SOAS Working Papers in Linguistics Vol. 12 (2002): 365-387

On the purposes of phonological phenomena: phonetics, parsing, lexical access, and/or acquisition?

Stefan Ploch
ploch@linguistics.wits.ac.za

1 Introduction

Most phonologists (and most linguists) believe that phonological phenomena are phonetically motivated (a view for which I shall adopt Ploch's 1997 term 'Phonetic Hypothesis').[1] The most common version of this is the view that humans do phonology because they are trying to achieve a greater degree of ease of articulation. I will support the claim made by Kaye (1989) and elaborated on in much detail by Ploch (cf. note 1) that the Phonetic Hypothesis can be proven wrong, that there is no evidence for it, that it is held up by its supporters via the usage of ad hoc hypotheses immunising it against refutation, and that the continued support it receives constitutes thoroughly unscientific behaviour (section 2).

This naturally leads to the question: what are phonological phenomena motivated by, then (section 3)? Kaye's (1989; 1992) answer is two-fold:

(1) According to Jonathan Kaye, the purpose of phonology is
- to help the hearer parse the continuous input string into distinct cognitive units (I will call this view the 'Parsing Hypothesis'),
- and to provide a lexical addressing system (this, I shall refer to as the 'Lexical Hypothesis').

I will show (a) that while the Parsing Hypothesis can, in principle, be set up as a testable hypothesis, Kaye's (1989) version appears not to be (section 3).[2]

My main claims, presented in section 4, provide the Acquisitional Hypothesis as an alternative proposal for the properties of phonological phenomena:

1. The internal representation of a melodic unit ('segment') corresponds, cross-linguistically, to a certain range within the acoustic spectrum, and there is some overlap between these correspondences, i.e., a specific acoustic cue cannot always be uniquely identified in terms of what phonological representation it belongs to *(acoustic cue overlap*, cf. Ploch 1998, 1999b).
2. Therefore, a child acquiring a language whose melodic (i.e., phonological) expressions correspond to non-uniquely phonologically identifiable acoustic cues would have an acquisition problem if there was no additional help.
3. The necessary additional help is of a phonological nature: Acquisition of non-uniquely identifiable systems is made possible by (certain) phonological phenomena: an analysis of what segments trigger what phonological phenomenon helps the child to make heuristic shortcuts about internal representations, i.e., phonology narrows down the analytical options the child has.

[1] It is not clear whether Piggott (1999) adopted the identical term 'Phonetic Hypothesis' from Ploch (1997) or coined it independently. A more detailed discussion of the Phonetic Hypothesis can be found in Ploch (1999a;b; 2000; 2001; in prep.).
[2] There is no space here to look at Kaye's Lexical Hypothesis.

An important finding of this paper is thus in support of what I would like to call the 'Acquisitional Hypothesis', or, in other words, the claim that without phonology, many languages as we know them (that is to say, many of the attested systems of lexical melodic units) could not be acquired, or, phonological phenomena widen the range of acquirable vowel (and, presumable, consonant) systems.

2 The Phonetic Hypothesis

In this section, I will look at the widely held doctrine that phonological phenomena are motivated by the properties of some phonetically defined system, say, the articulatory or auditory system. (For 'phonological phenomenon', I will use Kaye's 1989 definition: the shape/content changing of "a context-dependent variable"; some phonological unit appears, in a specific context, in a specific form, and in a different specific context, in a different specific form.) I will show that (a), from a quid juris point of view,[3] this doctrine (i.e., that phonological phenomena are motivated by the properties of some phonetically defined system) *can* be proposed as a testable hypothesis, in which case it can be falsified, and that (b), from a quid facti perspective, the supporters of this doctrine employ conventionalist stratagems (ad hoc hypotheses) to immunise it against falsification.

2.1 The Articulatory Hypothesis and its deconstruction

In the following, I will first show how Turkish [–back] harmony can be accounted for in terms of an articulatory version of Phonetic Hypothesis, i.e., in terms of the 'Articulatory Hypothesis' (section 2.1.1); I will then proceed to argue, in agreement with Kaye (1989), against such an account (section 2.1.2). After that, I will explain why an acoustic version of the Phonetic Hypothesis (the 'Acoustic Hypothesis') does not entail any improvement (section 2.2).

2.1.1 Apparent evidence for the Articulatory Hypothesis: [–back] vowel harmony in Turkish

I will start my deconstruction of the Articulatory Hypothesis by demonstrating what the supposed evidence in favour of it usually looks like. Generally, such evidence consists of the description of some phonological phenomenon in phonetic, and most frequently, articulatory terms.

The example I have chosen is a textbook example: Turkish [–back] harmony. So let us first look at the relevant data:[4]

(2) [–back] harmony in Turkish

Nom.sg.	3sg.poss.nom.	Nom.pl.	
kɪz	*kɪz-ɪ*	*kɪz-lar*	girl
at	*at-ɪ*	*at-lar*	horse
muz	*muz-u*	*muz-lar*	banana
ot	*ot-u*	*ot-lar*	herb, grass
fil	*fil-i*	*fil-ler*	elephant
ev	*ev-i*	*ev-ler*	house
süt	*süt-ü*	*süt-ler*	milk
gőz	*gőz-ü*	*göz-ler*	eye

[3] Quid juris? refers to questions of logical, epistemological or methodological validity, quid facti? to questions of factuality.

[4] My data, but similar data can be found in Lewis (1967); Charette & Göksel (1994; 1996a;b; 1998); Ploch (1998; 1999b); Ewen & Hulst (2001).

As we can see in (2), the Turkish plural suffix has two variants, *-lar* and *-ler*; *-lar*, which contains the [+back] vowel *a*, appears after the [+back] vowels *ɪ*, *a*, *u* and *o*; *-ler*, with the [–back] vowel *e*, can be found after the [–back] vowels *i*, *e*, *ü* and *ö*. An articulatory (autosegmental) analysis, as it is, for example, presented in Ewen & Hulst (2001: 46–50), would claim that the underlying representation of the suffix vowel contains the feature [+back] (/ɑ/) but that in the case of the presence of a [–back] specification preceding it on the [back] tier (without any intervening [+back] specification), this preceding [–back] feature spreads to the right to the suffix vowel, which is thus changed (at the so-called 'surface') to its corresponding [–back] vowel, [ɛ].

Supporters of the Phonetic Hypothesis could claim that Turkish [–back] harmony is not only captured by phonetic terms or circumscribed by it but is also part of the truth content of the Articulatory Hypothesis, i.e., part of what the Articulatory Hypothesis predicts to occur and in this way accounts for. So we see, they could say, that the hypothesis that phonological phenomena are motivated by attempts on the parts of speakers to achieve a greater degree of ease of articulation is actually borne out. Clearly, there is evidence for the Articulatory Hypothesis, no?

In the following, I will show why the argument for the Articulatory Hypothesis presented above is not logically valid.

2.1.2 Deconstructing the Articulatory Hypothesis

Kaye (1989) argues against the Articulatory Hypothesis by pointing out that if it were true that phonological phenomena exist in order to increase the degree of ease of articulation, this would predict the wholesale phonetic (and since in this case the phonology would be motivated by articulation, also the phonological) convergence of human languages over time. It should then be possible to demonstrate that, cross-linguistically, language change moves in the same direction. However, nothing of the kind can be shown; there is no wholesale convergence of spoken languages, be it phonetic or phonological.[5]

In this context, it would not be a sound argument to try to counter Kaye's attack by saying that there is 'some agreement' amongst languages as far as the predicted convergence is concerned, and that 'some agreement' provides at least 'some evidence' for the Articulatory Hypothesis; after all, there are certain diachronic changes that occur in all sorts of unrelated languages, say, palatalisation, syncope of unstressed vowels, epenthesis of hiatus breakers, nasalisation of vowels preceding a nasal consonant, place assimilation, or even total assimilation of certain consonant clusters, lenition of intervocalic consonants, etc. Does this not confirm the Articulatory Hypothesis?

Such a response to Kaye would not be scientific because it would make the ease-of-articulation hypothesis untestable; that is to say that no matter what we find when we investigate this world, we could always maintain such an untestable version of the Articulatory Hypothesis, since we would systematically discount all of its counter-examples and only count those cases where it works. Using this tactic, we would just have to look at enough 'confirming evidence'. Self-evidently, all hypotheses can be upheld this way, as long as we can find some scenarios where they 'work'. Examples would be astrological hypotheses such as the universal statement that *Virgoans are more meticulous than non-Virgoans*. As long as we only collect

[5] Kaye (1989) also shows in what way a number of counter-arguments that some may levy against his views do not weaken his deconstruction.

examples of meticulous Virgoans, ignoring the possibly high number of counter-examples, we could talk about 'evidence' for astrology, and if we were to look for meticulous Virgoans for a few decades, we could certainly find an impressive number of 'confirming' cases -*as long as we ignore counter-examples*.[6] In the same way, only testable versions of the Articulatory Hypothesis can be provided evidence for, and, as Kaye has shown, the prediction that languages should phonetically and phonologically converge is not borne out.

