

THE CONCEPT OF RULE OPACITY AND ITS USEFULNESS
FOR PHONOLOGICAL ANALYSIS —
EVIDENCE FROM POLISH AND ENGLISH

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The notion of rule opacity was originally introduced by Paul Kiparsky (1971, 1973) mainly to explain some diachronic phenomena such as rule reordering and rule loss. In this paper¹ our concern will not be historical linguistics but rather the advantages of the concept of rule opacity for synchronic phonological analysis². Therefore, an attempt will be made to show that opacity is an important property of phonological rules and that its degree, sources and ways of accounting for it cannot be omitted in any exhaustive phonological description. Moreover, opacity will be claimed to be a significant factor in comparing rules of various languages. Furthermore, the present article is based on the conviction that the concept of rule opacity is particularly helpful in arriving at the proper formulation of phonological rules as well as in testing the adequacy of existing formulations. Finally, the relationship between rule opacity and exceptionality will be briefly discussed.

Before presenting the arguments supporting the above claims, let us recall Kiparsky's definition of rule opacity and illustrate it with some examples.

“A rule $A \rightarrow B/C \text{---} D$ is opaque to the extent that there are surface representations of the form:

(i) A in environment $C \text{---} D$

¹ This paper would not have arisen without the invaluable comments and criticism of doc. Edmund Gussmann, to whom I wish to express my deep gratitude.

² Other fields where the concept of rule opacity has proved to be useful are language acquisition, conspiracies, global rules and evaluation measure. An interesting attempt to incorporate rule opacity into the principles of natural order was made by Anderson (1974).

- (iia) B derived by the process P in environment other than C—D
 (iib) B not derived by the process P (i.e., underlying or derived by another process) in environment C—D'. (Kiparsky 1973:79)

An example of a rule which is opaque under case (i) is Trisyllabic Laxing in English. It laxes tense vowels when they are found in a word in the third syllable from the end, e.g., before the suffix *-ity*.

divine—divinity
 profound—profundity

However, Trisyllabic Laxing is not a general rule of English since there are forms such as

obesity
 probity

where the rule fails to apply although its context is met. Consequently, the laxing rule is opaque in these cases. This is probably due to the exceptional character of these items with respect to the above process.

Case (iia) of Kiparsky's definition, generally speaking, deals with the situations where the context for the application of a given rule is not present in the phonetic output. This can be observed, for instance, in the case of nasal assimilation in English. The rule causes a nasal to assimilate to the point of articulation of the following obstruent. If this obstruent happens to be a voiced velar stop, it is deleted in word final position by the process of velar dropping. Thus, the derivation of *sing*, for example, can be presented in the following way:

- | | |
|-----------------|--------|
| | /sing/ |
| 1. nasal assim. | sing |
| 2. velar drop. | [sɪŋ] |

This ordering is opaque since /g/, which is the conditioning segment for nasal assimilation, is subsequently deleted by velar dropping.

The last case of the definition treats as opaque the rules whose application results in the phonetic shapes identical to some underlying structures or those derived by some other rules. We envisage such a situation in Polish, for instance, where there is a rule devoicing word final voiced obstruents, e.g.,

- próg [pruk] "threshold" — progu [progu] "id. gen. sg."
 sad [sat] "orchard" — sadu [sadu] "id. gen. sg."
 glob [glop] "globe" — globu [globu], id. gen. sg.

The rule under consideration is opaque since there are underlying voiceless consonants word finally and the distinction between voiced and voiceless obstruents is neutralized in this position. That leads in many cases to the rise of homophones, e.g.,

kot [kot] "cat"	kod [kot] "code"
buk [buk] "each"	bóg [buk] "god"
snop [snop] "sheaf"	snob [snop] "snob"

It has been noted by several linguists (Kissesberth 1973, Kaye 1974) that Kiparsky's definition of rule opacity is not precise enough. Moreover, as Gussmann (1976) notices, there are cases where the effect of a given rule is completely undone on the surface and this is not included in Kiparsky's definition at all. Therefore, although we make use of the definition of rule opacity as presented by Kiparsky throughout this paper, we must keep in mind that further refinement of this notion is necessary.

We shall now illustrate the importance of the concept of rule opacity³ by discussing two processes operating in English and Polish phonology which may be termed j-anterior palatalizations.

