assigned a high plausibility value on the basis of Wurzel (1981) as a source; nevertheless, they don't receive the maximal plausibility value because they contain linguistic analysis based on the linguist's linguistic intuition and linguistic knowledge as well as generalisation. Wurzel examines the relationship between (SR1) and (I$_W$)(a) and (I$_W$)(b) with the help of (D1)(a) and (b). His argumentation can be reconstructed as a series of plausible inferences in the sense of (ii) in Section 2. The first inference goes as follows:

(1) $0 <$ |If the alveolar affricate is biphonemic (= (I$_W$)(b)), then it has the phonemic structure /ts/.|$_W < 1$
$0 <$ |*zwar* [tsvɑːr] is a German formative.|$_W < 1$ (= (D1)(a))
$0 <$ |If the alveolar affricate has the phonemic structure /ts/, and *zwar* [tsvɑːr] is a German formative, then the phonological representation of the formative *zwar* will be /tsvɑːr/.|$_W < 1$
$0 <$ |If the phonological representation of the formative *zwar* is /tsvɑːr/, then, according to (SR1)(a), the phoneme cluster /sv_/ should also exist in German.|$_W < 1$
$0 <$ |No formative exists with the structure [sv_] in German.|$_W < 1$ (= (D1)(b))
$0 <$ |The alveolar affricate is not biphonemic.|$_{(1)} < 1$ (= ~(I$_W$)(b))

This reconstruction shows that inference (1) can be regarded as a source that does not prove that (I$_W$)(b) is false but rather, makes (I$_W$)(b) *implausible*. From a logical point of view, this result means that the premises of this inference and (I$_W$)(b) cannot be true at the same time: the assumption that the alveolar affricate is biphonemic is in conflict with the structural rule (SR1) and the relevant linguistic data.

Then, Wurzel examines the tenability of the opposite assumption and checks whether (I$_W$)(a) is consistent with (SR1) and the linguistic data with the help of the following plausible inference:

(2) $0 <$ |If the alveolar affricate is monophonemic (= (I$_W$)(a)), then it has the phonemic structure /t^s/.|$_W < 1$
$0 <$ |*zwar* [tsvɑːr] is a German formative.|$_W < 1$ (= (D1)(a))
$0 <$ |If the alveolar affricate has the phonemic structure /t^s/, then the phonological representation of the formative *zwar* will be /t^{s}vɑːr/.|$_W < 1$

0 < |If the phonological representation of the formative *zwar* is /tˢvɑːr/, then, according to (SR1)(a), the phoneme cluster /v_/ should also exist in German.| w < 1

0 < |There exists a formative of the structure [vɑː_] in German.| w < 1 (= (D1)(c))

0 < |The alveolar affricate is monophonemic.| (2) < 1 (= (Iw)(a))

Confirmation theory[5] would interpret (2) in such a way that (Iw)(a) has become more probable, while according to the p-model, (2) is a source on the basis of which one can deem (Iw)(a) plausible.[6] The reason for the latter claim is that (2) is a plausible inference that is deductively invalid and also requires latent background assumptions in order to make the conclusion plausible.[7]

From a logical point of view, these findings mean that the set {(Iw)(a), (SR1), (D1)} is consistent; the relevant data and the first structural rule are fully compatible with the hypothesis that the alveolar affricate is monophonemic. In the p-models terminology this means that the data in (D1) and (SR1) provide evidence (in the sense of (*v*) in Section 2) for (Iw)(a) because they make it plausible, and they provide evidence against (Iw)(b) by making it implausible.

Figure 1 summarizes the findings we have reached so far:

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[5]   Confirmation theory has been popular among philosophers of science and practicing scientists for decades. It has several versions but it also has to face severe criticism:

> To say that a body of information is evidence in favour of a hypothesis is to say that the hypothesis receives some degree of *support or confirmation* from that information. What sorts of information confirm what hypotheses is a question which has long been controversial; it was discussed as avidly three centuries ago as it is today, when, under the heading of 'confirmation theory', it is one of the central topics in contemporary philosophy of science. Its profound interest to philosophers is due to its intimate connection with the *philosophical problem of induction*, concerning what grounds, if any, observational data can give us for accepting as a basis for action and belief hypotheses whose content logically transcends the observational data. Presumably, if it could be shown that any such hypothesis is sufficiently well confirmed by the evidence, then that would be grounds for accepting it. (Howson 2000: 108; emphasis as in the original)

[6]   For the relationship between probability and plausibility, see Kertész & Rákosi (2012: 74f.).

