SEGMENT, SEQUENCE AND MIRROR—IMAGE:
AN ITALIAN EXAMPLE.

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I. INTRODUCTION: MIRROR—IMAGE RULES

One of the distinguishing traits of modern linguistics is the search for gener-
alities transcending the level of individual phenomena. The quest for universal
and quasi-universal properties of language has brought to linguistics a number
of expanded perspectives, and the methodology has been correspondingly en-
riched by the addition of numerous theoretical proposals. Within the area of
phonological theory, the hunt for universal characterizations has assumed two
main facets: a description of universal rule schemata, and the establishment of
universal constraints on possible phonological rules. The first-mentioned as-
pect seeks to determine the characteristics of phonological rules in general,
while the second acts to circumscribe the set of possible rules by a set of limi-
ting conditions. It is to the first of the two aspects of the search for phono-
logical universals, namely universal rule-types, that the present study is direc-
ted.

Within the realm of diachronic phonology, the types of rules accounting for
the majority of phonological change can be simply enumerated. Kiparsky
(1965), King (1969) and others have proposed the four-way division of phono-
logical change into rule addition, rule loss, rule reordering, and rule simplifi-
cation. While the need for four separate and independent categories may per-
haps be brought into question,[1] no evidence has been brought forth to date
which indicates the existence of a major type of phonological change which
cannot be subsumed under one of the categories listed above. Thus any inves-
tigation delving into the matter of universal rule schemata may be safely con-
fined, for the present time at least, to the limits of this four-way partitioning.

Within each of the major change-types, a variety of subcategories are evi-
denced by close examination of phonological change. Since rule addition and
rule simplification account for the majority, and perhaps all, of sound change,
the greatest variety of mutational schemata is found within these two major
categories. One of the most theoretically intriguing rule types, and one which
remains relatively unexplored, is the MIRROR—IMAGE RULE, in which a given
change or alternation is effected in environments which are mirror-images of
each other. First brought up as a theoretical proposal by Bach (1968) and

Langacker (1969), mirror-image rules were shown to result in the collapsing of otherwise non-conflatible rules, and were consequently offered as a means of generalizing phonological descriptions. While the concept of mirror-image rules can be logically interpreted both on the synchronic and on the diachronic planes, it is in the diachronic dimension that mirror-image rules offer the greatest potential for theoretical ground-breaking.

Closer scrutiny was directed at mirror-image rules by Naro (1971), who set out to establish a universal characterization of the mirror-image convention in phonology. In the synchronic dimension, Naro notes (p. 58) that "It is striking that many, but not all, of the instances of application of the mirror image convention in synchronic phonology involve clearly assimilatory rules". Since synchronic rules often combine the results of phonetically motivated processes and analogy or extension, it is generally the case that diachronic rules are more strongly constrained than their synchronic counterparts; thus, with regard to diachronic mirror image rules, Naro postulates (p. 59) that "neighborhood assimilations are not only typical of added rules, but are the only allowable mirror-image rules". As a corollary of this hypothesis is the claim that apparent exceptions, i.e. mirror image rules which are not clearly neighborhood assimilations, are the result of simplification of an originally directional diachronic rule. For purposes of further discussion, let us denote these claims as hypothesis A, restated as follows:

HYPOTHESIS A: Any diachronic rule of the form

$$X-Y$$
$$A \rightarrow B / \qquad Y-X$$

which is not the result of the bidirectional generalization of a rule of the form

$$A \rightarrow B / X-Y$$

or

$$A \rightarrow B / Y-X$$

is the result of a neighborhood assimilation of features of A to features of X, or Y, or both.

Hypothesis A is supported by a number of specific examples but, as with any theory, only confimation, not proof, has been offered.