Let us first focus on the English process. It converts dental obstruents into their palato-alveolar counterparts, e.g.,

[s—ʃ]	confess—confession
[z—ʒ]	visible—vision
[t—tʃ]	depart—departure
[d—dʒ]	grade—gradual

Although the segment triggering palatalization is not present in the phonetic output, it has been claimed (Chomsky and Halle 1968) that the conditioning element is a high front glide, which is later deleted. There is some evidence for it in the form of fluctuating pronunciations, i.e., words which are pronounced either with a palato-alveolar or with a dental and a glide, e.g.,

factual	}	[č] or [tj]
actual		
gradual	}	[j] or [dj]
sensual		
sexual	}	[š] or [sj]
casual		
visual	}	[z] or [zj]

In addition, to that sandhi phenomena confirm this suggestion as well, i.e., when ever one word ends with a dental obstruent and the following with a front glide in fast speech the dental gets palatalized, e.g.,

³ In our discussion of the opacity of the j-palatalization rules in Polish and English we disregard case (iib) of Kiparsky's definition since it seems marginal and certainly does not bear directly on the issues discussed in the present text. For fuller treatment of this case, however, see Szpyra (1979).

I miss you [šj]
 I need you [jj]
 not you [čj]
 as you [žj]

Thus, the general shape of the palatalization rule is the following:

dental obstruent → palato-alveolar / —j

According to *The Sound Pattern of English* (Chomsky and Halle 1968, henceforth SPE) the process in question is blocked if the dental consonant is followed by a vowel (e.g., *satiety*) or it is followed by a glide and a stressed vowel (e.g., *endure, resume*). Finally, the rule can be formalized in terms of distinctive features as follows (SPE:230):

$$\left[\begin{array}{l} - \text{sonor} \\ + \text{coron} \end{array} \right] \quad \left[\begin{array}{l} - \text{anter} \\ + \text{strid} \end{array} \right] \quad / \quad \left[\begin{array}{l} - \text{back} \\ - \text{voc} \\ - \text{cons} \end{array} \right] \quad \left[\begin{array}{l} - \text{cons} \\ - \text{stress} \end{array} \right]$$

The above rule operates on structures provided by Velar Softening, two Glide Insertions, and Spirantization which all feed the Palatalization. There are, however, several difficulties with the above rule. Chomsky and Halle mention some cases which point to the inadequacy of their analysis. They note the words such as *sassociate, emaciate, luxurious, mature* which in some dialects are pronounced with palato-alveolars although this is in disagreement with the structural description of the rule. (Faced with dialectal differences we will base our remarks on British English pronunciation as presented by Jones 1967).

What is striking in the SPE formulation of the palatalization rule is the fact that it does not reflect the existence of three categories of words which behave differently in palatalizing contexts:

1. words that always undergo the rule (regardless of the dialect or the tempo of speech) such as *racial, television, expression*
2. forms in which palatalized and non-palatalized segments occur in free variation, i.e., which form he uses depends on the speaker, e.g., *casual, fatuous, gradual*
3. words that fail to undergo the rule in question in spite of the palatalizing context, e.g., *gymnasium, medium, invidious*.

We shall now try to test the adequacy of the above rule by analysing its opacity. With Chomsky and Halle's formulation the process under consideration is seen as opaque (case (i)) in words containing [tj, dj, sj, zj,] (phonetically) if the following vowel is not stressed⁴.

⁴ It must be remembered, however, that Chomsky and Halle do not use the term "rule opacity" in SPE as it was created by Kiparsky some years later.

a)	b)	c)
supreme	accordion	potassium
duality	collodion	magnesium
tutorial	terpodion	gymnasium
tuition	euchiridion	symposium
duration		
tumidity		
superior		
supremacy		
dubiety		
	d)	
	prosodian	
	Canadian	
	invidious	
	medial	
	primordial	
	intermediary	