[7]   For the analysis of this type of inference, see Kertész & Rákosi (2012: Section 9.5).
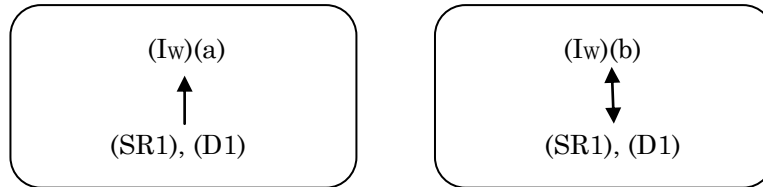
Figure 1[8]

Since no well-founded decision can be based on the application of a sole hypothesis, Wurzel extends the p-context with a new hypothesis and further data.

The second structural rule applied by Wurzel is the following 'mirror-image rule':

(SR2) $0 <$ |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.| $w < 1$

Wurzel relies on the following set of data:

(D2) (a) $0 <$ | *Pfote* [pfo:tə] ('paw') is a German formative.| $w < 1$
       (b) $0 <$ |No formative exists with the structure [_fp] in German.| $w < 1$
       (c) $0 <$ | *Pfropfen* [pfrɔpfən] ('plug') is a German formative.| $w < 1$
       (d) $0 <$ |There exists a formative of the structure [_rpf] in German, cf. *Karpfen* ('carp').| $w < 1$

First, Wurzel checks, with the help of (D2), whether the biphonemicity of the labial affricate is compatible with (SR2). The inference drawn by Wurzel can be reconstructed as follows:

(3) $0 <$ |If the labial affricate is biphonemic (= (I_W)(b)), then it has the phonemic structure /pf/.| $w < 1$
       $0 <$ | *Pfote* [pfo:tə] is a German formative.| $w < 1$ (= (D2)(a))

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[8] In Figures 1-13b, double arrows indicate inconsistency, simple arrows indicate support.

> 0 < | If the labial affricate has the phonemic structure /pf/, and *Pfote* [pfo:tə] is a German formative, then the phonological representation of the formative *Pfote* will be /pfo:tə/. | w < 1
>
> 0 < | If the phonological representation of the formative *Pfote* is /pfo:tə/, then, according to (SR2), the phoneme cluster /_fp/ should also exist in German. | w < 1
>
> 0 < | No formative exists with the structure [_fp] in German. | w < 1 (= (D2)(b))
> _____
> 0 < | The labial affricate is not biphonemic. | (3) < 1 (= ~(Iw)(b))

The premises of (3) make (Iw)(b) implausible instead of providing support for it. That is, we have to face p-inconsistency again, since the set {(Iw)(b), (SR2), (D2)(a)-(d)} turned out to be inconsistent.

   The contrary assumption that the labial affricate has a monophonemic character, however, does not lead to p-inconsistency:

(4)   0 < | If the labial affricate is monophonemic (= (Iw)(a)), then it has the phonemic structure /p^f/. | w < 1

        | *Pfropfen* is a German formative. | w = 1 (= (D2)(c))

        0 < | If the labial affricate has the phonemic structure /p^f/, and *Pfropfen* is a German formative, then the phonological representation of the formative *Pfropfen* will be /p^{f}rɔp^{f}ən/. | w < 1

        0 < | If the phonological representation of the formative *Pfropfen* is /p^{f}rɔp^{f}ən/, then, according to (SR2), the phoneme cluster /_rp^f/ should also exist in German. | w < 1

        0 < | There exists a formative of the structure [_rpf] in German. | w < 1 (= (D2)(d))
        _____
        0 < | The labial affricate is monophonemic. | (4) < 1 (= (Iw)(a))

Here again, we obtained that the hypothesis that affricates are monophonemic is in harmony with the second structural rule and the relevant linguistic data. Thus, the argumentation presented in connection with the structural rule (SR2) has led to the same results as with the rule (SR1), because both data sets provide evidence for (Iw)(a) and against (Iw)(b):
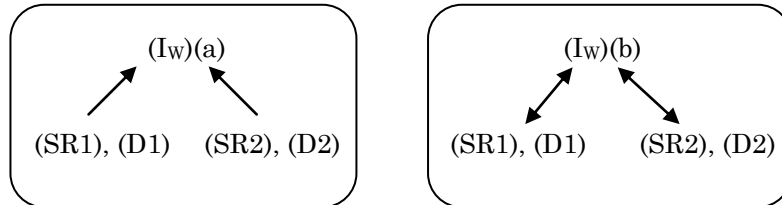
Figure 2

Therefore, the inferences (3) and (4) reinforced the conclusions of the inferences (1) and (2): the plausibility of (Iw)(a) and the implausibility of (Iw)(b) *have increased*. From a logical point of view this means that the supposition of (Iw)(a) leads to a consistent set of statements, while presuming (Iw)(b) leads to a doubly inconsistent set of statements on the basis of the linguistic data and structural rules taken into consideration so far.

These results might tempt us into a decision between (Iw)(a) and (Iw)(b) and suggest keeping (Iw)(a) while giving up (Iw)(b) as the solution to this p-problem. This would be, however, premature, since, as Wurzel also realizes, the two structural rules also have to be applied to the affricates in a reverse order.