To explain to the reader why only versions of the Phonetic Hypothesis that apply to *all* cases where some phonetic property is present (thus predicting that some phonological property must be present too) could have any explanatory power, it is important to understand the difference between strictly and numerically universal statements: Logically, in order to derive a prediction *P* (i.e., an existential statement, say, 'there is coffee in the cup in front of me') from some statement U, *U must* be a strictly universal statement, i.e., a universal statement ('For all *x*, *y* is true') that refers to an *infinite* set of *x*s; for example, if *U* is taken to be the numerically universal statement U_{num} 'All brown liquids (that I have encountered up to now) are coffee', then this universal statement refers to a *finite* set of *x*s. Crucially, if we assume both U_{num} and the existential statement *E* 'There is a brown liquid in the cup in front of me', then we *cannot* predict on the basis of this that any brown liquids we have not encountered yet (i.e., that are not a member of the set U_{num}) will be coffee too. In such a case, we cannot predict that the brown liquid in the cup in front of me (referred to in *E*) is coffee. This is also why any encounter with a brown liquid that is not coffee cannot falsify U_{num}, i.e., the statement that some other finite set of brown liquids are in fact always coffee.

On the other hand, if we take *U* to be the strictly universal statement U_{strict} 'All brown liquids (whatsoever) are coffee', then the assumption of U_{strict} *does* predict that any brown liquid that we may come across (taken to be a potentially infinite set of brown liquids) *must* be coffee. Thus, the assumption of both U_{strict} and *E* does in fact predict that the brown liquid referred to in *E* is coffee. Importantly, in the latter scenario, our universal statement U_{strict} can be proven wrong if we find that the existential statement $E{-}_{coffee}$ 'There is a brown liquid that is not coffee' is true. However, no case where $E{-}_{coffee}$ is true, i.e., where we find a brown liquid that is not coffee, can prove wrong U_{num} (the numerically universal statement that some finite set of brown liquids are all coffee).

We take note of the following: (a) In order to make scientific predictions, we need to assume some *strictly universal* statement plus some initial condition, i.e., an existential statement. (b) While both numerically and strictly universal statements are testable (numerically/strictly universal statements by showing that at least one member *a* of the finite/infinite set *x*, respectively, does not have property *y* that is specified by the universal statement), only strictly universal statements can make predictions about specific instantiations of variable *x* (about which the universal statement is made) that have not been encountered yet.

Consequently, only statements of the kind 'All instances of phonetic property *x* *whatsoever* cause phonological property *y*' are scientifically interesting universal statements, i.e., statements that are not themselves observations as numerically universal statements can be, and only such strictly universal statements can *explain*

[6] For details on the philosophy of science, cf. works by Karl R. Popper, e.g., Popper (1933; 1934; 1972a;b; 1973; 1994a;b). For arguments against subjectivism or usefulness as a scientific criterion, and against misrepresentations of Popper's philosophy of science on the part of Imre Lakatos and Daniel Everett, cf. Ploch (2002a) and note 1 in Ploch (in prep.).

certain observations. Statements of the kind 'All instances of phonetic property *x* that have been encountered on this planet up to now cause phonological property *y*', or 'Some instances of phonetic property *x* cause phonological property *y*', on the other hand, are not explanations but mere observations, from which nothing follows whatsoever, because of which no evidence for their general (i.e., potentially infinite) validity can be provided. In other words, whenever we find, by observation, that some 'universal' set merely has finite validity, if we then do not assume, as a thought experiment or theory, its strictly universal version (with infinite validity), we cannot make predictions, cannot go beyond our mere observations, and can thus not explain those observations. Any explanation requires a strictly universal statement. Such a strictly universal statement is proven wrong by existential statements that are in contradiction with them (or, rather, with the negative existential transformation of the strictly universal statement, cf. below).

One might try to counter this by saying that finding an increasing number of scenarios where the Phonetic Hypothesis *is* borne out provides evidence for it in that it makes the Phonetic Hypothesis ever more likely to be true to the extent that this number increases. Such a move, however, would not be logical. More generally, to think that the more cases one can find where basic statements predicted by a hypothesis have a match in reality, i.e., can be observed, the more likely that hypothesis is to be true, may be psychologically valid (i.e., in tune with some people's intuitions) but is, as Popper (1934; 1972b) has shown and as has been known by Hume (1888; 1966) as early as in the 18th century, certainly not logically valid.

The reason for this is simple. Remember that any explanation must contain a strictly universal statement (i.e., one that makes a relationship between an infinite number of argument *x* and some property *y*). This means that when we observe that the existential statement E_1 '*a* has property *y*', then, if we want to relate this one observation with *all* observations of the same kind in a scientifically relevant way (where only strictly, not numerically universal statements count as universal statements), we have observed one out of an infinite number of cases. Similarly, when we observe E_2, E_3 ... E_n (with *n* being some finite number), we always make a finite number of observations out of an infinite number of observations (n / ∞). Where our intuitions go wrong is when we think that because n / z (with *z* being some finite number) is smaller than $(n + o) / z$ (with *o* being some other finite number greater than zero), i.e., because, say, 5 / 4000 is smaller than 3876 / 4000, that therefore also (n / ∞ is smaller than $(n + o) / \infty$, and it is this conclusion that is flawed: for n / ∞, and o / ∞, and $(n + o) / \infty$ all equal: 0.

We are now in a position to understand why the Phonetic Hypothesis, nor any hypothesis, for that matter, can be probabilified: No matter how many cases we can point to where some hypothesis 'works', say, where language change moves towards more easily articulated forms (and let us assume for the moment that it can actually be established independently of phonological phenomena what constitutes more or less ease of articulation), none of these cases provide any evidence for that hypothesis nor does it make it more likely be true, because we can always only observe a finite number of cases, and since the observation of any finite number of cases results in the same relationship (zero), we cannot *ever* provide 'confirming' evidence for any hypothesis. Note also that any number of attested cases where a hypothesis 'works' corresponds to the same relationship between observed cases (finite number) and cases to be observed (infinite number), i.e., 0.

This means, as far as evidence for the Phonetic Hypothesis is concerned, that it makes no difference whatsoever how many 'confirming' cases its supporters can list:

no evidence for it has been provided by doing so nor have the numerous 'confirming' cases found during the last decades made it one iota more likely to be true. Since probabilification of hypotheses is not possible, we can only compare different *testable* hypotheses about the purpose of phonological phenomena, do our best to destroy them, and then see which one is left standing or which hypothesis has been damaged least by our rigorous testing.[7] (An untestable hypothesis, like any violable ranked constraint in the Optimality pseudotheory, is always left standing and is in this way not scientifically interesting.)

All that is left for a supporter of the Phonetic Hypothesis is to make statements about the supposed relationship 'from' phonetics 'to' phonology of the most trivial kind: For example, one could claim that the phonetic component makes available phonetic options to the phonology. Note that the way this is phrased (the phonetics does something 'to' the phonology) still gives the impression that the phonetics is relevant to the phonology. However, 'the phonetics makes available phonetics to the phonology' (out of which the phonology then selects) says nothing more than (a) there is something called 'the phonology', (b) phonology can be pronounced, perceived, etc., and let us call pronunciation and perception 'phonetics', and (c) there are (phonetic) rules of pronunciation and perception, or in terms of the 'options' phonetics makes available, what can be pronounced and perceived can be pronounced and perceived, what cannot, cannot. In other words, to 'claim' that the phonetics makes available phonetics to the phonology contains no claim about the phonetics causing anything phonological and has no explanatory power, neither as far as the motivation of phonological phenomena is concerned nor the motivation of any other. However, the way this claim is formulated (with an implied directionality from phonetics to phonology) either *pretends* that there is a *causal* relationship from phonetics to phonology or says very little about that relationship other than that there is some correlation, and phrases that observation in a somewhat unfortunate manner, obviously influenced by three, four decades of phonetically 'motivated' phonology.[8]

More generally, since no hypothesis can be 'confirmed', not only the claim that language change is motivated by the phonetics, but also the proposal that any phonological phenomenon is caused by the properties of the articulatory or auditory system cannot be 'confirmed' but can only be scientifically investigated if it is set up in form of testable strictly universal statements and if one then tries to levy against such statements as much counter-evidence as possible. A comparison amongst competing hypotheses will show which of the hypotheses is less wrong and in this way closest to the truth.