Let us analyse individual groups of examples. Words such as those in a) are very numerous. The reason for the opacity of the palatalization rule here is—if we follow Chomsky and Halle's line of reasoning—the fact that vowel following the glide is not stressed and, consequently, the process in question should apply. The placement of stress is thus said to be crucial for the operation of the rule: if the vowel following the glide is not stressed, palatalization applies; if the vowel is stressed, the rule is blocked. This dependence is manifested by alternations such as:

perpé[č|ua]l — perpe[tj]úity

Therefore, palatalization is nontransparent in the words in column a). These forms, according to this analysis, are exceptions, i.e., the rule fails to apply to them although its structural description is met. Consequently, the SPE palatalization rule forces us to treat words such as:

tuition	tutorial
supernal	duration
tumidity	supreme

as exceptions, whereas forms which are very similar in terms of their segmental structure to these above are perfectly regular under the same analysis, e.g.,

tune	duty
student	tulip
duke	super

Moreover, there are numerous cases in which the shift in stress does not bring about any other changes, i.e., even if the following vowel is unstressed the sequence "dental plus glide" appears phonetically, e.g.,

dúal — duálicity
 tútor — tutórial
 túmid — tumíidity
 súicide — suicídal

Here the left-hand forms are again quite regular, whereas the right-hand ones are irregular and, consequently, exceptional. In addition to that, in the word *supine* the palatalization rule is opaque if it is an adjective and its second syllable is stressed-[sju:pain]—but it is transparent if *supine* is used as a noun-[sju:pain]—here the first syllable is stressed.

These are some consequences of accepting Chomsky and Halle's formulation of the palatalization rule. They are counter-intuitive and suggest that some modification of the rule in question is necessary.

Before proceeding with our argument, we should like to stress once again that we take British English pronunciation as a subject of our analysis. In American English, on which SPE is based, the words which are discussed above are pronounced with the vowel [u̠] and the palatalization is not opaque here.

We would like to bring attention to the fact that the words in a) have one thing in common, namely the sequence of a dental and a glide appears morpheme internally in them. Moreover, words displaying the effect of palatalization contain suffixes which, according to SPE, at the stage where palatalization applies begin with a high front glide which subsequently triggers the process in question, e.g.,

-ure
 depart — departure
 press — pressure
 -ion
 diffuse — diffusion
 express — expression
 -ual
 visible — visual
 fact — factual
 -ial
 face — facial
 space — spacial
 -ious
 sagacity — sagacious
 space — spacious

Thus, the presence of morpheme boundary⁵ seems to condition the application of palatalization ("a conditioning function of a boundary" -- Kenstowicz and Kisseberth 1977:83). Under this reformulation, the words in a) and b) turn out not to be opaque with respect to the palatalization since the problematic sequences are morpheme-internal there.

It can be argued, however, that there are words in which palatalization takes place morpheme-internally, i.e., where there is no basis for morphological division of a given item, e.g.,

tissue	issue	euthanasia
virtue	statue	pasteurization

Notice, however, that all these words have more than one pronunciation. This phenomenon, as well as dialectal differences, seem to indicate that the process of palatalization in English is undergoing some changes. Basically it is triggered by morpheme boundary. Sometimes, particularly in careless and rapid speech, there is a tendency to generalize the rule's context and then morpheme boundary is no longer indispensable for its application. This tendency is particularly conspicuous in some dialects of American English. It affects mainly foreign words and it may be claimed that "the weakening of a morphological boundary is a part of anglicization" (Hill and Nessly 1973:84).

To summarize the issue briefly: it is not justifiable to treat the palatalization rule as opaque in the words from column a), which in this particular situation means regarding them as exceptions, since they do not contain morpheme boundary to induce the palatalization. Similarly, the words in b) fail to undergo the process in question because they are morphologically indivisible (SPE:226).

Nevertheless, even after our modification of the palatalization rule we are still left with the words in c) and d), in which the process is opaque.

The forms in c) all end in the Latin suffix *-ium*. We can either associate the failure of the palatalization here with the synchronically foreign character of these words or, following Chomsky and Halle's suggestion, claim that a morpheme boundary there is placed not immediately after a dental but after the following vowel.

The words in d)⁶, all contain a voiced dental stop which seems to be exceptional with regard to the palatalization rule.⁷ This suggestion is consistent with

⁵ An even stronger type of boundary is needed in the case of cross-word palatalizations.

⁶ All these words can be nevertheless pronounced with a vowel and not with a glide — in the case of such pronunciations the problem of the opacity of the palatalization does not arise.

