HOW ABSTRACT IS ABSTRACT?

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ABSTRACT

This article steps back from the abstractness issue in order to examine it in a new light. An attempt is made to define the issue rather than offer a solution. Kiparsky's "alternation condition" is shown to comprise four distinct constraints, which are not equivalent, as most phonologists have assumed. Others have defended, implicitly or explicitly, a number of other possible conditions. A definition is given of each of these conditions and a number of celebrated "abstract" analyses are compared with respect to them. The absence of a single condition on abstract analyses forces us to reexamine the question of whether such a constraint is necessary and if so, how to construct a principled formulation.

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Even the narrowest phonetic transcription is an abstraction from the articulatory/acoustic continuum that constitutes speech. Such transcriptions omit subtle differences in length, degrees of aspiration, and coarticulation effects such as the lip rounding accompanying the [t] of [tu]. Yet we know from such evidence as rhymes and spoonerisms that these abstract segments are psychologically real. The abstractness controversy in phonology involves a higher degree of abstraction.

The non-publication of Kiparsky's paper "How abstract is phonology?" (1968) created a situation where every phonological analysis had to be defined as "abstract" or "non-abstract." A flurry of papers, e.g. Brame (1972), Kisseberth (1969), Hyman (1970) and Jensen (1972), among others, was generated defending more-or-less abstract analyses, while a few counter replies by Crothers (1971) and Harms (1973) have attempted to defend some sort of anti-abstractness condition. Kiparsky's paper was the first attempt to make explicit the notion that the evaluation measure is not a mere feature counting device, but must take other factors into account. In particular, Kiparsky argued that "rules of absolute neutralization" are hard to learn, and therefore very "expensive" in a grammar; that is, they cost more than the count of their features. This appeal to acquisition mechanisms, rather than to purely formal devices, set the stage for some recent concepts in evaluation measures that are important in linguistic change--in particular, paradigm regularity and opacity.

This paper will not attempt a solution to the abstractness controversy, but rather try to define it. A careful reading of

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Kiparsky's paper reveals that he actually defines at least four

distinct anti-abstractness conditions, which are by no means equivalent,

although their equivalence seems to have been assumed by nearly

everybody.

The first formalization of the alternation condition[1] that I

shall consider here is what I call the segment subset condition,

which requires that the systematic phonemic inventory be a subset

of the systematic phonetic inventory. Apparently, a condition of

this sort was maintained by Sapir   (Cf. McCawley 1967).

A second formalization is what I call No absolute neutralization,

which says that no rules of absolute neutralization are permitted in

grammars. We must be careful with this definition. I take it to

mean that grammars must not contain rules of the form (1), that is,

rules with no environment:

(1)   A   →   B

More technically, a rule of the form (1) is called a rule of

non-contextual change: the change takes place without regard to

environment. Such a rule is a rule of absolute neutralization

only if it merges distinct underlying segments regardless of context.

Consider exchange rules. Given a language with both A and B as

underlying segments, but where A appears as B on the surface and B

appears as A on the surface, the exchange rule that switches A and B

is one of non-contextual change, but not a rule of absolute neutraliza-

tion. English vowel shift as formulated in Chomsky and Halle (1968) is

clearly an exchange rule of this sort.

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The third formalization of the alternation condition is what
I shall call the segment paradigm condition. By this condition,
each segment appearing in the underlying form of a morpheme must
be present in that position in at least one allomorph of that
morpheme on the surface.[2] A somewhat stronger version of this
condition would require that the underlying form of any morpheme
be chosen from among its surface allomorphs.