2.2 The failure of the Acoustic Hypothesis

The main problem with auditorily motivated claims about the motivation of phonological phenomena is identical to the flaw of articulatorily motivated claims discussed above: they are not testable and are argued for on the basis of metatheoretically unsound 'confirming' evidence. Some examples are discussed in Ploch (1999a) and Ploch (1999b: chapter 1).

To mention one example, Hawkins & Stevens (1985) point to the fact that "some languages have the same number of nasal as non-nasal vowels, with no reported differences in quality between the two sets" while in a "substantial minority

[7] For more details on why probabilification of hypotheses is not possible, cf. Popper (1972b); Ploch (in prep.).

[8] Ploch (1999b) discusses two strategies, viz., the strategy of denial and the strategy of exibility of applicability, employed by many supporters of the Phonetic Hypothesis in order to uphold it.

of languages that contrast nasal and non-nasal vowels, there is a reduced number of nasal vowels" such that "it is the mid vowels that are missing in these imbalanced systems". This can supposedly be explained by saying that the reduced discriminability of nasal vowels that is caused by nasalisation is "thereby avoided in that only those vowels with the most distinctive values of *F* 1 are retained" (p. 1574).

This explanation is unfortunately question-begging: it begs the question why such nasal mid vowels occur in other languages. How can the speakers of the balanced systems cope with the auditory difficulty the reduced discriminability of nasal vowels induces, without eliminating the vowels with the not-so-distinctive values of Formant 1? Hawkins & Stevens's (1985) explanation works when it works and is not testable: as long as some languages (i.e., the imbalanced languages) 'confirm' their hypothesis (without this 'confirmation' providing any evidence, cf. above!) no amount of counterexamples need to be taken seriously. Remember that the same line of argument is used to 'confirm' astrological claims.

3 Kaye's view on the purposes of phonology: parsing (and lexical access)[9]

In this section, I want to look at the first half of Kaye's claim that the purpose of phonology is (a) to help the hearer parse the continuous input string into distinct cognitive units (the Parsing Hypothesis), and (b) to provide a lexical addressing system (the Lexical Hypothesis) (cf. 1). I will show that the Parsing Hypothesis can, in principle, be corroborated by some evidence but that, in its current form, it is not testable. It will also become apparent that certain phonological phenomena (e.g., vowel harmony) cannot be explained by this hypothesis, not even by a testable version thereof. This will make evident that we still need an explanation for the function of phonology. My proposal that this purpose is to make more vowel and consonant systems acquirable will be discussed subsequently, in section 4.

In Kaye (1989: 50), Kaye states the following:

> "Clearly, human beings come equipped with a parser . . . If I am correct, phonological processes serve to facilitate parsing. It is the existence of phonological processes that makes possible the speed of oral communication that we observe in the languages of the world. Although individual phonological processes are not adaptive, it is quite possible that our current transmission rate is. Human linguistic capacity is certainly an enormous advantage to our species, doubtless essential to our survival. Would a communicative system that functioned at, say, one-fifth our speed offer the same adaptive qualities?"

Kaye (ibid.) also refers to the thought-experiment of removing the effects of all phonological processes from a string of speech, resulting in a string without context-dependent variables; he explicitly mentions stress effects and boundary phenomena like final devoicing as examples of such phonological phenomena. Later (on the same and the following page), he adds harmony phenomena (delimitating word or morpheme boundaries) and processes sensitive to syntactic structure and/or morphological categories (e.g., English palatalisation of coronal obstruents before the palatal glide *j* in *you*, *your* but not in *university*, *Eunice* or *Yorick*).

[9] As pointed out above, there is not enough space to discuss Kaye's Lexical Hypothesis

The problem with Kaye's Parsing Hypothesis is that even though it accounts for some data (e.g., boundary phenomena and those sensitive to syntactic or morphological categories), it is not testable. It may well be the case that a string of speech from which all phonological processes have been removed may be harder to parse or require more time to be parsed, just as it may well be that English palatalisation of coronal obstruents before the palatal glide may in fact increase ease of articulation, but such explanations merely account for data (and the fact that this is so provides, for logical reasons, no evidence for these explanations, cf. above). The crucial question is: are these explanations testable? I have already explained why some version of the Phonetic Hypothesis is testable and falsified without this being interesting to its supporters, and why the version that is currently upheld and taught by the mainstream in phonology is not testable. Similarly, I will now show that while some version of the Parsing Hypothesis may well be testable, Kaye's version is not.

In order to understand this point, it is important that we distinguish feasible from corroborated hypotheses. 'Feasible', if it is not a subjective and therefore unarguable notion equivalent to 'intuitive(ly sound)' or 'useful (according to somebody's wishes, needs, etc., i.e., confirming what someone wants to hear)',[10] simply means the conjunction of the two properties 'possible, thinkable' plus 'it accounts for data'. (For some, a disjunction may do.) So if it is feasible that phonological phenomena are motivated by properties of the articulatory system then this is another way of saying that one can account for certain phonological data with such a hypothesis; that is all, and I have already explained why no hypothesis can be supported in such a way. A better corroborated hypothesis, on the other hand, has stood up to tests better than some other hypothesis and is thus, for logical reasons, closer to the truth than that other hypothesis.

Now there is a particular problem when it comes to finding support for evolution- and selection-related hypotheses: such propositions about the motivation of some property *y* of some species *x* are commonly portrayed as supported by evidence by making them appear feasible, i.e., by showing that species *x* had some advantage

[10] There is rarely any point to having a discussion with subjectivists. A subjectivist can always be right no matter what the world looks like. There is simply no point in *discussing* whether a tree falling in a forest without anyone observing that tree falling really exists, or whether we all only share the dream that the sun is hot. More specifically, there is hardly any point in discussing whether any scientific proposal is 'useful', as the pragmatists, i.e., a type of subjectivists, like Dan Everett (2002a;b), following William James, do. Everett first 'argued' against Popper based on a series of misrespresentations of Popperian objectivity, cf. Ploch (2002a) for details, and then, when the misrepresentations were pointed out to him by Ploch (ibid.), Everett (2002a) simply dismissed objective truth as a relevant concept. He can of course do that, but then any discussion must deteriorate to a sharing of subjective experiences. So Everett can say to anything one may levy as counterarguments against some of his 'useful' views "Yes, but *I* like it. *I* find it useful. The majority of linguists [who may well be wrong] find it most useful.", etc., just like any non-pragmatist subjectivist can say "Yes, but maybe we're all dreaming this". Obviously, there is, for a scientist, little if any point in having any discussion with subjectivists, i.e., with people who do not even subscribe to the common courtesy of proposing views that can be *argued* at all. (Equally obviously, *arguing* and *sharing subjective experiences as regards usefulness* are not identical. Sauerkraut recipes can be useful, but they do not explain anything nor do they make testable predictions nor can their usefulness be *argued* at all.) All subjectivism is sophistry, i.e., clever points without any point. In this way, all subjectivism is entirely disrespectful to anyone who gets used by a subjectivist when they make one of their 'clever' non-arguable points while the objectivist abused in such manner may actually have tried to provide *arguments*. (I actually mean something *arguable*.) Also, the logics of falsifiability will not disappear because Everett or other subjectivists dismiss them for subjective reasons or based on judgments of 'useless' levied against strawman-Popperianisms that make nonsense out of what Popper did in fact propose.

or other over an imagined comparable, i.e., otherwise identical, species without property *y*. So members of *x* with *y* stood a better chance of survival than members of *x* without *y*, and so it is *feasible* that the former group (with *y*) was selected *because of* having property *y*, and thus property *y* survived. In other words, because the hypothesis that property *y* gives an advantage to species *x* accounts for the fact that species *x* did in fact survive, one may think that it is feasible that species *x* survived because of *y*. The problem is that even though this hypothesis is feasible, i.e., it accounts for certain data, it is not logical to conclude that property *y* did in fact give an advantage to species *y* (and will always do; the conditions under which this advantage would have occurred may not have been present).