On the level of phonetic detail, the claims offered by Hypothesis A regarding diachronic mirror-image rules are intuitively satisfying, for the bidirectional assimilatory (or dissimilatory) action of a segment provides the only ready conceptualization of mirror-image behavior. Since the disjunctive environments of a mirror-image rule are formally united only by the segment(s) in contact with the one undergoing change, one naturally turns to features in the immediate vicinity of the modified segment when seeking the causes for the change. On higher levels of phonology, however, the possibility still remains that diachronic

mirror-image rules may arise without the direct mirror-image action of neighborhood assimilation. Any claims to this effect must nonetheless be substantiated from a number of different angles. First, the existence of the mirror-image rule itself must be established. Second, and most important from a methodological point of view, it must be shown, as unequivocally as possible, that the events in question are not the result of the bidirectional generalization of an originally directional rule. Finally, if the resulting counterexample is to be of any value to phonological theory, an alternative characterization of mirror image rules must be offered, or further schemata must be admitted under the rubric of the already existing definition. The remainder of the present study constitutes an attempt to justify a restriction of the class of possible diachronic mirror-image rules, by the elaboration of a situation which may not be accounted for by the mechanism of neighborhood assimilation. Since the events in question occured many centuries ago, the available data exhibit many lacunae and conflicting interpretations; consequently, the conclusions to be derived from these data are in no way to be regarded as definitive, but merely suggestive of future areas of investigation. However, since no alternative explanation accounts for all the data, it is hoped that the theoretical potential to be gained by careful speculation exceeds the indeterminacy inherent in the data.

II. VERBAL ALTERNATIONS IN ITALIAN

The changes to be discussed occured in the earliest periods of Italian, and involve the raising and fronting of *a* to *e* in a variety of forms.[2] This change is most evident, and indeed is often considered to have exclusively affected, the future and conditional forms of verbs of the first conjugation, in *-are*. A short illustration should suffice to indicate the nature of the change.

Following the typical Romance synthetic pattern, Italian forms the future and conditional utilizing the entire infinitive as the stem. In the case of verbs of the second conjugation, in *-ere*, and of the third conjugation, in *-ire*, the future and conditional endings are merely added to the infinitive, after dropping the final *e*. There are no additional developments, except for syncopation of the thematic vowels in a handful of verbs such as *morire* 'to die', *vedere* 'to see', *venire* 'to come', etc. In the case of the first conjugation verbs, the theme vosel of the infinitive, normally *a*, is shifted to *e* in the future and conditional. Consider, for example, a typical diachronic paradigm, that of the verb *parlare* 'to speak'; here the stressed vowels are in italics:

FUTURE

parlar*ò*	>	parler*ò*	1st s.
parlar*ai*	>	parler*ai*	2nd s.

parlarà	>	parlerà	3rd s.
parlaremo	>	parleremo	1st pl.
parlarete	>	parlerete	2nd pl.
parlaranno	>	parleranno	3rd pl.

CONDITIONAL

parlarei	>	parlerei	1st s.
parlaresti	>	parleresti	2nd s.
parlarebbe	>	parlerebbe	3rd s.
parlaremmo	>	parleremmo	1st pl.
parlareste	>	parlereste	2nd pl.
parlarebbero	>	parlerebbero	3rd pl.

This set of alternations is common to all first conjugation verbs, with the exception of *dare* 'to give', *stare* 'to stand, be', and *fare* 'to do, make', which retain the unmodified infinitive stem in the future and conditional, and *andare* 'to go' which exhibits the syncopated future and conditional stem *andr-*. In addition, the verb *essere* 'to be' manifests the stem *sar-* in the future and conditional, apparently as a result of analogy with the forms of *stare*.

III. TENTATIVE EXPLANATIONS

Among historians of the Italian language, there have been a number of attempts at explaining the *a* ~ *e* alternation in the first conjugation verbs,[3] but all potential explanations cluster around two major hypotheses. The first theory holds that the thematic vowel was shifted to *e* by the analogical influence of the verbs of the second conjugation, in *-ere*, whose theme vowel *e* appears in the future and conditional.[4] The second proposal imputes a 'rasing power' to the segment [r], which immediately follows the vowels in question in all future and conditional forms.