Of these three interpretations, the subset condition is clearly
the weakest. Consider the SPE (Sound Pattern of English) analysis
of the English vowel shift. In SPE, all occurrences of surface [aj]
are derived from underlying /ī/. The subset condition is clearly met
in this case, since there are surface occurrences of [ī]. (I am
ignoring the complication that the SPE analysis contains the under-
lying vowel /ǣ/, which has no surface counterpart, so the subset
condition is not met for the SPE vowel system as a whole.) Clearly,
/ī/ must be converted to [aj] by a rule or series of rules of non-
contextual change; thus the condition of no absolute neutralization
(as I have defined it) is not met. Furthermore, in a word like size,
from underlying /sīz/, there is never any vowel other than [aj] on
the surface. Thus the segment paradigm condition is not met. A
similar case is Schane's analysis of French, in which all instances
of the surface vowel [y] are derived from underlying /u/. The surface
inventory contains all the vowels used in the underlying inventory,
plus a few more such as [y] and [œ]. But in a word like dur [dyr]
from underlying /dur/, the surface form never has any vowel but [y].
A rule of non-contextual change is required to convert /u/ to [y].

Schane's analysis, like SPE, meets the subset condition without
meeting the other two conditions.

Similarly, an analysis may meet both the subset condition and
the no absolute neutralization condition without meeting the
segment paradigm condition. A mundane example is English [ŋ].
A word like <u>sing</u> has /siŋg/ as its underlying form. But the surface
representation has only three segments: <u>s</u>, <u>i</u>, <u>ŋ</u>. Since English has
/n/ and /g/ both underlying and surface, this analysis meets the
subset condition. Since the rule converting /n/ to [ŋ] before
velars and the rule deleting /g/ after [ŋ] both have contexts, there
is no rule of absolute neutralization, or of non-contextual change.
Therefore, this analysis meets both the subset condition and the no
absolute neutralization condition. But it does not meet the segment
paradigm condition, since the alveolar nasal /n/ never appears on
the surface in a word like <u>sing</u>. Therefore we have established an
implicational hierarchy: the segment paradigm condition implies no
absolute neutralization, and no absolute neutralization implies the
subset condition.

It should be noted that this discussion of the "strength" of
these conditions in this implicational scheme does not mean the same
as what Kiparsky meant by the "strong" and "weak" alternation
condition. He meant by the "strong" alternation condition that the
prohibition of rules of absolute neutralization was absolute and
that they could never appear in grammars: by "weak" he intended to
say that rules of absolute neutralization are "hard to learn" and
that they are therefore more costly to the grammar than the count

of their features. One is an absolute prohibition against rules of
a certain type; the other is additional cost for such rules. All
the conditions I have discussed so far can be considered as "strong"
or "weak" in this sense.

A fourth interpretation of Kiparsky's condition is what I call
<u>recoverability</u>: this is an idea which has been around a long time
in syntax, and I take it to mean that the underlying form is
recoverable from the surface form. The question here is: how much
knowledge of the grammar is necessary to recover the underlying form?
If you know the whole grammar, then every "abstract" analysis that
has ever been proposed, with the exception of arbitrary analyses,
is recoverable in this sense. In his discussion, Kiparsky denies
that English vowel shift (as analyzed for example in SPE) involves
a violation of the alternation condition:

> ...if a form appears in a constant shape, its
> underlying representation is that shape, except for
> what can be attributed to low-level, automatic
> phonetic processes. These can be defined as processes
> which do not cause neutralization of distinct
> representations. For example, the vowel shift of
> English or the loss of final /g/ in <u>sing</u>, are
> low-level automatic phonetic processes, since the
> underlying form is in each case recoverable from
> the phonetic form. (Kiparsky 1968:11)

It is hard to understand the claim that the English vowel shift
is a low-level automatic phonetic process: I am sure that this is
not what (for example) David Stampe means by the term <u>process</u>.
What Kiparsky really means is that the alternation condition
excludes rules whose inputs are not recoverable from the output,
which amounts to a trans-derivational constraint, not the exclusion
of rules of a certain type. English vowel shift is a rule of

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non-contextual change, not a rule of absolute neutralization, but
you can know that only if you know the grammar of English.