What would test such a species-*x*-survived-because-of-property-*y* hypothesis? Nothing.) Whenever some property survives, it was 'apparently' advantageous enough and 'therefore' it survived, whenever a property did not survive, it was 'apparently' not advantageous enough and 'therefore' did not survive. What counts as advantageous is not established independently of survival, and therefore: whatever survives, survives, what-ever does not, does not, what is advantageous is, and what is not, is not. Such is the tautological nature of the 'theory' of Darwinism.[11]

To come back to the Parsing Hypothesis, some phonological phenomena, especially those sensitive to morphological domains or word-domains, may in fact be accounted for by the Parsing Hypothesis. From this however it does not follow that the motivation of phonological phenomena is to help the hearer parse the continuous input string into distinct cognitive units. Such a claim could, for example, be backed up by some test that shows that a certain kind of independently measureable level or parsability is always maintained in human languages. (And that would be a case in which Kaye's untestable and thus non-explanatory theory of parsing would, as part of a scientifically interesting research program—cf. note 9—, have resulted in a testable and therefore explanatory theory.) Unfortunately, there are, to my knowledge, no ideas for such tests let alone tests of this sort that have already been undertaken. The evidence that Kaye (1989) points to is quite different.

For example, Kaye refers to nasal harmony (indicating morpheme or word domains). Applying this to Turkish vowel harmony we could try to say that I- and U-harmony, as discussed above, exist in order to increase parsability or to speed up parsing. Consider the following data:[12]

[11] I am aware of the fact that Popper (1992), i.e., in his autobiography, which was first published in 1974 and 1976, stated that Darwinism is not a testable scientific theory but then, in Popper (1978), changed his mind somewhat in that in his view the theory of selection *may* be so formulated that it is far from tautological. The problems with Kaye's Parsing Hypothesis discussed here are not affected by this. I should also say that just as Darwinism may be interpreted as a scientifically interesting metaphysical research program, generating ideas that may become testable and only then usable for explanations—as Popper (1992) also pointed out—even Kaye's untestable theory of parsing may be so interpreted.

[12] In (3), in the rightmost column, regular letters or symbols indicate lexical, subscript letters indicate derived specifications. The empty-set symbol (∅) denotates a lexically empty nucleus into which, if there is a subscript letter, the element symbolised by that subscript letter spreads as part of phonological derivation. Whether the two levels of Government Phonology, i.e., the lexical and the derived phonological level of representation, can in fact be collapsed into one lexical level, goes beyond the scope of this paper.

(3) Juxtaposing two (I-harmonic and I-unharmonic) domains: four possibilities

	Example	Gloss	Type of combination
a.	*köpek balığ-ı*	'type of shark *(lit.* dog fish-3sg.poss.)'	$I/U–A_I$ — A–Ø–Ø
b.	*köpek diş-i*	'eye-tooth *(lit.* dog tooth-3sg.poss.)'	$I/U–A_I$ — $I–Ø_I$
c.	*yılan kemiğ-i*	'remorse *(lit.* snake bone-3sg.poss.)'	Ø–A — $A/I–Ø_I–Ø_I$
d.	*yılan balığ-ı*	'eel *(lit.* snake fish-3sg.poss.)'	Ø–A — A–Ø–Ø

There are four compounds in (3). In (3a), we find an I-harmonic domain followed by an I-unharmonic one; in (3b), there are two adjacent I-harmonic domains; in (3c), an I-harmonic domain follows an I-unharmonic one; and in (3d), an I-unharmonic domain precedes another I-unharmonic one. These are all of the four possible combinations.[13]

So, applying Kaye's proposed parsing-based explanation of phonological phenomena, and, more specifically, of vowel harmony, we could say that the change from an I-harmonic to an I-unharmonic domain in (3a) and from an I-unharmonic to an I-harmonic domain in (3c) always coincides, at the derived phonological level,[14] with a domain change, i.e., the first changed vowel (viz., the first nucleus not dominating I in 3a and the first nucleus dominating I in 3c) is the first (i.e., leftmost) nucleus in a new domain. The Parsing Hypothesis accounts for this neatly; a harmony-domain change provides the hearer with a parsing cue: chop here (i.e., before the onset preceding the first changed nucleus)! Parsing cues are give-aways. So does this not provide evidence for the Parsing Hypothesis?

Unfortunately not. The problem is not so much that, as (3b, d) show, there are also domain changes that are not 'given away' by a harmony-domain change. As Kaye (1989: 51) points out rightly (in relation to nasal harmony),

> "[d]etection of morpheme or word boundaries is [only] *facilitated* [my emphasis] by the harmony process . . . This is not 100% effective, because sometimes two oral or nasal [or I-unharmonic and I-harmonic] words occur in succession. Failure to find a change of nasalization [or I-harmonisation] does not always imply that we are in the middle of some domain."

Where Kaye is wrong in my opinion is when he states (right after the above quote):

> "On the other hand, changes in nasalization [or I-harmonisation] are fairly reliable indicators that we are at a boundary. (ibid.)"

Kaye would only be correct if all words in Turkish were vowel-harmonic. This is far from true: there are plenty[15] of unharmonic words, i.e., domains within which either U and I are attached lexically to a non-leftmost nucleus (i.e., when there is no U or I, respectively, in the left-most nucleus of that domain), or where lexical U or I in a leftmost nucleus do not spread into non-leftmost nuclei of the same domain. So it is precisely not the case that changes in I- or U-harmonisation 'are fairly reliable indicators that we are at a boundary'. It was already shown in Jensen (in prep.); Ploch

[13] These examples do not take into account Turkish U-harmony, cf. (2.) This omission is not relevant to the argument pursued here.

[14] Regarding levels of representations in Government Phonology, cf. Kaye (1995).

[15] What 'plenty' refers to depends on the variety or, rather, register or (diachronic) version of Turkish. The Turkish of an educated Muslim may well contain 10–20% of non-harmonic Arabic or Persian borrowings. A Turk with Western inclination will use more non-harmonic Western words, often borrowed from French. Any good dictionary will support this claim.

(2002b) that the problem here is the Grammaticality Hypothesis, i.e., the belief that the Language Acquisition Device can take any input and 'know' about it whether it is grammatical or not. This hypothesis is not testable, as the case of Turkish vowel harmony illustrates well: all words that are unharmonic must be dismissed as 'foreign' and thus assigned a status of 'does not have to be accounted for by Turkish grammar'. So what would prove wrong the Grammaticality Hypothesis can always be discounted.[16]

Obviously, Turkish speakers can have vowel harmony for certain domains, and, at the same time, make use of various sets of unharmonic domains. The point is that a compound like *Türk tarih kongresi* 'Turkish history congress/convention'[17] is parsable, even though it contains two unharmonic domains. In what way did harmony facilitate processing here? How many words that do not participate in facilitation by harmony does it take to falsify the facilitation/parsing hypothesis? Since the change from an I-unharmonic domain to a I-harmonic domain in both *tarih* and *kongres* can be disregarded by Kaye (such counterexamples are not referred to or discussed anywhere in his writings, as far as I know), his Parsing Hypothesis is not testable; it would only be so if it could in fact be shown that unharmonic domains in Turhish increase processing time. Then, we could however not support the Grammaticality Hypothesis any longer and would have to consider unharmonic words to be part of the set of phenomena that are predicted to occur or, is some cases, not to occur in Turkish.

I conclude that Kaye's Parsing Hypothesis is not testable as long as we subscribe, like most linguists, to the Grammaticality Hypothesis. And even if we abandon the Grammaticality Hypothesis, rendering the Parsing Hypothesis testable, we would then have to come up with tests that try to disprove the Parsing Hypothesis by trying to find phenomena that are predicted by it to make parsing more costly, but do in fact not do so. If we can show that such phenomena do in fact stand up to our tests in that they do make parsing more costly or time-consuming, we would have found corroborating evidence for the Parsing Hypothesis, and would have changed Kaye's interesting but untestable and thus non-explanatory parsing-based research program into a testable and thus explanatory version. The fact that this is not part of the Government Phonology research program makes it clear though that the version of the Parsing Hypothesis used is not a testable one.

4 The Acquisitional Hypothesis

4.1 Some premises

Having dicussed the problems of a number of hypothesis about the purpose of phonology, let me propose the Acquisitional Hypothesis:

(4) The Acqusitional Hypothesis

- The internal representation of a melodic unit ('segment') corresponds, cross-linguistically, to a certain range within the acoustic spectrum, and there is some

[16] Ploch (2002b) goes through a few objections against my anti-Grammaticality Hypothesis stance. So before any reader objects to what I am saying here, I would like to encourage them to have a look at Ploch (2002b) first. Note also that I am not arguing against Universal Grammar. The abandonment of the Grammaticality Hypothesis does entail, however, the abandonment not of principles but of parameters.