Analogical explanations, while accounting for many of the complex and intertwined developments characterizing the Italian verbal system, appear to be doomed from the outset in the case of the vocalic alternations under discussion. Verbs of the first conjugation, with thematic vowel *a*, are more common and more numerous than verbs of the second and third conjugations combined;[5] thus, in some southern Italian dialects, the change of *e* to *a* occured in the future and conditional stems of second conjugation verbs, apparently the direct result of analogy. On the other hand, verbs of the third conjugation, with theme vowel *i*, have never exhibited a tendency to fall under the dominant future/conditional pattern characterized by the thematic vowel *e*, first represented by verbs of the second conjugation and later joined by the first conjugation verbs. More-

over, as will be seen below, there exists a number of non-verbal forms in Italian in which precisely the same change occured, at the same time as, or prior to, the vocalic shift among the verbal paradigms. As a consequence, it appears safe to assert that, while perhaps operative in other dialects, analogy played a negligible rôle in shaping the events in those Italian dialects giving rise to the vocalic alternations under study.

Proposals involving the possible assimilatory effects of the segment [r] are intuitively much more satisfying than analogy-based explanations, as parallels may be found elsewhere in Italian, among other Romance languages, and in unrelated language families. Since the segment [r] immediately follows the theme vowel in each future and conditional form in Italian, it is natural to 'factor through' by the common element and implicate this segment in the change. Unfortunately, among Romance linguists there has been no common concensus regarding the assimilatory effects exercised by *r*. Some investigators maintain that an [r] tends to RAISE a preceding vowel, while others adduce data hinting at a LOWERING influence of a following [r]. To complete the picture, there are investigators who have noticed no particular assimilatory effects at all which may be attributed to [r]. It is useful to briefly review some representative opinions, in order to comprehend the nature of the debate.

Among some general studies, the raising of *a* to *e* before *r* in Italian was merely catalogued, e.g. by d'Ovidio and Meyer-Lübke (1904, 671), Rohlfs (1949, 230) and Mendeloff (1970, 14). More prevalent, however, has been the view that the presence of a following *r* in some way REQUIRED the presence of the vowel *e*. Among adherents of this latter position, we may list Meyer-Lübke (1890, 290), Guarnerio (1918, 354), Lausberg (1956, 155), Bourciez (1967, 485), Battaglia (1970, 169) and Bec (1970, 152). Grandgent (1927, 55-6) feels that "the choice of *e* when *r* follows and *i* elsewhere is probably a phenomenon of association, *e* being in the whole mass of words the commonest intertonic vowel before *r*, *i* the commonest before other consonants". These remarks are, needless to say, circular, since the reason for the predominance of *e* before *r* is precisely the fact that *a* was raised to *e* in this position in a great number of words, the full extent of which will be seen below.

Turning now to the opposing view concerning the effects of [r], we may note the opinion of Grandgent (1927, 55-6), who feels that, in the absence of opposing forces, such as analogy, Italian *r* acted to OPEN preceding vowels. An even more restrictive assertion was offered by Deferrari (1954, 29, 164) who declared that the segment [r] in general, and the Italian [r] in particular, exhibits a marked tendency to open vowels, being strongest when *r* follows the vowel and is followed by a consonant, and weakest when *r* appears intervocalically preceding the vowel in question. Obviously realizing the discrepancy between his remarks and the events occuring in Italian, Deferrari makes vague reference to the analogy, for example, with the (nearly unique) Italian development *sternuta* > *starnuta* 'sneeze', where both forms coexist in modern Italian. Gili i

Gaya (1932, 245) postulates for the Catalan *r* the power to lower preceding vowels, while a similar observation is offered by Otero (1971, 60) regarding the development of Spanish *sarao* 'dance' from the Galician-Portuguese *serão* 'soirée'. Leaving the Romance field, Vennemann (1972, 883) has collected instances from the Germanic and other language families which indicates that [r], at least in some cases, exerts a lowering force on contiguous vowels. As a result, the author proposes that [r] be universally specified as [+ low]. relative to other segments in its environment.

As matters presently stand, no clear picture of the assimilatory potential of the Italian [r] has been obtained. Nor does an expansion of the segments involved into simultaneous bundles of distinctive features clarfiy the situation,[6] since, aside from a few basic features, the intervocalic voiced alveolar flap [r] shares no properties with the vowels [a] and [e]. Given this indeterminacy surrounding the specification of [r], a few remarks, directed solely at the Italian *r*, may be tentatively offered toward a characterization of this segment.