A number of commentators have noted that the "strong" form
of Kiparsky's condition (interpreted now as the segment paradigm
condition) is too strong in that it rules out otherwise well-motivated
analyses. A particularly interesting example is Kisseberth's (1969)
analysis of Yawelmani, where he shows that the language must have
underlying long /u:/ and long /i:/ even though no such vowel appears
on the surface. The relevant data are summarized in (2).

		/-hin/	/-al/	
(2)	gloss	aorist	dubitative	underlying
	'tangle'	xilhin	xilal	/xil/
	'recognize'	hudhun	hudal	/hud/
	'procure'	maxhin	maxal	/max/
	'throw'	koʔhin	koʔol	/koʔ/
	'report'	doshin	do:sol	/do:s/
	'destroy'	comhun	co:mal	/cu:m/

The relevant rules are as in (3), in the order given:

(3) a. VOWEL HARMONY

$$i \rightarrow u / u\, C_0 \underline{\quad}$$

$$a \rightarrow o / o\, C_0 \underline{\quad}$$

 b. LOWERING

$$\left[\begin{matrix} V \\ + \text{long} \end{matrix} \right] \rightarrow [\, -\text{high}\,]$$

 c. SHORTENING

$$V \rightarrow [\, -\text{long}\,] / \underline{\quad} C \left\{ \begin{matrix} C \\ \# \end{matrix} \right\}$$

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Kisseberth demonstrates the correctness of the underlying forms
given in (2) with respect to the rules of (3). In particular, the
underlying form of 'destroy' must be /c̆u:m/, since this stem conditions
u-harmony (the first part of the harmony rule), but does not condition
o-harmony (the second part). The "concrete" reinterpretations of
these facts (e.g. Vennemann 1971, Crothers 1971) are forced to miss
these generalizations. In particular, for the "concrete" analyses
it is a complete accident that a stem like /c̆u:m/ conditions u-harmony
but not o-harmony: in a system that is forced to regard stems like
/c̆u:m/ as "exceptions," there is no explanation for the fact that no
such stem exists which conditions both u-harmony and o-harmony,
whereas this fact is an automatic consequence of the "abstract"
analysis, which posits underlying /u:/ for these stems and the ordered
rules of (3). In this case the "abstract" analysis is more constrained
and more explanatory than the "concrete" analysis of Vennemann and
Crothers.

    Kisseberth's analysis suggests (although he does not state
it this way) a fifth abstractness condition, which I call the
feature paradigm condition, which is somewhat weaker than the
segment paradigm condition. This condition states that the features
defining any segment of an underlying form of a morpheme must
appear in this segment in at least one allomorph of the morpheme.
That is, if a segment S is defined by the features [+A], [-B]
in underlying form, then [+A] must appear in at least one allomorph
in this position, and [-B] must appear in at least one allomorph
in this position, although it is not necessary for both features

[+A -B] to appear together in the same allomorph (as is required

by the segment paradigm condition). It should be clear that any

analysis which meets the segment paradigm condition also meets the

feature paradigm condition, but not conversely.

A sixth possible interpretation of the anti-abstractness

condition is what I call the feature subset condition: this

condition requires the set of features defining the underlying

segments to be a subset of the features defining the surface

segments. Two kinds of analyses violate this condition: (a) those

using a diacritic feature (for example Harris' (1969) [+D] in

Spanish) which has no phonetic manifestations;[3] (b) those requiring

an additional feature to describe the underlying segment inventory.

For example, Hyman (1970) requires the feature [round] to describe

the seven-vowel underlying segment inventory he posits for Nupe,

whereas this feature is not necessary to describe the surface

five-vowel inventory (i.e. this feature is redundant on the surface).

One of Kiparsky's primary objections to abstract underlying

segments is that they are, or may be, arbitrary. In discussing

the familiar Sanskrit example, where some a palatalize k to č

and others do not, the "palatalizing" variety of a can be set up

as underlying e. We can then have a rule to convert e to a ordered

after the palatalization rule, as in (4).