Thus, he employs (SR1) to the labial affricate and, with the help of inferences similar to (2) and (4), he obtains that the first structural rule is consistent with both (Iw)(a) and (Iw)(b). In particular, both the assumption that the labial affricate is biphonemic and that it is monophonemic is in harmony with (SR1) and the following data:

(D3) (a) $0 < |$ *Pflicht* [pflıçt] ('duty') is a German formative. $|_W < 1$
(b) $0 < |$ There exists a formative of the structure [fl_] in German, cf. *flicht* (3rd person singular of the verb *flechten,* 'to plait'*). $|_W < 1$
(c) $0 < |$ There exists a formative of the structure [l_] in German, cf. *Licht* ('light'). $|_W < 1$

From this it follows that adding (D3) to the p-context version containing (Iw)(a) in Figure 2 does not lead to inconsistency, and the plausibility of (Iw)(a) has risen again. The p-context version around (Iw)(b), however, has become p-inconsistent because (SR1) and (D3) also provide evidence in the sense of (*v*) in Section 2 for the hypothesis that affricates are biphonemic:
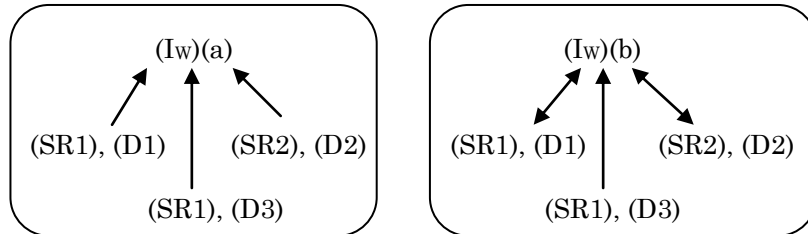
Figure 3

Wurzel (1981) also tries to reveal the relationship between the alve-
olar affricate and the mirror-image rule (SR2) with the help of the
data in (D4):

(D4)   (a) 0 < |*zehn* [tse:n] ('ten') is a German formative.|$_W$ < 1
       (b) 0 < |There exists a formative of the structure [_st] in Ger-
            man, cf. *Nest* [nɛst] ('nest').|$_W$ < 1

With the help of an inference similar to (2) and (4), he comes to the
conclusion that the assumption that the alveolar affricate is biphonemic
is consistent with the second structural rule and the data in (D4).

At this point, let us summarize the results of Wurzel's considera-
tions. As Figure 4 shows, his argumentation in connection with the
structural rules (SR1) and (SR2) seems to motivate the decision that
(I$_W$)(b) should be given up and (I$_W$)(a) kept, because the p-context on
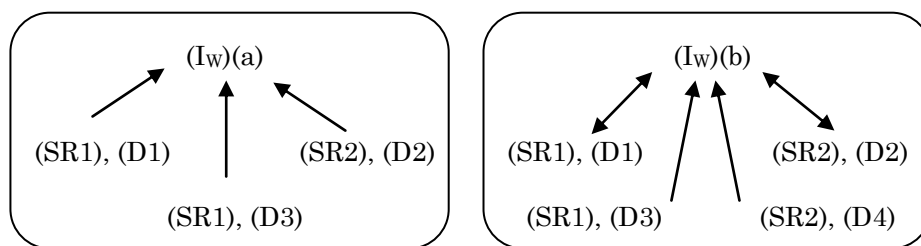the left is p-consistent while the p-context on the right is p-incon-
sistent:

Figure 4

There are, however, further relevant structural rules which have to
be taken into consideration such as (SR3):

(SR3) 0 < | If the phoneme /v/ precedes a vowel, then it can only occur alone or as part of a two-member phoneme sequence. | w < 1

The starting point of Wurzel's argumentation in connection with the structural rule (SR3) is the following datum:

(D5) 0 < | *zwingen* [tsvɪŋən] ('to force') and *zwar* [tsvɑːr] ('although') are formatives of German. | w < 1

Wurzel's conclusion with respect to (D5) and (SR3) is that the biphonemic character of the alveolar affricate is incompatible with them, since in this case, the phoneme /v/ would be preceded by the two consonants /t/ and /s/. In contrast, the assumption that the alveolar assumption is monophonemic, does not lead to a conflict with the third structural rule and (D5), because /tˢ/ has to be regarded as a single phoneme.