⁷ Chomsky and Halle (SPE) suggest that (d) is exceptional with regard to the rule converting a high front vowel into the corresponding glide. Consequently, the words containing (d) cannot undergo spirantization and palatalization. The problem of whether the voiced dental stop is exceptional with respect to the glide formation or to the palatali-

the fact that the addition of the same suffixes to the stems ending in a dental obstruent other than /d/ does cause the palatalization, e.g.,

ambitious — indivious
 magician — iridian
 beneficiary — stipendiary
 social — medial

We would like, however, to stress the fact that alternative ways of explaining the opacity of the palatalization in these words are available. Notice that numerous forms containing the problematic [dʒ] (or even [tʃ]) sequence may be treated as derived from nouns ending in -y, e.g.,

prosody — prosodian
 melody — melodious
 remedy — remedial
 pity — piteous
 plenty — plenteous

We may therefore suggest that the stems of these words phonologically end in a high front vowel (or glide) and not in a dental stop. Consequently, there is no context here for the application of spirantization and palatalization. Such a procedure seems justified in many cases (although not always)*.

The other problem that deserves mention here is that of the optionality of the palatalization rule. This issue is discussed in Gussmann (1978a), who associates the obligatoriness or optionality of the palatalization rule with the presence or absence of a morpheme boundary within a suffix. If the formative boundary is present, palatalization is optional, e.g.,

sensuous	gradual
virtuous	actual
fluctuate	accentuate
textuary	sanctuary ≠

In all these words palatalization is optional and all of them contain complex suffixes which phonologically can be represented (SPE) as:

/u+Vs/, /u+æɪ/, /u+At/, /u+ǣr+y/

zation rule is not of primary importance here although the presence of the glide in some pronunciations should be accounted for.

* There are alternations which indicate that in some cases morpheme boundary must be postulated immediately after the stem final voiced stop, e.g.,

orchid — orchideous
 splendid — splendidious
 stipend — stipendiary

There are, however, suffixes beginning with a high front vowel which are also complex but where palatalization is obligatory. For instance, the word *revision* can be claimed to have the following phonological structure:

/reviz+i+Vu/

Here, in spite of the presence of the boundary within the suffix the rule is obligatory. Therefore, it seems that the above generalization concerning the optionality of the rule is valid only with respect to suffixes beginning with /u/*.

In light of this discussion, it appears that we can treat the opacity of the palatalization rule in words which do not contain the formative boundary as negligible. In this way we are left only with forms in which the nontransparent character of the process under consideration derives from the exceptionality of some items, i.e., synchronically foreign words such as *calcium*, *potassium* and some words which contain the voiced dental stop, e.g., *stipendiary*, *splendidious* (which are also foreign).

Let us now pass to the second clause in the definition of rule opacity. According to this, the process in question is rendered opaque in words in which palato-alveolars derived by the palatalization appear phonetically in a non-palatalizing context, i.e., when they are not followed by a glide and an unstressed vowel. It is striking that in almost all words displaying the effects of palatalization the result of this process is opaque since the conditioning glide is not present on the surface. This is accounted for by the glide deletion rule formulated in SPE (p. 231) as follows:

$$\left[\begin{array}{l} - \text{cons} \\ - \text{voc} \end{array} \right] \rightarrow \emptyset \quad / \quad \left[\begin{array}{l} - \text{sonor} \\ + \text{cor} \\ - \text{ant} \end{array} \right] _$$

Thus, the process of palatalization in each case is opacated by the above rule. This is, in fact, what we should expect — i.e., the context of the palatalization rule being destroyed — since the sequences of palato-alveolars followed by the high front glide are not permitted in English phonetics. If such impermissible clusters appear, e.g., in some possible pronunciations of words such as *tissue*, *magnisia*, *Asian*, they obviously add opacity to the glide dropping rule. According to Kiparsky (1973), opaque rules are unnatural or, at least, there

* The problem of optionality of the palatalization rule is, it seems, even more complicated. As E. Gussmann (personal communication) observes there is a considerable difference between the words such as *gradual*, *sensual*, *actual* where the palatalization depends on such factors as the tempo of speech, care etc., (i.e., where one speaker may use both shapes: palatalized and nonpalatalized) and such forms as *issue*, *situation*, *euthanasia*, *Neptune* which will be either consistently palatalized or consistently nonpalatalized by a given speaker regardless of the additional factors.

is a tendency towards more transparent orders of rules. In our case this would mean the preservation of the glide after palatals, which clearly does not happen. The preservation of the glide in this context is, from the phonetic point of view, undesirable. Therefore, the English example does not support the contention that opaque rules are marked.