(4) a. k → č / ___e   (palatalization)

     b. e → a   (absolute neutralization)

In fact some such sequence of events undoubtedly happened historically,

but it is not a fact of the synchronic grammar. The point is that

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any non-appearing front vowel could have been used instead of e:
the choice is completely arbitrary. Clearly, any analysis that violates
the feature subset condition is arbitrary in this sense, but an
arbitrary analysis need not involve the use of a diacritic feature.
An example of the latter is the Sanskrit case. Kisseberth's Yawelmani
example is clearly not arbitrary, since underlying long /u:/ may appear
phonetically either as a short [u] or as a long [o:] or as a short
[o]. Thus the underlying form is completely determined by the
features appearing in the surface forms; thus it meets the feature
paradigm condition. Any analysis which meets the feature paradigm
condition (as does Yawelmani) is non-arbitrary, but not necessarily
conversely. Thus, a seventh possible condition is non-arbitrariness.

Krohn (1973) defends an eighth condition, which he calls
invariance. He uses this term as a condition on rules: if a rule
A → B is such that the features defining A form a subset of the
features defining B, then the rule preserves invariance. In taxonomic
phonemic theory invariance was defined as follows: each phoneme
P has associated with it a certain set of defining features f(P),
and whenever P occurs in a phonemic representation, f(P) occurs in
the corresponding phonetic representation (Chomsky 1964). It may
be that Krohn's sequencing rules conform to invariance in this sense,
even though one phoneme is realized as two phonetic segments. It
seems to me that the condition of invariance reduces phonology to
taxonomic phonemics, since this condition would rule out such a
relatively non-abstract analysis as English writer - rider (the
derivations are as in (5) for my dialect:

(5) underlying /rayt + r/ 'writer' /rayd + r/ 'rider'

---------   ra:ydr $V \to$ [+long]/__(G)[+voice]

rayDr   ra:yDr   flapping

I do not believe that invariance can be taken as a serious candidate
for an anti-abstractness condition, although I have included it in my
table. I further believe that the added power of Krohn's sequencing
rules is undesirable, since such rules are not shown to be independently
motivated, and since affricates are no longer regarded as [-continuant
+ strident], but are designated as stops with the additional feature
[+ delayed release].

A ninth anti-abstractness constraint is one that insists that
at least two rules be dependent on the abstract segment in question,
which I call <u>two or more rules</u>. The more rules that depend on a
particular abstract segment, the more justified that segment is.
This condition is met by Kisseberth's Yawelmani example, and some
other analyses I have discussed here.

Table 1 (next page) gives a summary of the conditions discussed
here, along with the status of 10 analyses of various languages with
respect to these conditions. I assume the reader is familiar with
some of the more celebrated analyses, and will not review all the
pertinent facts here. The three analyses of Nupe have been the subject
of much debate lately (see Hyman 1970 and 1973; Harms 1973, Krohn 1973).
Brame's Maltese example is fairly well known (see Brame 1972), as is
Kisseberth's Yawelmani example discussed briefly above (see Kisseberth 1969).
The case of English [ŋ] is included mainly for comparison. The two

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	Hungarian (Jensen)	Hungarian (Esztergar)	Spanish (Harris)	English /ŋ/	Nupe (Hyman)	Nupe (Harms)	Nupe (Krohn)	Yawelmani (Kisseberth)	Maltese (Brame)	French /h/ Selkirk-Vergnaud
1. Subset condition	NO	YES	NO	YES	NO	YES	NO	NO	NO	NO
2. No Abs. Neut.	NO	NO	NO	YES	NO	YES	NO	NO	NO	NO
3. Segment paradigm	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Recoverability	YES	NO	NO	YES	YES	YES	YES	YES	YES	NO
5. Feature paradigm	NO	NO	NO	NO	NO	NO	NO	YES	NO?	NO
6. Feature subset	YES	YES	NO	YES	NO	YES	YES	YES	YES	YES
7. Non-arbitrariness	YES	NO	NO	YES	YES	NO	YES	YES	YES	NO
8. Invariance	NO	NO	NO	NO	NO	NO	YES?	NO	NO	NO
9. Two or more rules	NO	YES?	YES	NO	YES	?	NO	YES	YES	YES

Table 1

analyses of Hungarian are not so well known, and deserve some comment here.