If we add these results to our earlier findings, then the picture is not altered in comparison to the situation depicted in Figure 4. That is, the p-context version around (Iw)(a) has remained p-consistent, while the p-context version involving (Iw)(b) has become even more p-inconsistent in the sense that the plausibility of (Iw)(b) has increased, while its implausibility has not been reduced:
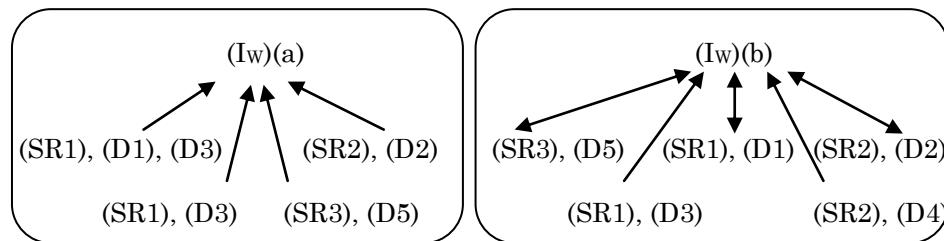

Figure 5

The last structural rule applied by Wurzel is the following:

(SR4) 0 < | Not only short vowels, but also long vowels and diphthongs may precede a single consonant. | w < 1

Wurzel examines the relationship of this rule to the alveolar and the labial affricate with the help of the data in (D6) and (D7), respectively:

(D6)   0 < | *Mieze* [mi:tsə] ('pussycat') and *Brezel* [bre:tsəl] ('pretzel')
are formatives of German. | w < 1

(D7)   0 < | There is no formative with the structure [_V_1V_2pf] in Ger-
man. | w < 1

(SR4) and (D6) are fully consistent with the assumption that the al-
veolar affricate is of a monophonemic nature. With the help of an in-
ference similar to (1) and (3) it is easy to show that the fourth rule
and the data in (D7) are in conflict with the hypothesis that the labial
affricate is monophonemic.

Now, after arriving at the final point of Wurzel's argumentation
and taking into consideration all four structural rules, we have to re-
alise that the conflict between (Iw)(a) and (Iw)(b) could not be re-
solved. As Figure 6 shows, both the assumption of (Iw)(a) and that of
(Iw)(b) result in a p-inconsistent set of statements (p-context).
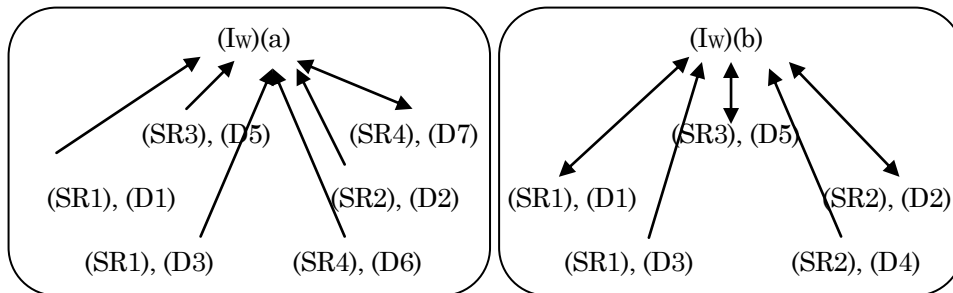

Figure 6

Thus we can make the substantial claim that both (Iw)(a) and (Iw)(b)
have to be regarded as plausible according to certain sources, while
they seem to be implausible on the basis of other sources. As we have
seen, there are data which provide evidence for (Iw)(a), while other
data provide evidence against it; and the same can be stated with re-
spect to (Iw)(b), although it is clear that in the case of (Iw)(a), there is
only one piece of counter-evidence in the p-context.

To build up this phonemic system, however, Wurzel *has to* decide
whether the affricates will be independent phonemes in the system or
not. Thus, as a last resort, he still accepts (Iw)(a) in his subsequent
reasoning. (Iw)(b) remains part of his approach but he does not use it
as a premise in later inferences – that is, he isolates this hypothesis

from the other hypotheses without eliminating it. This might correspond to the application of the *Combinative Strategy* in (*x*) in Section 2. Nevertheless, the separation of the two rival hypotheses is not well-motivated – it remains *ad hoc* – and Wurzel's proposal cannot be deemed to be a well-founded solution of the p-inconsistency (I) in the sense of Section 2. Moreover, since in Wurzel's argumentation as reconstructed above there are several problematic points, it seems to be reasonable to start new argumentation cycles in order to find out whether Wurzel's argumentation can be retrospectively re-evaluated in such a way that one arrives at a solution of (I). Accordingly, in the next section we will supplement the above reconstruction by our own line of argumentation, keeping within the same phonological framework, in order to find out whether there have been hitherto unrevealed possibilities of inconsistency resolution in Wurzel's approach.