We shall now discuss the j-anterior palatalization in Polish. Here it is not only dentals but all anterior consonants that are affected by two palatalization processes. One of them converts dental stops into affricates and dental fricatives become palato-alveolar fricatives, e.g.,

- [d-dz] władać "to rule" — władza "authority"
 [t-c] lotnik "airman" — lecę "I fly"
 [s-š] czesać "to comb" — czeszę "I comb"
 [z-ž] wozy "carts" — wożę "I cart"

The phonological conditioning of this process is not clear. It is assumed (Laskowski 1975, Gussmann 1978a, b) that a front high glide induces this kind of palatalization which is consequently called the j-anterior palatalization. Notice that the choice of the front glide as the conditioning factor is not supported by the same phonetic facts as in English (i.e., there are no fluctuating pronunciations or cross-word palatalizations). It is rather the result of some theoretical considerations: the conditioning segment cannot be /e/ nor /i/ because they would induce the i-anterior palatalization. It must be minimally different from /i/, i.e., it must be high and nonconsonantal. Therefore we choose /j/ particularly because there are no morpheme internal clusters [sj, tj, zj, dj]. If such sequences appear phonetically they render the results of the palatalization rule opaque. In formulating the rule of j-anterior palatalization in Polish one must also take into account the effect that the preceding strident spirants have upon dental plosives; in this case palato-alveolar affricates appear phonetically, e.g.,

- pusty "empty" — puszca "emptiness, forest"
 tłusty "fat (adj.)" — tłuszcz "fat (noun)"

Finally, the j-anterior palatalization rule can be formulated in the following way (Gussmann 1978:95):

$$\left[\begin{array}{l} \langle + \text{cont} \rangle_1 \\ + \text{obstr} \\ + \text{cor} \\ + \text{high} \end{array} \right] \rightarrow \left[\begin{array}{l} \langle - \text{anter} \rangle_{1,2} \\ + \text{del.rel.} \end{array} \right] / \langle + \text{strid} \rangle_2 \left[\begin{array}{l} - \text{cons} \\ - \text{back} \end{array} \right]$$

Under case (i) the Polish process is opaque in words containing the phonetic clusters [tj, dj, zj, sj]. There are several groups of such forms:

- | | |
|-----------------------|-------------------------|
| a) | b) |
| [zj]echać "go down" | [dj]eta "diet" |
| [zj]eść "eat" | [dj]abel "devil" |
| o[dj]echać "depart" | [tj]ara "tiara" |
| po[dj]echać "come up" | [sj]esta "siesta" |
| po[dj]ąć "pick up" | [dj]alekt "dialect" |
| [zj]awić "appear" | [dj]alog "dialogue" |
| [zj]ednać "win" | i[dj]ota "idiot" |
| [zj]eżyć "bristle" | [dj]ament "diamond" |
| o[dj]ąć "subtract" | [tj]ul "tulle" |
| | c) |
| | fanta[zj]a "fancy" |
| | proce[sj]a "procession" |
| | ges[tj]a "management" |
| | kome[dj]a "comedy" |
| | oka[zj]a "opportunity" |
| | se[sj]a "session" |
| | kwes[tj]a "question" |
| | gwar[dj]a "guard" |

The words in a) clearly contain a prefix boundary after dental obstruents, which prevents the rule from applying. Examples given in b) and c) are words of foreign origin and this may be said to be responsible for their failure to undergo the palatalization rule (Gussmann 1978a). Therefore, the categories of exceptions are well-defined and we can add two conditions to the rule:

1. no intervening prefix boundary is allowed if the rule is to apply
2. the rule applies to native words only

In this way the words in b) and c) are treated identically, i.e., they are reduced to exceptions. Nevertheless, such a solution does not reflect an important difference between the examples in b) and c). In our opinion only those in b) are exceptions, while those in a) and c) are perfectly regular although the palatalization is rendered opaque in them.

Let us start with analysing the words in a). Phonetically, dental obstruents which are the final elements of the prefixes *z-*, *od-*, *pod-*, are followed by the front glide which, contrary to our expectations, does not palatalize them. Closer analysis of these prefixes, however, reveals that they can appear in two phonetic shapes: with the final vowel [e] and without it, e.g.,

- od=jać — ode=jmować "subtract"
 pod=jać — podc=jmować "pick up"

Alternations such as these are accounted for by Gussmann (1978b), who suggests that these prefixes end underlyingly with a vowel which in some

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Alternations such as these are accounted for by Gussmann (1978b), who suggests that these prefixes end underlyingly with a vowel which in some

cases is deleted and elsewhere is preserved. Gussmann (1978b) also formulates a set of rules for Polish phonology. According to them the occurrence of the opacating clusters in a) results from the interaction of two rules, viz., palatalization and LOWER. The latter, among other things, deletes a prefix-final vowel in some contexts. The palatalization applies first. At this stage the prefixes in question contain a non-front vowel and, consequently, they do not undergo the rule. Then the application of LOWER creates the [tj, dj, zj, sj] clusters rendering the palatalization rule opaque. Notice, however, that at the stage where the palatalization applies, the words in a) are regular, i.e., the rule under consideration is locally transparent. Hence, they are not exceptions but merely "surface violations of the rule".