[17] *Türk* 'Turk, Turkish'; *tarih* 'history'; *kongres-i* 'congress-3sg.poss'. Both *tarih* and *kongres* are unhar-monic domains.

overlap between these correspondences, i.e., a specific acoustic cue cannot always be uniquely identified in terms of what phonological representation it belongs to *(acoustic cue overla*p, cf. Ploch 1998, 1999b).

- Therefore, a child acquiring a language whose melodic (i.e., phonological) expressions correspond to non-uniquely phonologically identifiable acoustic cues would have an acquisition problem if there was no additional help.
- The necessary additional help is of a phonological nature; acquisition is made possible by (certain) phonological phenomena: an analysis of what segments trigger what phonologigal phenomenon helps the child to make heuristic shortcuts about internal representations, i.e., phonology narrows down the analytical options the child has.

4.2 Vowel harmony in two Turkic languages: Turkish and Sakha

4.2.1 Turkish

The relevant Turkish data (repeated from 2):

(5) [–back] harmony in Turkish

Nom.sg.	3sg.poss.nom.	Nom.pl.	
kɪz	*kɪz-ɪ*	*kɪz-lar*	girl
at	*at-ɪ*	*at-lar*	horse
muz	*muz-u*	*muz-lar*	banana
ot	*ot-u*	*ot-lar*	herb, grass
fil	*fil-i*	*fil-ler*	elephant
ev	*ev-i*	*ev-ler*	house
süt	*süt-ü*	*süt-ler*	milk
göz	*göz-ü*	*göz-ler*	eye

As we can see in (5), Turkish has eight lexical vowels, *ɪ, a, u, o, i, e, ü, ö*. In a traditional articulatorily based analysis, we could classify these vowels as in (6):[18]

(6) The Turkish lexical vowel inventory

	[–round]		[+round]	
	[+high]	[–high]	[+high]	[–high]
[+back]	*ɪ*	*a*	*u*	*o*
[–back]	*i*	*e*	*ü*	*ö*

The third singular possessive (nominative) suffix exhibits four variants, *-ɪ*, *-u*, -i, *-ü*, with the [+back] vowels *ɪ* and *u* after the [+back] vowels *ɪ, a, u, o*, and the [–back] vowels *i* and *ü* after the [–back] vowels *i, e, ü, ö*.

In articulatory terms, we could describe the distribution of this suffix by saying that the suffix vowel is underlyingly specified as [–round, +high, +back] (= *ɪ* = /ɯ/), and that [round] and [back] specifications each spread at their tier from the stem to the suffix vowel, changing its specification accordingly (where applicable).

As pointed out in section 2.1.1, the plural suffix has two variants, *-lar* and *-ler*; *-lar*, which contains the [+back] vowel *a*, appears after the [+back] vowels *ɪ, a, u* and *o*; *-ler*, with the [–back] vowel *e*, can be found after the [–back] vowels *i, e, ü* and *ö*. Ewen & Hulst (2001: 46ff) demonstrate that in an articulatory (autosegmental)

[18] (6) is a rearranged version of the table in (81) in Ewen & Hulst (2001: 46).

analysis the underlying representation of the suffix vowel contains the feature [+back] ([–round, –high, +back] = *a* = [ɑ]) but that in the case of the presence of a [–back] specification preceding it on the [back] tier (without any intervening [+back] specification), this preceding [-back] feature spreads to the right to the suffix vowel, which is thus changed (at the so-called 'surface') to its corresponding [–back] vowel, [ɛ]. Interestingly, while the roundness specification of the stem spreads to the vowel of the third singular possessive suffix, it does not do so in the case of the plural suffix.

Finally, note that, apart from very few exceptions (around two), the representation and distribution of the vowels of all Turkish suffixes are either of the type exhibited by the third singular form (type 1, wide harmony) or by the plural suffix (type 2, narrow harmony); so we can talk about two types of suffixes (type 1 vs. type 1, or wide vs. narrow suffixes).

4.2.2 Sakha

The Sakha data:[19]

(7) [–back] and [+round] harmony in Sakha

Nom.sg.	Def. acc.sg.	Nom.pl.	
ɯt	*ɯt-ɪ*	*ɯt-tar*	dog
at	*at-ɪ*	*at-tar*	horse
bulčut	*bulčut-u*	*bulčut-tar*	hunter
oɣo	*oɣo-n-u*	*oɣo-lor*	child
ki:s	*ki:h-i*	*ki:s-ter*	sable
mekčirge	*mekčirge-n-i*		owl
siyemex		*siyemex-ter*	carnivor
üt	*üt-ü*	*üt-ter*	milk
börö	*börö-n-ü*	*börö-lör*	wolf

Ignoring consonantal variations, we see that Sakha has, phonologically, the same eight vowels that we have already encountered in Turkish (section 4.2.1). Similarly, the underlying representation and allophonic distribution of the definitive accusative singular suffix (type 1) appears to be identical to the Turkish third singular suffix.[20]

It is when we compare the plural suffix (type 2) of Turkish and Sakha that we notice a difference. Again, there is some common ground though: the backness specification of the stem vowel spreads to the suffix vowel. Its roundness specification, however, does, as in Turkish, not spread from *u* and *ü* (round high vowels) but does, unlike Turkish, spread from *o* and *ö* (round non-high vowels).

4.3 A short introduction to Element Theory

For reasons indicated and referred to in section 2, I object to a phonetically motivated analysis of not only the Turkic data presented above, but of any phonological phenomenon. Let me now provide a *phonological* analysis of the Turkic data within Element Theory, the subtheory of melody within Government Phonology (Kaye, Lowenstamm, & Vergnaud 1985; 1990; Harris 1990; 1994; Cobb 1997; Ploch 1999b).

[19] Data from Charette & Göksel (1996b; 1998), and from fieldnotes by Charette. Sakha is also called 'Yakut', but Monik Charette told me that some speakers appear to be unhappy about the latter term.

[20] In fact, all of the Turkish third singular possessive forms in (5) are identical to the Turkish definitive accusative singular forms of these nouns.

The main features of Element Theory are:

- Melodic units (phonological expressions) consist of *element*s, the melodic primes of Element Theory.
- Elements are not phonetically but phonologically motivated. In my view, this means phonological units and phenomena can only be motivated by an analysis (a) of what is contrastive in a language, and (b) of the nature and context of context-dependent variables that are *not* universal. (If they are universal, they are probably phonetic and thus *not* phonologically interesting.)
- Element are privative (i.e., Element Theory is far more restrictive than mainstream feature theories).
- The number of elements assumed to be part of Universal Grammar depends on the version of Element Theory one is dealing with. I am using the most restrictive version that I know of, i.e., Revised Element Theory (as revised by Kaye 1992; 1993a; 1997).
- I assume six elements: A, I, U, L, H, P.[21] For the purposes of this paper, I will only use the A-, I- and U-element.
- Phonological expressions are sets of elements. The definition of a phonological expression is: phonological expression $\subseteq$ {A, I, U, L, H, ?}. Note that this means that an element can only occur once in a phonological expression.
- Elements (and in this way, phonological expressions) are, phonologically, redundancy- free and fully interpretable at all phonological levels. There is no phonetic 'filling in' at the 'surface' (cf. Kaye 1993b; Harris 1996; Ploch 2000).
- Elements within a phonological expression have one of two statuses: head or operator. A phonological expression can only have 0–1 heads.
- Using only A, I, U, this predicts the following phonological expressions for Universal Grammar (phonological expressions are written between parentheses here, heads are underlined):

(8) All possible phonological expressions using A, I, U (experience-based guidelines only as regards what expression corresponds to what vowel type)

Vowel type	Headless expressions	Headed expressions
'ɪ, i'	(I)	(I)
'ʊ, u'	(U)	(U)
'a, æ, ɑ, ɐ'	(A)	(A)
'æ, ɛ, e'	(A,I)	(A,I) (A,I)
'ɒ, ɔ, o'	(A,U)	(A,U) (A,U)
'ʏ, y'	(U,I)	(U,I) (U,I)
'œ, ø'	(A,U,I)	(A,U,I) (A,U,I) (A,U,I)
'ɪ/i, ɛ, i, ə, ɵ, ʌ, ɐ'	—	—

[21] There is no space here to explain the motivation or the application of these elements. For discussion, cf. Cobb (1997); Kaye (1997); Ploch (1999b). Also see Harris (1994) for information; note that Harris uses a higher number of elements.