In my dissertation (Jensen 1972) I defended an analysis of Hungarian which involves the abstract underlying segments /ɯ/ and /ʌ/, and a rule of absolute neutralization converting these to [i] and [e] respectively. This analysis is justified by data like those of (6).

(6)

gloss	nom. sg.	nom. pl.	iness. sg.	underlying
'bridge'	hi:d	hidak	hi:dban	/hɯ::d/
'water'	vi:z	vizek	vi:zben	/vi:z/
'blood'	ve:r	ve:rek	ve:rben	/ve:r/
'goal'	ce:l	ce:lok	ce:lban	/cʌ:l/
'I'	e:n	-----	bennem	

Some nouns with neutral vowel stems (the neutral vowels are i and e)
require front vowel suffixes (vi:z, ve:r), others require back vowel
suffixes (hi:d, ce:l). Kiparsky's solution (1968:10) is to mark
certain neutral vowel stems "exceptions" to vowel harmony (such as
hi:d), and to have the suffixes with back vowels in underlying forms.
But the personal form bennem 'in me' shows that the underlying form
of 'in' must have a front vowel /-ben/, while other suffixes have
back vowels (na:lam 'by me', underlying form /-na:l/). This shows
that vowel harmony must be formulated as an alpha-rule.[4] These facts
are very awkward to accomodate in a theory where such things must be
handled by exception features, and it is also clear that these forms
are not regarded as "exceptions" by native speakers. For a variety
of reasons, therefore, the abstract analysis seems justified.

Esztergar (1971) has argued that these facts can be handled
without an abstract underlying segment and without a rule of absolute
neutralization. Her analysis involves setting up the underlying
form /hida/ for hi:d. If the plural morpheme -k is added, nothing
happens. If no suffix is added, /hida/ changes to [hi:d] by rules of
metathesis and vowel coalescence given in (7):

(7) Metathesis

$$
\begin{array}{cccc}
C & - & V & - \\
 & & \begin{bmatrix} -high \\ -long \end{bmatrix} & \left\{ \begin{array}{c} \# \\ +CV \end{array} \right\} \\
1 & & 2 & 3 \implies 2\ 1\ 3
\end{array}
$$

Vowel coalescence

$$
\begin{array}{ccc}
V & - & V \\
1 & & 2 \implies 1 \qquad \emptyset \\
 & & [+long]
\end{array}
$$

If the suffix /-ben/ is added, the /a/ of /hida/ conditions back
harmony, and metathesis and vowel coalescence convert /hida + ban/
(by vowel harmony) to [hi:dban]. It should be noticed first of all
that the rule of vowel coalescence is a rule of non-contextual change,
thereby violating the condition of no absolute neutralization. In
fact, it is a true rule of absolute neutralization, since it merges
distinct underlying representations. In this case the underlying
representation of [hi:d], namely /hida/, is non-arbitrary, since the
final /a/ shows up in the plural hidak, with shortening of the stem
vowel. So far, so good. But there are forms like ce:l (see 6),
which have no alternation in root vowel length. Esztergar handles
these by setting up the underlying form /ceal/. The /a/ then
conditions back harmony, and is merged by vowel coalescence with the
/e/ to form a long e: on the surface. Here it is clear that the rule
of vowel coalescence is acting as a rule of absolute neutralization,
since there are underlying e: which also show up as surface e: but
condition front harmony, e.g. in ve:r 'blood'. It should also be
clear that the /a/ in the underlying form of /ceal/ is totally arbitrary:
any other back vowel would have done as well. Therefore, while
Esztergar's analysis meets the subset condition, it fails the non-
arbitrariness condition, the segment paradigm condition, and others noted
in table 1. Esztergar was obviously concerned only with the subset
condition, whereas there are at least eight other possible criteria to
take into account. Her analysis strikes me as being in fact much more
abstract than mine: although I use a non-occurring underlying segment,

it is not arbitrary.