3.2 *Additional retrospective re-evaluation of Wurzel's argumentation*

Cycle 2: The first criticism we would make of Wurzel's approach is that the hypothesised structural rules were not checked against the whole domain of the available data. If we examine with respect to (SR2), for example, whether Wurzel's investigations conducted in Cycle 1 were comprehensive, then we have to conclude that they were not. For example, let us consider the following data, whose plausibility value stems from the present author's linguistic intuition, abbreviated as R:

(D8) (a) $0 < |$ *Pflaume* [pflaʊmə] ('plum') is a German
            formative. $|_R < 1$
      (b) $0 < |$ There exists no formative of the structure [_lpf] in
            German. $|_R < 1$

According to (D8)(a), the phoneme sequence [pfl] can occur formative-initially, but as is captured by (D8)(b), one cannot find a formative with a final [lpf]. If we apply the second structural rule to (D8) by supposing (I$_W$)(a), we obtain the following inference:

(5) $0 < $ | If the labial affricate is monophonemic (= $(I_W)(a)$), then it has the phonemic structure $/p^f/.\,|_W < 1$

              $0 < $ | *Pflaume* [pflaʊmə] is a German formative.$\,|_R < 1$ (= (D8)(a))

              $0 < $ | If the labial affricate has the phonemic structure $/p^f/$, and *Pflaume* [pflaʊmə] is a German formative, then the phonological representation of the formative *Pflaume* will be $/p^f$laʊmə/.$\,|_R < 1$

              $0 < $ | If the phonological representation of the formative *Pflaume* is $/p^f$laʊmə/, then, according to (SR2), the phoneme cluster $/\_lp^f/$ should also exist in German.$\,|_R < 1$

              $0 < $ | There exists no formative of the structure [_lpf] in German.$\,|_R < 1$ (= (D8)(b))

              $0 < $ | The labial affricate is not monophonemic.$\,|_{(5)} < 1$ (= $\sim(I_W)(a)$)

This leads, however, to fatal consequences, because neither $(I_W)(a)$ nor $(I_W)(b)$ is consistent with the structural rule (SR2) and the whole set of linguistic data:
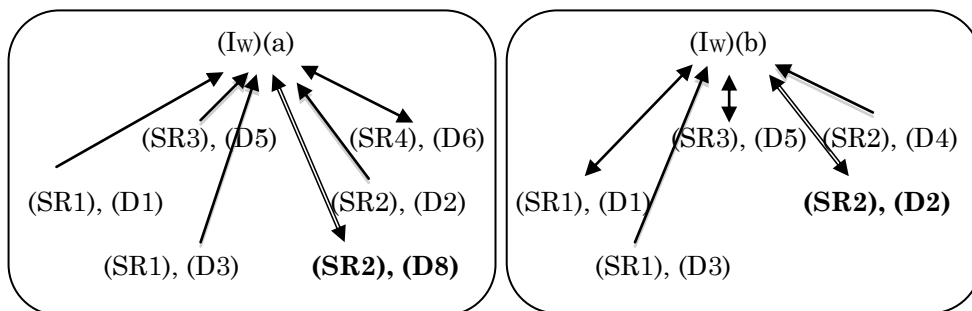

Figure 7

This motivates the introduction of a subcycle: we might try to re-evaluate the p-context in such a way that we give up (SR2).

Subcycle 1: Let us consider the rejection of (SR2). This decision is also motivated by the finding that several counterexamples can be found against it. For example, as Wurzel (1981: 938) also mentions, *Twist (*'twist'*)*, *Schwall (*'stream'*)*, *quer (*'diagonally'*)* are exceptions to (SR2).

After giving up (SR2), the situation seems to be less problematic. However, it is still the case that both (Iw)(a) and (Iw)(b) are in conflict with certain structural rules and data, as Figure 8 shows:
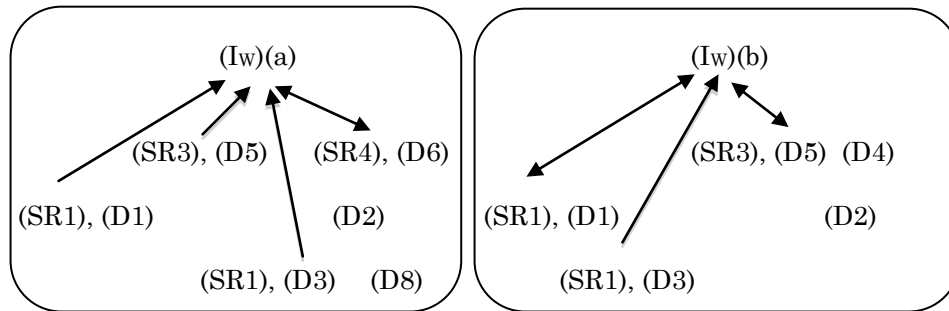

Figure 8

Another problem with the rejection of (SR2) is that it leads to information loss. Namely, none of the rival hypothesis systems obtained in Cycle 2, Subcycle 1 are capable of describing the cases in which (SR2) functioned properly.