Universally, this makes seven headless and twelve headed (i.e., altogether 19) phonological expressions (only using A, I, U). Note, since phonological expressions are assumed to be pronounced only if they are attached to a skeletal point, there is the possibility of a (phonetically realised) empty nuclear point, which makes a twentieth lexically contrasting vowel (cf. the bottom line in 8).

Furthermore, a head is said to license its operators. So, for example, in (A,I), both the A- and the I-operator are not licensed by any melodic head; however, in (A,I), an I-head licenses an A operator; in (I,A), an A head licenses an I operator; in (A,I,U), an U-head licenses both an A- and an I-operator.

4.4 Generating vowel systems via constraints

I will use the following constraints to generate vowel systems:[22]

1. An empty nucleus is not licensed.
2. I and U cannot fuse.
3. Licensing constraints on the element status (head/operatorship):
   a. Phonological expressions must not be headless, or
   b. Phonological expressions must not be headed.
4. Licensing constraints on elements ('X' stands for some element):
   a. X must not be a licensor, and/or
   b. X must not be a licensee.

4.5 Generating the Turkic system

In order to generate the Turkic vowel system, we have to say that constraints 1 and 2 are not made use of. (In classical Grammaticality-Hypothesis-supporting terms, we would say that the parameters in 1 and 2 are switched 'off'.) This means that an empty nucleus *is* licensed in Turkic languages (so we get a phonetically realised empty nucleus, in the Turkic languages, [ɯ]), and that I and U *can* combine (so *ü*- and *ö*-type vowels are grammatical).

As for the licensing constraints under 3 and 4, there are seven settings that will generate a Turkic-type system. These will be discussed in the following.

4.5.1 The headless system

For this system, we select licensing constraint 3b. So there can be no headed expressions, i.e., all phonological expressions are headless. (Note that the licensing constraints in 4 cannot be selected when 3b is selected.) This results in the following vowel system:

[22] Of course, I am of the opinion that there is good evidence for these constraints. For discussion, cf. Cobb (1997); Kaye (1997); Ploch (1998; 1999b). I am also aware that such constraints, often called 'licensing constraints' in Government Phonology, presuppose the Grammaticality Hypothesis, which I, as pointed out above, reject. How the patterns that are viewed as consonant or vowel 'systems' by researchers who consciously or unconsciously support the Grammaticality Hypothesis can be expressed in a theory that does not support this hypothesis is most interesting but beside the point here. For ease of demonstration, I will pretend that the world is as simple as that there was a Language Acquisition Device that can know about any input it receives whether it is grammatical, i.e., part of the system to be accounted for by some set of constraints, or not. Note also that the constraints used here are parameterised. As someone who rejects the Grammaticality Hypothesis, I also reject parameters. Again, for convenience's sake, I will abstract away from that here.

(9) The headless system

Symbol	Phonological expression
i	(I)
u	(U)
a	(A)
e	(A,I)
o	(A,U)
ü	(U,I)
ö	(A,U,I)
ɪ	(empty)

4.5.2 The headed systems

To generate a headed system, we must select licensing constraint 3a. So there can be no headless expressions, i.e., all phonological expressions are headed. This, however, still leaves with six options (combinations of element-specific versions of 4a and 4b). These six are:

(10) Licensing constraints on elements for the headed system:[23]

a)	b)	c)	d)	e)	f)	
I	I	U	U	A	A	must not be a licensor.
A	U	A	I	I	U	must not be a licensee.

All in all, we get the following six headed systems:

(11) The six headed systems:[24]

Symbol	a)	b)	c)	d)	e)	f)
i	(I)	(I)	(I)	(I)	(I)	(I)
u	(U)	(U)	(U)	(U)	(U)	(U)
a	(A)	(A)	(A)	(A)	(A)	(A)
e	(I,A)	(I,A)	(I,A)	(A,I)	(A,I)	(A,I)
o	(U,A)	(A,U)	(U,A)	(U,A)	(A,U)	(A,U)
ü	(I,U)	(I,U)	(U,I)	(U,I)	(U,I)	(I,U)
ö	(U,I,A)	(A,I,U)	(U,I,A)	(A,U,I)	(A,U,I)	(A,I,U)
ɪ	(empty)	(empty)	(empty)	(empty)	(empty)	(empty)

4.6 The Acquisitional problem

It may well be the case that in a language with only headed vowels in which there are two *e*-type vowels /e/ and /ɛ/, /e/ corresponds, universally, to I-headed (A,I), /ɛ/ to A-headed (I,A) (and ditto. for two *o*-type vowels, etc.). To discuss that is beyond the scope of this paper. Be that as it may, there is no evidence to suggest that in a language (like the Turkic languages) where there is only *one* contrastive *e*-, *o*-, *ü*- and *ö*-type vowel, the openness or closedness, or tenseness or laxness of the acoustic percept indicates what element does or does not occupy the head position of an element. We could of course decide that this must be so, but that would be an ad hoc constraint that does what we want it to do but that is not supported by evidence.

This means that we are facing an acquisition problem: If the acoustic cues (which give a child acquiring one of the Turkic languages most of the information

[23] Cf. the constraints under 4. Read like this: Option a): I must not be a licensor *and* A must not be a licensee, etc.

[24] Numbers a)–f) in (11) correspond to numbers a)–f) in (10), respectively.

he/she needs to know which phonological expressions he/she is dealing with) do not provide enough information to narrow down a child's options to the extent that he/she can pick out the correct phonological expressions uniquely, how can a child know whether (A,I), (A,I) or (I,A) was encoded? Knowing that he/she is perceiving an *e*-type vowel, for example, is not sufficient knowledge for the child to select the appropriate phonological expression. This is the Acquisitional problem, which I will solve below.

4.7 The phonological solution to the Acquisitional problem

4.7.1 Some preliminary remarks on vowel harmony in Government Phonology

In Government Phonology, vowel harmony is analysed as the spreading of an element from one nuclear point to another nuclear point adjacent to the source nuclear point at the nuclear projection, i.e., the projection of skeletal points to which only *nuclear* skeletal points are visible.

Below, I will analyse Turkic backness and roundness harmony as I- and U-spreading, respectively.

4.7.2 How an element-theoretical analysis of Turkic vowel harmony solves the Acquisition problem

There are earlier element-theoretical analyses of Turkic vowel harmony, viz., Charette & Göksel's (1996b; 1998) accounts. There is no space here to repeat the arguments levied against their approaches by Ploch (1996; 1998).

The analysis I want to propose consists mainly of three claims (cf. Ploch 1998):

(12) Ploch's (1998) analysis of Turkic vowel harmony

1. The lexical representation of the vowel in wide suffixes is a (phonetically realised) empty nucleus (no phonological expression attached); the lexical representation of the vowel in narrow suffixes is (A) in the case of the headless system, and (A) in any of the six headed systems.
2. I spreads at the nuclear projection from left to right (rightward I-harmony).
3. U spreads at the nuclear projection from left to right subject to the constraint: U may not change its lexically assigned head/operator role (rightward non-switch U-harmony).
4. In the case of a headed system: an A-head in a target nucleus may not switch its lexically assigned head/operator role (fixed target A-head).

If we apply these constraints to the seven systems presented in section 4.5, we predict the following seven harmonic systems:[25]

[25] That is, providing that the constraints in 3 only apply to the lexical level, not the derived phonological level, i.e., specifically, provided that derived target phonological expressions may be headless in the headed systems; cf. Ploch (1998) for more details. Note also that licensing constraints are set up to generate *lexical* systems.