To summarize my major conclusions, this paper has been concerned with defining the abstractness condition, which is widely assumed to be important in phonological analysis. At least nine different conditions are possible, which are by no means identical, although some of them have been wrongly assumed to be equivalent. The nine conditions which I discuss here are in no way assumed to be exhaustive. Some implicational relationships which hold among the nine conditions discussed here are given in (8).

(8)   3 implies 2   3 implies 5

           2 implies 1   5 implies 7

         (numbers refer to conditions in table 1)

I cannot now defend a position which says that an analysis meeting some one of these conditions is allowed, nor a position which says that an analysis meeting at least some number, say three, of these conditions, is allowed, otherwise not. Compare Harris' Spanish example with the Selkirk-Vergnaud (1973) analysis of h-aspiré in French. The Spanish meets only the two or more rules condition. My intuitive feeling is that this analysis is nevertheless well motivated, although I cannot show this here, since the facts are quite complicated and the analysis is quite abstract in other ways, involving considerable depth of ordering, etc. The French meets two or more rules and feature subset: one condition that the Spanish meets and one other. However, as Kiparsky showed in his forum lecture (summer 1973 linguistic institute, Ann Arbor), this analysis

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must be wrong. Kiparsky notes that underlying /h/ is lost in deriva-

tional forms:

    (9)   le Hitler   <u>but</u> l'Hitlérisme

           le héros   l'héroïque   l'héroïne

It would be very strange to have to posit the rule (10):

    (10) h → $\emptyset$ / # _____ X + derivational affix

which would be required in the Selkirk-Vergnaud analysis. But it is

quite normal for derived forms to be regularized: consider <u>cast</u>,

past tense <u>cast</u>, but <u>broadcasted</u>, <u>forecasted</u>, etc. Kiparsky suggests

that the correct analysis for French says that words like <u>héros</u>

are exceptions simultaneously to several rules: liaison, final consonant

deletion, etc., and that this irregularity is removed in derived

contexts. Thus, whatever abstractness conditions are important, they

interact in mysterious ways with other facts of grammar.

Footnotes

[1] I use Kiparsky's (1968) term as a cover term for the various

abstractness conditions I discuss here. Technically, it should

probably be identified with the <u>segment paradigm condition</u> (see

below and footnote 2). While these conditions bear some relation

to Postal's (1968) <u>naturalness condition</u>, the latter is too vaguely

stated to be adequately compared.

[2] Apparently it is the <u>segment paradigm condition</u> that Vennemann

(1971) advocates. Vennemann correctly observes that this condition

forces an analysis of English containing three distinct <u>underlying</u>

series of stops: voiceless aspirated, voiceless unaspirated, and

voiced -- i.e. <u>pin</u>, <u>spin</u>, and <u>bin</u> have underlying /p^{h}in/, /spin/,

and /bin/ respectively. Surely this is an unacceptable result, since

it makes Vennemann's "natural phonology" more concrete than even

taxonomic phonemic theory, which recognized that [p^h] and [p] are

positional variants of a single phoneme /p/. Incidentally, Vennemann

is also required to have /siŋ/ underlie [siŋ], in spite of his earlier

arguments (1970) for having /ng/ underlie [ŋ], at least in German,

and many of the same arguments are also valid for English.

[3] James Harris has pointed out to me (personal communication)

that some diacritic feature would still be required in any

alternative analysis of Spanish, e.g. one which used diphthongs

to underly the alternations o - we and e - je. The status of such

diacritics is still in doubt, since they are neither phonetically

nor syntactically motivated; however, they seem to be required, at

least in this case.

[4] This argument was discovered independently by Vago (1973).

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