Italian [r], when occuring word-internally, is a single flap, that is, its articulatory characteristics involve a rapid movement of the tip of the tongue from a central region of the mouth to the alveolar region, and back again into a more central location.[7] The full effect of the flap is apprehended only if the tongue travels sufficiently both before and after the point of alveolar contact. Thus, in the articulation of the nearly homorganic clusters [dr] and [zr], the apex of the tongue disengages itself from the alveolar region following articulation of the first consonant, lowers somewhat, then returns to produce the flap, after which the tongue is lowered again. The precise central location involved in the articulation of [r] is imprecise, but is generally in the mid-front region of the mouth, in the general area characteristic of the mid-front vowels.[8] The conclusion to be drawn from these articulatory characteristics is that any assimilatory effect to be anticipated from Italian [r] would be such as to achieve a degree of tongue height comparable to that of the mid vowels. One would expect, therefore, a slight raising effect to be exerted on the low vowel [a] and a slight lowering effect on the high vowel [i], with no noticeable mutation of the mid vowels [e] and [ɛ]; significantly, most well documented instances of the purely phonetic lowering of a vowel adjacent to [r] involve high vowels.[9] As a further verification of this supposition, one may note that, while initial-syllable atonic [e] in Italian was quite frequently raised to [e], it invariably remained unaltered before [r]. Moreover, vowels were often inserted in a consonant cluster through hypercorrection or partial restoration, on the assumption that the vowel had been lost through syncope. This epenthetic vowel was *i* except before *r*, where an *e* was inserted: e.g. *supplère* > *sopperire* 'to provide for', *cīthăra* > *cetra* > *cetera* 'zither', *macrum* > *magro* > *maghero* 'lean' vs. *spasmo* > *spasimo* 'spasm', *blasphēmat* > *biasma* > *biasima* 'blaspheme', etc.

In addition to any possible assimilatory effects exerted by the following *r*, it is immediately noted that all theme vowels in the future and conditional ap-

pear in unstressed position,[10] thus implicating the combined action of the general process of unstressed vowel raising, prevalent in early Italian, and the apparently quite weak assimilatory effects of the following *r*. Further examination reveals that, with only a few exceptions, all the modifications occured between the first-syllable atonic vowel and the main stressed vowel; i.e. in a quasi-intertonic position. The sole exceptions to this generalization are the verbs *fare*, *dare*, and *stare*, and the future and conditional of *essere*, with stem *sar-*, in which cases the theme vowel, in first syllable pretonic position, remains unalterd in the future and conditional. The verb *andare*, now exhibiting the syncopated stem *andr-*, originally raised the thematic *a* to *e* in the future and conditional.[11] We have thus arrived at a true generalization concerning the Italian verbal system: the vowel *a* was changed to *e* before *r* when preceding the main tonic syllable and preceded by at keast one unstressed syllable. Further inspection indicates that this generalization is true for other, non-verbal, forms as well. In a statistical study, the scope of which precludes its description here,[12] it was shown that in this position, ALL instances of *a* were raised to *e* before *r*, while no instances of the raising of *e* to *i* before *r* in an atonic position may be found. Examples include *margarita* > *margherita* 'daisy', *lazzaretto* > *lazzeretto* 'fever hospital', *separare* > (dial.) *sceverare* 'to separate', *smaragdu* > *smeraldo* 'emerald',[13] etc. It is thus possible to unconditionally describe the raising of pretonic *a* to *e* before *r* in terms of a purely phonetic environment.

Of central interest to the topic of the present study is the fact that precisely the same raising and fronting of *a* before *r* occurred in the MIRROR—IMAGE environment: in the posttonic penultimate position. All cases of *a* before *r* in the position following the stressed syllable and preceding the final syllable became shifted to *e*; e.g. *camăra* > *camera* 'chamber', *mattăris* > *mattero* 'a type of shoot', *albărus* > *albero* 'tree', etc. This change was completely general, with the result that, in the Florentine dialect, no instances of *a* before *r* remain in this position.