Subcycle 2: There is, however, an alternative solution to this problem which avoids this deficiency. It is based on the circumstance that the exceptions to (SR2) mentioned in Cycle 2, Subcycle 1 have the structure /Cv_/, that is, their second consonant is a /v/. Therefore, we might try to declare that formatives of the phoneme structure /Cv_/ are *exceptions* to (SR2). Moreover, since /f/ is the voiceless counterpart of /v/, by analogy formatives with the structure /pf_/ could also be regarded as an exception to (SR2). Against this background, if we re-introduce (SR2) into our two rival sets of statements with a slight modification as (SR2'), the inconsistency of the p-context version around (Iw)(b) does not increase, while (Iw)(a) remains p-inconsistent with (D8) and (SR2'):

(SR2') (a) $0 <$ |If the phoneme cluster $/C_1C_2\_/$ occurs formative-initially and C_2 is not a /v/ or a /f/, then there exists a formative in which the phoneme cluster $/\_C_2C_1/$ occurs formative-finally.| $_R < 1$

    (b) $0 <$ |If C_2 is a /v/ or a /f/, then the above rule cannot be applied to the given formative.| $_R < 1$

Since (SR2') results from a thought experiment that serves solely to discover whether its introduction leads to a more satisfactory hypothesis system, the plausibility of both statements in (SR2') is positive but rather low on the basis of the source R. After adding (SR2') to both p-context versions, the following situation emerges:
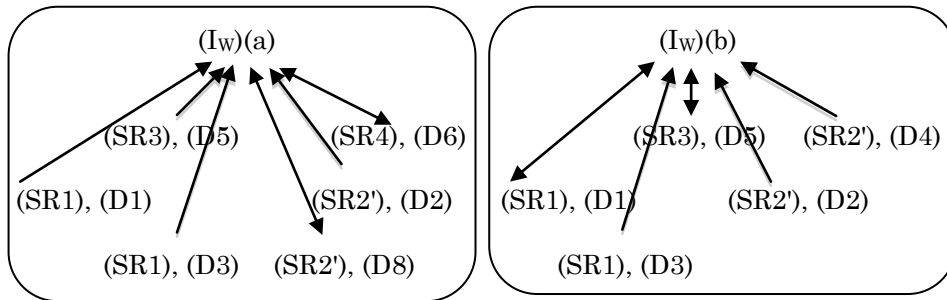

Figure 9

Subcycle 3: In connection with the conflict between the structural rule (SR4), $(I_W)(a)$ and (D6), we may try to keep $(I_W)(a)$ and give up the structural rule (SR4) by declaring the data in (D6) to be counter-examples against this hypothesis:
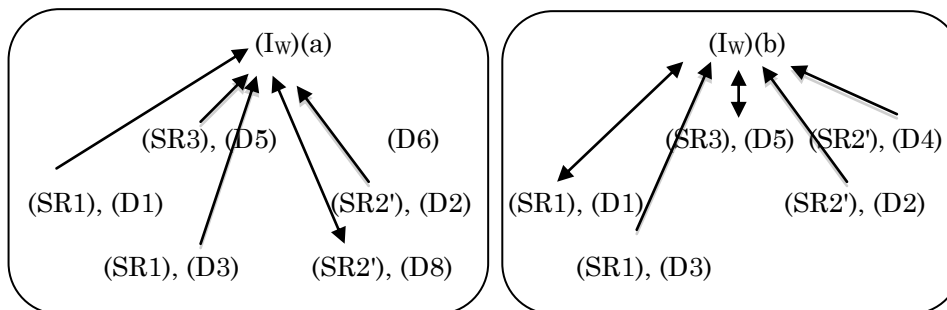

Figure 10

As Figure 10 shows, we arrive again at a situation in which neither $(I_W)(a)$ nor $(I_W)(b)$ is consistent with all structural rules and linguistic data, although $(I_W)(a)$ is only in conflict with (SR2') and (D8). Therefore, still no solution is obtained and further subcycles should be started.

Subcycle 4: Since (SR3) only rules out possible phoneme structures that are also prohibited by (SR1), (SR3) can be deemed to be redundant. Therefore, it can be eliminated without information loss. The resulting situation is as in Figure 11:
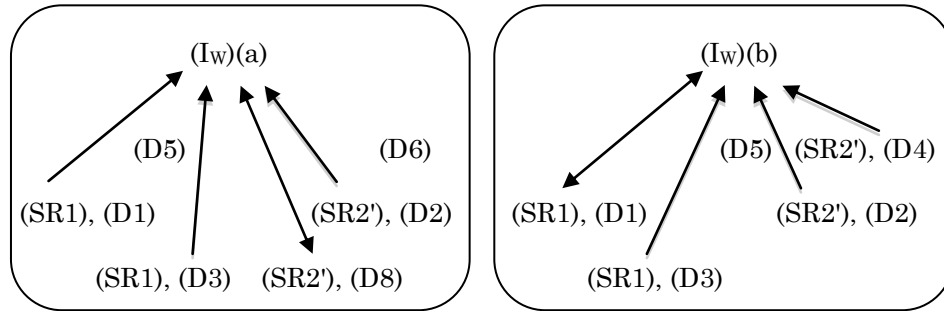

Figure 11

Here again, neither p-context version seems to lead to a satisfactory solution.