We shall now concentrate on the examples in b) and c). These words are synchronically foreign, although the frequency of their occurrence in Polish is very high and native speakers do not perceive the foreignness of many of them (e.g., *diabel* "devil", *partia* "party", *idiota* "idiot"). As has been mentioned, there is a significant difference between the forms in b) and c). Notice that the examples given in c) display the presence of a high non-front vowel between a dental obstruent and a glide in their adjectival forms as well as in their diminutives, e.g.,

Ro[sj]a "Russia" — ro[sij]ski "id. adj."
oka[zj]a "opportunity" — oka[zij]ny "id. adj."
melo[dj]a "melody" — melo[dij]ny "id. adj."
par[tj]a "party" — par[tij]ka "id. dim."
proce[sj]a "procession" — proce[sij]ka "id. dim"

Again, according to Gussmann's analysis (1978b), such alternations point to the phonological presence of a non-front vowel between the dental obstruent and the glide. Therefore the situation here is identical to that involving prefixes; the palatalization cannot apply because a non-front vowel prevents it. Then the vowel is deleted and opacating sequences are created. Thus, the words in c) behave quite regularly with respect to the palatalization rule in spite of their foreignness. They are clearly not exceptions, and the opacity of the palatalization here derives from its interaction with LOWER (counter-feeding order). To make our line of reasoning clearer, consider a sample derivation of two words from a) and c), where only interacting rules are taken into account.

	zjechać "go down"	okazja "opportunity"
	/zi=jexati/	/okaz+ij+a/
1. Palat.	—	—
2. LOWER	∅ ∅	∅
Output	[zjexać]	[okazja]

We can now see the difference between the regular forms in c) and those in b);

the opacity of the palatalization rule in the latter cannot be accounted for in the similar way.

The foreignness of the words in b) is very striking and it seems to prevent the application of the palatalization rule. Thus, if our reasoning is correct, the forms in a), b), and c) are all opaque with respect to the palatalization rule but only those in b) are exceptions. While the exceptional character of the examples given in b) is evident, it is not altogether clear whether their exceptionality refers to the j-anterior palatalization. What is striking in Polish is the fact that there are no vowel sequences morpheme internally in native Polish words. We would like to suggest that whenever a consonant is followed by the front high vowel /i/ and some other vowel in a foreign word, /i/ is changed into a front glide. This can be seen in numerous cases, e.g.,

liana "liana"	triangulacja "triangulation"
Dior "Dior"	dioptria "dioptria"
siesta "siesta"	mania "mania"

It can be assumed that these words contain two vowels in their phonological structure. The i-anterior palatalization fails to apply to them (as well as to numerous other forms such as: *tik* "tic", *Dickens*, *sinus* "sine" because they are foreign. And then the late phonetic rule converts the first vowel into the glide. The rule can be tentatively formulated as follows:

$$i \rightarrow j / - V$$

If we adopt this line of reasoning, the words in b) will not be treated as exceptions to the j-anterior, but to the i-anterior palatalization rule. The process changing a vowel into a glide would, obviously, opacate the j-anterior palatalization (counter-feeding order) by creating clusters of dental obstruents and the glide.

Summing up the first case of the opacity of the j-anterior palatalization rule: it derives mainly from the interaction of the palatalization with LOWER and the rule changing the high front vowel into the glide.

Under the second clause of Kiparsky's definition the process in question is nontransparent in forms which contain dental affricates or palato-alveolar fricatives not followed by the glide (phonetically). Here, as in English, the j-anterior palatalization rule is rendered opaque by the glide deletion. Palatalization triggered by the glide applies first and then the conditioning element is always dropped. The glide deletion rule predicts that there should be no phonetic clusters of palatals and glides in Polish. In fact, such sequences do not appear in the phonetic structure of this language.