Combining the developments affecting atonic *a* before *r* in Italian, both before and after the stressed syllable, one may establish the environments for a mirror-image rule: *a* was raised to *e* before *r* when occuring between the main stressed syllable and an unstressed syllable. Although the segment *r* is common to both the structural description and the structural change, it is impossible to factor it out of the environments and still be able to demonstrate the mirror image behavior. Thus, as a first approximation, the events in question may be displayed as the following diachronic rule, using the notation // to indicate that what follows to the right is in reality two mirror-image environments, after Langacker (1969, 858-9), Harris (1970), and Naro (1971, 58):

(1) $\quad\quad$ ar → er // $VC_0^1\_\_C_0^1\acute{V}$

Even this formulation provides several difficulties, for the introduction of the optional consonantal environments into a putative mirror-image rule brings in a

hitherto unexplored dimension. Up until now, mirror-image rules have been
presented with constant environments, thus providing only two possibilities,
as shown in hypothesis A. By introducing variable environments, however,
the situation becomes more complex; for example, rule (1) generates the fol-
lowing pairs of mirror-image environments:

a) $V\_\acute{V}$ c) $VC\_C\acute{V}$ e) $V\_C\acute{V}$ e) V_CV
b) $\acute{V}\_V$ d) $\acute{V}C\_CV$ f) $\acute{V}C\_V$ h) $VC\_\acute{V}$

Thus, rule (1) may be regarded as an abbreviation of *four* different mirror-
image rules, producing the pairs a-b, c-d, e-f, and g-h. It appears, therefore, that
a rule such as (1) in effect camouflages its constituent parts, and consequently
that the use of optional environments in mirror-image rules should be disal-
lowed. In any event, the problem at hand reduces to determining whether one
or more of the above mirror-image environment pairs can be satisfied, in order
to ascertain whether we are dealing with a true mirror-image rule.

Due to the phonotactics of Italian, types (f) and (h) are the most common.
One could possibly find valid attestations of (e) and (g), although the latter is
inconsistent with the general Latin/Italian stress pattern. Types (a) and (b) may
occasionally be found, although quite rarely, due to the limited possibilities for
hiatus in Italian. Type (c) is also to be found in certain dialects. Type (d), like
(g), is unlikely given the general Italian phonotactic structure, but certainly oc-
curs when enclitic pronouns are added to 'strong' second conjugation infinitives,
e.g. *léggerlo* 'to read it'; it would be more difficult, however, to find examples
of the change of *ar* to *er* in such a position.

It appears, therefore, that it might conceivably be possible to squeeze at
least two mirror-image rules out of the data. The fact remains, however, that
in the overwhelming majority of cases, it was in environments of the form (f)
and (h), a non mirror-image pair, that the changes in question occured. And yet,
at least intuitively, there seems to have been some sort of mirror-image process.
One possible means out of this dilemma is to include a larger portion of the en-
vironment in the structural description of the rule, and to utilize the generally
accepted abbreviation (VC_0) to indicate a syllable. This yields:

(2) $C\ a\ r\ V \rightarrow 1,\ e,\ 3,\ 4\ //\ \acute{V}\_(VC_0)_1$

This rule is inelegant, but provides the necessary mirror-image environments,
given the syllabic convention; it raises a problem, however, when faced with
Hypothesis A. While [r] may have exerted an assimilatory effect on the prece-
ding vowel, there is nothing in the environment of the sequence [ar] which could
have exerted an assimilatory or dissimilatory influence on this sequence, thus
apparently providing a counterexample to the hypothesis that diachronic mirror-
image rules are invariably cases of neighbourhood assimilation. To verify the exist-

ence of a true counterexample, however, it would be necessary to show that
rule (2) is not the result of the generalization of an originally directional rule.
As noted previously, the events in question, occuring during the earliest per-
iods of Italian, in its development from Vulgar Latin, defy accurate documen-
tation and chronological tracing. Nevertheless, an ennumeration of the avail-
able data should demonstrate the small probability of the rule's being the re-
sult of a non-phonetic process of extension or generalization.

IV. ORIGIN OF THE CHANGE

In the Florentine dialect, the change of atonic *ar* to *er* may be traced back to
the earliest available documents, while throughout the rest of Italy, such al-
tered forms were adopted only under the influence of the prestige status early
accorded the Tuscan dialect. Such borrowing mainly involved the future and
conditional verbal forms, as well as some nouns, but in modern Italian, con-
siderable regional variations serves to demonstrate that in the non-Florentine
dialects no unconditioned sound change was operative.