Subcycle 5: As Figure 11 shows, while (SR1) combined with (D3) supports (I_W)(b), (SR1) and (D3) provide evidence against it. In order to resolve this conflict, we might try to abandon (SR1). This would, however, intensify the information loss. Accordingly, a better strategy seems to be to modify (SR1) in the following way:

(SR1') (a) $0 <$ |If a vowel /V/ follows a formative-initial /$C_3C_2C_1$/ consonant cluster and C_1 is not a /v/, then the consonant cluster /C_2C_1/ also occurs in the same position.|$_R < 1$

  (b) $0 <$ |If a vowel /V/ follows a formative-initial /C_2C_1/ consonant cluster, then the consonant /C_1/ also occurs in the same position.|$_R < 1$

Thus, we could proceed similarly as in the case of (SR2), since this rule has also been modified because of the counterexamples. That is, here again certain formatives are declared to be *exceptions* to a rule. As a result, the following constellation would be obtained:
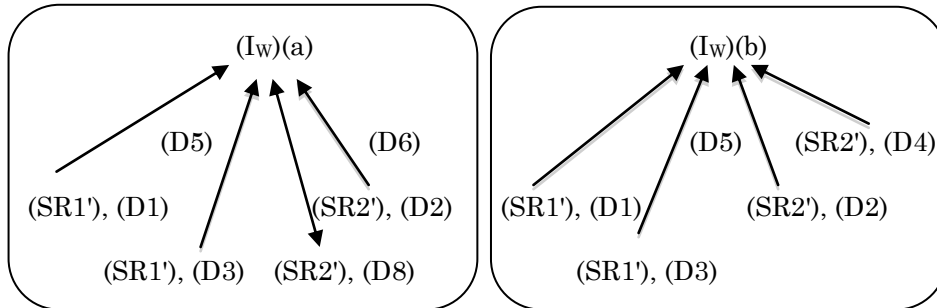
Figure 12

As Figure 12 shows, we reached a p-context in which a solution of the initial p-problem has been obtained. Namely, it seems to be reasonable to give up (I$_W$)(a) and opt for the biphonemicity of German affricates, because the p-context around (I$_W$)(b) is p-consistent, while that around (I$_W$)(a) remained p-inconsistent.

Cycle 3: However, this would mean that a decision has been made on the basis of only two structural rules. Moreover, both (SR1') and (SR2') rely on the strategy of forbidding the application of rules to formatives of a certain structure and maintaining the latter as "exceptions", without giving an explanation of the latter's disobedient behaviour. Therefore, it might be a rational choice to say that that amount of informational underdetermination cannot be tolerated and the process of plausible argumentation cannot yet be terminated.

There are further points as well at which Wurzel's argumentation can be re-evaluated. For example, Wurzel set up the conflict between the monophonemic and biphonemic character of the labial and the alveolar affricate in such a way that he forced a common judgement about their mono/biphonemicity. In particular, the only alternatives he considered were that both affricates were biphonemic or both were monophonemic. There are, however, other combinations possible: it may be the case that one of the affricates is biphonemic, while the other one is monophonemic. From this it follows that instead of the inconsistency between (I$_W$)(a) and (I$_W$)(b), we should start from two sets of inconsistencies which can be resolved separately:

(I$_W^1$) (a)   The German affricate [pf] is monophonemic.
        (b)   The German affricate [pf] is biphonemic.

(Iw²) (a)   The German affricate [ts] is monophonemic.

     (b)   The German affricate [ts] is biphonemic.

Against this background, for example, the final state of Wurzel's argumentation can be reconstructed as follows (cf. Figure 6):
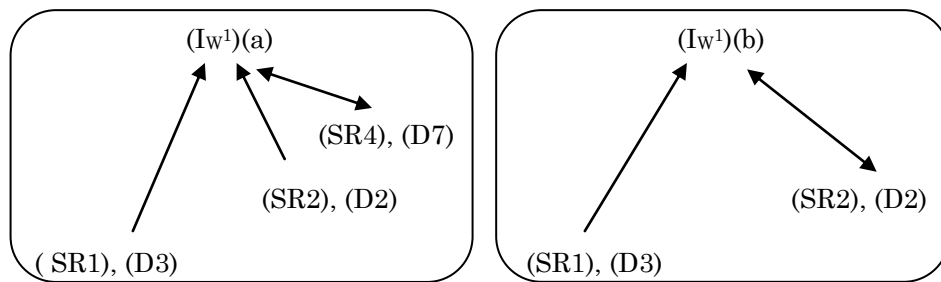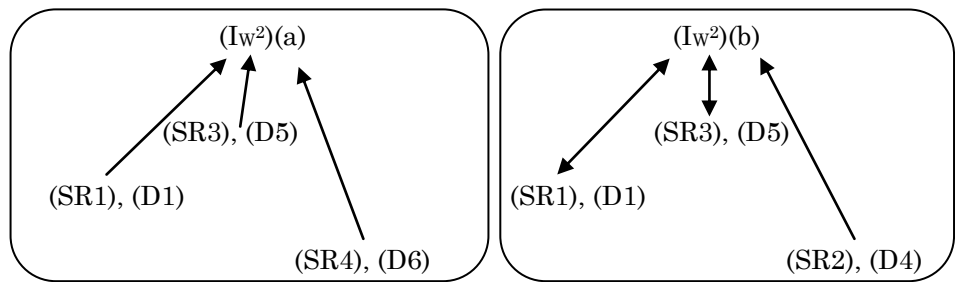