(13) The headless harmonic system

Lexical stem vowel		Wide harmony		Narrow harmony	
Symbol	Expression	Symbol	Expression	Symbol	Expression
ɪ	(empty)	ɪ	(empty)	*a*	(A)
a	(A)	ɪ	(empty)	*a*	(A)
u	(U)	*u*	(U)	*o*	(A,U)
o	(A,U)	*u*	(U)	*o*	(A,U)
i	(I)	*i*	(I)	*e*	(A,I)
e	(A,I)	*i*	(I)	*e*	(A,I)
ü	(U,I)	*ü*	(U,I)	*ö*	(A,I,U)
ö	(A,U,I)	*ü*	(U,I)	*ö*	(A,I,U)

(14) Headed system a)[26]

Lexical stem vowel		Wide harmony		Narrow harmony	
Symbol	Expression	Symbol	Expression	Symbol	Expression
ɪ	(empty)	ɪ	(empty)	*a*	(A)
a	(A)	ɪ	(empty)	*a*	(A)
u	(U)	*u*	(U)	*a*	(A)
o	(U,A)	*u*	(U)	*o*	(U,A)
i	(I)	*i*	(I)	*e*	(I,A)
e	(I,A)	*i*	(I)	*e*	(I,A)
ü	(I,U)	*ü*	(I,U)	*e*	(I,A)
ö	(U,I,A)	*ü*	(I,U)	*ö*	(U,I,A)

(15) Headed system b)

Lexical stem vowel		Wide harmony		Narrow harmony	
Symbol	Expression	Symbol	Expression	Symbol	Expression
ɪ	(empty)	ɪ	(empty)	*a*	(A)
a	(A)	ɪ	(empty)	*a*	(A)
u	(U)	*u*	(U)	*a*	(A)
o	(A,U)	*u*	(U)	*a*	(A)
i	(I)	*i*	(I)	*e*	(I,A)
e	(I,A)	*i*	(I)	*e*	(I,A)
ü	(I,U)	*ü*	(I,U)	*e*	(I,A)
ö	(A,I,U)	*ü*	(I,U)	*e*	(I,A)

(16) Headed system c)

Lexical stem vowel		Wide harmony		Narrow harmony	
Symbol	Expression	Symbol	Expression	Symbol	Expression
ɪ	(empty)	ɪ	(empty)	*a*	(A)
a	(A)	ɪ	(empty)	*a*	(A)
u	(U)	*u*	(U)	*a*	(A)
o	(U,A)	*u*	(U)	*o*	(U,A)
i	(I)	*i*	(I)	*e*	(I,A)
e	(I,A)	*i*	(I)	*e*	(I,A)
ü	(U,I)	*ü*	(U,I)	*ö*	(U,I,A)
ö	(U,I,A)	*ü*	(U,I)	*ö*	(U,I,A)

[26] System numbers a)–f) in headed system a) (14) and in the other headed harmony systems below correspond to numbers a)–f) in (10) and (11), respectively.

(17) Headed system d)

Lexical stem vowel		Wide harmony		Narrow harmony	
Symbol	Expression	Symbol	Expression	Symbol	Expression
ɪ	(empty)	ɪ	(empty)	*a*	(A)
a	(A)	ɪ	(empty)	*a*	(A)
u	(U)	*u*	(U)	*a*	(A)
o	(U,A)	*u*	(U)	*o*	(U,A)
i	(I)	*i*	(I)	*e*	(I,A)
e	(A,I)	*i*	(I)	*e*	(I,A)
ü	(U,I)	*ü*	(U,I)	*ö*	(U,I,A)
ö	(A,U,I)	*ü*	(U,I)	*ö*	(U,I,A)

(18) Headed system e)

Lexical stem vowel		Wide harmony		Narrow harmony	
Symbol	Expression	Symbol	Expression	Symbol	Expression
ɪ	(empty)	ɪ	(empty)	*a*	(A)
a	(A)	ɪ	(empty)	*a*	(A)
u	(U)	*u*	(U)	*a*	(A)
o	(A,U)	*u*	(U)	*a*	(A)
i	(I)	*i*	(I)	*e*	(I,A)
e	(A,I)	*i*	(I)	*e*	(I,A)
ü	(U,I)	*ü*	(U,I)	*ö*	(U,I,A)
ö	(A,U,I)	*ü*	(U,I)	*ö*	(U,I,A)

(19) Headed system f)

Lexical stem vowel		Wide harmony		Narrow harmony	
Symbol	Expression	Symbol	Expression	Symbol	Expression
ɪ	(empty)	ɪ	(empty)	*a*	(A)
a	(A)	ɪ	(empty)	*a*	(A)
u	(U)	*u*	(U)	*a*	(A)
o	(A,U)	*u*	(U)	*a*	(A)
i	(I)	*i*	(I)	*e*	(I,A)
e	(A,I)	*i*	(I)	*e*	(I,A)
ü	(I,U)	*ü*	(I,U)	*e*	(I,A)
ö	(I,A,U)	*ü*	(I,U)	*e*	(I,A)

When we look at the system from (13) to (19) and try to find a match for the Turkish pattern, we see that only the systems in (15) and (19) are possible candidates, because only they split, in the case of the narrow harmony type, the vowel system into two groups, i.e., those vowels that are followed by *a* or *e* in the suffix, respectively. Since there is no perceivable difference between the suffix vowel in a type 1 suffix (wide harmony) after *i* and *e* in the stem, as system b) would predict, I propose that the Turkish vowel system is system f) (19). The vowel harmony exhibited in Sakha could only correspond to system a) (14).

I have not seen any other analysis of Turkic vowel harmony yet that can with a simple constraint on U-harmony (non-switch harmony) in combination with the constraint that a lexically assigned A-head in the target nucleus may not switch its role during derivation explain: (a) why it is 'roundness' harmony spreading to a suffix containing a vowel lexically specified as [–round, +high, +back] (*ɪ*) that is not restricted; (b) why the spreading of [+round] may or may not be restricted when

spreading to a vowel lexically specified as [–round,–high, +back] (*a*); and (c) why, when spreading to a lexical [-round,–high, +back] vowel (*a*), [+round] never spreads from the [+round, +high, +back] vowel (*u*).

A further advantage of my analysis is that it can also explain roundness harmony in Yawelmani, a totally unrelated language with a different set of lexical vowels.[27]

Importantly, my analysis also provides a solution to the Acquisition problem mentioned above: It is non-switch U-harmony that disambiguates for the child acquiring one of the Turkic languages which underlying system he/she is dealing with. Remember that the problem consists in the child not being able to know which of the two to four possible phonological representations for complex expressions (phonological expressions containing more than one element) he/she has to assign to any perceived *e*-, *o*-, *ü*- and *ö*-type vowel.

The solution is simple: If U spreads into (A) (wide harmony), it must be operator in the lexical representation of the stem vowel, if it does not, it must be head. This is all the help the child needs. In combination with his/her knowledge of licensing constraints, he/she can then uniquely identify the underlying vowel system. The Acquisition problem is solved.

I should mention finally that I have provided evidence for the synchronic relevance of my non-switching-based proposal and shown that it can solve the Acquisition problem. What I have not done is to provide evidence for the claim that my Acquisition hypothesis explains the purpose of phonology from an evolutionary angle. Since novelties are regarded as random in evolution theory, there can also be no such 'purpose'.

Where does this leave us? It is futile to talk about the evolutionary purpose of developments. What we can do, however, is to make hypotheses about what kind of properties phonological phenomena have. So if we want to say, in agreement with Kaye (1989), that phonological phenomena improve the speed of parsing, then this can be set up as a testable hypothesis, as I have shown (even though the version currently observable in Government Phonology does not appear to be testable). So there may in fact be evidence for the Parsing Hypothesis; this, we need to find out. Be that as it may, I have shown that phonological phenomena disambiguate acoustic percepts such that a child acquiring some language can come to a unique decision about what kind of vowel 'system' it is dealing with, and that phonological phenomena narrow down the analytical options the child has.

Conclusion

I have provided a non-phonetically motivated alternative analysis of Turkic vowel harmony (I-harmony plus non-switch U-harmony) which explains the unique restrictions on roundness harmony in relation to both source and target vowels and which also solves the Acquisition problem, i.e., the problem that the Turkic eight vowel system would, without further information, be unacquirable. The phonology, more specifically, non-switch U-harmony, provides the information necessary to make the Turkic vowel system acquirable.

[27] Cf. Ploch (1998) for details.

References

Charette, Monik & Aslı Göksel (1994). Switching and vowel harmony in Turkic languages. In: Cobb, Margaret & Sean Jensen (eds.) *SOAS Working Papers in Linguistics and Phonetics. Volume 4*, 31–52. London: School of Oriental and African Studies, University of London. Later published as Charette & Göksel (1996b).

Charette, Monik & Aslı Göksel (1996a). Licensing constraints and vowel harmony in Turkic languages. In: Ploch & Simpson (1996), 1–25. Later published as Charette & Göksel (1998).

Charette, Monik & Aslı Göksel (1996b). Switching and vowel harmony in Turkic languages. In: Kardela, Henryk & Bogdan Szymanek (eds.) *A Festschrift for Edmund Gussmann from His Friends and Colleagues*, 29–55. Lublin (Poland): The University Press of the Catholic University of Lublin. First published as Charette & Göksel (1994).