In the earliest Florentine texts, nominal forms in which atonic *ar* had be-
come raised to *er* in the positions indicated above may be found; the first at-
testations appear in a fragment of a Florentine bank book dated 1211.[14] Tra-
cing the change among verbal forms is more difficult, since during the transi-
tion from Vulgar Latin, many sets of endings, some not involving the stem-fi-
nal *r* of the infinitive, were used to indicate the future and conditional, in ad-
dition to vestiges of the old Latin synthetic future and conditional endings.
One of the first instances of the raising of *a* in verbal stems comes in a docu-
ment dated 1250,[15] where the 'new' future and conditional forms appear to-
gehter with the older Latin forms. Throughout the rest of the 13th century,
the change appears to have spread rapidly, although in view of the lack of ad-
equate documentation for this period, it may have been generalized by an
earlier date. Arabic words borrowed during the 13th century modified the com-
bination *ar* to *er* in the appropriate environments, or inserted an epenthetic *e*
before *r*: *zúcchero* 'sugar' (cf. Spanish *azúcar*), *zafferano* 'saffron' (Sp. *azafrán*),
cássero 'quarter deck' (Sp. *alcázar*), and so forth.

By the 14th century, the change had become genralized in Florence, al-
though variation with forms in *ar* still can be found. At this point, evidence
exists that the change was spreading into other dialects, especially that of
Rome.[16] A century later, the first grammar books, the *Grammatichetta Vati-
cana* of Leon Alberti and Bembo's *Prose della Volgar Lingua*, indicate a com-
plete regularity of the change within the verbal paradigms, although the latter
author mentions that many people still use the 'non-Tuscan' variants. The same
grammatical treatises also indicate a comparable generality in the spread of
nominal forms with the new combination *er* replacing the older *ar*.

While the documentation supporting the changes in early Tuscan does not completely eliminate the possibility of analogical spreadings from one group of forms to another, the available data, representing several time periods and authors, contain absolutely no indication of such a trend. From the earliest times, the mutation of *ar* to *er* appears to be the rule in the Florentine dialect both in word-interbal pretonic position and in posttonic penult position, in both nominal and verbal forms, with no apparent chronological precedence of one group of forms, or environment, over the others. Thus, in view of the lack of disconfirmatory evidence, one may tentatively affirm that the change represented by rule (2) did indeed occur as a single, environmentally conditioned, phonetic change, and not as the result of the generalization of a directional rule. This conclusion, if valid, forces us to examine in greater detail the statement schematized by (2), which is clearly not an instance of neighborhood assimilation. Rather than rejecting outright Hypothesis A, which in itself would add nothing to out knowledge of diachtonic phonology, some remarks will be appended regarding a possible alternative representation of the events given in the mirror-image rule (2). It will be claimed, in fact, that the mirror-image format of (2) is an artefact of the notational system, and that the true generalization lies elsewhere.

V. AN ALTERNATIVE PROPOSAL

The history of the Romance languages is characterized by a highly differential treatment of vowels depending upon their position within the word. In addition to the obvious dichotomy stressed/unstressed, there is a noted differentiation of the various unstressed word positions, as may be discovered by consulting any manual of Romance philology. So consistent was this differential behavior of atonic positions in Italian that it may be demonstrated, on the basis of a more comprehensive survey,[17] that atonic positions diachronically group themselves along a scale of strength, from weakest to strongest: intertonic syllable, posttonic penult syllable pretonic vowels, secondary tonic and final atonic vowel. This means that, given a large segment of diachronic data, the proposed strength scale offers predictions as to the relative behavior of the various atonic positions, predictions which are in large measure borne out by observations effected on various Romance languages. Within the domain of Italian phonology, one may, on the basis of their diachronic behavior, group certain of the atonic positions together, thus arriving at a strength hierarchy with fewer divisions; the weakest syllables, namely intertonic, posttonic penult and second-syllable pretonic, may be denoted as [strength 1],[18] the first-syllable pretonic and pre-pretonic syllables as [strength 2], and the remaining positions as [strength 3]. The statistical characteristics of these positions across time, as measured by rate of syncopation and modification of vowels in these positions, support such a

reduction of the number of points on the hierarchy.