Figure 13a

Figure 13b

As Figure 13b shows, the assumption that the alveolar affricate [ts] is monophonemic leads to a consistent hypothesis system. As for the labial affricate, however, both the hypothesis that it is biphonemic and the assumption that it is monophonemic leads to inconsistency. Therefore, we have not reached a solution of the initial p-inconsistency. Of course, one may (and should) check the applicability of the steps presented in this section in connection with the conflict between (Iw)(a) and (Iw)(b) in the case of (Iw¹)(a)-(b) and (Iw²)(a)-(b) as well. Thus, a new series of alternatives emerges that also have to be analysed and compared. Nevertheless, one has to find a solution to (Iw¹) and (Iw²) parallelly, in the sense that the same changes to the

given constellation of structural rules and data should be made use of with the p-contexts around $(I_{w^1})(a)$, $(I_{w^1})(b)$, $(I_{w^2})(a)$ and $(I_{w^2})(b)$.

To sum up, our analysis of Wurzel's approach has led to the following conclusions:

(6) (a) There is no solution-candidate which would be clearly better than others; most candidates cannot even be regarded as solutions in the sense of (vi) in Section 2.

 (b) Therefore, the Contrastive Strategy failed in this case.

 (c) A pivotal point of several resolution attempts was the reference to "exceptions", which raises problems:
   – Rules are most often supposed to be applicable to all cases. Permitting exceptions would mean that they could be declared to be inapplicable to a certain range of linguistic items.
   – Nonetheless, this strategy is usually judged to be fully legitimate if one finds an *explanation* for the behaviour of the disobedient linguistic items. In such cases, their separation from the obedient items can be deemed *well-motivated*.
   – In contrast, the application of this strategy without such explanations may lead to *inconsequentiality*: there might be cases in which one rejects a hypothesised rule because there are counterexamples against it, while in other cases one keeps the rule and treats pieces of counter-evidence as "exceptions".
   – Nevertheless, if the disobedient cases possess some *common characteristic*, then one might suppose that their exceptional behaviour will find an explanation in future. Thus, as a last resort, their separation from the scope of the rule may be acceptable, and the p-inconsistency at issue may be *tolerated provisionally*.

 (d) The analysis and comparison of the possibilities discussed in the previous subsections revealed that inconsistency is not the only factor that has to be taken into consideration when comparing different hypothesis-constellations:
   – As we have seen in (c), in several cases the p-inconsistency was treated in such a way that the "disobedient" formative structures were declared to be "exceptions" to some structural rule and the scope of the rule

was restricted to those cases which conform to the rule. This strategy is, however, often not satisfactory from a linguistic point of view. That is, the decision about the acceptability of such solutions *goes beyond purely formal considerations*.

– The rejection of a structural rule (or in general: a hypothesis) may lead to a consistent system of accepted statements and data but it also causes information loss. Namely, the reduced hypothesis system is no longer capable of accounting for the conforming cases when the structural rule could be applied.

– The structural rules stipulated by Wurzel are based on inductive generalisation. Despite their similar origin, they do not seem to be equally strong. For example, (SR1) appears to be more reliable, and firmer than (SR2), (SR3) or (SR4), because it has no counter-examples and it gets support from a greater amount of positive examples.

– The circumstance that Wurzel made use of only a few and similar criteria (i.e., "structural rules" based on inductive generalisation) might be regarded as a decisive factor in the failure of his approach.

On the basis of these considerations, we came to the conclusion that the inconsistency between (I)(a) and (I)(b) *cannot be resolved* within Wurzel's framework. From this, the following solution to (P)(a) presents itself:

(SP) (a) The basic inconsistency of German affricates is *irresolvable* within Wurzel's approach. This is primarily due to the circumstance that he relied on a few criteria which were of similar origin (inductive generalisation) and related to similar aspects of affricates (phonotactics). Since the application of these criteria yielded conflicting results, the use of the Contrastive Strategy, that is, forcing a decision between rival alternatives could not lead to a satisfactory result.

A further important finding was that this failure cannot be ascribed to Wurzel's erroneous argumentation; there seem to be deeper, more substantial reasons at work. One possible explanation of this conclu-

sion and a radically new approach to the problem of German affricates was provided in Prinz & Wiese (1991). Rákosi (2014) will be devoted to the reconstruction of its argumentation structure.

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