One may have objections to our reasoning on the basis of the fact that it is not obvious whether the front glide is the segment which conditions the process of palatalization (evidence for it, as we have mentioned, is only indirect).

But even if we assumed that a completely different element was responsible for inducing palatalization, the opacity of the rule under this case would remain constant. In other words, whatever the conditioning segment, it is always deleted after causing palatalization. This observation is particularly important since our analysis of both Polish and English j-palatalizations has revealed that in neither language is the conditioning segment present on the surface. Therefore, the existence of such interactions considerably weakens Kiparsky's claims concerning the unnatural status of opaque orders.

In the preceding parts of this study two processes operating in Polish and English have been discussed with particular regard to their opacity. We are fully aware of the fact that such fragmentary analyses are doomed to failure unless they are placed in the context of the whole grammars. Therefore, we felt it justified to base our remarks on the most exhaustive existing works on English and Polish phonology, viz., *The Sound Pattern of English*, Laskowski's (1975) and Gussmann's (1978a, b) books. Our aim, among other things, was to demonstrate how it is possible to shed some light on the functioning of phonological rules by concentrating on a small point in phonological theory, i.e., rule opacity.

It appears that this concept is particularly important in comparing rules of various languages since: "By functional analysis we understand attempts to reveal similarities and differences between two languages by specifying the interactions among rules as well as their relation to underlying and surface forms". (Gussmann 1978a:161).

The comparison of the opacity of j-palatalizations in both languages reveals that the Polish process is more opaque than its English counterpart. The English rule is nontransparent mainly in words which contain the dental voiced stop (e.g., *orchideous*, *stipendiary*) and in some synchronically foreign items (such as *calcium*, *potassium*), whereas there are several categories of such forms in Polish (*podjąć* "pick up", *misja* "mission", *diaskop* "projector"). It seems to us that the differences in the degree of opacity of both rules are caused by different places the processes in question occupy in the phonologies of these languages. The English rule is relatively late: it operates on structures provided by the processes of Velar Softening, Spirantization and two Glide Insertion rules. The only rule of importance that applies after the palatalization is the Glide Deletion rule which opacates the former under case (iia). Consequently, the opacity of the palatalization in English derives mainly from the existence of exceptions. In Polish, however, the j-palatalization is placed deeper: it operates on underlying structures and those provided by j-insertion. In addition, it feeds palatal assimilation and depalatalization and — what is crucial here — stands in counter-feeding order to the rule of LOWER and the rule changing the high front vowel into the corresponding glide. The latter, together with exceptions, render the Polish rule opaque. Consequently, the

process of palatalization in Polish is more opaque than in English since the opacity of the former derives not only from the existence of exceptions but also from rule interaction. It seems therefore that earlier rules tend to be more opaque than later ones for they are more exposed to the opacating application of some other rules.

In this paper we have attempted to show how the notion of rule opacity may be helpful in arriving at the proper formulation of phonological rules as well as in verifying their adequacy. Let us recall that the analysis of the opacity of j-palatalization in English led us to suggest a slight modification of the rule, i.e., introducing morpheme boundary into it. In this way a large number of words no longer has to be treated as opaque with respect to the palatalization. It is necessary to add that we are not interested in reducing the opacity of rules for its own sake. What we are concerned with is the proper formulation of phonological rules. In this respect a large number of opacating forms may be suspicious since it may result simply from improper formulation of the processes themselves. Furthermore, in our survey of the opacity of the j-palatalization in Polish, we tried to apply the existing rules of Polish phonology (those suggested by Gussmann 1978a, b) to account for the nontransparent character of this process. It has turned out that these rules adequately describe the part of Polish phonology which concerns the j-palatalization for it has been possible to explain the opacity of this process without modifications of rules.

Moreover, the concept of rule opacity appeared to be useful in distinguishing genuine exceptions from mere "surface violations of the rule".

An interesting problem that has been a bone of contention among linguists dealing with rule opacity for a long time¹⁰ is its relationship with naturalness, recoverability and some other significant issues. We have not discussed this problem since our aim was to indicate that the concept of rule opacity — regardless of the validity of the whole opacity theory — is useful and important in phonological analysis.

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¹⁰ The whole concept of rule opacity is the result of the theoretical assumptions of Standard Generative Phonology. It does not, for example, appear in Natural Generative Phonology where only completely transparent rules are admitted.

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