As a consequence of such a hierarchical ranking of atonic environments in Italian, rule (2) may be rewritten as:

$$(3) \qquad a \to e \ / \ \left[\ \overline{\text{strength 1}} \ \right] \quad r$$

In other words, [a] was raised to [e] before [r] in just those environments which, by virtue of their phonetic and phonological properties, are characterized by a diachronic strength of *1*.

The data support both forms of representation, and yet the empirical consequences of rule (2) are different from those of rule (3). Which is correct? If the Italian vowel modifications under discussion are considered to represent a true instance of a diachronic mirror-image rule, à la (2), there is no way to salvage the intuitively satisfying Hypothesis A. Certainly the data which gave been discussed are not sufficient to warrant any detailed claims regarding the theoretical status of mirror-image rules in diachronic phonology; nonetheless, given the apparent discrepancy, an attempt at elucidation will be forwarded.

I would like to suggest that, as formulated by Naro (1971), Hypothesis A, stating that diachronic mirror-image rules are the end result of neighborhood assimilation, is basically correct, and that the fact that the vocalic changes in Italian can be formally expressed in the mirror-image notation is irrelevant to the actual processes which the contending rules represent. All of the examples of diachronic mirror-image rules adduced by Bach, Harris, Naro, and others, involve the assimilation of a SEGMENT to some features contained in its immediate environment. On the other hand, the data being considered in the present study refer, not to a particular segment, but to a SEQUENCE of segments, acted upon not by surrounding segments, but by virtue of its general POSITION within the word. In effect, we are dealing with a double faceted change in Italian: a purely directional assimilation of [a] to [e] before [r], and the differential treatment of a general phonotactic position, irregardless of the particular segments occuring in any individual case. Only by combining the assimilatory effects of the segment [r] and the inherent diachronic instability of the particular positions in which the change occured can one account for the vocalic modifications which occurred.

As a result of the above considerations, a revised hypothesis concerning diachronic mirror-image rules can be proposed:

HYPOTHESIS B: A diachronic rule of the form

$$A \to B \ / \qquad \left\{ \begin{array}{c} X\_\_Y \\ Y\_\_X \end{array} \right\}$$

which is not the result of the bidirectional generalization of an earlier rule of the form

$$A \rightarrow B \, / \, X\_\_Y$$
<div align="center">or</div>

$$A \rightarrow B \, / \, Y\_\_X$$

is the result of assimilation of features of A to features of X, or Y, or both, *if and only if* A is a single, uniquely defined, phonological segment.

This revised hypothesis in effect proposes a twofold distinction in the case of diachronic mirror-image rules: rules affecting individual segments, and rules affecting sequences of segments or general word positions. Since by definition, assimilation involves the principled change of distinctive feature coefficients of one segment to match those of another segment(s), it seems logical that phonological changes making essential reference to a general position, which is not described in terms of distinctive features, could not directly involve an assimilation. Therefore, it is possible to interpret the above twofold distinction as being implicit in the hypothesis regarding diachronic mirror-image rules in general. This may be rephrased as asserting that the only theoretically relevant type of diachronic mirror-image rule is one involving changes affecting a single segment, and that the fact that a diachronic rule altering the configuration of a sequence of segments or a general position is expressable as a mirror-image rule is irrelevant to the actual process involved. Under such a conception, it would then appear almost tautological to assert anything further about the action of true diachronic mirror-image rules in phonology.

VI. FUTURE DIRECTIONS

The implication that a particular notational convention may yield spurious or irrelevant generalizations in certain instances should come as no shock, in view of the difficulties experienced by other notational devices within phonological theory. Such conventions are generally proposed on the basis of a restricted range of phenomena, and as a consequence the true nature of the original generalization may be obscured until such a time as an apparent counterexample arises and the entire theoretical proposal must be reappraised. The present note has contained one attempt at further explication of a proposed notationl convention, but any definitive statement must await future research into the detailed properties of sound change. In particular, it will be necessary to develop a more complete characterization of sound changes as applied to generalized word positions and to sequences of segments. The notions of diachronic and positional strength must be refined to the point where they can be offered as a viable addition to, or alternative to, diachronic phonological theory in cases where the current notational system appears inadequate. By extending our search to include such topics as the general areas of diphtongization and mono-

phthongization,[19] metaphony, vowel harmony, and the overall behavior of atonic vowels, we may continue the quest for the most adequate set of constraints on possible diachronic rules.