Charette, Monik & Aslı Göksel (1998). Licensing constraints and vowel harmony in Turkic languages. In: Cyran, Eugeniusz (ed.) *Structure and Interpretation. Studies in Phonology*, vol. 4 of *PASE Studies and Monographs*, 65–88. Lublin (Poland): Folium. First published as Charette & Göksel (1996a).

Cobb, Margaret (1997). Conditions on Nuclear Expressions in Phonology. Ph.D. thesis, School of Oriental and African Studies, University of London, London.

Everett, Daniel L. (2002a). Disc: Addendum/falsifiability vs. usefulness. Reply to Ploch (end of thread). *Linguist List* 13.1402.

Everett, Daniel L. (2002b). Disc: Falsifiability vs. usefulness (beginning of thread). *Linguist List* 13.1279.

Ewen, Colin & Harry van der Hulst (2001). *The Phonological Representation of Words*. Cambridge: Cambridge University Press.

Harris, John (1990). Segmental complexity and phonological government. *Phonology* 7,2: 255–300.

Harris, John (1994). *English Sound Structure*. Oxford: Blackwell.

Harris, John (1996). Phonological output is redundancy-free and fully interpretable. *UCL Working Papers in Linguistics* 8: 551–574.

Hawkins, Sarah & Kenneth N. Stevens (1985). Acoustic and perceptual correlates of the non-nasal–nasal distinction for vowels. *Journal of the Acoustic Society of America* 77,4: 1560–1575.

Hume, David (1888). *A Treatise on Human Nature*. Oxford: Clarendon Press. Edition L.A. Selby-Bigge. First published 1739.

Hume, David (1966). *Enquiry Concerning Human Understanding and Concerning the Principles of Morals*. Oxford: Clarendon Press, 2nd edn. Edition L.A. Selby-Bigge. First published 1777.

Jensen, Sean (in prep.). Meta-phonological speculations. To be published in Ploch (in prep.).

Kaye, Jonathan (1989). *Phonology: a Cognitive View*. Hillsdale (New Jersey) et al.: Lawrence Erlbaum Associates.

Kaye, Jonathan (1992). Introduction to phonology. Lectures held at the School of Oriental and African Studies, University of London.

Kaye, Jonathan (1993a). Current issues in phonology. Lectures held at the School of Oriental and African Studies, University of London.

Kaye, Jonathan (1993b). Derivations and interfaces. In: Cobb, Margaret & Yan Jiang (eds.) *SOAS Working Papers in Linguistics and Phonetics. Volume 3*, 90–126. London: School of Oriental and African Studies, University of London. Later published as Kaye (1995).

Kaye, Jonathan (1995). Derivations and interfaces. In: Durand, Jacques & Francis Katamba (eds.) *Frontiers of Phonology: Atoms, Structures, Derivations*, 289–332. London & New York: Longman.

Kaye, Jonathan (1997). Why this article is not about the acquisition of phonology. In: Ploch & Swinburne (1997), 209–220.

Kaye, Jonathan, Jean Lowenstamm, & Jean-Roger Vergnaud (1985). The internal struc-ture of phonological elements: a theory of charm and government. *Phonology Yearbook* 2: 305–328.

Kaye, Jonathan, Jean Lowenstamm, & Jean-Roger Vergnaud (1989). Rektion und Kon-stituentrektion in der Phonologie. *Linguistische Berichte* 114: 31–75. German version of Kaye, Lowenstamm, & Vergnaud (1990).

Kaye, Jonathan, Jean Lowenstamm, & Jean-Roger Vergnaud (1990). Constituent struc-ture and government in phonology. *Phonology* 7,2: 193–231. English version of Kaye, Lowenstamm, & Vergnaud (1989).

Lewis, G. L. (1967). *Turkish Grammar*. Oxford: Oxford University Press.

Notturno, M. A. (ed.) (1994). The Myth of the Framework. In *Defence of Science and Rationality. Karl R. Popper*. London & New York: Routledge.

Piggott, Glyne L. (1999). How phonological is the phonology of nasality? Paper presented at the 4th HIL Phonology Conference (HILP 4), Leiden (NL).

Ploch, Stefan (1996). The role of parsing. In: Ploch & Simpson (1996), 76–105.

Ploch, Stefan (1997). The nasal fallacy. In: Ploch & Swinburne (1997), 221–273.

Ploch, Stefan (1998). Non-switch harmony in Yawelmani (and Turkish and Sakha). In: Ploch, Stefan & Gary-John Scott (eds.) *SOAS Working Papers in Linguistics and Phonetics. Volume 8*, 209–238. London: School of Oriental and African Studies, University of London.

Ploch, Stefan (1999a). Can phonological 'nasality' be derived from phonetic nasality? Paper presented at the 4th HIL Phonology Conference (HILP 4), Holland Institute of Generative Linguistics, Leiden; to appear in van de Weijer, Jeroen, Vincent van Heuven, and Harry van der Hulst (eds.) *The Phonological Spectrum*, vol. 1. Amsterdam & Philadelphia: John Benjamins.

Ploch, Stefan (1999b). *Nasals on My Mind. The Phonetic and the Cognitive Approach to the Phonology of Nasality*. Ph.D. thesis, School of Oriental and African Studies, University of London, London.

Ploch, Stefan (2000). Phonetic specifiability *versus* radical phonological and phonetic autonomy. Paper presented at the Departmental Seminar of the Department of Linguistics of the School of Oriental and African Studies (University of London, February 2000).

Ploch, Stefan (2001). Metatheoretische Probleme in der Phonologie mit den handels-üblichen Kriterien Einfachheit (Occams Rasiermesser) und Unwillkürlichkeit (Nicht-ad-hoc-heit). Paper presented to the Wiener Sprachgesellschaft [Viennese Language Society].

Ploch, Stefan (2002a). Disc: Addendum/Falsifiability vs. usefulness. Disc: Falsifiability vs. usefulness. *The Linguist List* 13.1402.

Ploch, Stefan (2002b). Link Phonology: a functional explanation of non-monotonicity in phonology. Paper held at the parasession on "Functionalism and Formalism in Linguistic Theory" of the 37th Conference of the Chicago Linguistic Society, Chicago, 2001. Published in the selected proceedings (parasession), *CLS* 37.2: 123–138. For a copy of the handout, cf. my Downloads page at http://languages.wits. ac.za/~stefan.

Ploch, Stefan (ed.) (in prep.). *Living on the Edge. Phonological Essays*. Studies in Generative Linguistics, Berlin & New York: Mouton de Gruyter. To be published in 2003.

Ploch, Stefan (in prep.). Metatheoretical problems in phonology with Occam's Razor and non-*ad-hoc*-ness. In: Ploch (in prep.).

Ploch, Stefan & Andrew Simpson (eds.) (1996). *SOAS Working Papers in Linguistics and Phonetics. Volume 6*. London: School of Oriental and African Studies, University of London.

Ploch, Stefan & David Swinburne (eds.) (1997). *SOAS Working Papers in Linguistics and Phonetics. Volume 7*. London: School of Oriental and African Studies, University of London.

Popper, Karl Raimund (1933). Ein Kriterium des empirischen Charakters theoretischer Systeme. *Erkenntnis* 3: 426–427. A letter to the editor.

Popper, Karl Raimund (1934). *Logik der Forschung*. Vienna: Julius Springer Verlag. With the imprint '1935'; cf. Popper (1972b) for an English translation.

Popper, Karl Raimund (1972a). *Conjectures and Refutations: the Growth of Scientific Knowledge*. London & Henley: Routledge & Kegan Paul, 4th edn. First published 1963.

Popper, Karl Raimund (1972b). *The Logic of Scientific Discovery*. London: Hutchinson of London. First published 1959; translation of Popper (1934).

Popper, Karl Raimund (1973). *Objective Knowledge: an Evolutionary Approach*. Oxford: Oxford at the Clarendon Press. Reprinted edn. (with corrections). First published 1972.

Popper, Karl Raimund (1978). Natural selection and the emergence of mind. *Dialectica* 32: 339–355.

Popper, Karl Raimund (1992). *Unended Quest*. Fontana Paperbacks, London & Henley: Routledge. First published 1976 and as the *Intellectual Autobiography* in Schilpp (1974).

Popper, Karl Raimund (1994a). Models, instruments, and truth. The status of the rationality principle in the social sciences. In: Notturno (1994), 154–184.

Popper, Karl Raimund (1994b). Science: problems, aims, responsibilities. In: Notturno (1994), 82–111.

Schilpp, Paul Arthur (ed.) (1974). *The Philosophy of Karl Popper. Book I*. The Library of Living Philosophers XIV.1., La Salle, IL: Open Court.