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NOTES

1. The rigidness of this categorization has been questioned, for example, by Bhat (1970) and Lipski (1973a), while the viability of rule loss as an independent form of phonological change is discussed by Campbell (1971), Dressler (1972), and Lipski (1973b). In addition, many investigators now feel that the phenomenon which has been described as rule reordering is merely an artefact resulting from paradigm simplification, thus tentatively reducing inceptive phonological change to rule addition and rule simplification.

2. Throughout this study, the designation 'Italian' will refer to the literary standard which, largely through the influence of the Renaissance figures Dante, Boccaccio, and Petrach, is primarily derived from the Tuscan dialect of Florence. In some dialect of Italy, the changes in question did not take place, and in a few southern Italian and Sicilian dialects, the opposite vocalic modification, from *e* to *a*, took place. Grandgent (1927, 55-6) feels that this latter change is the result of analogy with the verbs in *-are*, which are more common than the verbs in *-ere* and *-ire* combined. See also Pei (1941, 103).

3. For a more complete survey and discussion of the data in question and the attempts at accounting for them, see Lipski (1974).

4. For example, Grandgent (1927, 55-6), Deferrari (1954, 29).

5. Cf. Lipski (1974), Pei (1941, 103f.).

6. Little leeway is provided for the specification of /a/ and /e/, whether one chooses to utilize Jakobsonian distinctive features or those of Chomsky and Halle. With respect to /r/, however, mor confusion results. In the Jakobsonian framework, /r/ is [+vocalic, −consonantal, +diffuse, −compact, −grave, −continuant], while Harris (1969, 46) describes the same segment as [+vocalic, −consonantal, +voice, +anterior, +coronal, −strident, +continuant, −tense]. Chomsky and Halle (1968, 77) offer a similar specification, except that they categorize /r/ as [−anterior], presumably referring to the English *r*. Andersen (1968, 175) has regarded /r/ as [−continuant], while Vennemann (1972, 886) proposes that it be specified as [+ low].

7. Actually, the central point reached in the articulation of [r] may be somewhat more centralized than that of the front vowels. For example, in Rumanian, the vowels [e] and [i] exhibit the centralized allophones [ ] and [ɨ], respectively, in contact with [r], allophones corresponding to the vowel phonemes orthographically represented as *ă* and *î*. See Vasiliu (1968, 130) and Ruhlen (1973, 39, 41).

8. Cf. Householder (1971, 57).

9. For English and Germanic see Kurath (1964, 78) and Vennemann (1972); for Spanish, see Navarro Tomás (1966). Newton (1972, 569) notes the lowering of [i] to [e] before [r] in a modern Greek dialect. Other instances of vocalic lowering caused by *r* stem from its velar, uvular, or retroflex pronunciation in many languages; for English, cf. Kurath (1964), Vennemann (1972, 872); for French Canasian, see Orkin (1971, 66).

10. Cf. Rohlfs (1950, 587), Lausberg (1965, 293, 845).

11. An example of the unsyncopated stem, *anderà*, is found in Dante's *Divina Commedia* (*Paradiso*, Canto 30, line 144).

12. For a complete description, see Lipski (1974).

13. The development of *smaragdu* to *smeraldo* may be accounted for by the fact that, particularly in the early stages of Italian, the initial *s* of such clusters had syllabic value. Cf. Bourciez (1967, 48, 156), Andersen (1972, 34).

14. Cf. Migliorini (1963, 106, fn. 4).

15. Migliorini, *op. cit.*, p. 140.
16. See, for example, Ernst (1970, 59).
17. The details are given in Lipski (1974).
18. More research is called for before the numerical values proposed for the various atonic positions may be definitively established. The numerical strength figures are not used as distinctive features, but as interpretive devices characterizing diachronic behavior, in a fashion analogous to the 'cover features' introduced by Vennemann and Ladefoged (1973) and further discussed by Chen (1974). For additional disuccsion, see Lipski (1974).
19. For some additional remarks on the interlocked processes of diphthongization and monophthongization, see Andersen (1972), Lipski (forthcoming).

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